ICL POWER (PVT) LTD

23.09.2024

The Director General Licensing,
National Electric Power Regulatory Authority (NEPRA),
NEPRA Tower, G-5/1, Islamabad.

SUBJECT: **Application for Grant of Electric Power Generation / Concurrence for 37.2 MW Biomass Power Plant at ICL Power (Pvt.) Limited at Kala Shah Kaku, Punjab, Pakistan.**

Dear Sir,

I, Azhar Abbas, Head of Administration & IR being the duly authorized representative of ICL Power (Pvt.) Limited by virtue of Board Resolution dated April 19, 2024 hereby apply to National Electric Power Regulatory Authority for the grant of a concurrence to ICL Power (Pvt.) Limited, pursuant to section 14/(B)/(5) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

I certify that the documents in-support attached with the application are prepared and submitted in conformity with the provisions of the National Electric Regulatory Authority Licensing (Application, Modification , Extension and Cancellation) Procedure Regulation 2021 and undertake to abide by the terms and provisions of the aforementioned regulation. I further undertake and confirm that the information provided in the attached documents in-support in true and correct to the best of my knowledge and belief.

A bank draft sum of Rupees Nine Hundred Ten Thousand, Four Hundred and Twenty Four Only (PKR 910,424/-) being the license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application, Modification, Extension and Cancellation) Regulations, 2021 is also attached herewith.

The application is filed in triplicate with all annexures appended with each set of the application.

REGISTRAR OFFICE
Diary No. 10260
D 24/9/24

Continuous .... *Page 2*

ICL POWER (PVT) LTD

Date: 23.09.2024

Following documents have been attached for your kind consideration

1. Application for Issuance of NEPRA License
2. Cheque in favor of NEPRA for submission of Cogeneration of License
3. Board Resolution
4. Certificate of Incorporation
5. Attested copy of Certificate of Incorporation
6. Memorandum of Association of ICL Power (Private) Limited
7. Article of Association of ICL Power (Private) Limited
8. List of Key Management of ICL Power (Private) Limited
9. CVs of Key Management of ICL Power (Private) Limited
10. Profile of Subcontractor
11. Reference in Respect of the Experience of Sub-Contactor
12. Location Map, Site Map
13. Technology, Size of Plant, Number of Units
14. Fuel: Type, Imported/Indigenous, Supplier, Logistics, Pipelines
15. Emission Values
16. Cooling Water Source Utilization and Discharge Compliance
17. Infrastructure overview-Roads
18. Project Commencement and Completion Schedule
19. Safety and Emergency Plan
20. Efficiency Parameters
21. Load Flow Analysis
22. Feasibility
23. Environment and Social Soundness Assessment

Azhar Abbas
Head of Administration &
Industrial Relations
ICL Power (Pvt.) Ltd. (ICLPPL)

Enclosed: As Above

PROSPECTUS

New ICL Power (Private) Limited is a private limited company incorporated under the companies ordinance, 1984 and is limited by shares. ICL Power (Pvt) Limited, a subsidiary of Ittehad Chemicals Limited, is focused on developing high-quality renewable energy assets in Pakistan to cater to industrial consumers on a B2B basis. The company's inaugural project is a 37MW biomass fueled co-gen power plant, which is designed to use farm waste as its primary fuel. The company is actively collaborating with agricultural stakeholders to address crop residue burning on farms, a significant contributor to smog in Punjab.

ICL Power enables its customers to not only reduce their environmental footprint but also reallocate their energy expenditure away from foreign fossil fuel corporations and towards small and medium-sized enterprises in the surrounding agricultural community, catalyzing an economic and social transformation of the region. The Company is engaged in the business of cogeneration of electricity. The facility is located at 20-K.M, G.T. Road, Kala Shah Kaku, Punjab with its business office at 39-Empress Road, Lahore.

An expense of USD 16 Million is estimated for procurement, installation and commissioning of new equipment (including transformer, Panels, Cables etc.) which will enable to meet the requirement of Ittehad Chemicals Limited.

On the social front, it has become a significant source of employment, providing jobs within the community. This has not only improve the local economy but also fostered community development by contributing to infrastructure and services. Additionally, the power plant has played a role in skill development, offering opportunities for individuals to enhance their capabilities.

On the environmental side, the use of bagasse, a byproduct from crushing sugarcane during sugar production, has proven to be environmentally friendly around the globe. The plant operates with reduces emission, as bagasse is considered a carbon-neutral fuel source, meaning it doesn't add extra carbon dioxide to the atmosphere.

Furthermore, the plant contributes to waste reduction by utilizing biomass, effectively recycling a byproduct that might otherwise become waste. The sustainable approach has also lessened our dependence on traditional fossil fuels, promoting a cleaner energy source. The overall impact includes a healthier environment with improved air quality, making the biomass -fired power plant a positive force for both the community and the surrounding.

ICL POWER (PVT) LTD

CERTIFIED TRUE COPY OF THE RESOLUTION PASSED BY THE BOARD OF DIRECTORS OF M/S ICL POWER (PRIVATE) LIMITED (A WHOLLY OWNED SUBSIDIARY OF M/S ITTEHAD CHEMICALS LIMITED) AT THEIR MEETING HELD ON APRIL 19, 2024, AT THE REGISTERED OFFICE, 39-EMPRESS ROAD, LAHORE.

BOARD RESOLUTION

Resolved that ICL Power (Pvt.) Limited (hereinafter referred as the "Company") be and is hereby authorized to apply for NEPRA License for our Biomass 37.2 MW Power Plant to apply for the License.

Further resolved that Mr. Azhar Abbas, Head of Administration & IR of the Company be and is hereby authorized to sign and present all necessary documents, Authority Letters etc. for & on behalf of the Company to apply the above said License before the National Electric Power Regulatory Authority, Islamabad.

Certified To Be True Copy
ICL Power (Pvt.) Limited

(Abdul Mansoor Khan)
Company Secretary

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

Company Registration Office

CERTIFICATE OF INCORPORATION

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

Corporate Unique Identification No. 0248153

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

Given at **Lahore** this **Second** day of **January,** Two **Thousand** and **Twenty Four**

Company Registration Office Lahore

CERTIFIED TO BE TRUE COPY

22/1/24

ASSISTANT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE, LAHORE

This Certified True Copy is not valid for purpose of Bank account opening. The banks may verify company's record through bank portal launched by the SECP

SEAL OF REGISTRAR OF COMPANIES
SECP

Moeen Rajput
Deputy Registrar

https://eservices.secp.gov.pk/eServices/ControllerServlet?request_id=VERIFY_ONLINE_INCORP_CERT&id=0248153

3(5)(a)(i)

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THE COMPANIES ACT, 2017 (XIX of 2017)

(COMPANY LIMITED BY SHARES)

MEMORANDUM

OF

ASSOCIATION

OF

ICL POWER (PRIVATE) LIMITED

3(5)(9)(ii)

THE COMPANIES ACT, 2017 (XIX of 2017)

(COMPANY LIMITED BY SHARES)

MEMORANDUM OF ASSOCIATION

1. The name of the company is ICL Power (Private) Limited

2. The registered office of the Company will be situated in Punjab

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 Biomass Power Plant, thermal power plants, coal fired power plants, hydal power plants, wind mills, 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 (Asset Management Services, Leasing, Investment Finance Services, Investment Advisory Services, REIT management Services, Housing Finance Services, Private Equity and Venture Capital Fund Management Services, Discounting Services, Pension Fund Scheme Business, Micro Financing), Corporate Restructuring Company, Insurance Business, Modaraba management company, Stock Brokerage business, forex, Clearing House, Securities and Futures Advisor, Commodity Exchange, managing agency, business of providing the services of security guards or any other business subject to license and 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 license 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. 10,000,000/- (Rupees Ten Million only) divided into 1,000,000 (One Million) Ordinary shares of Rs. 10/- (Rupees Ten only) each.

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 name(s):

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
ITTEHAD CHEMICALS LIMITED through WAQAS SIDDIQ KHATRI	42301-2909442-7	S/O MUHAMMAD SIDDIQ KHATRI	PAKISTAN	CHEMICAL MANUFACTURER	39-EMPRESS ROAD, LAHORE.	99,998 (Ninety Nine Thousand Nine Hundred Ninety Eight)	
WAQAS SIDDIQ KHATRI (NOMINEE DIRECTOR)	42301-2909442-7	S/O MUHAMMAD SIDDIQ KHATRI	PAKISTAN	BUSINESS	219/2, 35th STREET, KHYABAN-E-QASIM, PHASE-8, DHA. KARACHI	1 (One)	
AHMED MUSTAFA (NOMINEE DIRECTOR)	35202-8805314-7	S/O GHULAM MUSTAFA	PAKISTAN	BUSINESS	31-A, TECH SOCIETY, CANAL BANK, LAHORE	1 (One)	
		Total number of shares taken (in figures and words) (One Hundred Thousand)				100,000 (One Hundred Thousand)	

Dated the day of, 18 December 2023

Company Registration Office
Securities and Exchange Commission of Pakistan

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ASSISTANT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE, LAHORE

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THE COMPANIES ACT, 2017 (XIX of 2017)

(PRIVATE COMPANY LIMITED BY SHARES)

Articles of Association

of

ICL POWER (PRIVATE) LIMITED

3(5)(a)(ii)

THE COMPANIES ACT, 2017 (XIX of 2017)

(Private Company Limited by Shares)

ARTICLES OF ASSOCIATION

OF

ICL 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 **ICL 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. Mr. Waqas Siddiq Khatri (Nominee Director)
   2. Mr. Ahmed Mustafa (Nominee Director)

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a company, in pursuance of these articles 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
ITTEHAD CHEMICALS LIMITED through WAQAS SIDDIQ KHATRI	42301-2909442-7	S/O MUHAMMAD SIDDIQ KHATRI	PAKISTAN	CHEMICAL MANUFACTURER	39-EMPRESS ROAD, LAHORE.	99,998 (Ninety Nine Thousand Nine Hundred Ninety Eight)	
WAQAS SIDDIQ KHATRI (NOMINEE DIRECTOR)	42301-2909442-7	S/O MUHAMMAD SIDDIQ KHATRI	PAKISTAN	BUSINESS	219/2, 35th STREET, KHYABAN-E-QASIM, PHASE-8, DHA, KARACHI	1 (One)	
AHMED MUSTAFA (NOMINEE DIRECTOR)	35202-8805314-7	S/O GHULAM MUSTAFA	PAKISTAN	BUSINESS	31-A, TECH SOCIETY, CANAL BANK, LAHORE	1 (One)	
		Total number of shares taken (in figures and words) (One Hundred Thousand)				100,000 (One Hundred Thousand)	

Dated the day of. 18 December 2023

Company Registration Office, Lahore — Securities and Exchange Commission of Pakistan

CERTIFIED TO BE TRUE COPY

SECP

28/11/24

ASSISTANT REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE, LAHORE.

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Key Management of Biomass Power Plant

Mr. Sajjad Ahmad, Marine Engineer by profession, having an experience of 27 years, operating and managing Co-generation Power Plants.
Mr. Taqi-ud-din, a Mechanical Engineer by profession, having an experience of 25 years, operating and managing Cp-geenration Power Plants.
Mr. Aamer Ghafoor, an Electrical Engineer by profession, leading electrical side for power plants for the last 30 years.
Mr. Fayaz Hussain, an Electronics Engineer serving as Lead E&I, having field experience of 25 years.
Mr. Saleem Awan, First Class Boiler Engineer, serving as Utility Manager, having an experience of 20 years in boilers operation and maintenace.
Mr. Suhail Anwar, Masters in Environmental Sciences, serving as EHS Manager, having an experience of over 20 years.
Mr. Muhammad Rizwan, MBA and Supply Chain, serving as head of sourcing, having an experience of over 20 years in supply chain.

H.No.3, Street No.2 Sanjoli Estate, Addiala Road, Rawalpindi Pakistan.
Phone:92-51-5572607
Cell:92-3005176277

Sajjad Ahmad

Experience

April 13 – to Date **Head of Engineering** Ittehad Chemicals Ltd. Kala Shah Kaku, Lahore.

Reporting to Director Operations

Responsibilities:

- Oversee and coordinate on daily basis the ongoing maintenance activities of process equipment, Utility Grid, Power Plant and Utilities. Setting up and maintaining clear lines of communication with all maintenance & production functions involved.
- Coordinate Maintenance Plan and look ahead to meet Asset objectives and ensuring MTBR increases and MTTR reduces.
- Prepare analytical/statistical reports associated with maintenance activities, performance, cost, failure, resources and assets for various equipments.
- Actively monitoring, reporting monthly, and as required, the status and quality of the maintenance activities (to be) executed and the reporting through SAP maintenance reports with the aim to ensure continuous improvement regarding the effectiveness of maintenance.
- Participating in project teams in order to prepare and execute scope and maintenance preparations for the operational phase.
- Setting up and maintain an Asset Repair & Life Extension database to identify and control the activities/jobs required for future assignments of the Project.
- Ensure compliance with all company Health, Safety, Environment as well as Work Permit, policies and procedures.
- Compile/provide input for preparation of department Capital and Operating budgets and ensure annual expenditure remains inside the budgeted figures.

Jan 12 – to April 13 **HOD Utilities** Ittehad Chemicals Ltd. Kala Shah Kaku, Lahore.

Reporting to Director Projects

Responsibilities:

- Operation & Maintenance of 30 MW Power Plant.
- Compressed Air System.
- Gas fired and Hot Water Chillers 1300 USRT.
- Refrigeration Compressors 240 USRT.
- Boilers.
- Coal Gasification Plant 7000 Cu. Meter/hr.
- Cooling Water System of the Complex (Cooling Towers & Heat Exchangers).
- Deep well Turbines and pumping system.
- Natural Gas supply Network

July 09 – to Dec 12 **Captive Power Plant**, Ittehad Chemicals Ltd. Kala Shah Kaku, Lahore.

Plant Manager
Reporting to Director Projects

A 30 Mega watt Captive Power Plant with Wartsila engines as prime movers and their auxiliary machineries including Waste Heat Recovery and Fire Tube Boilers.

Responsibilities:

- As head of department looking after operation and maintenance of Plant.
- Ensuring cost effective operation of Plant.
- Procurement of spares for overhauls, essentials for smooth operation of Plant like Oils, chemicals and consumables.
- Establishing and implementing standard procedures for activities at Power Plant.
- Preparing annual budgets.
- Responsible for preparing feasibilities for any extension of Plant.

Engines included:

5 X Wartsila 18V34 SG **8042 BHP Each**

July 07 – to July 09 **Captive Power Plant**, Ittehad Chemicals Ltd. Kala Shah Kaku, Lahore.

Sr. Manager Power Plant
Served in a 30 Mega watt Captive Power Plant with Wartsila engines as prime movers and their auxiliary machineries.

Responsibilities:

- Reporting to Plant Manager Power
- Managing operation and maintenance of engines.
- Responsible for all maintenance activities planned, Preventive and troubleshooting through standard job requests and work orders systems.
- Indenting of spares for overhauls, Oils, chemicals and consumables.
- Establishing and implementing standard procedures for activities at Power Plant.
- As ISO representative for Power Plant.

Engines included:

5 X Wartsila 18V34 SG **8042 BHP Each**

Jan 04 – to June 07 Gadoon Power Plant, Gadoon textile mills
Industrial estate, Gadoon Amazai.

Maintenance Engineer

Worked in a 42 Mega watt Captive Power Plant with various engines as prime movers and their auxiliary machineries including Waste heat recovery and Fire Tube Boilers.

Responsibilities:

- Reporting to DGM Power Plant and leading maintenance department team in trouble shooting, routine/planned maintenances, Major overhauls of Engines and Turbochargers, record keeping and spares indenting and up keeping.
- Training of Staff for major activities and implementing standard procedures.
- Making Engines performance data sheets and planning corrective maintenance activities.

Engines included:

1 X Wartsila VAASA18V32E	**8042 BHP**
3 X MAN B&W 18V28/32S	**5500 BHP each**
2 X SsangYong 18V28/32H	**5027 BHP each**
4 X Caterpillar G – 3616	**4825 BHP each**
1 X Jenbacher JGS 620	**4155 BHP**
5 X Caterpillar G – 3516	**1293 BHP each**

June 2003 – Dec 2003 **Sitara Energy Limited**, Faisalabad.

Assistant Maintenance Engineer

Worked in a 48 Mega watt Captive Power Plant with Niigata Engines as prime movers running on furnace oil as fuel and their auxiliary machineries including Waste Heat Recovery Boilers.

Responsibilities:

- Reporting to Deputy Manager Power and leading maintenance team in trouble shooting, routine/planned maintenances, record keeping and spares consumption.
- Training of Staff for major activities and implementing standard procedures.

Engines Include:

8 X Niigata 18V32 CLX **8042 BHP each**

May 1997–May 2003

Started my service as Trainee Engineer on Sea Going vessels where I got training on Power Generation and Propulsion Systems.

After one year training, appeared in Competency Certificate Examination in Singapore 1999 and qualified as Certified Engineer Officer of the Watch.

Served for two years again in Pakistan National shipping Corporation, appeared for 2nd Engineer Certificate of Competency Examination in U.K in 2002, and qualified the Exam. Served another one and half year on board vessels.

Engines worked on during this period:

B&W 6L67GFC	**11200 BHP**
Sulzer 6RND 68M	**11200 BHP**
M.A.N 6KSZ 70/BL	**11200 BHP**
Daihatsu 8PSHTb 28D	**650 BHP**

Education:

B.Sc. Maritime studies Engineering branch.	1996	Grade A
F.Sc. Pre-Engineering, Lawrence College, Murree	1993	Grade A
Secondary School Certificate, Lawrence College,	1991	Grade A

Qualifications:

2002 College of Nautical Studies Glasgow U.K.

- Chief Engineer Naval Arch and Electro technology.
- Second engineer certificate of competency.

1999 Maritime port and security Agency Singapore

- Class 4 certificate of competency.

Professional Courses:

Advanced Fire Fighting	PMA, **Pakistan**
Medical First Aid	NMA, **Singapore**
Proficiency in Survival Craft & Rescue Boats	NMA, **Singapore**
Personal Safety and Social Responsibility	PMA, **Pakistan**
Basic Tanker Training Course	**Pakistan**

Personal Details

- Date of Birth 18th Jan, 1975
- Father's Name Ghulam Sarwar Khan
- Marital Status Married

TAQIUDDIN MUNIS

Lead Mechanical Manager

+923334293800
taqimunis@hotmail.com

https://www.linkedin.com/in/taqiuddin-munis-b119a888/

Lahore, Pakistan

SUMMARY

Experienced Industrial Maintenance Engineer/Manager having more than 20 years of experience in the field of **Chemical Manufacturing** and **thermal power plants.**

Dedicated Mechanical Maintenance Manager with 20 years of experience in overseeing maintenance operations in thermal power plants and chemical manufacturing complexes. Proven track record of optimizing equipment reliability, reducing downtime, and ensuring regulatory compliance. Seeking opportunities to contribute my expertise to a dynamic organization.

EDUCATION

BSc. Mechanical Engineering
University Of Engineering & Technology, Lahore, Pakistan

SKILLS

- Team Leadership
- Budget Management
- Technical Expertise
- Problem Solving
- Communication abilities
- SAP ERP
- 5 S
- MS Office
- Auto Cad

PROJECTS

- Linear Alkyl Beneze Sulphonic Acid (Labsa) 6 ton/hr. Apr 2021-May 2022 Linear Alkyl Benezene Suphonic Acid (Labsa) & Sodium Laureth Sulfate (SLES) 3 ton/hr.

  Mar 2018-May 2019
- Membrane Chlor - Alkali Plant 150 ton/day. Jul 2017-Aug 2018
- Steam Turbine & HRSGs

  Apr 2014- Aug 2016

PROFESSIONAL EXPERIENCE

Lead Mechanical Manager
Ittehad Chemicals Limited, Jul 2017- Preset

Ittehad chemicals is a pioneer in manufacturing of Chlor-Alkali products in Pakistan such as Caustic Soda, Hydrochloric Acid, Sodium Hypochlorite and Liquid Chlorine and surfactants plant producing different grades of LABSA and SLES.

Job description:

- Optimum utilization of resources to ensure all smooth and efficient operation of all plants/machines to meet annual production targets.
- Preparation of Annual Engineering Budget.
- Tracking expenses and overseeing the budget for maintenance in accordance of implementation of safe working practices.
- Supervising and leading all maintenance processes and operations. Planning & supervising annual maintenance shutdowns.
- Staff Training /Evaluation
- Developing company policies and standard operating procedures for all maintenance work
- Supervising new plant /equipment construction, installation. Staff Training /Evaluation
- Vendor evaluation with the liaison of procurement manager. Inventory management.
- Hiring and management of subcontractors and other vendors for specialized maintenance work

- Hand on experience of maintenance/major overhauling of **pumps** (Grundfos, KSB,and Bertram high temperature salt pumps etc.), **Engines (**Pielstick 23.6 Mwatt, Cat 3516B, Jenbacher 620E, and Wartsila 16V34SG etc.), **turbines** (Solar Gas turbine 7.2 Mwatt, HTC steam turbine), **compressors** (Gardner Denver, Flowtech, Ochner Gas compressor,ingersol rand air compressor etc.) And other rotary, Hydraulic and static equipment (boilers, HCl furnaces, Heat exchangers, condensers, evaporators etc.)

Deputy General Manager
Gadoon Textile Mills (Power Plant), Dec 2013- May 2017

Gadoon Power plant comprise gas & Furnace oil based Thermal Power units (Reciprocating engines) of make Man B& W, Caterpillar, SsangYong, GE Jenbacher and steam turbine along its auxiliaries HRSGs, Compressors, Cooling towers etc. with total installed capacity of 60 Mega Watt.

Job description:

- Overall plant operation, maintenance.
- Supervising predictive/preventive maintenance schedules for HFO, diesel, Gas generators and steam turbine.
- Managing boilers annual inspection for certification.
- Planning, Plant modifications and execution of upcoming new projects.
- Leading Mangers and engineers for day to day issues and problems.

Technical Manager
National Engineering & Trading Co, May 2011- Dec 2013

Netco is service providing company, dealing in industrial parts, services and trouble shooting, mainly in IC Engines, Compressors, and rotary equipment.

Job description:

- Leading technical teams
- Managing and organizing service teams as per requirements.
- Handling client technical inquiries and complaints.
- Projects technical evaluations and feasibilities.

Deputy Plant Manager (Power House)
Kohinoor Textile Mills (Genertek Division)
Apr 2009- May 2011
Kohinoor Genertek was set up as an independent power plant to supply un-interrupted electricity to the other divisions Kohinoor textile Mills. The division has an installed capacity of about 30 Mega-Watts electricity and 30 ton per hour steam, which can be produced on a variety of fuel such as gas, furnace oil, coal and biomass depending on price and seasonal availability.

Deputy Manager (power Plant)
Ittehad Chemicals Limited, Fab 2007- Mar 2009

Maintenance Engineer (power Plant)
Ghazi Fabric International Limited, Oct 2003- Fab 2007

Trainee Engineer
Southern Electric Power Company Limited
May 2002- Sep 2003

CURRICULUM VITAE

Name:	Aamer Ghafoor
Father's Name:	Abdul Ghafoor Chaudhary
Date of Birth:	03-9-1965
Religion:	Islam
Permanent Address:	334 B Gulfishan Colony Jhang Road Faisalabad
Phone:	0336-7982298
Email:	aamer.ghafoor@yahoo.com

QUALIFICATION:

EDUCATION/QUALIFICATION

- Bachelor of Science in Electrical Engineering.
  From University of Engg & Technology, Lahore **IST DIVISION**
- F.Sc Pre Engg.
  From Pakistan Steel Cadet College Karachi. **IST DIVISION**
- Matriculation **IST DIVISION**

Experience:

- **Fuji Pakistan Pvt Ltd**
- Electrical Engineer.
- 1991-1993
- **Saudi Aramco Saudi Arabia**
- Project Engineer (E&I)
  1993-1995
- **Schneider Pakistan (Mark**
- **Industries Pvt Ltd)**
- Electrical Manager
- 1995-2006
- **Masood Textiles Ltd**
- Deputy Manager Electrical
- 2006-2007
- **Ittehad Chemicals Ltd**
- **Unit Manager Power**
- **Electrical**
- Working as Unit Manager Power Electrical from 2007 to date at **30**

MW Gas Power Plant **(Wärtsilä Engines 18V34SG)** at Ittehad Chemicals Ltd, Kala Shah Kaku Sheikhupura

Field Experience:

- Installation and Commissioning of all Electrical and Instrumentation Equipment of the 30 MW **Wartsila** Gas Power Plant and worked with WARTSILA service engineers during 16K ,32K,48K maintenance & **UNIC C3 Upgrade**.
- Trained on Supcon DCS from China
- Installation & commissioning of SUPCON DCS on Power Plant auxiliary
- Installation and configuration of **DCS** of Process Plant equipment.
- Installation and parameter settings of the **ABB UNITROL 1000-15**, Excitation system through its software **CMT. & ABB 1020 AVR**
- Installation, wiring and parameter settings of the **BASLER** Digital Excitation Control Systems through its software.
- Troubleshooting, and testing of the **Wärtsilä** Engine Control System **WECS 3000/UNIC C3**, Cylinder Control Unit, Knock Detector Unit, Sensor Multiplexer Unit, Distributed Control Unit.
- Troubleshooting and Control Circuit checking of Engine Control and Monitoring systems.
- Worked on SIEMENS S7 300 &200 PLCs
- Troubleshooting and maintenance of **ABB Variable Frequency Drives** and parameter settings.
- Troubleshooting and maintenance of the different types of Control Valves actuated by **I/P** transducers, electric motors etc...
- Installation, wiring and commissioning of Field Instruments including Pressure, Temperature transmitters.
- Installation, wiring and configuration of Field Instruments including Pressure Transmitters based on **HART** Communication Protocol.
- Installation and calibration of **HART** based Transmitters used for Process Flow, Level and Pressure.
- Installation and wiring of different types of Temperature Sensors including PT100, Thermocouples and Controllers.
- Used **Fluke** Process Calibrators **743B**, **ABB HART** Communicator.
- Worked on ABB, SIEMENS, MURPHY, EUROTHERM, Yokogawa and ROSEMOUNT Instruments.
- Installation, wiring and configuration of Gas Flow meter make **RMG** Flow /Totalizer
- Measurement of Generator stator winding insulation test using High Voltage Megger, and winding insulation condition assessment.
- Maintenance of LV electrical motors, winding resistance check, winding insulation resistance & PI test and assessment.
- Installation and commissioning of Amot Control Valve for hot water chiller.
- Testing of Instrument Transformers and interpreting of different classes.

- Troubleshooting, testing and maintenance of Operating Mechanism of 13.8KV & 11KV Switchgear Vacuum type Circuit Breakers.
- Installation & configuration of Vamp/Schneider protection relays.
- Installation & configuration of MRN3-1 Woodwards relay.
- Trouble Shooting of **GGT** (Gerber Garments Technology U.S.A.) fabric cutters.
- Maintenance & trouble shooting of WHRB,gas/furnace fired boilers.

PRINCIPAL DUTIES AND RESPONSIBILITIES

To manage a team of **55** men looking after Maintenance Installation & Troubleshooting regarding E&I, mechanical maintenance & operations

- **Finalization of programme** and works including all activities in accordance with electrical, electronics, and mechanical.

Repairing of all **electronic cards** (PLC I/O, DC Drives, VFD, Power Supplies, Temperature Controllers, Pressure transmitters, flow meters etc.)
Programming of PLC
- Calibration of all instruments
- I have done with full responsibility of all trouble shootings for electrical, electronics and instruments problems.
- I am a member & Key User of **ERP SAP** Plant Maintenance module Team.

- **PERSONAL VALUES**

- Achievement, expertise, to strive towards perfection and self-realization are the values I hold very close.

- **STRENGTH & WEAKNESSES**

- Good communication, Self-confidence, rational approach towards situation, adaptability towards surroundings, relating well, and sense of humor are my strength. I would like to work on the area such as being diplomatic where required.

RESUME

Fayaz Hussain Shah

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BELOW FOR RÉSUMÉ DETAILS

- Career
- Skills
- Trainings
- Education
- Qualification
- Awards
- Personal Data
- References

Thursday, March 14, 2024

Attention :
Reference No. :
Job ID :
Dear Sir or Madam:

I have 28+ years of Engineering/Managerial experience in Manufacturing/Operations, Utilities, Projects, Maintenance and Procurement. Most of my job experience is in Lever Chemical Private Limited (Sulphonic Acid Plant), Unilever Pakistan Limited (HPC Plant), Rahim Yar Khan, and Wall's Ice Cream Plant, Lahore. In Ittehad Chemicals Limited worked as Senior Manager E&I and currently is working as Head of Electrical/I&C/TPM.
My goal is to work at senior level position in the Supply Chain Function where I can use my **Knowledge & Experience** to deliver the best results to the organization.

Specialties:

Electrical & Instrumentation, Project Management, Manufacturing Management, Procurement, Engineering Planning, Inventory Management, Supply Chain Management, Electronics Engineer, FMCG, CMMS – MP2/D7i, ERP – SAP, ARIBA, MS office, TPM, TQM, HSE, HAZOPS, HACCP, FWS- Frame Work Standards, Maintenance, Innovation, Cost Saving Projects, PSRM, PLC & DCS, HT/LT Switchboard Designing, Field Instrumentation & Cabling.

Sincerely,

Fayaz Hussain Shah

WORK EXPERIENCE/ACHIEVEMENTS:

Lead Manufacturing Project, Electrical/I&C	ttehad Chemicals Limited	2021 - Present
Unit Electrical/I&C	Ittehad Chemicals Limited	2016 - 2021
Senior Manager Electrical/I&C/Projects	Ittehad Chemicals Limited	2012 - 2016
Procurement Manager – Indirects	Unilever Pakistan Limited/Unilever Bangladesh Limited	2009 – 2012
Factory Engineer / Maintenance Manager	Unilever Pakistan Limited	2008 – 2009
Corporate Manager E&I/Services Manager	Wall's Pakistan Limited	2006 – 2008
Assistant Manager E&I/ Engineering Planning	Unilever Pakistan Limited	2001 – 2006
Junior Manager E&I	Lever Chemicals Private Limited	1994 – 2001

Lead Manufactruing Project, Electrical/I&C — 2021 – Present

Ittehad Chemicals Limited - Lahore

Responsible & Accountable for **Maintenance, TPM & CAPEX** related activities of site E&I Department & Projects, Ittehad Chemicals Limited (ICL) is the pioneer and one of the largest manufacturers of industrial chemicals in Pakistan:

Our Products:

- Caustic Soda (Liquid / Solid / Flakes)
- Sodium Hypochlorite
- Liquid Chlorine
- Hydrochloric Acid
- Shaffaf (Bleaching Earth)
- CP (Chlorinated Paraffin)
- Zinc Sulphate
- Barium Sulphate
- Calcium Chloride

- Project LABSA-II 6TPH
- Project Capacity Enhancement Power Plant
- Project Grid Up-gradation
- Project Energy Conservation
- Anuual KPIs, Performance development, and Maintenance Management through Monthly, Quatrly & Half Yearly reports.
- Manpower rationalization through trained work force & systems up-gradations by 29%
- **RESOURCE TO BE MANAGED**: Total number of Team Members – 20 Managers & Engineers, 89 Officers and Technicians/Fitters & 6 Contractors & their staff.

Unit Manager Electrical/I&C — 2016 – 2021

Ittehad Chemicals Limited - Lahore

Responsible & Accountable for **Maintenance & CAPEX** related activities of site E&I Department & Projects,

- Developed **ICL Maintenance Strategy** - focus on key deliverables, which are:
  - Developed Maintenance Schedulers
  - Maintenance Criteria - **RBI**
  - Equipment Ranking
  - Failure Ranking
  - Breakdown Analysis – **Pareto Tools (YY – Analysis, FMEA, PM Analysis)**
- Successful Implementation of 5S – A Launch Pad to Lean Manufacturing (TPM) at Plant as well as in Head Office (Total circles at plant – 57 & at HO – 6)
- 2nd Step towards TPM is activation of Five Major Pillars (PM, KK, JH, E&T, HSE), this will take two years' time to achiever Level-1.
- ICL is fed via 132kV single circuit overhead transmission line from LESCO grid station. This supply is stepped down to 11 kV through 04 No. Step down power transformers of capacity 10/13 MVA & 20/26 MVA.

- The 11kV network includes 04 No. rectifier transformers which are IEM rectifier of 12.74 MVA, and axillary side of plant we have 6 No Substations with are powered by two 2000KVA, Two 1600KVA, and 3 1500KVA Distribution Transformers.
- Power Plant Maintenance – 5 Nos. Gas Gensets 7.491MVA capacity each - Wartsila
- Managing & reducing R&M 43.7 Mln to 25.1 Mln PKR (Reduction of 42.6Mln till date) with 275 Mln PKR CAPEX.
- Project IEM-II Phase-2 & IEM-III includes:
    - 3Nos 12.74 MVA rectifier transformer
    - ABB Rectifiers of 60KA capacity at 350 VDC
    - SUPCON DCS Capacity increase in terms of I/Os
    - Three HCL Furnaces automation

- Project Grid Up-gradation & Substations includes:
    - Replacement of 12 MVA TR with 20/26 MVA TR
    - Replacement of 3 Nos 10/13 MVA TRs with 20/26 MVA TR
    - Replacement of CP/RP panels
    - Replacement of 36 Nos. 11KV Switch gears across plant (Grid, Substations, Power Plant)
    - Replacement of old Electrical Distribution Panels on LT side of circuit.
- Project Caustic Evaporation Plant installation & Commissioning
- Project LABSA installation & commissioning.
- Reduction in breakdowns by 65%.
- Inventory Reduction by 30%
- Energy Conservation Study through internal teams – targeting a saving of 5% this year.
- Anuual KPIs, Performance development, and Maintenance Management through Monthly, Quatrly & Half Yearly reports.
- Manpower rationalization through trained work force & systems up-gradations by 29%
- **RESOURCE TO BE MANAGED**: Total number of Team Members – 15 Managers & Engineers, 89 Officers and Technicians/Fitters.

<u>Senior Manager Electrical/I&C/Projects</u> **2012 – 2016**

Ittehad Chemicals Limited - Lahore

Responsible & Accountable for **Maintenance & CAPEX** in my area of responsibility,

- **Planned Maintenance Jobs** completion rate - Achieved **80% A-Rank & 50% B-Ranks Equipment.(** That includes, 132KV Grid Station installed with four transformers, 11KV Main Distribution Board, LT Electrical Substations – 04, MCC Panels & Motors - +700, ABB/Supcon DCS – 03 (with +5000 I/Os), Siemens PLCs 300 Series, Control Valves, PT/LTs, etc.)
- **Breakdown Reduction Plan of 10%** because of our Maintenance Strategy – 2012/2013 Vs 2013/2014. **Achieving ZERO BD in two major areas.**
- **SAP Implementation** – Leading Engineering Team Activities for PM Module in SAP.
- Planned **Capital Expenditure - 1100 Mln PKR& Maintenance budget – 20 Mln PKR.**
- Developing companywide **KPIs – Key Performance Indicators, to monitor Departmental Performance.**
- **Implemented 5S across site - TPM** – Profit through Maintenance.
- **Leading plant Energy Conservation activities –** by establishing Task teams in every department to generate **"Idea to Save Energy".**
- Established **TNA – Training Need Analysis,** for all Engineers & Technician.
- Ensuring availability of critical spares & Inventory Levels.
- Establishing PM (Planned Maintenance) Schedules & Calibration procedures for a **750 IOs** system, **AC800F ABB DCS.**
- Commissioning of **Coal Gasification Plant**, cascaded with**15 Ton/Hr Boiler** at 15 Bars working pressure.

- Establishing redundancy of **ABB 800F DCS** system, at our **IEM (Ion Exchange Membrane) Plant – 400 Ton/Day Capacity installed with VMS (Voltage Monitoring System)**.
- Ensure maintenance of **Substations SS-2/3, CCIL Plant (HCL Furnaces, Cl2 Compressors & Utilities), 2-1500KVA 2- 1000KVA Distribution Transformers**.
- Installation & Commissioning of **ABB Rectifier System, designed total DC of 2X(2X15KA), AC800PEC** with input voltage of 11KV, rated DC voltage 380V.
- Installation & Commissioning of New **Spin Flash Dryer – Bleaching Earth**, Capacity **2Tons/Hours.**
- **New IEM Plant**, Finalization of E&I requirements specially **SUPCON DCS** & field instrumentation (Control Valves Sizing-Flowserve, Flowmeters-Honeywell etc). Rectifier ABB of 60KA capacity at 350 VDC and other electrical switch gears & panels.
- **Heat Recovery Boilers** on each furnace, in-house programming & Logic development on **AC800F.**
- Commissioning activities – **A Success Story of "Load Management System" on Supcon DCS achieved Zero Breakdown.**
- **RESOURCE TO BE MANAGED**: Total number of Team Members – 8 Assistant Managers, 4 Officers and 45 technicians.

Procurement Manager – Indirects **2009 – 2012**

Unilever Pakistan Limited/Unilever Bangladesh Limited – HO (Karachi)

- Responsible & Accountable - Achievement of **Cost Saving** targets in country – 500Mln PKR, Increase in **IP coverage – from 54% to 90%**, Excellent in **Cash Delivery**(credit of payment) – 112Mln PKR.
- Clarification in systems & processes for procurement activities in **POS-Marketing, Activation, Outdoor, AW Production, CAPEX, R&D & MRO, ESPS, IT, Logistics & Warehousing** and waste disposal activities.
- Led **Project Ariba** – for Pakistan & Bangladesh – a **Procurement Management System P2P** & be part of **SAP implementation Team** of Supply Management Module.
- Implemented **No PO No Pay Policy** in Unilever to enhance further controls & streamline payment process.
- Responsible for ongoing **Supplier Relationship Management** - monitoring, review and continuous improvement as well as leading supplier side of innovation/sustainability/cost savings projects.
- Coordination for spend, **Internal Customer** needs, insight of **Supply Markets** (e.g. suppliers, price trends, cost drivers, acquisitions & disposals etc.)
- Developed **Bulk Ordering / Cataloguing System** to further get competitive rates for company savings, value addition & quickened the procurement cycle.
- Developed **Sourcing Strategy** (tendering, analysis, selection, including crafting and placing of legal agreements / contracts, criterion for **Supplier Selection** and **Negotiation)**- in accordance with Unilever's code of business ethics and corporate social responsibility requirements..
- Created **Cost Models**, identify and track cost drivers for all areas of spend, especially Travel, Transport, warehousing, Engineering & Construction services.
- Established **VMI – Vendor Managed Inventory** Program, to reduce engineering inventory by 15% at different plants across Pakistan.
- **Supplier rationalization (from 8500 to 2500)**
- **Spent Coverage** was around 16% to 18% of total company turnover.
- Identify need for and support **Design of Business Processes** to facilitate use of appropriate **"Buying Channel"** (e.g. spot buying desk in factories/3Ps etc.).
- Managing total Spent of around **10Bln PKR and 3.9Bln PKR** of CAPEX Spent.
- **RESOURCE TO BE MANAGED**: Total number of Team Members – 19,Out of which UPL payroll Managers – 7, and contractual staff – 12

Factory Engineer / Maintenance Manager **2008 – 2009**

Unilever Pakistan Limited – HPC Factory (R. Y. Khan)

- Responsible & Accountable for successful implementation of **PSRM, MoC, & TPM** within the HPC site. Led the Preventative **MAINTENANCE, Operational Efficiency, Minimum Downtime, CAPEX, and Engineering Store & Utilities area.**
- Increased **overall equipment efficiency – OEE** of the plant from **70% to 85%.**
- Coordinate all **Autonomous MAINTENANCE**, **Preventative MAINTENANCE**, Energy Conservation Projects **(300 Mln PKR)** & all Focused Improvement activities.
- Helped the manufacturing site in achieving **TPM Level-1 Consistency Award**. Increased the **Autonomous Maintenance Ratio** at the plant from **30% to 60%** by training the machine operators so that they could take care of their own machines.
- **Reduced Inventory Cost from 63Mln PKR to 53 Mln PKR**.
- Ensured that the **Maintenance Expense** did not exceed the budget – **100 Mln PKR & 1Bln PKR of CAPEX**.
- Directed and managed **Planned Maintenance** of machines as per schedule and monitored the performance of the machines
- Worked to continuously improve the plant operating cost structure, through productivity and/or **CM – Corrective Maintenance.**
- Participation in all aspects of employee relations including, Performance Management, Counselling/Corrective Measures, Positive Reinforcement, Union Relationship and Grievance Management.
- Launched **SCT training program** first time in HPC– **Achieving 100% Result in developing superior talent for future leadership**.
- Complying with **Unilever Health & Safety Framework and Specific Standards** – Zero LTA in Engineering.
- Improved the overall **Quality Demerit Index** of the products through dedicated cross functional teams with a focused approach. Improved the **Quality Ownership Ratio** at the plant from **60% to 90%** by transferring jobs from QA Inspectors to Machine Operators.
- Ensuring the integrity of the process for capturing improvement ideas **(Kaizens)**.
- Monitoring & Enhancing productivity, performance of equipment/prepare **cost & benefits analysis** and payback period for proposed development/equipment.
- Led plant - **EEM (Early Equipment Management)** Pillar of TPM.
- Developed and Led training regarding the transfer of all TPM through OPL's (One Point Lessons)
- **CSM – Contactors Safety Management**, to monitor the performance of Engineering contractors (Fabrication, Machining, Civil, Electrical, Piping etc) – Reduced 450 to 150
- **RESOURCE TO BE MANAGED**: 4 Assistant managers, 6 Junior Managers, 35 Workers and 140 Contract workers.

<u>Corporate Manager E&I/Services Manager</u> **2006 – 2008**

Wall's Pakistan Limited – Ice Cream Factory (Lahore)

- Responsible & Accountable for successful Operations, CAPEX, & MAINTENANCE in Utilities/Services **(Boilers, HVACR, E&I).**
- MAINTENANCE costs **Reduction by 10%, Reduction in Cost of Parts and Inventory** by **15%**
- Ensured implementation **Regulatory Procedures** and requirements at Plant by the local, state and federal levels (Electricity Act, Boiler Act & Petroleum Act).
- Breakdown Reduction by 20% - **Achieved 5 Zeros Failures** through **PM & KK (Focused Improvement)** Processes.
- Developed **CBM – Condition Based Maintenance System** for Electrical Department across Pakistan.
- **Project Management** - Primary objective is to implement agreed capital projects in accordance to agreed timelines and cost – **400 Mln PKR**.
- Managed Projects with adherence to required quality and agreed timelines, monitored activities using **MS Project**
- Developed **PSRM (Process Safety & Risk Management)** & Standardization department - **Established PSI (Process Safety Information), PHA (Process Hazard Analysis),** implement all 13 modules of PSRM in HPC

Plant. Main features were **(MoC, PTWs, HAZOP, Documentation** & Standardization of all 3Ps (Process, People, & Procedures).

- Developed Electrical Systems (**LT/HT Substations, Transformers, distribution Network, MCCs & Equipment selection) and Instrumentation (Siemens PLC S7, S5Programming, field instrumentation selection)**
- Ensured **Zero accident** in Utilities by rigorously following the DuPont's Safety Model (**Safety Contacts, Deep Compliance Audits, Near Miss Reporting, THA, HACCP**, etc.), meeting all the **leading and lagging indicator** targets set at the start of the year. Played active role in the site's successful passing of the Framework of Standards Audit.
- Worked as **Project Manager** at our **Wall's Expansion 2.5 Bln PKR Project**, Installation of Pakistan's Largest Ice Cream Plant, major highlights:
  - Installation of **HT Main Switch Board 11KV, Siemens VCBs**
  - Installation of **Distribution transformers** 4 Numbers **2000KVA/each**, Siemens make
  - Installation and commissioning of **LT Switch board to run 5MW load**, designed at 50C and IP-54
  - Installation & Commissioning of **Four Ammonia Compressors 410KW** (double stage)/each for Refrigeration Plant
  - Installation of **S7 PLC and SCADA – WinCC** system for Refrigeration Plant to run 8 Compressors
  - Installation & Commissioning of Ice Cream Mix Plant, field instrumentation and wiring of more than 5000 I/Os
  - Installation & Commission of **Honeywell EXPERION DCS** have three **controllers C-210 series** with dual server system
  - Installation of Ice Cream Packing machines
  - Coordination with WAPDA & Electrical Inspector for expansion in load
- **RESOURCE TO BE MANAGED**: 6 Junior Managers, 35 Workers and 40 Contract workers are reporting at HPC Plant and 4 Managers on other four sites (Walls, Tea & Foods).

Assistant Manager E&I/ Engineering Planning — 2001 – 2006
Unilever Pakistan Limited – HPC Factory (R. Y. Khan)

- Responsible & Accountable - Successful Operations, MAINTENANCE & CAPEX in E & I team.
- Design & development **HT/LT substations, Distribution Transformer selection, design of distribution Network LT side, MCC panels & Electrical equipment selection**.
- **Design & development of Instrumentation & Control systems**, field instrumentation selection, and establishing calibration procedures.
- Led, Effective assets management, **New CMMS (computerized Maintenance Management System) D7I (Datastream 7I software)** was launched, previously we were using MP2.
- Responsible & Accountable, for all activities related to **Engineering Planning**, like developing maintenance schedules for Planned Maintenance activities, coordinate between Production, Engineering, Production Planner & Engineering store to successfully initiate **PM tasks** and allocation of proper resources, managing workload.
- Led site **Planned Maintenance Pillar**: Developing equipment ranking, analysis of breakdowns, implementation of planned maintenance system & reviews, trainings to increase man & machine efficiency. Monitoring of all PM related KPIs achieved an increase of **MTBF**, reduction in **MTTR**, reduction in **breakdowns**, reduction in **Repair and Maintenance cost**, reduction in Energy consumption.
- Initiated **8-WEEK PM Rolling Plan** for HPC site against all sort of PM activities, to synchronize all present tasks, pending tasks and future PM tasks between all stake holders (Area Engineers, E&I Engineer, Utility Engineer, Maintenance Engineer)
- Setting and developing of annual Targets / **SIA (Strategy into Action)** - Coordinator of Engineering Team
- Responsible for the Budget control of Services department - **Reduced by 40%**

- Implementation of **TPM (Total Plant Maintenance)** philosophy in maintenance and following PM-6 steps to minimize breakdown losses in **utility area -Achieved Zero Breakdowns in utility for two years**.
- Coordinating all Safety related activities of engineering department, developing **THA, Risk assessments, PHA, HAZOP studies, DuPont Behavioural safety contacts, and 5-Hazard Program**.
- **Lead Auditor – Electrical & Instrumentation systems**
- Engineering department **ISO 9001/14001/18001 Coordinator**, and developed procedures.
- Installation of **15TPH, 12Bar - fire tube Boiler - Siemens PLC S7-314C** & UniGas Italy make Burner installed with LMV-51 (Siemens Fire Sequence & Gas Proving Controller)
- Zero Breakdown Project - Three LUX soap line integration - Using **Siemens PLC S7-314C and HMI (Human Machine Interface) OP-270** – Reduction in man-power (from 12 to 2). Designed MCC Panels and coordination of all installation & commission activity.
- Developed **Skill Matrix** for technical staff - Training modules were developed, after their skill gap analysis- Trainings were conducted through Training Modules, SOPs, OPLs & Team discussions.
- Commissioning of Soap bits making plant was done with in-house manufacturing of all **control panels and MCC panels**. Total installed load of this Plant 200KW.
- Installation/Commissioning of Two High speed soap wrapping lines (450TPM) with **PLC S7-314c & Simodrives U611(Stamping USN-2400 & Wrapper BSW-550)** -Total Installed Load 1000KW load(Developed MCC Rooms, Cable layings, Trays etc.)
- New Soap drying plant was installed, **Binacchi Italy made.**
- Slurry Feeding System for Lux Soap with Stripes – Using **VFDs, Dosing and flow-metering system**.
- In-house manufacturing of Jar Filling machine was done for Ponds face cream. Installed with **PLC-S5-103-** Saving of Rs. 7Mn.
- Installation and commissioning work was complete **on 3-Ton shampoo mixer**, which included auto-dosing system, automatic system was also developed for heating/cooling cycle.
- Electrical up-gradation of Soap making plant, to reduce breakdowns & improve safety.
- Installation and commissioning of **11KV switchboard Room (1-incoming, 3-outgoing),** Vacuum circuit breaker (VCB) Siemens (2 – 1000KVA & one-1500KVA).
- Responsible for **MAINTENANCE of TWO DIESEL GENERATORS (624KVA & 425KVA).**
- **RESOURCE TO BE MANAGED**: 3 Junior Managers, 10 Workers and 40 Contract workers are reporting.

Junior Manager E&I — **1994 – 2001**

Lever Chemicals Private Limited – HPC Factory (R. Y. Khan)

- Responsible for the Schedule Maintenance activities in E&I: **Maintenance record Cards** for motors (700 in number), **Annual De-hydration** of Distribution Transformers (two 1000KVA, one 1500KVA, one 750KVA). Maggering of **HT/LT Winding of transformers, Earth Pits, Power cables, Checking of VCB & ACB parameters** and testing, Inspection of portable equipment & Classified areas Installations like (Diesel storage tanks, perfume storage area),
- **Earth loop testing procedure, Short Circuit current level study** at different areas from main switchboard room.
- Replacement of **Old Main Switch Board with New**, to handle 4MW load, Three Incoming feeders from Transformers – Bus Couplers & Generator incoming Feeders with new **PFI Plant**.
- Responsible for E&I in **Continuous Process plant, Balastra Italy Make** with a capacity of 24tons per day, to produce **sulphonic acid** which is used in detergent Powder and laundry soap:
    - Worked on **Honeywell PLC 9200e series**, and **SCAN-3000 (SCADA) system**, was installed on plant utilities, storage tanks for raw material
    - Development of maintenance history cards for motors overhauling, calibration schedules for field instruments like Mazoniline Control valves, Auto-tuning of **Honeywell UDC-3000/3300** single loop controllers, E & H mass-flow meter and pressure transmitters through deadweight tester , **RTD simulator, Beamex TM305 and PM 405**.
    - Mazoniline Control Valves, I/P Converters, Positioner, and their calibration.

- Transmitters (Pressure, Flow, Temperature & Level), selection & calibration.
- Dorman **Diesel and gas generators (350KW each)** operation & maintenance.
- Training of operators on generator panels on followings, share load in auto & manual modes, synchronization of both generators etc
- Auto control system development for Instrument Air dryer.
- Developed auto tuning procedure for PID loops.
- Developed control for critical loop of interlocking of LAB & SO3 in reactor.
- Conducted **HAZOP study**.

- Repair & Maintenance of **Komatsu Fork lifters** (Four Battery operated lifters), that includes quarterly inspection of DC motors (Main Motor, Steering Motor, Hydraulic Motor) & carbon brushes.
- Installation and Commissioning of **ETP (Effluent Treatment Plant).**
- Designing and development of Perfume post dosing system on **PLC S5-103** and its instrumentation.
- In-house development of Soap Processing plant controls using - **SEW VFD** (Frequency Inverters) for agitators **– Developing Automatic Dosing System for Oil, Caustic and Water storage tanks**
- Installation and commissioning of **Tea Processing Plant** in Mansahra, Northern Area of Pakistan, which included distribution transformer, LT main Switch Board Room, Tea Dryers and Blowers
- Installation & commissioning of Big Nose machine, sachet with nozzle & cap, Bossar Italy, with **Omron PLC-C20.**
- Shampoo Sachet Filling machines were manufactured in-house (10 No.). Developed all controls logics, installation of field pneumatics, photocell, proximity sensors, door safeties, etc. – Savings Rs. 80Mn.
- Commissioning & Installation of **Screw Compressor 675CFM** with VFD (110KW) ALUP.
- Complete centralization of HVAC Department of 300TR Capacity - six Carrier Chillers (30TR each) – In-house developed all controls and Electrical Panels.
- Made new control panels for **slip-ring motors (100HP each)**, 4 numbers, for Ammonia Compressors.
- Installation and commission work of **Fire-alarm system** for our, Main office Block, Admin Block, Material Storage Warehouses,
- In-house Developing Automation & Control System for **TFM control on Soap Dryer, used E&H magnetic flow meter Megpro, UDC-3300, SEW VFD** on soap feed pump, and **Spirax Sarco motorized control valve** on steam – Achieving Savings Rs.10Mn/Annum.
- Installation/commissioning of **12TPH, 12Bar DDFC fire tube Boiler**, with Gas and Fire protection system by Lands & Gayer LFL & LDU on Hamworthy (England) Burner
- **Safety Coordinator**, to initiate safety meetings, developing plant Planned Inspection procedures to strengthen systems in E&I.
- Programming of control of Case Packing Machine on **Siemens PLC S5-103**, using STEP-5.
- Troubleshooting & maintenance of **Soap packing machine Tavoform** – Using Corrective maintenance techniques by replacing its mechanical Cam switches with proximity sensors.
- Responsible for the repair & maintenance and safe operation of **Imaje Ink Jet Printing machines S3, S4, S7, & S8 series**
- Circuit tracing & Development of Control diagrams in HPC factory
- Personal skills development of Instrumentation Technicians, like PLC trainings, in-house developed **S5 - Simulator.**
- **RESOURCE TO BE MANAGED**: 6 electrical technicians & 4 Instrumentation technicians, 40 Contractor workers and 4 Ink Jet Technicians.

KNOWLEDGE & SKILLS:

- Maintenance Management
- Cost Management
- Negotiation and Communication
- Supply Chain Management

- Continuous Improvement
- Project Planning & Management
- People Management
- Team Building
- TPM Implementation
- Cost Modelling
- Inventory Management
- ERP SAP/ARIBA
- CMMS systems implementation D7i, MP2
- Field Instrumentation & Control Selection & Maintenance
- Field Cabling, Ducting - Sizing & Installation.
- MV/LV Distribution Network Designs, Equipment Selection.
- ABB DCS, Honeywell DCS, SUPCON DCS and S5, S7 Siemens PLC Programming
- Work Experience on **Honeywell EXPERION & ABB S800 DCS**
- Hand-on Experience in Maintenance of ACMA, Binnachi, Bossar, Ulma, Dimmar, Mazzoni, Ballastra Plants, Caustic Soda Plant & Equipment.

TRAININGS:

➢ Slim Fast & Regional Cost Management Workshop	AAC Team, Malaysia
➢ Unilever Intermediate Management Leadership Course	AAC Team, Malaysia
➢ IPLC-Intermediate Procurement Leadership Course	AAC Team, Singapore
➢ Finance for Supply Chain Managers	LUMS, Pakistan
➢ Advance Negotiations	LUMS, Pakistan
➢ Project Management	LUMS, Pakistan
➢ Process Safety Risk Management & HAZOPs Workshop	UPL, Pakistan
➢ TPM Instructor Course	JIPM, Vietnam
➢ HAZOP Study Course	FFC, Pakistan
➢ Regional training of Behavioral Safety Program	Du Pont, India
➢ Electrical Design & Safety Instructor Course	EET, Thailand
➢ ISO 9001/14001/18001 Basics	BVQI, Pakistan
➢ Simodrives 611U & Servomotors FT/FK Course	Siemens, India
➢ SUPCON DCS Configuration & Programming Course	SUPCON, China
➢ Asset Integrity Management	GII, Pakistan

EDUCATION:

B.E. Electronics, NED University of Engineering & Technology Karachi, Pakistan	**1993, 85.7%, Grade A+**
F.SC Pre-Engineering, Khawaja Farid Degree College, R.Y. Khan, Pakistan,	**1987, 73.9%, Grade A**
Secondary School Certificate, Pilot Secondary School, R.Y. Khan, Pakistan	**1985, 79.3%, Grade A**

QUALIFICATIONS:

- Professional Engineer (PE), Pakistan Engineering Council, Pakistan
- TPM (Total Plant/Productive Maintenance) Certified Instructor, JIPM (Japan Institute of Plant Maintenance), Japan
- Certified Auditor of BBS (Behavioural Based Safety), DuPont Model, India
- Lead Auditor of Electrical & Control Systems, Engineering Excellence Team Unilever, UK

PERSONAL AWARDS:

- **VIP Award** - Passion for Winning - Developed Software of Packing Machine and saved a production loss of one week
- **VIP Award** - Bringing out Best in All of Us - Timely execution of Project Saigon, New High Speed Soap Production Line of Binacchi Italy
- **VIP Award** - Project Simplification - Simplified more than 7 control Processes

- **Ittehad's Bests** - BPO - SAP Implementation

PERSONAL DATA:

- Father's Name: Zahoor Ahmed Shah
- Marital Status: Married
- Blood Group: O+
- CNIC No.: 31303-8377153-9
- Passport No.: KR 5141532
- Nationality: Pakistani
- Date of Birth: May 03, 1970

REFERENCE:

"Contact information will be shared on request." Or

pk.linkedin.com/pub/fayaz-hussain-shah/59/1ab/963/

MUHAMMAD SALEEM AWAN

Mailing Address

S/o Muhammad Khan Awan
C/O Umer Medical Store, Rayon Pura
Kala Shah Kaku, Tehsil Ferozewala
District Sheikhupura, Punjab, Pakistan
ID # 35401-1804061-1
Mob: +92 333-4534797
Email: m.saleem_awan@yahoo.com

Objective

To pursue a challenging and career oriented job as a Manager Utilities in a dynamic and progressive organization that will utility my interpersonal skills at the maximum extent so as to keep pace with changing dimensions of technological fields.

Qualification

• Boiler Engineer 1st Class	2006	Qualified
• DAE Mechanical	2013	Qualified

Personal

- Date of Birth : 01-11-1975
- Gender : Male
- Domical : Sheikhupura

Achievements

1. Experience of thermal power plant Ravi Rayon Ltd.
   3 water tube boilers each capacity 25 tons/ hr.
   3 steam turbines each capacity 2.2 MW.
2. Operation and maintenance experience of 3.2 Meter dia coal gasification plant.
3. Experience of waste heat recovery Boilers on 30 MW WARTSILA Power Plant in **Ittehad Chemicals Ltd.**

4 Erection experience of fire tube package type boiler capacity 12 and 15 Tons/hr in **Ittehad chemical Ltd.**

5 Erection and operation experience of 50 tons/hr DI & RO water treatment plant

Training

- Auto Cad
- Advanced Drafting (Mechanical)
- ISO 14001, 2004 Transition Plan.
- Working on SAP

Experience

Unit Manager Utilities at Ittehad Chemical Ltd G. T Road Kala Shah Kaku.

From 11.06.2007 to present.

Responsible for the operation of.

- Dual Fuel (Natural gas & furnace oil) Boiler & waste heat recovery Boilers
- RO & DI plant.
- Tube well & pumping station.
- Cooling towers
- Instrument air compressor.
- Chillers
- Coal gasification plant capacity 7500 m3/hr with tar coal catcher.

UTILITY ENGINEER at Asian Food Industries (Pvt.) Ltd.
From 10.12.2003 to 10.06.2007

- Entire operation of utility department e.g. Boiler, Reverse osmosis water plant, compressor, chiller and Cooling tower.
- Ensure safety of employees through training and safe methods to avoid accidents.
- Plan and ensure the best performance of staff under charge by effective training and motivation.
- Planned monitoring of critical operational parameters e.g. Boiler Pressure and Firing Conditions, Compressed air Pressure, Cooling water temperature, RO water, Permeate and reject flow and take corrective or preventive action to avoid any deviation.
- Preparation and effective execution of preventive maintenance activities.
- Collection of planned data through staff and analysis to get results for continuous improvement.
- Keep all the operational measuring and testing equipment and tools functional and calibrated.
- Develop and implement work instruction for different activities and processes as per ISO 1200:2004. And HACCP food safety requirements.

BOILER ENGINER at Shaheen Paper Industries (Pvt.) Ltd.
From 13.07-2001 to 09.12-2003.

- Experience of Management, Maintenance and operation of Package type fire tube boiler capacity of 5 ton/hr.
- Experience of fabricate wood furnace and change the fuel furnace oil to wood.

Boiler Supervisor Ruppa Fab Pvt. Ltd
From 14.11.2000 to 12.07.2001.

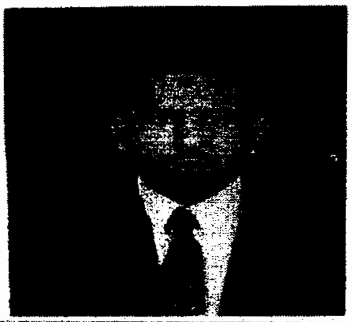
- Two Steam Boilers each capacity 10 ton / hr.
- Five Thermo Oil Boilers.
- Two Air Compressors.
- Chiller
- Raw water turbines & Pumps.

Boiler Operator Saman Ghee Mills
From 15.9.1997 to 6.6.1999.

- Water Tube Boiler Capacity 15 tan / hr.
- Water Softing Plant.

Senior Plant Attendant at Ravi Rayan Ltd
From 1.2.1995 to 30.8.1997.

- Three water tube Boilers each capacity 25 ton / hr.
- Three Steam turbines with generator each capacity 2.2 MW.



CURRICULUM VITAE

Name: Muhammad Sohail Anwar

Career Objective:

I am looking forward to working at a place where I can make best use of the experience and knowledge that I have so as to maximize output.

Work Experience:

From August 2014 to till now: I am working as Unit Manager –EHS in Ittehad Chemicals Limited responsible for implementation of EHS standards and procedures in ICL, also working as Management Representative for Integrated Management system (IMS) for three management systems including Quality Management system ISO 9001:2015, Environment Management System ISO 14001:2015 and ISO 45001:2018 for safety Management system & URSA/SMEDA Social Compliance Audit and HALAL Certifications.. I am also responsible for legal liaison with Environment Protection departments. I am responsible conducting for in-house and out sourced trainings. I am also conducting audits by customers such as Procter & Gamble, Unilever, Halliburton, PEPSI, Coca Cola, Bhulley Shah Paper Mills etc.

Jan.2013 to August 2014: I have worked as senior executive QHSE (Quality Health Safety & Environment) in Pak Elektron Limited (PEL) PEL is IMS (Integrated Management System) certified. (ISO 9001:2008 QMS (Quality management system), ISO 14001:2004 EMS (Environment Management system) & ISO 18001:2004 OSHAS (Occupational Health & Safety)

I am responsible to devise & implement EHS system in PEL, to formulate SOP (Standard operating procedures), work instructions & procedures for system implementation. Conducted HIRAC (Hazard identification and risk assessment) of all sections of the organization, on the basis of HIRAC PPEs (personal protective equipments) are suggested and implemented.

Working to prepare awareness & training modules for in-house trainings

Liaison with Environment protection Agency in Pakistan.

Coordination with departmental heads for EHS issues

Incident/Accident investigation

- **May 2007 to Jan.2013**: Kohinoor Mills Limited (Power Plant/Dyeing division)

I worked as Assistant Manager Environment Health & Safety; I was responsible for the SA-8000 compliance and certifications CT-Pat (Customer trade Partnership against terrorism) compliance and certification and WRAP (Worldwide responsible apparel production) compliance and certification of the company. I am responsible for the EHS issues at the work place relating safety of man & material, also conduct accident investigations to take corrective actions. Conduct compliance audits SA-8000-2008, internal audits, accidents record, evacuation drills. Assure the emergency preparedness equipment ready for use.

Training needs analysis and trainings of the employees to give awareness about safety and safe operations, emergency preparedness that is fire fighting and first aids.

I am developing training materials for safety awareness.

Compliance of EMS system, also conducted Hazard and Risk assessment at the work place and suggested and implemented safety measures.

worked on installation of Waste Water Treatment Plant also responsible for Environmental approval/NOC from Environment Protection department, routine environment monitoring and correspondence with Environmental officials from Government. ***Also worked as consultant for the Project"Mecury Inventory in Pakistan" by Minitsry of Climate Change Pakistan.***

July 2006 through May 2007: Vetgrow pharmaceuticals

I joined as Environment Health & Safety Officer. Major work area was HSE at the site.

January 1999 through June 2006: SIZA International (Pvt.) Ltd.,

I joined as Executive Quality control and was responsible for the ISO 9000:2001 documentation and implementation of quality standards, corrective & preventive actions, internal audits and was responsible to conduct surveillance audits for ISO 9001:2001 certifications. In addition I was responsible for Health & Safety activities

August 1989 through December 1998: gsk Pakistan Ltd. A multinational pharmaceutical

I joined the organization as junior analyst in quality assurance department and gradually promoted to junior executive, my job was to perform in process and finished product quality control activities.

<u>Academic background:</u>

MS-TQM (Total Quality Management): In 2006 from Institute of Quality & Technology, University of the Punjab with 69.9 % marks.

MSc (Environment Sciences): In 2003 from center for earth sciences, University of the Punjab with 70.6 % marks.

MSc (Science Education): In 1992 from Institute of Education and research, University of the Punjab with 61 % marks.

BSc (Chemistry, Physics, Mathematics):

In 1988 from Govt. College Faisalabad, University of the Punjab, Lahore with 55.75 % marks

Personal Information:

Marital Status: Married with three college/school going children.

Short Courses/Certificates:

1-IOSH
By
Institute of occupational safety & Health (October 2015)

2- Auditor/Lead Auditor IRCA Approved OHSMS ISO 45001:2018 Course
By
RICI Pakistan (May 2019)

3- Auditor/Lead Auditor IRCA Approved EMS ISO 14001:2015 Course
By
TUV Austria

4- Auditor/Lead Auditor IRCA Approved QMS ISO 9001:2015 Course
By
TUV Austria (May 2016)

5- IRCA Approved CPD 2014 Introduction to ISO 9001:2015 Course
By
SGS Pakistan Ltd. (October 2014)

6- Auditor/Lead Auditor Course HALAL

7- **Implementation and internal auditing to integrated Management System (ISO 9001:2000, ISO 14001, 2000, & OHSAS 180001: 2007)**
By
SGS Pakistan (Private) Ltd. (2007)

8- **Introduction to Environmental Management Systems ISO 14001**
By
The Postgraduate centre for Earth Sciences, University Of The Punjab, Lahore (September 2004)

9- **Certificate of ISO 9001: 2000 Internal Quality Auditing**

By

Arslan Consultants (March 16, 2004)

10-**Profitability through Industrial Safety Management.**

BY

Pakistan Chemical Manufacturers Association
(July 23-24, 2018)

11-Regional Process Safety Meeting

BY

Center for Chemical Process safety/American Institute of Chemical Engineers (Alche)

12-Pakistan secure Chemical Management for Chemical Incident Prevention and Response.

By

Chemical Weapon Convention , National Authority and Arms Control Armament , Ministry of foreign affairs/ Chemical Security Program , United States
(January 15-17, 2019)

13-**Final Work shop on Minamata Initial Assessment.**

By

United Nations Environment Program/Ministry of Climate Change
(7^{th} September 2018)

14-National Workshop on Inventory of Initial and New Persistent Organic Pollutants (POPs)

By

United Nations Environment Program/Ministry of Climate Change
(31 August, 2017)

15-One Day training workshop on "Approaching towards comprehensive elimination of persistent organic pollutants(POPs)

By

United Nations Environment Program/Ministry of Climate Change

16-Responsible Care Gap Assessment Workshop

By

Pakistan Chemical Manufacturers Association (July 05-06, 2017)

17-Environmental Impacts of Geological Hazards

By

The TOKTEN program Of the United Nations Development Program in association with the Ministry of Labor, Manpower and Overseas Pakistanis, Government of Pakistan at University of the Punjab
(May 144 to June 13, 2003)

18-Hazardous Waste Management

By

The Atomic Energy Mineral Centre Lahore and University of the Punjab Lahore (February 3-7, 2003)

19-Laboratory Techniques for water and wastewater in Environmental Sciences

By

The Postgraduate centre for Earth Sciences, University Of The Punjab, Lahore (October 17-25, 2003)

20-Introduction to Environmental Management System for Environmental Audit

By

The Postgraduate centre for Earth Sciences, University Of The Punjab, Lahore (October 2004)

21- Risk Assessment

Held by

Haseen Habib (Private) Ltd,

22-Certificate of Computer Language

(DOS/WINDOW/WINWORD/EXCEL/INTERNET/&E-mail)

Held by

Pak Canadian Polytechnic Institute Lahore (May 1, 2000 to July 31, 2000)

23-Course of Good House Keeping

BY

gsk Pakistan Ltd.

24-Course of Fire Fighting

By

gsk Pakistan Ltd.

25-Certificate of National Cadet Corps

By

National Guards (Pakistan Army)

26-Seminar on UNESCO's Contribution for the Development of Science Education.

By

Institute of Education & research, University of the Punjab, Lahore – Pakistan

27-Hazardous Waste Management

Conducted by

Center for the improvement of Environment and working Condition, Directorate of Labor welfare- Lahore

28-Awareness Training course on FIRST AID (Basic Life Support)

Conducted by

Directorate of Worker's Education, Government of Pakistan
Dated 24-05-2010 to 25-05-2010

29-2nd Annual Occupational Health & safety Seminar,

Held By

PSSHMC Dated April 11, 2012 at Punjab Social Security Health Management Company (PSSHMC)

30-Seminar on "Total Quality Management"

By

JICA & PITAC (September 2005)

31- 5S and Total Production Maintenance (TPM)

By

National Productivity Organization (NPO) in collaboration with LCCI (Lahore Chamber of Commerce and Industry)
(March 12-13, 2017)

32-Certificate of Participation in "International/National Stakeholders workshop on HCFC phase out plan"

Held by

UNEP, UNDP, UNIDO & NPM Ozone Cell, on HCFC phase out management plan dated 27th February 2012

33-Certificate of Appreciation in Outstanding performance

For

Fire fighting at Thermoil Boiler in Dyeing Division dated
(January 1, 2010)

34- **Certificate of participation in "Two days Basic awareness training course**

ON

"Fire Safety" dated 07-04-2010 to 08-04-2010 by Directorate of worker Education, Government of Pakistan.

35-Certificate of participation in "8th National Seminar on Occupational Health Safety & Environment "

Dated 21st & 22nd October 2011 BY The Institute of Engineers Pakistan (Karachi Centre).

36-A Course on "Occupational Safety & Health"

By

Post Graduate Centre for Earth Sciences, University of the Punjab (November 2-4, 200)

37- Course on Chemical Communication and Hazard waste Management

By

Center for the Improvement of working Conditions and Environment, Government of the Punjab (December 23-24, 2009)

38- Workshop on HCFC,s phase out and alternatives

By

Ministry of Climate Change, Government of Pakistan (February 2013)

39-Training techniques for trainers

By

Pakistan Institute of Management (PIM) (November 19-24, 2007)

40- French Language Course – Unit 1-4

By

Alliance francaise de Lahore (June –August, 93)

41-National Inception work shop for the project of Minammata Convention

By

Ministry of Climate Change, Government of Pakistan /UNEP/gef (May 2016)

Computer skills:

Computer literate in Microsoft office/Microsoft word/in page/Visio/internet/intranet and Microsoft Excel

Contact:

Hose #310, Block # G-5, Wapda Town, Phase-1, Lahore-Pakistan
Cell # 0301-4465921
E-Mail: Sohail2911@hotmail.com

Cell # **+92 300 9451909**
Land Line **+92 4236306182**
H # 323 – Block J2, Wapda Town, Lahore.
Pakistan.
muhammad.rizwan@ittehadchemicals.com
muhammadrizwangsk@yahoo.com

Muhammad Rizwan

Objective

To work in a dynamic and transparent organization with opportunities for learning, professional growth and continuous improvement.

Experience

Jan'2015 to Date **ITTEHAD CHEMICALS LTD.**

Head of Sourcing & Procurement

- Heading the Local as well as Import Team.
- Lead the Logistic team.
- Leading member of all major projects for ICL
- IEM 2 , IEM 3 (Caustic Soda) , SRS & LABSA 1& 2, SLS

Dec 2011 to 2014 **Colony Textiles Mills**

Purchase Manager

- Responsible of all purchasing for weaving & Spinning Division
- Handling approx. Rs.40.0 M monthly purchasing volume.
- Responsible for imports for the group.

Jan. 2009 – April 2011 **Kohinoor Mills Ltd.**

Assistant Manager Purchase

- Handling Centralized Procurement For Five Divisions.
- Overall management of all general procurement operation.
- Procurement of Packages material , Industrial Equipments, Construction Material, Electrical Items, etc
- Develop & Implement new procedures and systems.
- Defined relevant procurement policies, strategies, procedures & documentation. Supplier evaluation.

- Getting best rates & services. Cost effectiveness.
- Optimum procurement strategies are selected at all time.

April. 1990- December. 2008 **GlaxoSmithKline Pakistan Ltd .**

Sr. Executive Procurement

- Overall responsible and liaison with govt. agencies i.e customs, heath & local govt. bodies.
- Budget Management.
- Liaison with suppliers & vendors. Improving planning and management of quality systems and procurement policies.
- Procurement of raw material &chemicals, local & imported items, Lab. equipments & spare parts, general & printed material.
- Prepare related documents & reports. Procurement planning, design, implementation & management.
- Negotiate and resolve difficult procurement related issues & complaints.

Education

Masters of Business Administration (MBA)

1994-96 **Hajvery University Lahore.**
(HEC Recognized)

- Major in Sales & Marketing.

M.A English Literature.

1993-95 University Of Punjab

Professional Certifications / Diploma/workshops

- **Strategic Procurement Management LUMS.**
- **CSCP Diploma In Supply Chain Management.(PIM)**
- **CISCOM certification.**
- **Materials Management. (PIM)**
- **Double Express (Presentational Skills) & Fore casting techniques for managers.**
- **Business Communication .GSK in house.**

IT Skills

- **Proficient knowledge in MS Office.**
- **Oracle purchasing system.**
- **SAP 1**

Marital Status:	Married
DOB :	8/11/1965
Reference:	furnished upon request.

Profile of Sub-Contractors

FABCON Design and Engineering (Pvt.) Ltd. is a multidisciplinary EPC Management Company, engaged in engineering, manufacturing, and construction in the field of civil, mechanical, electrical, and automation projects. FDE is a total solutions provider with an impressive track record in the construction of:

- Power Plants
- Power Boilers
- Automation of Plant
- Erection Service

- WHRB Boilers
- Heat Exchangers
- Electrical & Instrumentation
- Pressure Vessels
- Piping Systems
- Environmental Protection Equipment

Profile of EPC contractor is attached here with.

3. References in Respect of the Experience of Sub-Contractor

The following references serve as demonstrative evidence of the experience and proficiency of proposed subcontractor (FDE) in the realm of power plant design, manufacturing, installation, and commissioning.

Hunza Sugar Mills (Unit -II), Jhang, Punjab - Pakistan

- Power Plant Capacity: 43MW
- 18MW Back Pressure Steam Turbine Generator
- 25MW Extraction-Condensing Steam Turbine Generator
- 2 x 120 TPH, 87 Bar(g) Biomass fired boilers

This project underscores the applicant's capability in managing a multi-faceted power plant installation, showcasing adeptness in handling varied power generation components.

Meeran Sugar Mills, DI Khan, KPK - Pakistan

- Power Plant Capacity 12MW
- Components: 6MW Thermal Power Plant Steam-Driven Turbo Generators (2 sets)
- Details: Demonstrates the subcontractor's expertise in smaller-scale yet intricate thermal power plant setups with multiple turbo generators.

Chashma Sugar Mills Unit-II, DI Khan, KPK, Pakistan

- Power Plant Capacity 3MW
- Component: 30TPH, 25Bar(g), 364°C Bagasse Fired Boiler
- Details: Showcases the applicant's proficiency in the design, manufacturing, and installation of specialized boilers tailored for biomass-based fuel sources.

The detailed reference list is attached here with.

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- Component: 30TPH, 25Bar (g), 364°C Bagasse Fired Boiler
- Details: Showcases the applicant's proficiency in the design, manufacturing, and installation of specialized boilers tailored for biomass-based fuel sources.

The detailed reference list is attached here with.

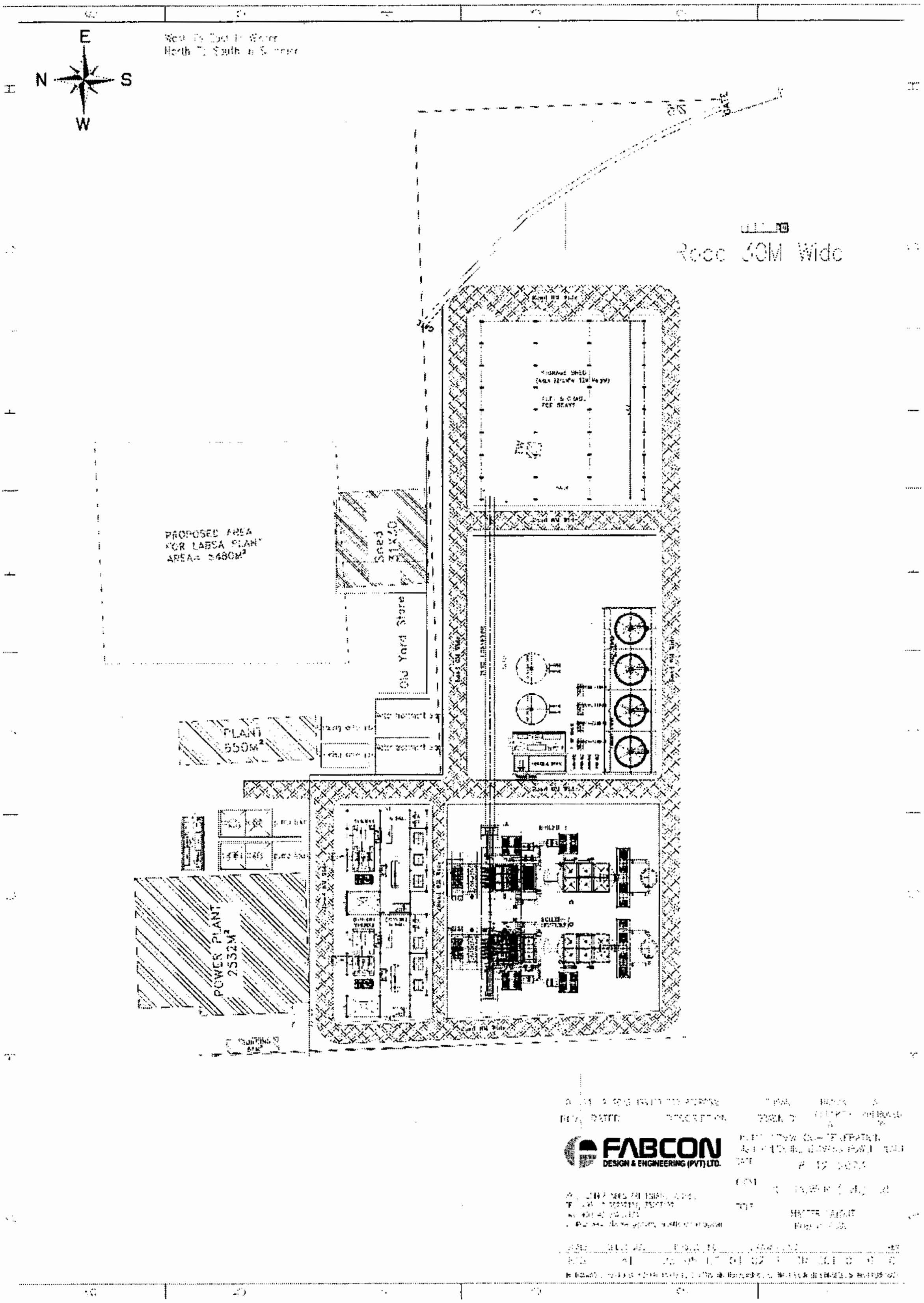
Location Maps, Site Maps, Land

The plant is located at Kala Shah Kaku, Punjab Pakistan, adjacent to existing Ittehad Chemical Plant. Total designated area is approximately 20 acres of land which include power plant area and biomass storage as well.

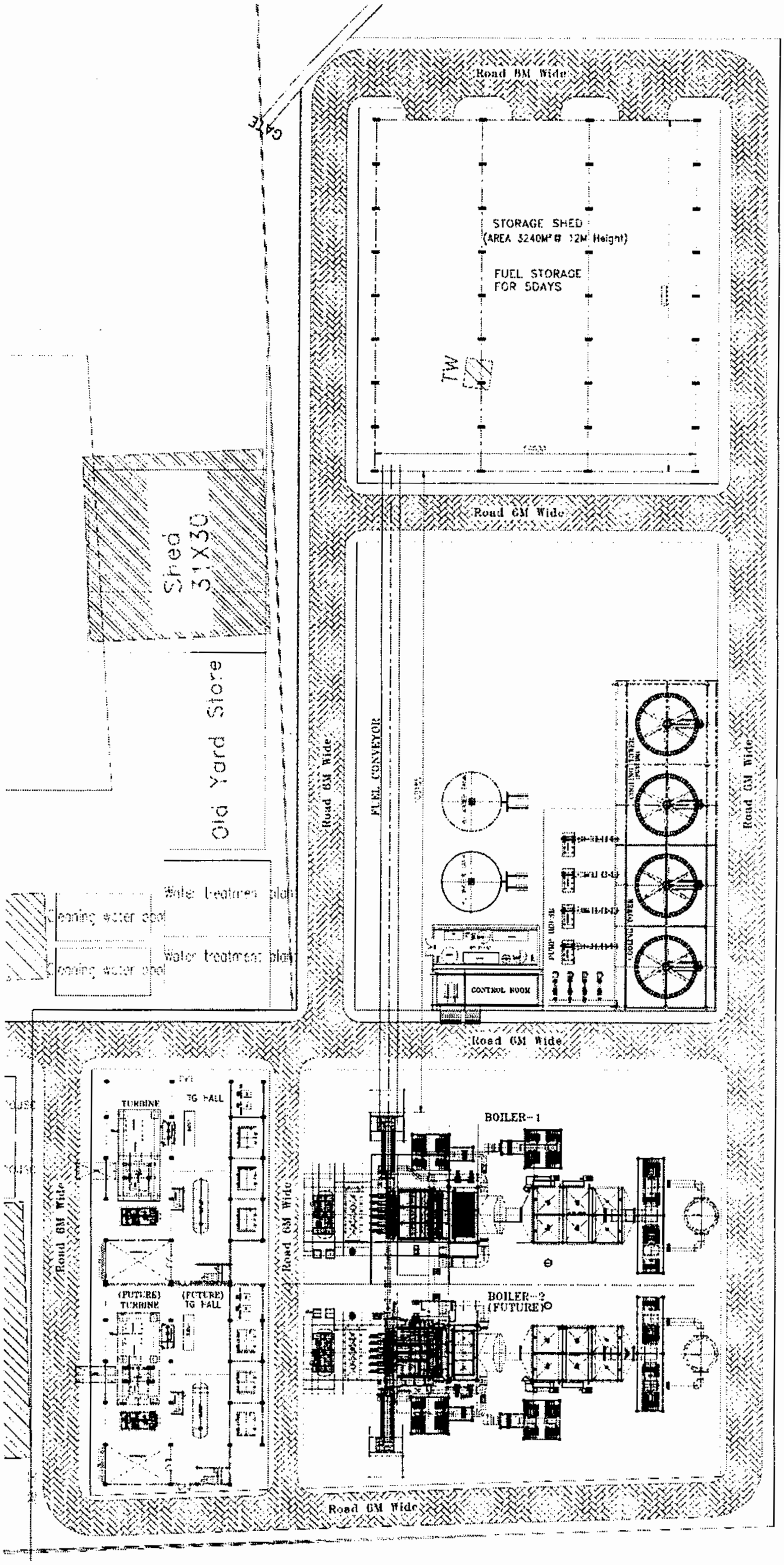
Location Map

	TECHNICAL DOCUMENTS FOR POWER GENRATION LICENCE	FABCON DESIGN & ENGINEERING (PVT) LTD.
FDE-ICLPPL-PGL-002	2 X 17MW CO-GENERATION POWER PLANT	

Master Layout



Plant Layout



5. Technology, Size of Plant, Number of Units

5.1 Selection of High-Pressure Technology

ICL Power (Pvt.) Ltd. (ICLPPL) is interested in technology that is the latest and proven. The 9.8 MPa, 480 °C system is identified with assumptions of **17MW** gross output, **30tph** net extraction, as offering a significantly superior return on investment. This configuration strikes a balance between substantial fuel savings and a modest increase in capital investment.
The broad parameters of the project are:

Project Capacity	:	17 MW
Construction Period	:	12 Months
Boiler Capacity	:	100 TPH, 100 Bar(g), 485 °C
Turbine Capacity	:	17 MW Extraction/Condensing
Total Net Power Generation	:	15,000 kW

5.2 Specifications of Extraction Condensing Steam Turbine are as follows:

Power Output	:	17MW
Type	:	Extraction Condensing
Steam Extraction	:	30TPH @ 10 bar (g)
Stage	:	Multistage, Nozzle Governed
Steam Inlet Pressure	:	98 Bar(g)
Steam Inlet Temperature	:	480 °C

5.3 Specifications of Generator are as follows:

Voltage Level	:	11000 V
Frequency	:	50 Hz
Power Factor	:	0.8
Insulation Class	:	F

5.4 Specifications of Boiler are as follows:

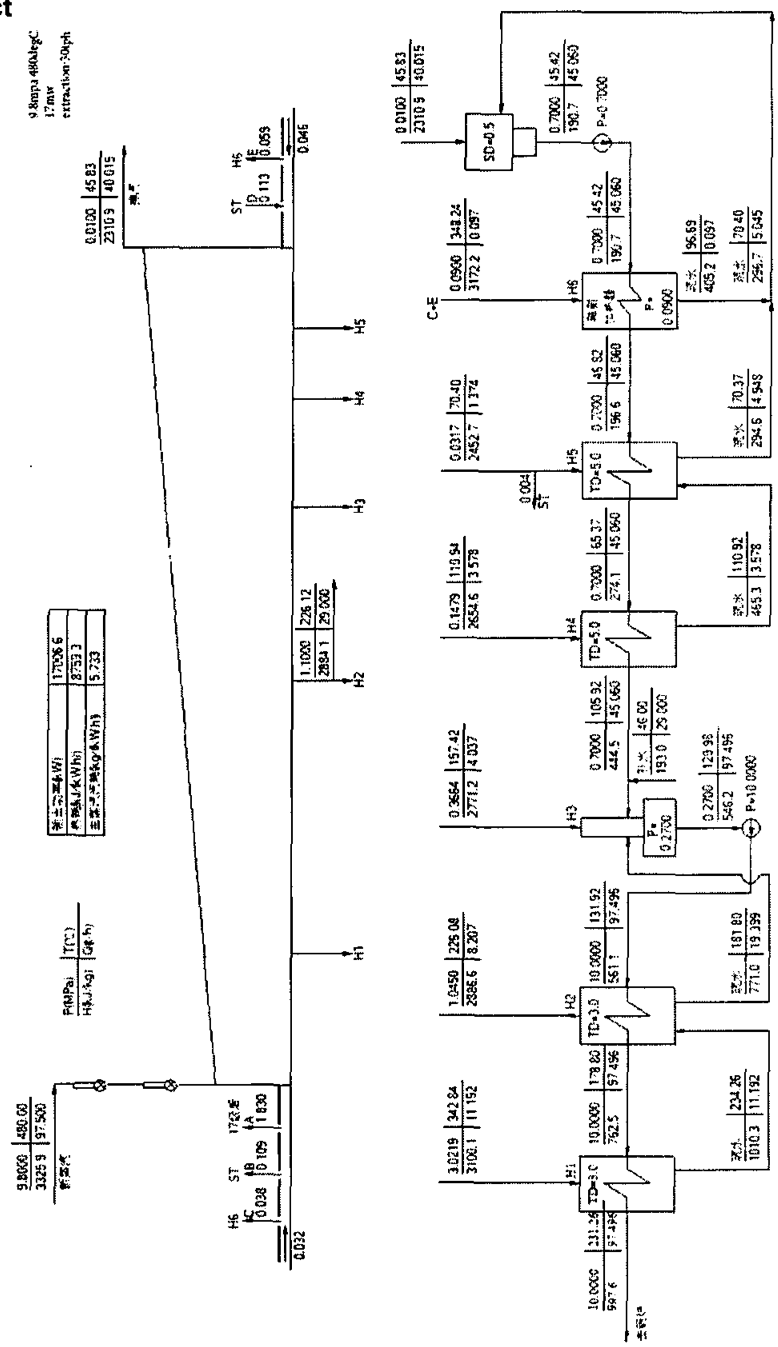
The biomass fired boiler is a bottom supported natural circulating boiler with single drum and consisting of a rigid water-cooled frame for supporting the heating surfaces and steam drum. The boiler is provided with a membrane wall construction which is water cooled and fully gastight. Due to the welded construction, its water-cooled frame and low wall thickness of the steam drum the boiler can react very fast to load changes and can be started relative fast compared to other types of boilers.

Boiler has following key parameters

Type	:	Single Drum Membrane Type
Evaporation Capacity	:	100 TPH

Steam Pressure	:	100 Bar(g)
Steam Temperature	:	485 °C ± 10 °C
Grate	:	Reciprocating Grate
Fuel	:	Biomass (Agriculture Waste)
Feed Water Temperature	:	210°C
Boiler Efficiency on LCV	:	88%
Flue Gas Temperature	:	145°C

5.5 Project



6. Fuel: Type, Imported/Indigenous, Supplier, Logistics, Pipelines energy

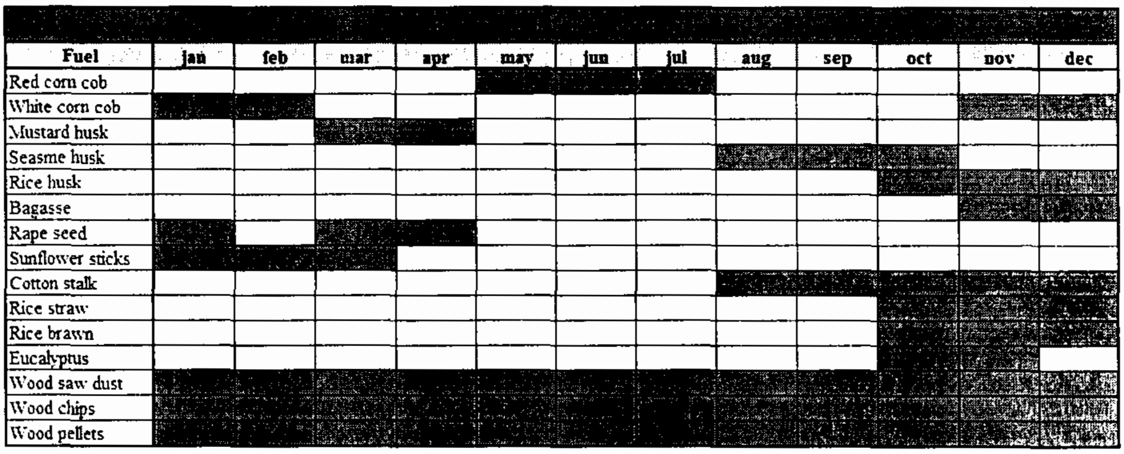
Biomass (Agricultural Waste) is selected as fuel for this project. Biomass emerges as a promising, cost-effective, and sustainable alternative with the potential to address both energies needs and environmental concerns.

6.1 Selected Types of Biomass Fuel

The following types of biomass are selected for power generation that are readily available in Pakistan.

1- Bagasse
2- Rice Husk
3- Rice Straw
4- Corn Cob (Red)
5- Corn Cob (White)
6- Corn Stalks
7- Brassica
8- Mustard Straw
9- Wood Chips
10- Cotton Stalks
11- Wheat Straw
12- Sugarcane Trash
13- Maize Husk

6.2 Seasonal Availability Chart for Biomass of Pakistan



6.3 Annual production potential of crop residue in Pakistan

The annual production potential of crop residue biomass and their use is given as follow:

Biomass Residues	Theoretical Potential	Technical Potential	Past Annual Usage (%)
Bagasse	11,790	4,224	35.8
Rice husk	1,288	557	43.2
Corn cob	599	67	11.2
Corn husk	400	45	11.3
Cotton stalk	25,865	2,764	10.7
Wheat straw	16,323	2,604	16.0
Rice straw	6,438	2,784	43.2
Sugarcane trash	4,716	1,690	35.8
Maize stalk	2,270	256	11.3
Total	69,689	14,991	21.5

6.4 Composition of Biomass (Proximate and Ultimate Analysis).

The proximate analysis and ultimate analysis of Pakistan's crop residues-based biomass are given as follows:

Parameter	Unit	Corn Cob	Corn Stover	Corn Stalk	Wheat Straw	Rice Husk	Brassica	Bagasse	Coal Foreign
					Specific Energy				
Gross Calorific Value	kJ/KG	14856	14912	16206	16670	16126	15072	10249	23550.75
Net Calorific Value	kJ/KG	12526	13972	14185	14777	14816	14053	8360	22776.19
					Proximate Analysis (ar)				
Total Moisture	%	15	7.58	13.17	8.61	11	11	48	8
Volatile Matter	%	75	65.68	59.83	70.41	66	65	84.79	21
Ash	%	3.2	13.13	11.52	8.65	18	12	2.91	7.5
Fixed Carbon	%	13.92	13.61	17	16.11	17	22	11.82	36
Total Sulfur	%	0.15	0.31	0.18	0.21	0.17	0.16	0.02	0.33
					Ultimate Analysis (ar)				
Carbon (C)	%	42.7	38.36	48.23	43.11	38	42.79	49.2	58.5
Hydrogen (H)	%	6.49	6.65	8.18	5.81	6	6.06	4.69	3
Nitrogen (N)	%	0.25	0.57	0.81	0.63	0.8	0.84	0.18	0.9
Oxygen (O)	%	50.41	40.85	31.08	50.45	37	40	43	4
					Ash Fusion Temp. (reducing)				
Initial deformation Temp	°C	970	990	990	920	>1500	1080	1100	1150
Spherical (Softening) Temp	°C	1000	1000	1000	990	>1500	1240	1240	1210
Hemispherical Temp	°C	1030	1040	1040	1061	>1500	1275	1270	1200
Fluid Temperature	°C	1100	1070	1100	1100	>1500	1305	1352	1250
					Ash Analysis (db)				
Silica (SiO2)	%	63.6	58.8	67.02	41.52	95.4	17.2	73	38.5
Alumina (Al2O3)	%	5.85	8.81	2.15	1.01	0.1	7.9	6.7	16.5
Manganese (Mn3O4)	%	2.11	3.65	3.68	1.98	0.3	9.6	3.2	0.01
Calcium (CaO)	%	3.5	6.83	6.78	8.08	0.4	34	2.8	0.1
Iron (Fe2O3)	%	2.95	4.23	1.01	0.7	0.1	1.5	6.3	1
Phosphate (P2O5)	%	2.42	1.35	0.94	4.45	0.5	1.5	4	0.1
Sodium (Na2O)	%	0.45	1.26	0.4	0.6	-	0.5	1.1	0.1
Potassium (K2O)	%	8.42	10.56	5.24	31.9	1.8	17.7	2.4	0.2
Titanium (TiO2)	%	0.6	0.31	0.13	0.07	-	0.3	-	0.5
Sulfate (SO3)	%	1.14	0.57	2.42	3.33	-	7.5	0.4	-
Other Impurities	%	8.96	3.64	10.23	6.36	1.4	2.3	0.1	-

6.5 Biomass Transport Feasibility Matrix

Preprocess-sing steps (for transport purposes)		Feedstock density (kg/m3) and moisture content (%)						LHV (MJ/kg)		
		Raw (loose) feedstock		Baled/ Bundled		Chopped/Chipped		Raw feedstock	Baled/ Bundled	Chopped
		Density	Moisture %	Density	Moisture %	Density	Moisture %			
Wheat straw	Baling	40	0.1	175	0.1	n/a	n/a	14.4	14.4	n/a
Cotton stalks	Bundling or Chipping	55	0.125	160	0.125	300	0.125	15	15	15
Rice straw	Baling	30	0.105	155	0.105	n/a	n/a	12.5	12.5	n/a
Maize stalks	Bundling or Baling	60	0.16	230	0.16	n/a	n/a	13	13	n/a
Sugarcane trash	Baling	32	0.24	155	0.24	n/a	n/a	12.6	12.6	n/a
Rice husk	N/A	145	0.115	n/a	n/a	n/a	n/a	13.5	n/a	n/a
Corn cob	N/A	132	0.176	n/a	n/a	n/a	n/a	14	n/a	n/a
Maize husk	N/A	30	0.119	n/a	n/a	n/a	n/a	11.6	n/a	n/a
Bagasse	Baling	120	0.5	n/a	n/a	n/a	n/a	7.5	n/a	n/a

6.6 Transportation Modes

Biomass transportation primarily utilizes tractor trolleys, trucks, or similar road-based transport modes in Pakistan due to their accessibility and suitability for local roads.

6.7 Accessibility

Pakistan's road network supports the movement of biomass from local sources to power generation facilities, ensuring relatively easy access and transport feasibility.

6.8 Supply Chain Management

Biomass resources are locally abundant, reducing transportation distances and fostering a dependable and consistent supply chain.

6.9 Logistics and Efficiency

The chosen modes of transportation offer efficient delivery of biomass quantities, with regular and well-managed schedules to maintain a steady supply. Biomass transportation accounts for proper handling practices, and maintaining quality and quantity standards during transit and storage at the facility.

7. Emissions Values

The Management of ICL Power (Pvt.) Ltd. (ICLPPL) is committed to providing safe, healthy and pollution-free environment to its employees as well as surroundings. We shall strive to create pollution-free environment. We shall comply with all regulatory requirements imposed by the Pakistan Environment Law (PEQS)

To implement Environment Policy, ICLPPL shall:

- Comply with relevant environmental Law and Regulations.
- Comply with Punjab Environmental Quality Standards (PEQS)
- Ensure that all the activities of the company should according to company environment policy.
- Setting objectives and targets for continual improvement in environmental conditions.
- Ensure for provision of the safe working environment and to save all employees from illness and accident.
- Provide appropriate environment training/information to all employees.
- Require every employee to exercise personal responsibility in preventing harm to themselves, to others, and to the environment.
- Promote awareness and give due recognition to performance in the area of Health, Safety, and Environment.
- Shall monitor and treat all kinds of liquid effluents from plants before their disposal.
- Shall monitor and treat all gaseous emissions for safe and prescribed levels of CO, SOx, NOx and particulates.
- Our power plant operating on biomass as fuel shall, comply with the following Punjab Environmental Quality Standards (PEQS):

Sr. No	Parameter	Standards ((mg/Nm3)	Projected
1	Smoke	40% or 2 Ringlemann Scale or Equivalent smoke number	Within limits
2	Particulate Matter	300	<150
3	Hydrogen Chloride	400	-
4	Chlorine	150	-
5	Hydrogen Fluoride	150	-
6	Hydrogen Sulphide	10	-
7	Sulphur Oxide	1,700	<765
8	Carbon Monoxide	800	<300
9	Nitrogen Oxide	100,000	360@6% O_2

8. Cooling Water Source Utilization and Discharge Compliance

The proposed power generation facility aims to utilize tube wells as the primary source for obtaining the cooling water required for operational processes. The utilization of tube wells for sourcing cooling water and the discharge process planned for the power generation facility aims to not only fulfill operational requirements but also strictly adhere to the environmental standards set by PEQS. This commitment to environmental responsibility ensures minimal impact on local ecosystems and underscores our dedication to sustainable operations.

8.1 Tube Wells Utilization:

The choice to utilize tube wells for sourcing cooling water stemmed from their cost-effectiveness, reliability, and feasibility in accessing groundwater resources. Tube wells offer a dependable and controllable means to obtain ample cooling water essential for the power-uninterrupted functioning of the generation process.

8.2 Discharge Process and Compliance with PEQS:

At ICLPPL the discharge of used cooling water back into the environment follows a comprehensive process aligned with environmental regulations and best practices. The discharged water undergoes treatment via an advanced Effluent Treatment Plant (ETP) before being reintroduced into the environment.

- Cooling water utilized in our operations is systematically collected and channeled through our ETP for treatment before discharge.
- Our ETP utilizes advanced technology to treat used cooling water to the extent that it meets Semi-Commercial Use Standards, as prescribed by regulatory bodies, including PEQS
- The treatment process involves several stages, including filtration, biological and chemical treatment, and disinfection, ensuring the removal of contaminants and impurities from the water.
- Compliance with PEQS is a primary focus during the treatment process, ensuring that the discharged water meets quality standards acceptable for semi-commercial applications like water supply to colonies or similar purposes.

9. Infrastructure Overview - Roads, Staff Colony, and Amenities

The holistic infrastructure plan, encompassing administrative buildings, healthcare facilities, landscaping, roads, staff colonies, and strategically positioned security check posts, reflects our commitment to fostering a conducive work environment while ensuring operational efficiency and compliance with safety standards.

9.1 Road Network Overview for Power Generation Facility

- The road network within the facility premises shall be planned to be a grid-style layout that shall ensure efficient access to different sections of the power generation site.
- Roads shall be constructed with sufficient width to accommodate smooth vehicular movement, including space for heavy-duty vehicles.
- Entry and exit points shall be strategically placed to optimize access and traffic flow.
- Curves and turns shall be engineered with broader angles to accommodate larger vehicles and ensure safe maneuverability.
- Emergency response routes will be designated and marked for quick access by fire trucks, ambulances, and other emergency vehicles.
- Roadside signage and clear markings will aid emergency services in navigating the premises swiftly.

9.2 Administrative Buildings Overview

- The administrative buildings within the power generation facility shall serve as operational hubs and shall supporting a range of functions critical for effective management, operations, and workforce coordination.
- Their design and functionalities shall be tailored to meet the diverse administrative needs of the facility while emphasizing efficiency, functionality, and sustainability.

9.4 Medical Center/First-Aid Station

- The medical center/first-aid station shall be strategically available for easy access during emergencies.
- It shall be equipped to handle basic medical needs and initial emergency responses.

- Protocols shall be placed to manage emergency situations until professional medical assistance arrives.

9.5 Security Check Posts:

- Security check posts shall be strategically positioned at entry and exit points, perimeter boundaries, and critical access areas within the facility.
- These posts shall serve as checkpoints to monitor and the entry and exit of personnel, vehicles, and materials shall be regulated
- Surveillance cameras shall be installed to monitor activities and record footage for security purposes.

11. Project Commencement and Completion Schedule

ITTEHAD CHEMICALS LIMITED
2 x 17MW CO-GENERATION, HIGH PRESSURE, POWER PLANT
(MASTER SCHEDULE FOR ENGINEERING, PROCUREMENT, CONSTRUCTION AND COMMISSIONING)

ACTIVITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CIVIL CONSTRUCTION INCLUDING ENGINEERING AND CONSTRUCTION																		
Civil Foundations of Equipment																		
Water Treatment Plant																		
Extraction Condensing Steam Turbine																		
Electric Generator and Allied Equipment with Steam Turbines																		
Envoirnmental Protection Equipment																		
Boiler Island																		
Cooling Tower																		
Diesel Generators																		
Air Compressor																		
Plant Auxiliaries and Utilities																		
Buildings and Infrastructure																		
Mosque																		
Admin Building																		
RO Building																		
Turbine House Building and CCR Room																		
Workshop Utilities Building																		
Main Gate, Roads and Boundary Wall																		
MECHANICAL EQUIPMENT - ENGINEERING, PROCUREMENT, MANUFACTURING AND INSTALLATION																		
RO Plant																		
Extraction Condensing Steam Turbine																		
Electric Generator and Allied Equipment with Steam Turbines																		
Envoirnmental Protection Equipment																		
Boiler Island																		
Cooling Tower																		
Diesel Generators																		
Air Compressor																		
Fire Fighting System																		
Air Conditioning of Rooms																		
Overhead Crane																		
Plant Auxiliaries and Utilities																		
Electrical and Mechanical Workshop Equipment																		
Interconnecting Pipeline, Valves and Fittings																		
Insulation and Cladding																		

ITTEHAD CHEMICALS LIMITED
2 x 15MW CO-GENERATION, HIGH PRESSURE, POWER PLANT
(MASTER SCHEDULE FOR ENGINEERING, PROCUREMENT, CONSTRUCTION AND COMMISSIONING)

ACTIVITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ELECTRICAL & INSTRUMENTATION EQUIPMENT - ENGINEERING, PROCUREMENT AND INSTALLATION																		
Panels/Switch Gears																		
Motor Control Centers / Panels																		
MV Switch Gear																		
LV Switch Gear																		
Drives																		
Electric Motors																		
Geared Motors																		
Variable Speed Drives																		
Cables																		
Control Cables																		
HT Power Cables																		
MV Power Cables																		
LV Power Cables																		
Earthing Cables																		
Erection/Hook Ups																		
Cable Trays																		
Wiring Accessories																		
Cable Glands																		
Transformers																		
Earthing System																		
Lighting System																		
Instrumentation and Control																		
Distributed Control System (DCS)																		
Sensors, Transmitters, Detectors, Analyzers																		
COMMISSIONING AND TRIAL																		
Commissioning of Equipment																		
Commissioning of Equipment																		
Final Test Reports of Power Plant																		
Final Test Reports of Power Plant / COD																		

12. Safety and Emergency Plan for ICL Power (Pvt.) Ltd.

The safety and emergency plans are outlined below designed to ensure the highest standards of safety, preparedness, and response in the operation of ICL Power (Pvt.) Ltd. (ICLPPL). Continuous improvement and regular training sessions are integral parts of our commitment to maintaining a safe working environment.

12.1 Personnel Training and Safety Protocols

- All personnel shall undergo comprehensive safety training programs covering emergency procedures, hazard identification, and PPEs (Personal Protective equipment) and technical equipment usage.
- Regular safety drills shall be conducted to ensure preparedness for various scenarios.

12.2 Equipment Safety and Maintenance

- Strict maintenance schedules shall be implemented to ensure the safe operation of equipment, including biomass-fired boilers, turbines, and auxiliary systems.
- Protocols for regular inspections and immediate repair of any identified safety issues shall be in place.

12.3 Safety Standards and Compliance

- I ndustry-specific safety standards shall be a priority.
- Regular internal audits shall be conducted to verify compliance with safety regulations.

12.4 Emergency Contacts and Communication

- A comprehensive list of emergency contacts, including local authorities, emergency services, and internal response teams, shall be maintained.
- Clear communication protocols during emergencies shall be established and shall be reviewed regularly.

12.5 Evacuation Procedures

- Evacuation routes and assembly points shall be clearly marked and shall be communicated to all personnel.
- Regular evacuation drills shall be conducted to ensure familiarity with procedures.

12.6 Fire Safety and Prevention

- Fire detection and suppression systems shall be installed and regularly shall be tested.
- Fire safety protocols shall be in place, including the availability of firefighting equipment and trained personnel.

12.7 Hazard Identification

- Regular risk assessments shall be conducted to identify potential hazards across the facility.

13. Training and Development

13.1 Onboarding Training

- Newly hired personnel shall be given an extensive onboarding program covering facility operations, safety protocols, and company policies.
- Emphasis shall be placed on familiarizing new employees with the specific requirements of a biomass-fired power generation facility.

13.2 Technical Training

- Technical training programs shall be conducted to keep employees updated with the latest advancements in biomass power generation technology.
- Specialized training modules shall cover boiler operations, turbine maintenance, emissions control, and other relevant areas.

13.3 Leadership Development

- Programs focused on nurturing leadership qualities and managerial skills shall be provided to key personnel.
- Leadership development workshops shall be aimed to enhance decision-making and problem-solving abilities.

13.4 Skill Enhancement Programs

- Continuous skill enhancement initiatives shall be offered to improve technical proficiency and operational efficiency.
- Cross-training opportunities shall be provided to enable employees to diversify their skill sets.

13.5 Performance Assessments

- Regular performance evaluations shall be conducted to identify areas for improvement.
- Individual development plans shall be created based on these assessments to address skill gaps.

13.6 Feedback Mechanisms

- An open feedback culture shall be fostered, encouraging employees to provide suggestions and feedback on training programs.
- Feedback loops will ensure that training programs are being continuously refined to meet evolving needs.

14. Efficiency Parameters

14.1 Designed Efficiency of Power Plant

Parameter	Units	Value
Plant Efficiency (Based on Net Capacity)	%	24.09
Plant Efficiency (Based on Gross Capacity)	%	21.26
Power Capacity Factor (Based on Gross Capacity)	%	91.32

Ittehad Chemicals Limited

Short Circuit Calculations and Load Flow Analysis

Draft Report V1.0

Siemens Pakistan
Smart Grid Solutions and Services
Power Technologies International

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SIEMENS

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1. EXECUTIVE SUMMARY

1.1 Job Description

Comprehensive short circuit calculations and load flow analysis study of M/s Ittehad Chemicals Limited has been carried out to determine short circuit current levels on different bus bars and nodes, loading of power system equipments, checking of voltage drops on system buses under steady state operation and evaluation of spare capacities in the existing network for the post power plant expansion scenario.

The focus of this report is mainly on:

- 3 phase maximum short circuit results
- 2 phase minimum short circuit results
- 1 phase maximum and minimum short circuit results
- Load flow conditions

1.2 Network Background

M/s Ittehad Chemicals Limited is fed via 132kV single circuit over head transmission line from LESCO grid station. This supply is stepped down to 11 kV through 03 Nos step down power transformers of capacity 10/13 MVA each. A dedicated power transformer of 12 MVA capacity is also installed to supply the load of rectifier # 6. The main 132/11.5kV power transformers are equipped with onload tap changers that maintains constant 11kV supply at the transformer secondary. The 11kV incomers from these power transformers feed main 11kV buses having a closed bus coupler scheme. 01 No capacitor bank rated at 6.6 MVAR is installed on the 11kV bus.

The 11kV network includes 04 No. rectifier transformers which are IEM rectifier of 29.112 MVA, rectifier transformer#3 (FRIEM) of 5.6 MVA, rectifier transformer#4 (Trafo Union) of 9.8 MVA and rectifier transformer#6 (STROMBRG) of 19 MVA. Normally three rectifier transformers are operational at a time while rectifier transformer#3 is off. It is planned to install a new IEM rectifier#2 of 29.112 MVA in near future at 11 kV bus.

Distribution transformers of 11kV / 0.42 kV at substation#1, 2 and 3 are installed to feed the plant auxiliary load.

There are all LV motors in the network rated at 0.415kV. Most of the motors are direct on line (DOL) start.

The existing 11kV and 0.415kV network is solidly grounded. It is planned to install a 50 Hz power plant comprising of 05 gas generators of capacity 7.5MVA each which will operate in synchronism with the grid. The generators are equipped with NGR to limit the ground fault currents.

The maximum operating load of the network is around 25 MW / 14 MVAR. The 11kV capacitor bank is on automatic operation and is considered at full capacity in this report.

Short circuit current calculations and load flow analysis are carried out to evaluate the suitability of existing switchgears after addition of generators from the perspective of calculating the available fault current levels at different buses, voltage drops and components loadings.

This report covers the results of steady state analysis, including the 3-phase, 2-phase and 1 phase short circuit calculations, load flow analysis for relevant scenarios. Calculations are performed to ensure that the short circuit and voltage drop levels will remain within permissible limits for all relevant cases.

Please refer Annex A - Case 0 for the input data model of the network.

1.3 Simulation Cases

Following cases have been simulated with respect to short circuit and load flow calculations:

Case-1: The entire normal running load is fed through 04 No. 132/11.5kV power transformers.

Case 2: The entire normal running load is fed through 04 No. gas generators in parallel operation or synchronism with grid.

Case 3: The entire normal running load is fed through 04 No. gas generators in island mode.

2. METHODOLOGY

The data collection activity was initiated by Siemens at Ittehad Chemicals site. ICL provided this data from the available documentation of the plant. The network model of Ittehad Chemicals Limited for short circuit and load flow analysis is then prepared with the help of data provided on site by engineers of ICL, load lists and cable schedules in the form of excel templates, single line diagrams of MCCs and other necessary data in softcopy format. The data was input into the network analysis tool, PSS® SINCAL (Siemens Network Calculation) software.

2.1 Electrical Network Data

The electrical network input model is prepared with the help of data collected / provided at site. Single Line Diagram (SLD) of ICL network with the input data model of system is considered as per the following documents:

- Single Line Diagram of Power System
- Plant motors and Transformers data

Please see the input data model in Annex A, Case-0.

2.1.1 Nominal Voltages

Considering the nominal voltage of ICL's network at different points, following voltage levels are considered as reference voltage:

- 132 kV
- 11.5 kV
- 11 kV
- 0.415 kV

2.1.2 Generator Model

The generators are modeled as per their datasheets. The details are as follows:

Table 2.1 Specifications of Generators

S.No	Element Name	Rated Voltage (kV)	Rated Power [kVA]	Power Factor (p.u)	xd"sat [%]*
1	Gas Generator 1	11	7491	0.8	19.6%
2	Gas Generator 2	11	7491	0.8	19.6%
3	Gas Generator 3	11	7491	0.8	19.6%
4	Gas Generator 4	11	7491	0.8	19.6%
5	Gas Generator 5	11	7491	0.8	19.6%
6	Black Start Generator	0.415	640	0.8	19.6%

* Direct Axis Saturated sub transient reactance.

2.1.3 Transformer Model

- Transformers are modeled as per their name plate data.
- All the no-load tap-changers have been set at 0 positions (Central Point).

The details are as follows:

Table 2.2 Specifications of Transformer

S.No	Element Name	Vr1 (kV)	Vr2 (kV)	Sn (MVA)	*vk (%)	Vector Group
1	MEIDENSHA - T1	132	11.5	10.0	8.7	DYN11
2	SIEMENS - T2	132	11.5	10.0	8.62	DYN11
3	MEIDENSHA - T4	132	11.5	10.0	8.84	DYN11
4	SIEMENS T5	132	11	12.0	8	YNYN0
5	T-6	11	0.415	0.4	4	DYN11
6	T-4 (PEL)	11	0.415	1.0	6	DYN11
7	T-5 (PEL)	11	0.415	1.0	6	DYN11
8	T-1 (SIEMENS)	11	0.415	1.6	5.9	DYN11
9	T-2 (SIEMENS)	11	0.415	1.6	5.9	DYN11
10	T-3 (SIEMENS)	11	0.415	2.0	6.7	DYN11
11	CCIL Trafo	11	0.415	1.5	6.25	DYN11
12	SIEMENS for PP Motors	11	0.415	2.5	7.04	DYN11
13	SIEMENS for PP Motors	11	0.415	1.5	6.19	DYN11

2.1.4 Load Model

- All motor groups are modeled as separate individual motors as per the provided data.

- Starting current (Ia/In) of low voltage DOL motors is considered as mentioned in their data sheets. For those motors whose data sheets are not available the starting current is assumed as 6.7 times of their rated current as per IEC standard.
- For low voltage motors with cable connections, R/X ratio= 0.42 is considered as per IEC 60909-0.
- The running and intermittent motors, as discussed with ICL, are considered as always connected load and they contribute to 3 phase maximum short circuit current whereas the standby motors are considered as disconnected load. Static (non motorize) load is not considered for short circuit calculations.
- For all low voltage motors where efficiency and power factor is not known, we have considered power factor = 0.85 and efficiency = 0.95.

The details of motors are as follows:

Table 2.3 Specifications of Motors

S.No.	Element Name	Rated Power [kW]	Rated Voltage [kV]	cosphi	Ia/In [p.u.]	Efficiency [p.u]
1	CCIL	980	0.415	0.85	1.25	0.95
2	CT# 3	90	0.415	0.85	6.7	0.95
3	Caustic Filling	56	0.415	0.85	6.7	0.95
4	Screw AC	315	0.415	0.85	6.7	0.95
5	Grid	61	0.415	0.85	6.7	0.95
6	Tube Well	171	0.415	0.85	6.7	0.95
7	Old Zn Plant	120	0.415	0.85	6.7	0.95
8	Pumping Station	248	0.415	0.85	6.7	0.95
9	SCR	80	0.415	0.85	6.7	0.95
10	Caustic Solidication	83	0.415	0.85	6.7	0.95
11	CT#1	175	0.415	0.85	6.7	0.95
12	MCC-II	404	0.415	0.85	1.25	0.95
13	MCC-I	296	0.415	0.85	1.25	0.95
14	Evaporation	85.4	0.415	0.85	6.7	0.95
15	Screw AC	63	0.415	0.85	6.7	0.95
16	5P4-B	112	0.415	0.85	6.7	0.95
17	Hot WP	15	0.415	0.85	6.7	0.95
18	5P4-C	112	0.415	0.85	6.7	0.95
19	5P1-D	160	0.415	0.85	6.7	0.95
20	5P1-C	132	0.415	0.85	6.7	0.95
21	5P4-A	112	0.415	0.85	6.7	0.95
22	Chiller 2	180	0.415	0.85	6.7	0.95
23	Shaffaf	576	0.415	0.85	6.7	0.95

24	New Zn Plant	72	0.415	0.85	6.7	0.95
25	CT (Sodium Hypo)	48	0.415	0.85	6.7	0.95
26	Sodium Hypo	80	0.415	0.85	6.7	0.95
27	Boiler # 02	43.75	0.415	0.85	6.7	0.95
28	Boiler #1	50	0.415	0.85	6.7	0.95
29	CT#4/2B	125	0.415	0.85	6.7	0.95
30	Paraffine Wax	1809	0.415	0.85	6.7	0.95
31	CT#3 South	238	0.415	0.85	6.7	0.95
32	Mech Workshop	32	0.415	0.85	6.7	0.95
33	Boiler # 3	68	0.415	0.85	6.7	0.95
34	IC South W/S	1.7	0.415	0.85	6.7	0.95
35	Spin Flash	125	0.415	0.85	6.7	0.95
36	New Rotary Dryer	208	0.415	0.85	6.7	0.95
37	Shaffar Reactors	105	0.415	0.85	6.7	0.95
38	Coal Gasifier	1.2	0.415	0.85	6.7	0.95
39	Boiler # 4	54	0.415	0.85	6.7	0.95
40	CT#1 (PB-16)	150	0.415	0.85	6.7	0.95
41	HG Pump	78	0.415	0.85	6.7	0.95
42	Brine (PB-4)	28	0.415	0.85	6.7	0.95
43	Air blower	96	0.415	0.85	6.7	0.95
44	Brine (PB-2)	9	0.415	0.85	6.7	0.95
45	Dep Brine Pumps	26	0.415	0.85	6.7	0.95
46	IC-South Boiler	97	0.415	0.85	6.7	0.95
47	31% caustic	5.6	0.415	0.85	6.7	0.95
48	IEM CT	144	0.415	0.85	6.7	0.95
49	Hypo 1&2	63	0.415	0.85	6.7	0.95
50	Hypo # 3	38.5	0.415	0.85	6.7	0.95
51	Hg Removal	98	0.415	0.85	6.7	0.95
52	MCC-III	90	0.415	0.85	1.25	0.95
53	OH Line	2	0.415	0.85	6.7	0.95
54	New HCL	14	0.415	0.85	6.7	0.95
55	CT#2 Circuit B	110	0.415	0.85	6.7	0.95
56	HCL H/W Pump	3	0.415	0.85	6.7	0.95
57	Cylinder Maint	30	0.415	0.85	6.7	0.95
58	CT#2 Circuit A	95	0.415	0.85	6.7	0.95
59	Utility W/S	2	0.415	0.85	6.7	0.95
60	Air Comp	4	0.415	0.85	6.7	0.95
61	PP Motors 50 Hz	1296	0.415	0.85	6.7	0.95
62	PP Motors 60 Hz	340	0.415	0.85	6.7	0.95
63	CT#2 Circuit C	31.5	0.415	0.85	6.7	0.95

2.1.5 Modeling of Cables

The cable resistances and reactance are considered from Pakistan Cables. The zero sequence data was not available for the cables therefore zero sequence data of low voltage cables are chosen from PSS®SINCAL database whereas cable sizes, lengths and no of parallel systems have been provided by ICL during site visit of Siemens engineer. The permissible maximum continuous load current Ith is calculated by considering the reduction factor i.e. Ith =Irated x Reduction Factor.

Reduction factor of the cables is calculated by considering the following factors:

- Ambient temperature: 45qC.
- Number of parallel system.
- Cable laying method.

We have considered an overall reduction factor of 0.7 for all cables laid in the entire ICL plant.

The details of power cables are as follows:

Table 2.4 Specifications of Cables

S. No	Element Name	Size (mm²)	Length (m)	No. of Systems (p)	Permissible Current (A)
1	RECT #2	185	190	1	461
2	RECT #3	300	170	1	633
3	SS-1	120	180	1	367
4	IEM 1 RECT	300	60	4	633
5	Coupler for T2	300	7	2	633
6	Tube Well	25	250	1	159
7	RECT # 4	185	160	2	461
8	CCIL	70	350	1	303
9	RECT # 06	300	155	2	633
10	SS-1	120	200	1	367
11	SS-3 Main HT Cable	70	250	1	271
12	G1 cable	300	52	1	633
13	Boiler # 02	70	100	1	256
14	Chiller #2	95	150	1	305
15	Boiler #1	50	90	1	209
16	CT New Panel	185	50	1	445
17	CT#4/2B	300	150	2	689
18	Shafaf	70	200	1	256
19	Sodium Hypo	95	120	1	307
20	CT (Na Hypo)	120	50	1	349
21	Zn Old	95	80	1	307
22	Screw AC	300	100	2	689

23	CT#3 South	95	50	2	366
24	Mech Workshop	95	50	1	366
25	Lab/Plant Office	95	50	1	366
26	Boiler # 3	25	100	2	148
27	New Rotary Dryer	120	120	1	416
28	Shaffar Reactors	95	110	1	366
29	Coal Gasifier	70	70	1	307
30	Boiler # 4	70	90	1	256
31	31% caustic	95	60	1	366
32	MCC-I	120	90	2	416
33	IC-South Boiler	120	250	1	416
34	MCC-II	120	100	2	416
35	Colony/Engg Store	120	150	1	349
36	PBB	35	15	1	213
37	Grid	120	200	1	416
38	Main Office	400	200	1	783
39	Brine (PB-2)	120	110	1	416
40	Air blower	70	1000	1	307
41	Brine (PB-4)	120	90	1	416
42	HG Pump (SCR)	120	50	2	416
43	CT#1 (PB-16)	120	60	1	416
44	Pumping Station	120	230	1	416
45	CT # 1 (New)	185	60	1	526
46	Elect & Inst W/S	95	50	1	366
47	Winding W/S	185	70	1	526
48	CCR SS1	16	60	1	179
49	Solidification	185	100	1	526
50	Caustic Filling	35	90	1	213
51	SCR C&D	35	110	1	213
52	SS II Emergency Supply	95	180	1	366
53	Dep Brine Pumps	95	120	1	366
54	PP Lighting	95	300	1	366
55	IEM CT	120	280	1	416
56	Evaporation	95	60	1	366
57	SAC South	120	300	1	416
58	Utility W/S	25	40	1	148
59	CT#2 Circuit C	150	150	1	393
60	Mycomp Comp	95	50	1	307
61	Hypo 1&2	70	90	2	256
62	HW Pump	25	30	1	148
63	Hypo # 3	70	120	1	256
64	Mycomp Comp	70	50	2	256
65	CL 2 Comp	120	50	1	349
66	CL2 Comp	120	50	1	349
67	Hg Removal	25	1000	1	179
68	MCC-III	70	120	1	256
69	OH Line	120	180	1	349
70	New HCL	120	100	1	349

71	Mycomp	70	50	2	256
72	CT#2 Circuit B	120	150	1	349
73	HCL H/W Pump	95	100	1	307
74	Cylinder Maint	35	80	1	177
75	CT#2 Circuit A	150	150	1	393
76	Air Comp	4	50	1	54
77	T1 Incoming Cable	240	83	2	568
78	T2 Incoming Cable	240	149	2	568
79	T4 Incoming Cable	240	220	2	568
80	T5 Incoming Cable	300	200	2	633
81	To Power Plant	300	180	1	633
82	SS-2 Main HT Cable	70	170	1	271
83	RECT # 5	185	1000	2	461
84	Incoming from PP	150	180	2	445
85	SS1 Lighting	95	10	1	307
86	G1 Cable	300	10	2	689
87	G2 cable	300	58	1	633
88	G3 cable	300	63	1	633
89	G4 cable	300	68	1	633
90	G5 cable	300	70	1	633
91	IC South W/S	95	300	1	366
92	Spin Flash	150	125	1	465
93	Auto W/S	95	150	1	307
94	Zn New	120	150	1	349
95	T1 SS/1 Incoming Cable	185	12	1	461
96	T2 SS/1 Incoming Cable	185	12	1	461
97	O/G cable PP Motors 50 Hz	150	35	1	445
98	O/G cable PP Motors 60 Hz	150	37	1	445
99	Cable	300	60	2	633
100	PP Cable	300	100	2	633
101	IEM 2 RECT	300	200	2	633

3. SHORT CIRCUIT STUDY

3.1 Introduction

The short circuit calculations are carried out using IEC 60909-0 standard. The voltage factor c = 1.1 is used for 3-phase and 1 phase maximum short circuit calculations at medium voltage and c = 1.05 for low voltage network. The initial 3-phase (maximum) symmetrical short circuit (Ik") will be referred to the thermal stress of breaker and is used in the selection of circuit breaker and peak current (ip) will determine the mechanical stresses on the breaker.

2-phase and 1-phase minimum short circuit will be calculated by considering the voltage factor c = 1 for medium voltage and c = 0.95 for low voltage network. 2 phase minimum short circuit is used for protection coordination for phase faults while 1 phase minimum short circuit will be used for earth fault settings.

Maximum short circuit current will be calculated when all generating sources & all the load in the network is in operation. The minimum short circuit current will be calculated when all the load is disconnected from the system and minimum generating sources are in operation.

Short circuit study has been carried out to verify:

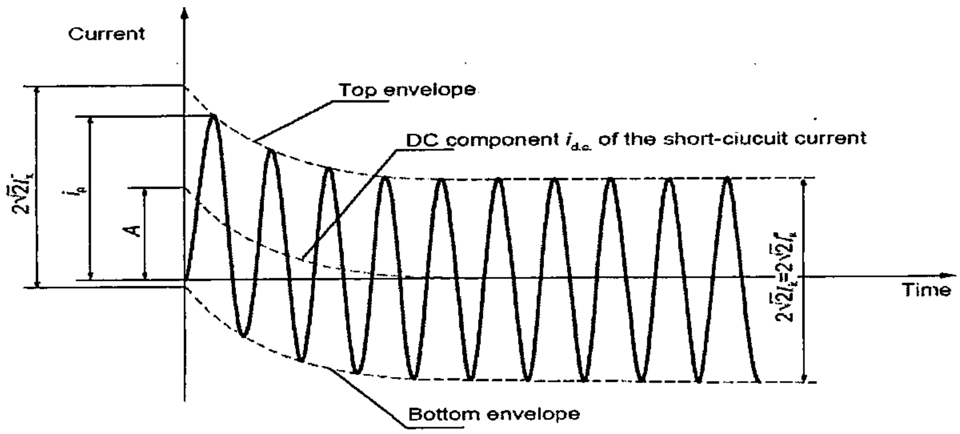
x The capability of all LV bus bars to withstand short circuit current.

x Peak current calculations to evaluate the mechanical stress.

x Minimum short circuit levels at the bus bars.

3.2 Adopted Procedure

The method used for calculation is based on the introduction of an equivalent voltage source at the short-circuit location. The equivalent voltage source is the only active voltage of the system. All network feeders, synchronous and asynchronous machines are replaced by their internal impedances. In all cases it is possible to determine the short-circuit current at the short-circuit location with the help of an equivalent voltage source. Operational data and the load of consumers, tap changer position of transformers, excitation of generators are dispensable. Short circuit current distribution diagram is given below:



I_k'' = initial symmetrical short-circuit current
i_p = peak short-circuit current
I_k = steady-state short-circuit current
$i_{d.c.}$ = d.c. component of short-circuit current
A = initial value of the d.c. component $i_{d.c.}$

Figure 3.1: Short-circuit current distribution in a far from generator short circuit

Initial symmetrical short circuit current (Ik"): RMS value of the ac component of short circuit current applicable at the onset of short circuit.

Peak short circuit current (i_p): The highest possible instantaneous value of the current, following the occurrence of the short circuit. The highest value of ip depends on the time constant of the decaying aperiodic component i.e on the X/R or R/X of the short circuit impedance and is reached if the short circuit starts at zero voltage. ip also depends on the decay of of the symmetrical ac component of the short circuit current.

Steady state short circuit current (Ik): RMS value of the short circuit current which remains after the decay of the transient phenomenon.

DC component of short circuit current (i_{dc}): Mean value between the top and bottom envelope of a short circuit current, decaying from an initial value A to zero.

Table 3.1 Voltage Factors according to IEC-60909-0

Nominal Voltage U_n	Voltage factor c for the calculation of: Maximum Short-Circuit Currents c_{max} [1]	Voltage factor c for the calculation of: Minimum Short-Circuit Currents c_{min}
Low Voltage 100V to 1000V (IEC 60038)	1.05 [3] 1.04 [4]	0.95
Medium Voltage >1kV to 35 kV (IEC 60038)	1.10	1.00
High Voltage [2] >35 kV (IEC 60038)		

[1] $c_{max}U_n$ should not exceed the highest voltage Um for equipment of power systems.
[2] If no nominal voltage is defined $c_{max}U_n = U_m$ or $c_{max}U_n = 0.90 \times U_m$ should be applied.
[3] For low-voltage systems with a tolerance of +6 %, for example systems renamed from 380V to 400V.
[4] For low-voltage systems with a tolerance of +10 %.

When calculating maximum short circuits, it is necessary to introduce the following conditions as per IEC 60909-0:

- Voltage factor c_{max} according to table 3.1 shall be used for the calculation of short circuit currents.
- Choose the system configuration and the maximum contribution from the power plants and the network feeders which lead to the maximum short circuit current at the short circuit location.
- When equivalent impedances are used to represent the external networks, the minimum equivalent impedance shall be used which corresponds to the maximum short circuit contribution from the network feeders.
- Motors shall be included in accordance with their appropriate reactance by resistance ratios.
- Resistance of line (overhead lines and cables) is to be introduced at a temperature of 20 degree centigrade.

When calculating minimum short circuits, it is necessary to introduce the following conditions as per IEC 60909-0:

- Voltage factor c_{min} according to table 3.1 shall be used for the calculation of short circuit currents.

- Choose the system configuration and the minimum contribution from the power plants and the network feeders which lead to the minimum short circuit current at the short circuit location.
- Motors shall be neglected.
- Resistance of line (overhead lines, cables and neutral conductors) is to be introduced at a higher temperature of 90 degree centigrade.

3.3 3 Phase Maximum Short Circuit Cases

For 3 phase maximum short circuit calculations, the following color coding have been used to check the switchgear thermal withstand capability (ik").

Green: OK

Red: Switchgear exposed to 100%of its rated limit under 3 phase fault condition.

The following scenarios have been simulated for 3 phase maximum short circuit faults:

Case-1: The entire normal running load is fed through 04 No. 132/11.5kV power transformers.

Case 2: The entire normal running load is fed through 04 No. gas generators in parallel operation or synchronism with grid.

Case 3: The entire normal running load is fed through 04 No. gas generators in island mode.

Case 1: The entire normal running load is fed through 04 No. 132/11kV power transformers

This case involves the maximum available short circuit level under existing network configuration and load.

3 phase maximum short circuit results at different bus bars are tabulated below:

S. No	Name of Bus / Node	Network Voltage level (kV)	Calculated		Rated Capacity	
			Ik" (kA)	ip (kA)	Ik" (kA)	ip (kA)
1	132kV Bus	132	16.15	39.79	31.5	80
2	Trafo T1 Bus	11	18.19	48.76	25	63
3	Trafo T2 Bus	11	18.18	48.01	25	63
4	11 kV Bus 3	11	16.42	40.62	25	63
5	Trafo T5 Bus	11	8.14	22.58	25	63
6	Power House Bus	11	17.05	43.81	25	63
7	Substation I	0.415	**81.26**	**192.10**	65	165
8	Substation II	0.415	48.38	124.45	65	165
9	Substation III	0.415	59.00	147.24	65	165

Table 3.2 Summary of results for 3 phase maximum short circuit analysis for Case 1

Ik": Three phase initial symmetrical short circuit current
ip: Peak short circuit current

Case 2: The entire normal running load is fed through 04 No. gas generators in parallel operation or synchronism with grid

This case involves the maximum available short circuit level under planned network configuration and load.

3 phase maximum short circuit results at different bus bars are tabulated below:

S. No	Name of Bus / Node	Network Voltage level (kV)	Calculated		Rated Capacity	
			Ik" (kA)	Ip (kA)	Ik" (kA)	Ip (kA)
1	132kV Bus	132	16.61	41.04	31.5	80
2	Trafo T1 Bus	11	**26.97**	**70.75**	25	63
3	Trafo T2 Bus	11	**26.93**	**70.34**	25	63
4	11 kV Bus 3	11	25.22	62.44	25	63
5	Trafo T5 Bus	11	8.15	22.62	25	63
7	Power House Bus	11	**26.84**	**70.46**	25	63
8	Substation I	0.415	**85.37**	**202.25**	65	165
9	Substation II	0.415	49.76	128.65	65	165
10	Substation III	0.415	60.72	152.45	65	165

Table 3.3 Summary of results for 3 phase maximum short circuit analysis for Case 2

Case 3: The entire normal running load is fed through 04 No. gas generators in island mode

This case involves the maximum available short circuit level under island network configuration and load.

3 phase maximum short circuit results at different bus bars are tabulated below:

S. No	Name of Bus / Node	Network Voltage level (kV)	Calculated		Rated Capacity	
			Ik" (kA)	Ip (kA)	Ik" (kA)	Ip (kA)
1	132kV Bus	132	16.00	39.50	31.5	80
2	Trafo T1 Bus	11	10.61	25.48	25	63
3	Trafo T2 Bus	11	10.60	25.45	25	63
4	11 kV Bus 3	11	10.48	25.07	25	63
5	Trafo T5 Bus	11	8.14	22.57	25	63
6	Power House Bus	11	10.72	26.26	25	63
7	Substation I	0.415	**75.39**	**176.43**	65	165
8	Substation II	0.415	46.30	117.66	65	165
9	Substation III	0.415	56.44	138.88	65	165

Table 3.4 Summary of results for 3 phase maximum short circuit analysis for Case 3

ICL is requested to arrange for the peak (making) short circuit current capacity of all the MV and LV switchgears from supplier so that reference values can be compared accordingly.

3.4 2 Phase Minimum Short Circuit Cases

The following scenario has been simulated for 2 phase minimum short circuit faults

Case 1: Entire normal running plant load fed by 05 new Gas Generators.

Case 1: The entire normal running load is fed through 04 No. gas generators

This case involves the minimum available short circuit level under island network configuration and load.

The 2 phase minimum short circuit results at different bus bars are tabulated below:

S. No	Name of Bus / Node	Network Voltage level (kV)	Calculated		Rated Capacity
			IL2 (kA)	IL3 (kA)	Ik" (kA)
1	132kV Bus	132	13.85	13.85	31.5
2	Trafo T1 Bus	11	6.96	6.96	25
3	Trafo T2 Bus	11	6.95	6.95	25
4	11 kV Bus 3	11	6.85	6.85	25
5	Trafo T5 Bus	11	6.43	6.43	25
6	Power House Bus	11	7.02	7.02	25
7	Substation I	0.415	44.91	44.91	65
8	Substation II	0.415	28.13	28.13	65
9	Substation III	0.415	30.79	30.79	65

Table 3.5 Summary of results for 2 phase minimum short circuit analysis for Case 1

IL: Initial symmetrical short circuit current in respective phase

For detailed fault current results on LV buses, please refer Annex A.

3.5 1 Phase Maximum Short Circuit Cases

The following scenarios have been simulated for 1 phase maximum short circuit faults:

Case-1: The entire normal running load is fed through 04 No. 132/11.5kV power transformers.

Case 2: The entire normal running load is fed through 04 No. gas generators in parallel operation or synchronism with grid.

Case 3: The entire normal running load is fed through 04 No. gas generators in island mode.

Case 1: The entire normal running load is fed through 04Nos 132/11.5kV power transformers.

This case involves the maximum available short circuit level under existing network configuration and load.

The 1 phase maximum short circuit results at different bus bars are tabulated below:

S. No	Name of Bus / Node	Network Voltage level (kV)	Calculated		Rated Capacity
			IL1a (kA)	3I0a (kA)	Ik" (kA)
1	132kV Bus	132	16.13	16.13	31.5
2	Trafo T1 Bus	11	18.38	18.38	25
3	Trafo T2 Bus	11	18.36	18.36	25
4	11 kV Bus 3	11	17.01	17.01	25
5	Trafo T5 Bus	11	2.84	2.84	25
7	Power House Bus	11	18.01	18.01	25
8	Substation I	0.415	83.41	83.41	65
9	Substation II	0.415	48.33	48.33	65
10	Substation III	0.415	57.11	57.11	65

Table 3.6 Summary of results for 1 phase maximum short circuit analysis for Case 1

IL: Initial symmetrical short circuit current in respective phase
3I0a: Absolute return current

For detailed fault current results on other LV buses, please refer Annex A.

Case 2: The entire normal running load is fed through 04 No. gas generators in parallel operation or synchronism with grid

This case involves the 1 phase maximum available short circuit level under planned network configuration with parallel operation of generators with grid.

The 1 phase maximum short circuit results at different bus bars are tabulated below:

S. No	Name of Bus / Node	Network Voltage level (kV)	Calculated		Rated Capacity
			IL1a (kA)	3I0a (kA)	Ik" (kA)
1	132kV Bus	132	16.43	16.43	31.5
2	Trafo T1 Bus	11	23.56	23.56	25
3	Trafo T2 Bus	11	23.53	23.53	25
4	11 kV Bus 3	11	21.45	21.45	25
5	Trafo T5 Bus	11	2.84	2.84	25
6	Power House Bus	11	23.15	23.15	25
7	Substation I	0.415	**85.86**	**85.86**	65
8	Substation II	0.415	49.12	49.12	65
9	Substation III	0.415	58.04	58.04	65

Table 3.7 Summary of results for 1 phase maximum short circuit analysis for Case 2

IL: Initial symmetrical short circuit current in respective phase
3I0a: Absolute return current

For detailed fault current results on other LV buses, please refer Annex A.

Case 3: The entire normal running load is fed through 04 No. gas generators in island mode

This case involves the 1 phase maximum available short circuit level under island network configuration.

The 1 phase maximum short circuit results at different bus bars are tabulated below:

S. No	Name of Bus / Node	Network Voltage level (kV)	Calculated		Rated Capacity
			IL1a (kA)	3I0a (kA)	Ik" (kA)
1	132kV Bus	132	16.03	16.03	31.5
2	Trafo T1 Bus	11	0.02	0.02	25
3	Trafo T2 Bus	11	0.02	0.02	25
4	11 kV Bus 3	11	0.02	0.02	25
5	Trafo T5 Bus	11	2.84	2.84	25
7	Power House Bus	11	0.02	0.02	25
8	Substation I	0.415	78.89	78.89	65
9	Substation II	0.415	46.83	46.83	65
10	Substation III	0.415	55.33	55.33	65

Table 3.8 Summary of results for 1 phase maximum short circuit analysis for Case 3

IL: Initial symmetrical short circuit current in respective phase
3I0a: Absolute return current

For detailed fault current results on other LV buses, please refer Annex A.

3.6 1 Phase Minimum Short Circuit Cases

The following scenario has been simulated for 1 phase maximum short circuit faults

Case 1: The entire normal running load is fed through 04 No. gas generators in island mode

The 1 phase minimum short circuit results at different bus bars are tabulated below:

S. No	Name of Bus / Node	Network Voltage level (kV)	Calculated		Rated Capacity
			IL1a (kA)	3I0a (kA)	Ik" (kA)
1	132kV Bus	132	16.03	16.03	31.5
2	Trafo T1 Bus	11	0.02	0.02	25
3	Trafo T2 Bus	11	0.02	0.02	25
4	11 kV Bus 3	11	0.02	0.02	25
5	Trafo T5 Bus	11	2.84	2.84	25
6	Power House Bus	11	0.02	0.02	25
7	Substation I	0.415	57.76	57.76	65
8	Substation II	0.415	34.98	34.98	65
9	Substation III	0.415	38.46	38.46	65

Table 3.9 Summary of results for 1 phase minimum short circuit analysis for Case 1

IL: Initial symmetrical short circuit current in respective phase
3I0a: Absolute return current

For detailed fault current results on other LV buses, please refer Annex A.

4. LOAD FLOW ANALYSIS

4.1 Introduction

Every load flow problem specifies a system of non-linear equations with no direct solution. Iterative methods, such as current iteration or the Newton-Raphson method, are the only methods that remain. With PSS®SINCAL, either of these procedures can be used.

Newtonian procedures solve problems through iteration by beginning with an initial solution to the desired solution. This solution is improved step by step in order to obtain a linearized statement. Corrections to the voltage rate and the voltage angle are calculated from the active and reactive power still at variance with the prescribed values.

In the existing network configuration the whole plant is fed through 04 No. power transformers from the 132kV grid. It is planned to install 05 No. gas generators to meet the power demand of the network and to reduce power import from the grid. All the continuous running motors are considered in load flow study. However, the entire standby load is disconnected from the system to achieve the real loading of the network.

Load flow study has been carried out to verify:

- The voltage drops at all main bus-bars.
- Loading of generators, motors and power cables.
- Active and reactive power flow in the network.

Load Flow Analysis:

<u>Generators Power Delivering Capability</u>

- G-01: 6.0MW at 11kV and 0.8pf
- G-02: 6.0MW at 11kV and 0.8pf

- G-03: 6.0MW at 11kV and 0.8pf
- G-04: 6.0MW at 11kV and 0.8pf
- G-05: 6.0MW at 11kV and 0.8pf

For load flow analysis the following color coding have been used to check the components loadings and voltage profile on buses.

Black: OK.

Red: Network element exposed to heavy loading based on its rated capacity / Voltages on the network buses drop to less than 95% of the rated values.

- **For Transformer**

0[%]<=S/Sb<90[%]

S/Sb>=90[%]

- **For Cables with applied derating factors**

I/Ib<95[%]

I/Ib>=95[%]

- **For Bus Bar Voltages**

0[%]<=V/Vn<95[%]

V/Vn>=95[%]

4.2 Simulation Cases and Results

The following scenarios have been simulated for load flow simulations:

Case-1: The entire normal running load is fed through 04 No. 132/11.5kV power transformers.

Case 2: The entire normal running load is fed through 04 No. gas generators in parallel operation or synchronism with grid.

Case 3: The entire normal running load is fed through 04 No. gas generators in island mode.

The voltage profiles results from load flow results are tabulated below. For detailed results at each node, active and reactive power flow and percentage loadings of MV cables in the branches and motor power consumptions, please refers Annex-A.

The voltage and the voltage profile of the network at LV buses are shown in the table below.

Table 4.1 Voltage Profile at all Main Buses

S.No.	Name of Bus / Node	Network Voltage Level [kV]	V/Vn(%) for Load Flow cases:		
			Case - 01	Case - 02	Case - 03
1	132kV Bus	11	100	100	100
2	Trafo T1 Bus	11	101.45	105.66	99.91
3	Trafo T2 Bus	11	101.45	105.65	99.91
4	11 kV Bus 3	11	101.37	105.69	99.93
5	Trafo T5 Bus	11	99.00	99.00	99.00
6	Power House Bus	11	101.42	105.74	99.98
7	Substation I	0.415	99.88	104.13	98.46
8	Substation II	0.415	100.06	104.31	98.64
9	Substation III	0.415	99.56	103.79	98.14

The loading of main power transformers is tabulated below:

Table 4.2 Loading of power transformers

S. No	Element Name	Sb (MVA)	*S/Sb (%)			Active Power P (MW)			Reactive power Q (MVAR)		
			Case 1	Case 2	Case 3	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
1	MEIDENSHA - T1	10	77	18	-	6.9	1.46	-	3.05	-1.24	-
2	SIEMENS - T2	10	78	19	-	6.94	1.46	-	3.04	-1.25	-
3	MEIDENSHA - T4	10	75	18	-	6.74	1.41	-	2.94	-1.22	-
4	SIEMENS T5	12	34	34	-	3.85	3.85	-	1.36	1.36	-

The loading of new gas generators in island mode is given below:

Generators Power

- G-01: 4.5MW and 3.37 MVAR
- G-02: 4.5MW and 3.37 MVAR
- G-03: 4.5MW and 3.37 MVAR
- G-04: 4.5MW and 3.37 MVAR

The summary of results for load flow analysis is mentioned below.

Case 1:

Transformer Loadings: All transformers are found to be loaded below 80% of their rated capacity.

Voltage Profile: The voltages under steady state normal operation (without considering motor startups) are found to be under acceptable limits at all the system buses.

Component Loading: Equipment loadings are within permissible range. However the following cables are found to be slightly to be loaded slightly above their derated current capacities.

The load flow conditions are found acceptable in general. All system components loadings and voltage profiles are observed to be within permissible operating ranges.

<u>**Case 2:**</u>

Transformer Loadings: All transformers are found to be loaded below 80% of their rated capacity.

Voltage Profile: The voltages under steady state normal operation (without considering motor startups) is found to be under acceptable limits at all the system buses.

Component Loading: Equipment loadings are within permissible range.

<u>**Case 3:**</u>

Transformer Loadings: All transformers are found to be loaded below 80% of their rated capacity.

Voltage Profile: The voltages under steady state normal operation (without considering motor startups) is found to be under acceptable limits at all the system buses.

Component Loading: Equipment loadings are within permissible range.

Please refers Annex-A, Load Flow Conditions for detailed results

5. OBSERVATIONS AND RECOMMENDATIONS

Short circuit calculation results show that for 3 phase faults in present network configuration, the existing MV switchgear is appropriately sized to handle the fault currents with reference to the considered short circuit levels of bus bars / breakers. Although the initial symmetrical short circuit current is not critical, the peak current will perhaps exceed the rated peak current capacity of the breakers. The rated peak current capacities of the breakers and other components of the switchgear assemblies are not known. We recommend ICL to confirm the rated peak capacities of the switchgear assembly and breakers from the switchgear manufacturer / supplier. Moreover for the LV switchgears where actual value of short circuit capacity is not known, we assumed the same to be equal to the main incoming breaker short circuit capacity.

The following short circuit capacities of the main MV and LV switchgears have been considered:

- 11 kV Switchgear: Short circuit capacity: ik" = 25 kA / 3 sec
- Substation I: Short circuit capacity: ik" = 65 kA / 1 sec
- Substation II: Short circuit capacity: ik" = 65 kA / 1 sec
- Substation III: Short circuit capacity: ik" = 65 kA / 1 sec

(ICL is advised to check the reference switchgear fault levels considered in this report).

For the load flow and short circuit calculations, the following loadings have been considered for auxiliary load:

- Substation I: Pload = 1.14 MW and Qload = 0.71 Mvar
- Substation II: Pload = 0.63 MW and Qload = 0.39 Mvar
- Substation III: Pload = 0.97 MW and Qload = 0.59 Mvar

The short circuit calculation results show that for 3 phase maximum faults the existing MV switchgears of Ittehad chemicals network are appropriately sized to handle the fault currents under existing network operation scenario. However after addition of 05 No. gas generators on main 11 kV bus bar, the 3 phase maximum fault levels are exceeding the rated switchgear capacities for parallel operation with the grid. Although the initial symmetrical short circuit current is not critical, the peak current is also exceeding the rated peak current capacity of the switchgear.

Case 1:

Short circuit results show that for three phase faults, the existing MV switchgears / busbars are suitably sized to handle the initial symmetrical and peak short circuit currents. However fault levels at LV Substation I have exceeded the rated capacity of the switchgear. (Please refer to the rated short circuit capacity of the busbars considered in this report).

The electrical network of Ittehad chemicals is solidly grounded. The single phase to ground fault results are within the switchgear limits for the MV network, however single phase to ground fault levels at LV Substation I have exceeded the switchgear limits.

Case 2:

Short circuit results show that for three phase faults, the fault levels on the existing MV switchgears / busbars have exceeded the rated capacity of the switchgear under parallel operation of gas generators with the grid.

It is observed that for up to 03 No. generators in parallel operation with the grid the 3 phase maximum fault levels are under the rated switchgear limits however the fault levels exceed for operation with more than 03 generators in parallel operation with the grid. However it is also observed that with 03 No generators in operation the transformers are lightly loaded and the power demand can be met using two transformers in parallel. This also reduces the fault levels on the main 11kV bus bars.

Therefore for the parallel operation of gas generators with grid, one of the power transformers i.e. T1, T2 or T4 should be disconnected from the network so that the fault current levels remain under switchgear limits.

Furthermore the three phase short circuit increases on Substation I bus bar during the parallel operation of step down transformers T-1 and T-2 of 1.6 MVA each. If one of the transformers is isolated or disconnected the fault current levels will decrease. Keeping in view the loading conditions one transformer can supply the entire load without overloading. Therefore we recommend operating the entire load via single transformer.

Another possible solution to limit the short circuit on Substation I is to split the bus bar with a coupler. Each transformer will supply half of the load with the bus coupler open. But the possibility of dividing the load on two bus bars by splitting it with a coupler needs to check by ICL.

Case 3:

For this case the three phase short circuit levels on the existing MV switchgears / bus bars are under the switchgear capacity for parallel operation of 4 No. gas generators.

6. ANNEX-A

6.1 Input Data Model

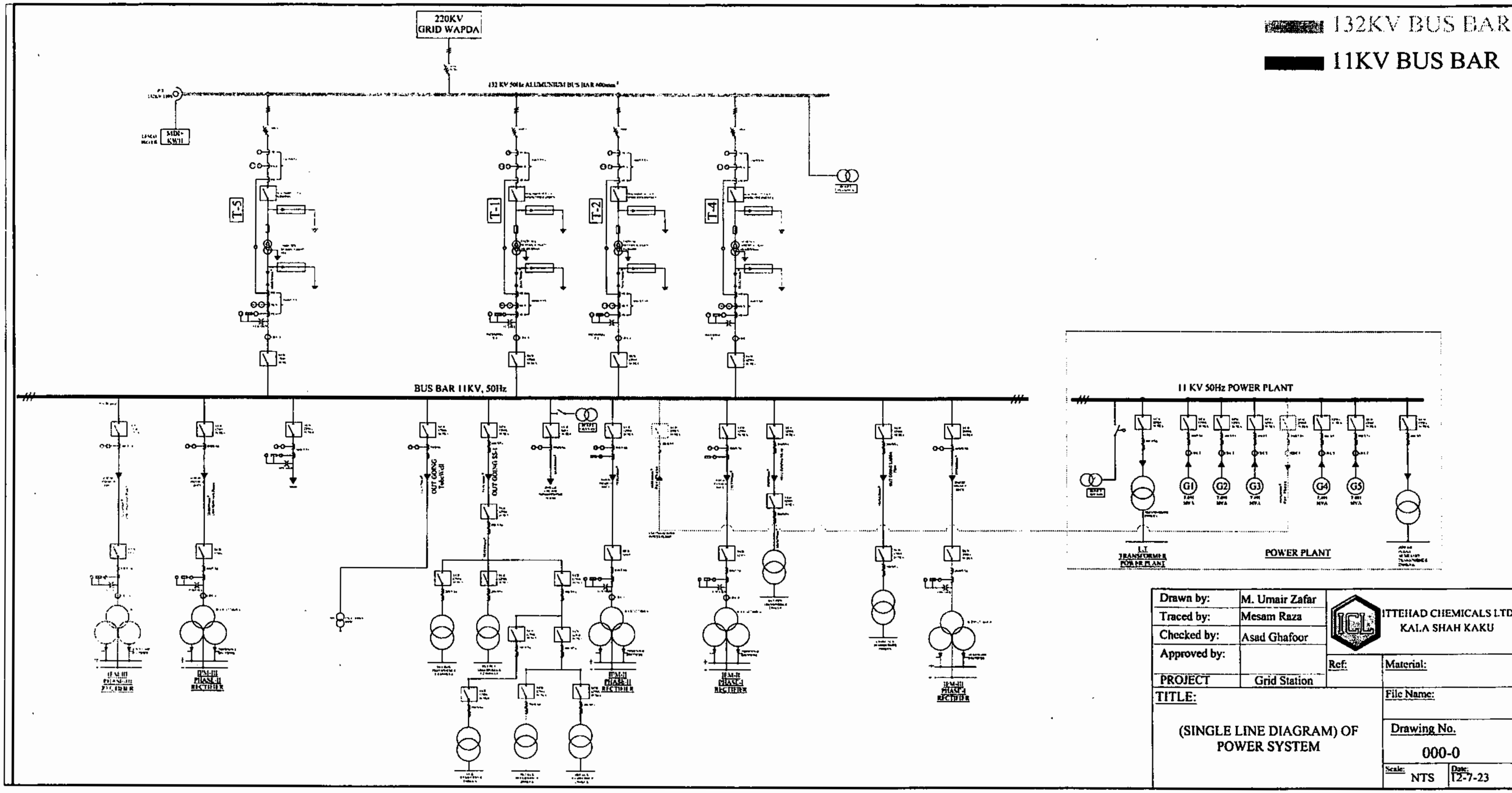
6.2 3 Phase Maximum Short Circuit Results

6.3 2 Phase Minimum Short Circuit Results

6.4 1 Phase Maximum Short Circuit Results

6.5 1 Phase Maximum Short Circuit Results

6.6 Load Flow Conditions



Drawn by:	M. Umair Zafar	ITTEHAD CHEMICALS LTD KALA SHAH KAKU		
Traced by:	Mesam Raza			
Checked by:	Asad Ghafoor			
Approved by:		Ref:	Material:	
PROJECT	Grid Station		File Name:	
TITLE:			Drawing No.	
(SINGLE LINE DIAGRAM) OF POWER SYSTEM			000-0	
			Scale: NTS	Date: 12-7-23

Rev	Date	Description	Prepared by		Checked by		Approved by		Client Approval	
			Initial	Signature	Initial	Signature	Initial	Signature	Initial	Signature
0	16.01.24	Issued for Review	MA		HJ		SMU			

Buyer:	ICL POWER (PVT.) LTD.
Consultant : FABCON DESIGN & ENGINEERING (PVT) LTD	FABCON DESIGN AND ENGINEERING (PVT.) LTD.
PROJECT	2 x 17MW CO-GENERATION POWER PLANT
DOCUMENT TITLE	TECHNICAL FEASIBILITY OF POWER PLANT

DOCUMENT NO.	SHEET	REV.
FDE-ICLPPL-TF-003	1 OF 31	0

Table of Contents

1. Introduction

1.1 Project Overview

ICL Power (Pvt.) Ltd. (ICLPPL) a private power generation company limited is going to install 2 x 17MW Cogeneration Power project adjacent to Ittehad Chemicals Limited (ICL) at Kala Shah Kaku, Punjab Pakistan. <u>The Project consists of two 17MW condensing and extraction steam turbine along with high pressure and high-temperature steam generator. One unit shall be constructed at present and second unit shall be constructed later.</u>

ICL Power (Pvt.) Ltd. (ICLPPL) has hired Fabcon Design and Engineering (Pvt.) Ltd., as the Project Consultant, to provide the engineering and supervision of procurement, manufacturing, installation, construction, and commissioning services for the co-generation power project.

1.2 Document Scope

The document offers a comprehensive feasibility report aiming to secure a Power Generation License, focusing on establishing a biomass-fired power plant in Pakistan. It outlines key project objectives, evaluating meteorological, seismic, and biomass factors. Detailed analysis covers plant capacity, technology, construction needs, staffing, and resource procurement, including demobilization and site restoration considerations. Operational aspects emphasize health, safety, and environmental standards, prioritizing personnel training. Extensive coverage spans fuel supply, infrastructure, and facility specifications, encompassing design basis, control systems, security, and electrical infrastructure. Detailed examination extends to water treatment, civil design, and electrical aspects, addressing equipment selection, layouts, protections, and safety measures.

1.3 Definition and Abbreviations

1.3.1 Definitions

Buyer:	ICL Power (Pvt.) Ltd. (ICLPPL). In this document the word Buyer and ICLPPL are interchangeable and mean the same.
Consultant:	Fabcon Design and Engineering (Pvt.) Ltd. (FDE). In this document the word Consultant and FDE are interchangeable and mean the same.
Vendor:	Means any and all persons, firms, partnerships, companies, bodies, entities, or a combination thereof including sub-vendors who are providing equipment, material, and services to perform duties specified by IPL.
Project:	2 x 17MW Biomass Fired Cogeneration Power Plant

1.4 Project Location

The plant is located at Kala Shah Kaku, Punjab Pakistan, adjacent to existing Ittehad Chemical Plant. Total designated area is approximately 20 acres of land which include power plant area and biomass storage as well.

Location Map

1.5 Project Activities

The proposed project shall involve the following activities:

- Construction and Commissioning Activities
- Operation Activities

2. Project Details and Prospective

2.1 General

ICL Power (Pvt.) Ltd. (ICLPPL) a private power generation company limited is going to install a 17MW Cogeneration Power project adjacent to Ittehad Chemicals Limited (ICL) at Kala Shah Kaku, Punjab Pakistan. ICL Power (Pvt.) Ltd. (ICLPPL) has hired Fabcon Design and Engineering (Pvt.) Ltd., as the Project Consultant, to provide the engineering and supervision of procurement, manufacturing, installation, construction, and commissioning services for the co-generation power project.

The description set out herein below is intended to be an indicative broad outline only; and may change by evolving Project needs.

2.2 Meteorology

Meteorological data sourced from the Kala Shah Kaku, Punjab Pakistan has been utilized to establish the fundamental climatic conditions of the project area and its vicinity. Over the past five years, data was gathered from the Pakistan Meteorology Department's station in Kala Shah Kaku, offering a comprehensive view of the area's climate patterns. The annual rainfall figures between 2009 and 2013 ranged from 1 to 243.1 mm, showcasing significant variation. Monthly minimum temperatures oscillated between 3.5 and 28.6°C, with mean values falling within the range of 16.6 to 41.9°C. Relative humidity in the project area fluctuates from 19 to 70. Wind speed averages between 0.4 and 7.6 Knots every month.

2.3 Water Source

The project area lies in the district of Kala Shah Kaku; the groundwater table normally exists 40 to 50 ft below the ground level. Tube wells shall be utilized for sourcing cooling water from groundwater resources. The choice to utilize tube wells for sourcing cooling water stemmed from their cost-effectiveness, reliability, and feasibility in accessing groundwater resources.

2.4 Seismic Condition

Pakistan lies on an active seismic belt of Earth. Seismic observations indicate that hundreds of shocks originate every year. Mostly, these seismic waves are of low intensity and do not have a significant effect. According to the seismic zones of UN-Habitat, the project area falls under Zone 2A.

2.5 Fuel (Biomass)

Biomass (agricultural waste) available locally shall be used for the project. A comprehensive analysis of the designated biomass is outlined in this report.

2.6 Capacity of the Plant at Reference Conditions

The Project has the following design ratings at reference site conditions based on the LHV of the biomass:

Parameter	Units	Value
Plant Efficiency (Based on Net Capacity)	%	24.09
Plant Efficiency (Based on Gross Capacity)	%	21.26
Power Capacity Factor (Based on Gross Capacity)	%	91.32

2.7 Description of the Plant

2.7.1 Proposed Plant Specifications

The broad parameters of the project are:

Project Capacity	:	17,000 kW
Construction Period	:	16 Months
Boiler Type	:	Single Drum Membrane Type Step Grate Biomass Fired Boiler
Boiler Capacity	:	100 TPH, 100 Bar(g), 485 ºC
Turbine Capacity	:	17 MW Extraction/Condensing
Total Net Power Generation	:	15,000 kW
Fuel	:	Biomass (Locally Available)

2.7.2 Major Systems of The Proposed Plant

The major systems of the proposed plant include biomass handling and processing system;

- Single Drum Membrane Type Step Grate
- Extraction-Condensing Steam Turbine
- Electrical Power Generator
- Flue Gas Treatment System
- Cooling Water System
- Ash Handling System
- Utilities and Waste Management System
- Boiler Feed Water Treatment System
- Fire Fighting System

2.7.3 Technology Description of the Proposed Power Plant

ICL Power (Pvt.) Ltd. (ICLPPL) is interested in technology that is the latest and proven. The 9.8 MPa, 480 °C system is identified with assumptions of **17MW** gross output, **30tph** net extraction, as offering a significantly superior return on investment. This configuration strikes a balance between substantial fuel savings and a modest increase in capital investment.

Specifications of Extraction Condensing Steam Turbine are as follows:

Power Output	:	17MW
Type	:	Extraction Condensing
Steam Extraction	:	30TPH @ 10 Bar (g)
Stage	:	Multistage, Nozzle Governed
Steam Inlet Pressure	:	98 Bar(g)
Steam Inlet Temperature	:	480 °C

Specifications of Generator are as follows:

Voltage Level	:	11000 V
Frequency	:	50 Hz
Power Factor	:	0.8
Insulation Class	:	F

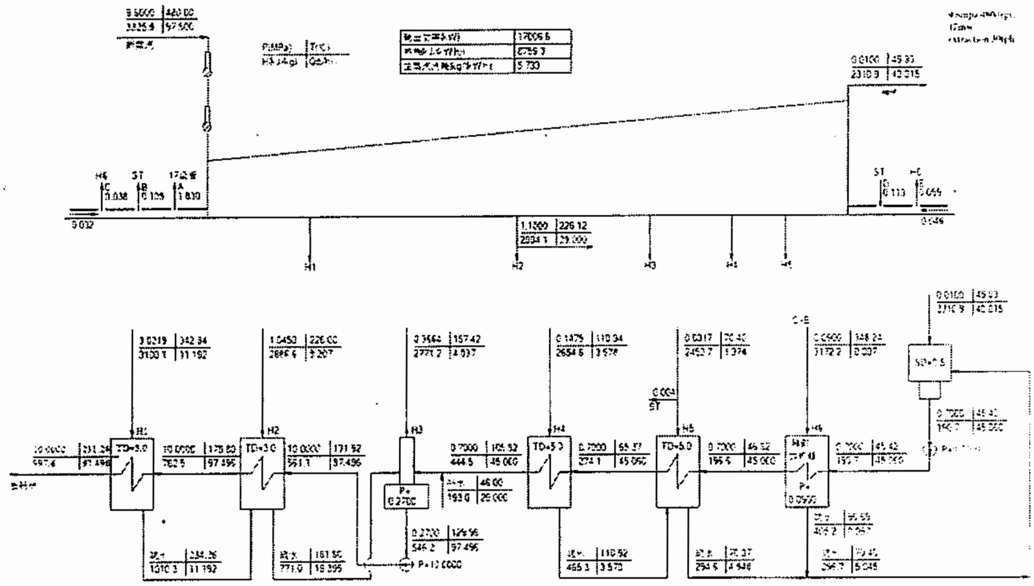
Specifications of Boiler are as follows:

The biomass-fired boiler is a bottom-supported natural circulating boiler with a single drum and consisting of a rigid water-cooled frame for supporting the heating surfaces and steam drum. The boiler is provided with a membrane wall construction which is water-cooled and fully gastight. Due to the welded construction, its water-cooled frame, and low wall thickness of the steam drum the boiler can react very fast to load changes and can be started relatively fast compared to other types of boilers.

The boiler has following key parameters

Type	:	Single Drum Membrane Type
Evaporation Capacity	:	100 TPH
Steam Pressure	:	100 Bar(g)
Steam Temperature	:	485 °C ± 10 °C
Grate	:	Reciprocating Grate
Draft	:	Balanced
Furnace Type	:	Membrane type water-cooled
Fuel	:	Biomass (Agriculture Waste)
Feed Water Temperature	:	210°C

Boiler Efficiency on LCV	:	88%
Flue Gas Temperature	:	145°C



2.8 Power Plant Construction

The proposed power plant shall take approximately 16 months for construction installation and commissioning. ICLPPL plans to start the construction activity for the proposed power plant by the start of January 2024 and expected to commission/operation shall be started by the end of July 2025.

Typical activities that are conducted during civil construction are listed below:

- Construction camp setup and mobilization of contractors
- Excavation for foundations
- Laying of foundations
- Masonry work
- Concrete work
- Asphalt work (pavement, roads, etc.)
- Finishing (plastering, painting, etc.)

The power plant and ancillary equipment, brought to the site by road in sections, shall be erected on-site and commissioned. Typical activities that are conducted during plant erection are listed below:

- Site fabrication (equipment/pipe supports, equipment assemblies, etc.)

- Placement of the vessels and equipment (Steam turbine) on the foundations
- Laying of pipes; Welding, joining, etc.
- Electrical installation (cabling, switchgear, transformers, etc.)
- Instrument installation (field instruments, control room instruments, instrument cabling, etc.) and painting etc.

2.8.1 Resources Consumption and Supplies

2.8.1.1 Staffing

It is expected that around 150-200 skilled and unskilled personnel shall be required during construction activities of the project. Local people shall also be hired for unskilled and semi-skilled work during project activities.

2.8.1.2 Water & Electricity Sourcing

Water required during the peak construction period shall be taken from a groundwater well(s). Potable water collected for the power plant shall meet NEQS for drinking water and WHO guidelines. Electricity from the WAPDA shall be the primary source during the construction, testing, and commissioning phase and afterward. Other supplies required during the construction phase include office and camp supplies.

2.8.1.3 Construction Material Sourcing

During the construction, a large amount of construction material shall be required. This shall include steel, cement, sand, and aggregates for road and pavement construction. Construction materials shall be mainly procured from the Punjab.

2.8.2 Demobilization and Site Restoration

On completion of the construction and commissioning phase, the construction contractor shall demobilize the site and construction camp. Temporary infrastructure shall be decommissioned, and sites shall be restored. This shall involve:

- Removing the temporary construction camp
- Closing all the temporary waste pits
- Removing all waste and leftover construction materials from the site
- Leveling and restoration of areas.

2.9 Power Plant Operations

A brief description of the whole process of the power plant (ICLPPL) is mentioned below,

The proposed power plant shall be a Biomass-Fired Power Plant

- A biomass storage shed shall be constructed at the project site.
- Highly refined quality water of is fed into the boiler to avoid internal scaling. Exhaust gases shall be passed through ESP/Bag Filter to minimize its corrosively for ambient air.

- Superheated steam @ P: 9.8 MPa & T: 480°C shall be produced to generate power through extraction-condensing type steam turbine generators (STG).
- Low-pressure exhaust steam is passed through a Water-Cooled Condenser (WCC) equipped with Cooling Tower for cold water supplies.
- Bottom ash shall be disposed-off by landfill.
- The proposed power plant shall produce about 17 MW gross.

2.10 Health, Safety, and Environmental Management Standards

The construction and operational phase of the project shall have to meet the requirements of health, safety, and environmental standards and HSE Policy of ICLPPL. ICLPPL standards highlight commitment on prioritizing health and safety of all its employees, contractors and visitors involved in its activities and confer overriding commitment towards minimizing impact of its activities on the natural environment. Moreover, the following procedures and arrangements shall be done during all phases of project activities.

- Personal Protective equipment (PPE's)
- Complete first Aid Facility
- Fire Protection & Prevention
- Emergency preparedness plan and procedures. Safety measures for excavation/openings
- Proper House Keeping
- Maintenance & Equipment Inspections
- Electricity Safety;
- Safe usage of Hand & Power Tools
- Standard Scaffoldings & Ladders
- Proper hoisting, cranes & lifting etc.
- Standard welding procedures
- Safe handling of hazardous materials: Chemicals & Gas Cylinders
- Safe working above ground levels
- Necessary Weather Protection Measures
- Safe working at confined places
- Avoid working at fragile roofing & materials
- Strict compliance of 'Warning signs
- Proper Waste Management plan and procedures

2.11 Training & Development

The contractor shall provide training, including on-site and training in the English language, so that such training is complete before the commencement date, for suitably qualified and experienced O&M personnel by Progress Event schedule, to provide such personnel with the knowledge required to operate the Power Station in accordance with the O&M manuals, the manufacturer's instructions and guidelines, and the level of competence of a reasonable and prudent operator. The contractors shall undertake to train at site installation, operation and maintenance of the offered plant equipment's, engineering personnel selected by the owner. The period and nature of training for the individual personnel shall be agreed upon mutually between the contractors and the owner covering the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable by the owner.

- Training on flue gas analyzers, as well as other Steam Generators/Turbine Generators/related E & I system equipment including related electrical areas such as generators and excitation systems.
- Training for special packages for various PLC/DCS-based systems.

The contractors shall provide the training equipment and materials during the training period. All the software, films, video CDs, transparencies, notes, etc. used in the training program shall remain the property of the owner at the end of the agreement.

The contractor's supervisory and erection personnel deputed to site works shall continuously and intensively instruct and train the Owner's personnel engaged in the erection or operation and maintenance of the plant at the site during erection, testing, and commissioning as well as during operation and maintenance. This shall cover all aspects of site work on the plant including special instructions and care required in attending to various jobs, whether or not they are incorporated in the relevant manuals.

3. Fuel Supply

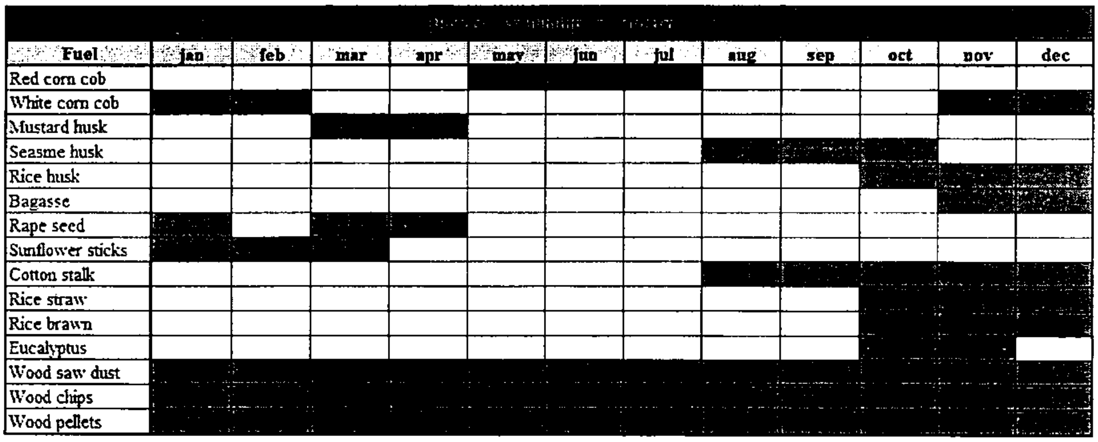
Biomass (Agricultural Waste) is selected as fuel for this project. Biomass emerges as a promising, cost-effective, and sustainable alternative with the potential to address both energies needs and environmental concerns.

3.1 Selected Types of Biomass Fuel

The following types of biomass are selected for power generation that are readily available in Pakistan.

1- Bagasse	2- Rice Husk	3- Rice Straw
4- Corn Cob (Red)	5- Corn Cob (White)	6- Corn Stalks
7- Brassica	8- Mustard Straw	9- Wood Chips
10- Cotton Stalks	11- Wheat Straw	12- Sugarcane Trash
13- Maize Husk		

3.2 Seasonal Availability Chart for Biomass of Pakistan



3.3 Annual production potential of crop residue in Pakistan

The annual production potential of crop residue biomass and their use is given as follow:

Biomass Residues	Theoretical Potential	Technical Potential	Past Annual Usage (%)
Bagasse	11,790	4,224	35.8
Rice husk	1,288	557	43.2
Corn cob	599	67	11.2
Corn husk	400	45	11.3
Cotton stalk	25,865	2,764	10.7
Wheat straw	16,323	2,604	16.0
Rice straw	6,438	2,784	43.2
Sugarcane trash	4,716	1,690	35.8
Maize stalk	2,270	256	11.3
Total	69,689	14,991	21.5

3.4 Composition of Biomass (Proximate and Ultimate Analysis).

The proximate analysis and ultimate analysis of Pakistan's crop residues-based biomass are given as follows:

Parameter	Unit	Corn Cob	Corn Stover	Corn Stalk	Wheat Straw	Rice Husk	Brassica	Bagasse	Coal Foreign
				Specific Energy					
Gross Calorific Value	kJ/KG	14856	14912	16206	16670	16126	15072	10249	23550.75
Net Calorific Value	kJ/KG	12526	13972	14185	14777	14816	14053	8360	22776.19
				Proximate Analysis (ar)					
Total Moisture	%	15	7.58	13.17	8.61	11	11	48	8
Volatile Matter	%	75	65.68	59.83	70.41	66	65	84.79	21
Ash	%	3.2	13.13	11.52	8.65	18	12	2.91	7.5
Fixed Carbon	%	13.92	13.61	17	16.11	17	22	11.82	36
Total Sulfur	%	0.15	0.31	0.18	0.21	0.17	0.16	0.02	0.33
				Ultimate Analysis (ar)					
Carbon (C)	%	42.7	38.36	48.23	43.11	38	42.79	49.2	58.5
Hydrogen (H)	%	6.49	6.65	8.18	5.81	6	6.06	4.69	3
Nitrogen (N)	%	0.25	0.57	0.81	0.63	0.8	0.84	0.18	0.9
Oxygen (O)	%	50.41	40.85	31.08	50.45	37	40	43	4
				Ash Fusion Temp. (reducing)					
Initial deformation Temp	°C	970	990	990	920	>1500	1080	1100	1150
Spherical (Softening) Temp	°C	1000	1000	1000	990	>1500	1240	1240	1210
Hemispherical Temp	°C	1030	1040	1040	1061	>1500	1275	1270	1200
Fluid Temperature	°C	1100	1070	1100	1100	>1500	1305	1352	1250
				Ash Analysis (db)					
Silica (SiO_2)	%	63.6	58.8	67.02	41.52	95.4	17.2	73	38.5
Alumina (Al_2O_3)	%	5.85	8.81	2.15	1.01	0.1	7.9	6.7	16.5
Manganese (Mn_3O_4)	%	2.11	3.65	3.68	1.98	0.3	9.6	3.2	0.01
Calcium (CaO)	%	3.5	6.83	6.78	8.08	0.4	34	2.8	0.1
Iron (Fe_2O_3)	%	2.95	4.23	1.01	0.7	0.1	1.5	6.3	1
Phosphate (P_2O_5)	%	2.42	1.35	0.94	4.45	0.5	1.5	4	0.1
Sodium (Na_2O)	%	0.45	1.26	0.4	0.6	-	0.5	1.1	0.1
Potassium (K_2O)	%	8.42	10.56	5.24	31.9	1.8	17.7	2.4	0.2
Titanium (TiO_2)	%	0.6	0.31	0.13	0.07	-	0.3	-	0.5
Sulfate (SO_3)	%	1.14	0.57	2.42	3.33	-	7.5	0.4	-
Other Impurities	%	8.96	3.64	10.23	6.36	1.4	2.3	0.1	-

3.5 Biomass Transport Feasibility Matrix

Preprocess-sing steps (for transport purposes)		Feedstock density (kg/m3) and moisture content (%)						LHV (MJ/kg)		
		Raw (loose) feedstock		Baled/ Bundled		Chopped/Chipped		Raw feedstock	Baled/ Bundled	Chopped
		Density	Moisture %	Density	Moisture %	Density	Moisture %			
Wheat straw	Baling	40	0.1	175	0.1	n/a	n/a	14.4	14.4	n/a
Cotton stalks	Bundling or Chipping	55	0.125	160	0.125	300	0.125	15	15	15
Rice straw	Baling	30	0.105	155	0.105	n/a	n/a	12.5	12.5	n/a
Maize stalks	Bundling or Baling	60	0.16	230	0.16	n/a	n/a	13	13	n/a
Sugarcane trash	Baling	32	0.24	155	0.24	n/a	n/a	12.6	12.6	n/a
Rice husk	N/A	145	0.115	n/a	n/a	n/a	n/a	13.5	n/a	n/a
Corn cob	N/A	132	0.176	n/a	n/a	n/a	n/a	14	n/a	n/a
Maize husk	N/A	30	0.119	n/a	n/a	n/a	n/a	11.6	n/a	n/a
Bagasse	Baling	120	0.5	n/a	n/a	n/a	n/a	7.5	n/a	n/a

Transportation Modes

Biomass transportation primarily utilizes tractor trolleys, trucks, or similar road-based transport modes in Pakistan due to their accessibility and suitability for local roads.

Accessibility

Pakistan's road network supports the movement of biomass from local sources to power generation facilities, ensuring relatively easy access and transport feasibility.

Supply Chain Management

Biomass resources are locally abundant, reducing transportation distances and fostering a dependable and consistent supply chain.

Logistics and Efficiency

The chosen modes of transportation offer efficient delivery of biomass quantities, with regular and well-managed schedules to maintain a steady supply. Biomass transportation accounts for proper handling practices and maintaining quality and quantity standards during transit and storage at the facility.

4. Information Regarding Infrastructure

The holistic infrastructure plan, encompassing administrative buildings, healthcare facilities, landscaping, roads, staff colonies, and strategically positioned security check posts, reflects our commitment to fostering a conducive work environment while ensuring operational efficiency and compliance with safety standards.

4.1 Road Network Overview for Power Generation Facility

- The road network within the facility premises is planned to be a grid-style layout that shall ensure efficient access to different sections of the power generation site.
- Roads shall be constructed with sufficient width to accommodate smooth vehicular movement, including space for heavy-duty vehicles.
- Entry and exit points shall be strategically placed to optimize access and traffic flow.
- Curves and turns shall be engineered with broader angles to accommodate larger vehicles and ensure safe maneuverability.
- Emergency response routes shall be designated and marked for quick access by fire trucks, ambulances, and other emergency vehicles.
- Roadside signage and clear markings shall aid emergency services in navigating the premises swiftly.

4.2 Administrative Buildings Overview

- The administrative buildings within the power generation facility shall serve as operational hubs and shall support a range of functions critical for effective management, operations, and workforce coordination.
- Their design and functionalities shall be tailored to meet the diverse administrative needs of the facility while emphasizing efficiency, functionality, and sustainability.

4.3 Staff Housing Plan Overview

- The accommodation capacity shall be designed to house both single and family units, considering the diverse needs of the workforce.
- Adequate water and electricity in all units shall be provided.
- The housing plan shall ensure easy access to essential services and facilities within the facility.
- Security measures shall be implemented to safeguard the staff colony, including surveillance and controlled entry/exit points.

4.4 Medical Center/First-Aid Station

- The medical center/first-aid station shall be strategically located within the facility for easy access during emergencies.
- It shall be equipped to handle basic medical needs and initial emergency responses.

- Protocols shall be placed to manage emergency situations until professional medical assistance arrives.

4.5 Security Check Posts:

- Security check posts shall be strategically positioned at entry and exit points, perimeter boundaries, and critical access areas within the facility.
- These posts shall serve as checkpoints to monitor and the entry and exit of personnel, vehicles, and materials shall be regulated
- Surveillance cameras shall be installed to monitor activities and record footage for security purposes.

5. The Type, Technology, Model, Technical Details and Design of Facilities

5.1 Principle on Unit Selection:

- Main equipment shall be Chinese-made equipment with proven design
- The main and auxiliary equipment has advanced technology, good quality, high reliability and availability
- The unit has high efficiency. The project is a newly built project. At this stage, one unit of 17 MW shall be constructed, and second unit of 17 MW shall be constructed later.

5.2 Main Equipment and Parameters

Specifications of Extraction Condensing Steam Turbine are as follows:

Power Output	:	17MW
Type	:	Extraction Condensing
Steam Extraction	:	30TPH @ 10 Bar (g)
Stage	:	Multistage, Nozzle Governed
Steam Inlet Pressure	:	98 Bar(g)
Steam Inlet Temperature	:	480 °C

Specifications of Generator are as follows:

Voltage Level	:	11000 V
Frequency	:	50 Hz
Power Factor	:	0.8
Insulation Class	:	F

Specifications of Boiler are as follows:

Type	:	Single Drum Membrane Type
Evaporation Capacity	:	100 TPH
Steam Pressure	:	100 Bar(g)
Steam Temperature	:	485 °C ± 10 °C
Grate	:	Reciprocating Grate
Fuel	:	Biomass (Agriculture Waste)
Feed Water Temperature	:	210°C
Boiler Efficiency on LCV	:	88%
Flue Gas Temperature	:	145°C

5.3 I & C Design Scope

This design scope includes the thermal control of boiler and its auxiliary system, turbine and its auxiliary system, deaerator& feed water system, circulating water systematic.

5.4 Level of I & C

5.4.1 Control Mode

This term project uses a DCS monitoring system control method to control and regulate the boiler system, turbine system and auxiliary system. According to the arrangement of plant, some system shall set DCS remote I/O stations, such as Circulating water pump system, Fuel oil pump system, etc.

The balance of plant shall adopt PLC control or on-site control mode and the PLC control system shall communicate with plant DCS system.

The unit is monitored and controlled via mouse/keyboard and LCD in the central control room. For safety and reliability, emergency measures are considered against "DCS" failure, that is, some hard-manual operations are reserved (for example, MFT push button, Drum emergency water releasing valve push button, emergency stop turbine push button, AC lube oil pump start/stop push button, DC lube oil pump start/stop push button, etc.).

The DCS network of unit covers:

- Control of Boiler and Its Auxiliary System
- Control of Turbine and Its Auxiliary System
- Control of Auxiliary System (Deaerator & Feed Water System, Etc)

Electrical System

- Circulating Water System (DCS Remote I/O Station)
- Fuel Oil Pump System (DCS Remote I/O Station)

The PLC System shall cover

- Fuel Handing System
- Air Compress System
- Cooling Tower System
- Water Treatment System;

5.5 Arrangement of Central Control Room and Electronic Equipment Room

Based on the arrangement of thermal equipment and auxiliary production equipment in the main building, one Central Control Room (CCR) and one Electrical Equipment Room (EER) shall be adopted for the main building thermal system.

5.5.1. Arrangement of Central Control Room

DCS operator stations, Electrical station, printer console supervising screen, etc. are arranged in the central control room which is on 8.00mfloor.

The DCS station mainly houses LCD (not less than 24 inches) and, mouse/keyboard for the DCS.

Steam drum water level TV, steam drum electrical contact water level gauge, DCS graphic display screen, plant CCTV video display screen, and LED display screen are set on the supervising screen.

5.5.2 Arrangement of Electronic Equipment Room

The DCS cabinets, I &C power supply cabinets, turbine cabinet, Electrical system cabinets, etc. are set in the electronic equipment Room. DCS engineer station and printers are set in the engineer station room.

5.6 I & C Automation Function

A set of DCS shall be provided for Units in the project. Power supplies shall be respectively provided according to Turbine, Boiler, Electrical, and Auxiliary System (deaerator &feed water system, etc.)

The automation function of DCS mainly consists of the following systems:

- Data Acquisition System (DAS)
- Modulating Control System (MCS)
- Sequential Control System (SCS)

The DCS shall be designed to achieve high levels of reliability by dual redundancy and provide self-diagnostics. Any single component failure shall not affect the operation of other parts of the system. The system parameters, alarm, and self-diagnostic function shall be highly displayed on LCD and printed out.

5.7 Distributed Control System (DCS)

The hardware system shall be implemented using field-proven experiential, 0 advanced, reliable digital technology of the microprocessor-based distributed control type.

All control processors and I/O modules in the system shall be of standardized, modular, plug-in construction and shall clearly show the identification of all components and have applicable LCD diagnostic indications.

All modules in the system shall be capable of on-line removal and replacement. Guidance and interlocks shall be provided to prevent the operated modules and other modules from damage and faults during removal or insertion of the modules. Module addresses shall not be position dependent, but modules shall function in any slot of a cabinet.

The number of types and sizes of modules shall be kept to a minimum to reduce the extent and cost of spare parts required. All DCS modules should be anti-corrosive coating.

5.7.1 Processor Modules

Processor functions in the distributed processing units shall be functionally dedicated to enhance the reliability of system. The functional processor modules shall utilize the process information gathered by the I/O processing functions to implement both modulating control and digital control.

If RAM is used it shall be backed up by batteries to support storage. Batteries shall be replaceable without interfering with equipment operation and the loosing of data.

All CPU load shall not exceed 60% load. A processor module shall be able to be removed, modified or restarted without affecting operation of other processor modules.

Upon failure of one processor module, the system shall automatically switch to the redundant processor module in a bump less fashion and alarm the fault at the Operator Station. The redundant processor module shall have parallel access to the system and shall continuously receive all changes (including those in configuration in the controlling processor module) and update itself while in the backup state.

5.7.2 Process Input / Output (I/O)

The I/O processing system shall be as smart as is practical to reduce control system processing load and shall perform functions such as scanning, data setting, digitalization inputs and outputs, linearization, cold junction compensation for thermocouple, process point quality checking and conversion of engineering units, etc. All signals of input and output shall be processed by independent devices.

The detection of Open circuit, break circuit and input signal over the technical system permission for thermocouple, RTD and 4-20mA signal shall be provided. Each function shall be performed during the point is scanned.

A power failure of a processor module shall not cause pulse inputs to lose readings accumulated at the time of the power failure and shall not limit the ability of accumulator for acquisition reading.

The signal processing for the thermocouples, RTDs, transducer inputs in a redundant scheme shall be performed in separate modules. No individual I/O module failure should result in any other equipment failure or trip.

5.7.3 System Cabinet

The system cabinets shall contain all controllers, I/O modules, power supplies, Foreign Device Interfaces, Network Interface Modules, Network Processor Modules etc. System cabinets and termination cabinets shall be capable of accepting cable entry from the bottom. All cabinets shall have front and rear access only.

All components within the cabinets shall be pre-wired to terminal blocks or utilize cable connectors.

Termination facilities for thermocouple extension wire shall include reference junction temperature compensation.

All system cabinets shall be of standard.

5.7.4 Engineering System

The engineering system is a part of the overall plant control system that shall be operated from a workstation based located in the Engineering room.

The engineering system shall be designed as a single engineering system that enables the engineer to access all system configurations with a uniform user graphic interface. The licenser of the hardware supply shall make the software development for the engineering and diagnostic systems.

The engineering system shall enable us to perform all detail engineering for commissioning, modification updating, documentation and on-line self-diagnostic routines.

5.8 Security Monitoring System

Information and security monitoring system includes CCTV, Access Control System, Fire detection and alarm system, supervisory information system (SIS).

5.8.1 CCTV

CCTV shall be installed for the project. The system includes 50 monitoring points (the biomass handling system is excluded). The CCTV subsystem shall be placed in the following areas:

- Turbine House Subsystem
- Central Control Building Subsystem
- BOP Subsystem
- Security Subsystem

All cabinets for these areas shall be placed at the local EER.

5.8.2 Fire Detection and Alarm System

A fire detection and alarm system shall be set for the project. The system shall be designed following the Pakistan fire code, and local-related design specifications shall be taken as a reference. Fire detection and fire alarm zone comprise the main powerhouse zone, BOP zone, and non-plant area. A central control panel shall be provided in CCR, and sub-panels shall be provided in the zone of the turbine house, water treatment plant zone, coal handling zone, and non-plant zone. The central control panel and sub-panel shall be interconnected to form a looped network. The control and alarm console shall be installed in CCR.

5.9 Turbine Digital Electro-Hydraulic Control System (DEH)

A digital electro-hydraulic control system (DEH) shall be supplied by Turbine manufacturer and choose Woodward (505) brand.

5.10 Turbine Emergency Trip System (ETS)

The turbine emergency trip function shall be implemented via PLC and shall be supplied by Turbine manufacturer.

5.11 Field Instrument

All field instruments and control system including process switch, transmitter, gauge for pressure, thermometer, level, flow, temperature and specialties, etc., primary elements for flow, temperature, shall be supplied for normal control, protection, monitoring of the boiler, turbine and generator. All field instruments shall be NEMA4X standards. All process connections with field instruments should be through Stainless Steel tubing and fittings.

5.11.1 Pressure measurement

The transmitter shall be smart type based on HART protocol. Pressure and difference pressure sensing elements shall be non-hysteresis type unless otherwise specified. The transmitter shall be 2-wire type and output signal shall be 4-20mA. All pressure gauges should be provided with isolation valves. The process switches for pressure, temperature, flow shall be of snap acting, single-pole, double-throw type (SPDT), able to switch 15 amps, continuous at 250 V ac or more and 0.5 amp continuous at 110Vdc or more.

5.11.2 Temperature Measurement

The primary element of temperature measurement shall be of the thermocouple, resistance temperature detector (3-wire) or thermometer.

Thermocouples (Type K) and Resistance Thermometer Detectors (RTD) are the most commonly used. All Temperature measurement gauges should be provided with separate thermowells.

5.11.3 Flow Measurement

Flow measurement device shall adopt orifice plate, vortex flow meter, wing air flow measurement device and other types.

All flow transmitters should be provided with 3-way manifold valve block assembly.

5.11.4 Level Measurement

Level measurement device shall adopt differential head type, ultrasonic type, capacitance type, magnetic type, bi-color water indicator type and others type level meter.

5.12 Cable and Cable Tray

- Cable tray shall select hot-dip galvanizing type.
- All power and control cables for 400/220 VAC should be PVC/SWA/PVC, and Armored copper Cables of 1000 Volts.
- Computer cables should be sub shielded and total shielded copper cables of size 1.3 to 1.5mm2. The thermocouple shall select extension cables.
- All instrument Cables should be shielded by twisted pair 99.9%copper cable.

5.13 Configuration of Main Monitoring and Control Equipment

1. This project shall adopt state-of-the-art DCS control system, since it has high cost/ performance ratio, and can fully utilize system functions. Besides, it can also prolong unit service life, save operation and maintenance expense.

Consequently, the producing cost can be reduced, and production managing level and market competitiveness can be improved.

2. Main L & C Equipment

    - Transmitters with internationally recognized brand (smart type) shall be adopted.
    - Critical logic switches of pressure, level, flow and temperature shall adopt internationally recognized brands.
    - Critical analyzers shall adopt internationally recognized brands.
    - High temperature & pressure sampling valve, drain valve shall adopt imported product.

3. Actuator

    Internationally recognized brands shall be adopted for automatic adjusting elements and critical actuators. Intelligent integrated electric actuators shall be selected.

5.14 I & C Laboratory

The laboratory equipment shall be configured according to the requirement of I & C system. Special maintenance and testing equipment shall be supplied together with individual automatic system.

6. Basic Design of Balance of Plant

6.1 Water Treatment System

The water source for this project is well water.

6.1.1 Water Source Quality

Water analysis reports have been provided; the data is as follows:

TESTS	Unit	Pakistan Standards	Results			
			Tubewell # 19-A	Tubewell # 21-A	Tubewell # 22	Tubewell # 23-C
Color	TCU	≤ 15.0	< 15.0	< 10.0	< 10.0	< 15.0
Taste	TEXT	Non objectionable/ acceptable	PASS	PASS	PASS	PASS
Oduor	TEXT	Non objectionable /acceptable	PASS	PASS	PASS	PASS
pH	-	6.5 - 8.5	8.1	8.0	7.9	7.0
Turbidity	NTU	< 5.0	6.3	1.2	2.9	9.0
TOTAL HARDNESS (as CaCO3)	mg/l	< 500.0	230.0	145.0	206.0	250.0
TDS	mg/l	Max. 1000	910.0	812.0	950.0	1080.0

6.1.2 Water Treatment System

System Function

- To provide make-up water with its quality meeting the requirement of unit's safe and good operation.
- To provide high purity water to the places such as laboratories, sampling and any other system where high purity water is used as well.
- To provide high purity water for equipment cleaning, washing, testing and protecting when shut off, etc.

6.2 Description of System

a. System Flow Process

The principal flow diagram of water treatment system is as follows:

Well water → raw water tank → dual media filter → cartridge filter → first stage RO → ROP buffer tank → second stage RO → middle water reservoir tank → EDI device → Demin Water storage tank → using point.

b. System Scope

In this project, water treatment system is comprised of the following: • ROP pre-treatment system

- ROP (first stage ROP +second stage ROP)
- EDI system
- ROP Chemical dosing system
- Output of water treatment system
- Output of system: 2x16m3/h Q
- Quality of demineralized water

The quality of water treatment plant outlet water is as follows:

- Conductivity: 0.2ps/cm (25°C)
- Silica dioxide: 20pg/1
- PH: 8.8-9.3

c. Operating and Controlling

The whole water treatment system shall be operated automatically. Reverse osmosis equipment shall be shut down and turned into chemical cleaning step when either of following condition exists:

- Pressure drop of film exceeds the preset value.
- Desalination ratio of film is less than the present value.
- Water output is less than the present value.
- When either of following phenomenon occurs, reverse osmosis device shall be shut down

d. Equipment Location

In this project, the equipment and control & instrument panel shall be located in the new building.

e. Chemical Dosing System for Turbine and Boiler Plant

- To maintain water chemical condition of thermal system and prevent scaling & corrosion.
- To maintain appropriate pH value in feed water to prevent corrosion by injecting ammonia to Demine. Water pump outlet pipeline.
- To remove residual oxygen in feed water by injecting hydrazine to deaerator water tank's downstream.
- To improve pH value in boiler water and prevent residual hardness depositing in boiler by injecting phosphate.

f. System Scope

Chemical dosing system consists of the followings:

- Ammonia injecting in DM water system
- Hydrazine injecting in feed water system
- Phosphate injecting in boiler water system

6.3 Design condition

a. Chemicals:

Hydrazine: liquid with concentration of 40 %(m/m), stored in barrel

Ammonia: liquid with concentration of 30%, stored in steel bottle

Tri-sodium phosphate: crystal with concentration of >951/c)/o

b. System Description

Each unit shall be equipped with one set of chemical dosing equipment which includes one set of ammonia dosing equipment, one set of hydrazine dosing equipment and one set of tri-sodium phosphate dosing equipment.

c. Ammonia Injecting in DM Water System

Liquid ammonia in steel bottle shall vaporize and be rationally injected into the agitating solution tank through transfer pump and measuring tank, then diluted to the concentration of 3%, finally pumped to DM water pump's outlet pipeline. PH value of DM water shall be controlled to be 8.8-9.3 by ammonia injection.

d. Hydrazine Injecting in Feed Water System

Concentrated hydrazine solution stored in barrel shall be rationally injected into the agitating solution tank through transfer pump and measuring tank, then diluted to the concentration of 0.3%, finally pumped into deaerator water tank downstream. Residual oxygen in feed water shall be controlled to be less than the limited value to weaken oxygen corrosion by hydrazine injection.

e. Phosphate Injecting in Boiler Water System

Solid and powder phosphate is dissolved in agitating solution tank and diluted to the concentration of 1%, then pumped into steam drum. Phosphate dosage shall be controlled by controlling P043- content.

f. Operating and Controlling

In this project, ammonia and hydrazine metering pump's dosage can be regulated by frequency. Ammonia solution dosage in DM water shall be adjusted by water flow and PH value of DM water. Hydrazine dosage in feed water shall be regulated by feed water flow. Phosphate dosage shall be controlled by manually.

g. Cooling Water Dosing System

The Cooling Water dosing system includes ant scale dosing system and dosing system. Ant scale dosing system shall be supplied for Cooling Water. In this system, one solution tank and two dosing pumps shall be supplied for cooling water. During the normal operation, one dosing pump operates and one standby. Dosing system shall be supplied for Cooling Water. In this system, one solution tank and two dosing pumps shall be supplied for cooling water. During the normal operation, one use and one standby.

h. Steam & Water Sampling System

Steam & water sampling and analyzing system are located in the main building. Chemical laboratory, analysis instruments and equipment in the project, chemical laboratory rooms shall be designed to perform the following operations:

Water analysis: this is the chemical and physical analysis of water used in the steam power plant cycle process, especially the analysis of characteristics which may destruct and/or decrease the unit performance, such as: conductivity, PH, hardness, alkalinity, silica content, ammonium, oxygen, phosphate, iron, copper, sodium, etc.

i. Biomass Analysis and Sample Preparation

This is the chemical and physical analysis of Biomass used in steam power plants, in order to shop Equipment, know the unit performance, handling characteristics and the constituents which can aggravate unit performance such as: heat value, water content, ash, volatile matter,

j. Lubricating Oil Analysis:

This is the chemical and physical analysis of lubricating oils used in steam power plants, in order to determine the performance of the oils. The analysis shall establish the oil properties and composition including carbon residue, flash point, specific weight, neutrality, viscosity, surface tension, Sulphur content etc.

k Flue Gas Analysis

This is the chemical and physical analysis of the flue gas in order to know the combustion quality and content of undesirable substances in the gas, e.g. dew point, content of O2, CO2, CO, SO2, and NOx.

6.4 Basic Design Of Electrical System

6.4.1 Design Scope of Electric Part

The scope of design includes all the electrical system of generator and auxiliary in the plant. The interface between the power plant and the outgoing lines shall be defined at the outgoing feeder line gantry for connection line and ten feeder lines.

6.4.2 Main Equipment Data

a. Main Data of Generator

- Rated output 5 OMVA
- Number of phases 3
- Rated voltage 11 kV

- Rated power factor 0.8
- Rated frequency 50Hz
- Rated current 2624A
- Direct axis sub transient reactance 11.7% (saturated)
- Short circuit ratio >0.55
- Efficiency >98.2%
- Insulation class (Applied according to temperature rise of insulation: class B)
- Speed 3000r/m
- Excitation system brush-less excitation type
- Cooling system air cooling system

The excitation control equipment shall consist of an automatic voltage regulator (AVR) (with power factor controller). The AVR shall as a minimum, be of the dual auto channel type with manual control device and appropriate auto/manual changeover circuits.

6.4.3 Electric Connections

The generator shall be connected to the 11kV switchgear via non-segregated phase bus bar. The grounding transformer shall be set at the neutral point of the generator. The 11kV bus is single bus. The low voltage bus including bus A, common bus and standby bus is from 3 set LV PDC transformers. The outgoing lines from 11kV bus are ten feeder lines and 1 connection line.

a. Excitation Transformer

The excitation system is brush-less excitation type.

b. Current Transformer

In order to meet the requirements of measurement, protection, energy metering and voltage regulation, the outlet side of generator are 3 groups CT equipped respectively.

c. Generator Circuit Breaker

The Generator Circuit Breaker is installed at 11kV switchgear. The switchgear is metal armoring draw out cabinet.

d. Generator Neutral Point Grounding Equipment

The neutral point of generator is earthed through a distributed transformer whose secondary winding is loaded by a resistance.

6.4.4 Electric Equipment Layouts

a. 11kV and 0.4kV Switchgear

The 11kV distribution equipment is set on 0.00m floor inside plant building. MCC is located on 0.00m floor of the plant building.

b. Generator Output System and Excitation Equipment

The 11kV bus bar is drawn out from output termination of the generator and Exciting transformer, then connect to Generator C.B switchgear through the no segregated phase bus. Exciting transformer, Neutral point equipment cubicle and excitation equipment cubicle are located in generator outlet chamber.

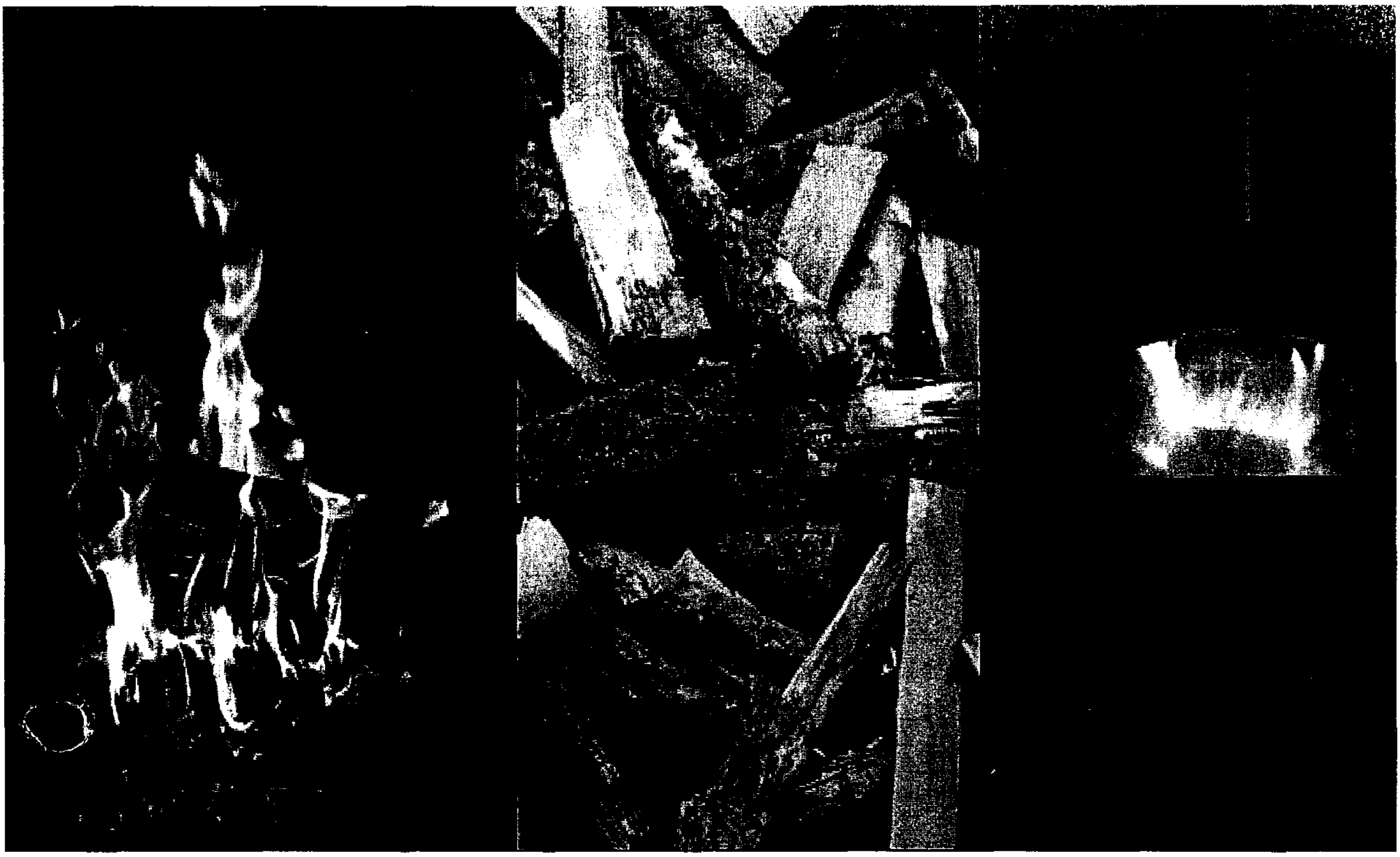
6.4.5 Cabling

Cables shall have copper conductors with extruded insulation/bedding/over sheath and be of the following or equivalent types MV single core and multicore power cables shall have XLPE insulation rated for restricted earth fault current, PVC bedding, galvanized steel or aluminum wire armor, PVC over sheath.

The over sheath of single core power cables shall have a suitable semiconducting coating applied for over sheath testing.

LV single core and multicore power cables shall be 600/1000V rating having either XLPE or PVC insulation, PVC bedding, galvanized steel or aluminum wire armor, PVC over sheath. The over sheath of single core power cables shall have a suitable semi-conducting coating applied for over sheath testing. Earthing cables shall be single core, PVC insulated colored as appropriate. Bare copper may also be used.

Fire resisting cable tested to the highest test temperature shall be used for essential circuits required to remain functional in the event of a fire. This shall include the trip circuits necessary to safely, shut down the plant and isolate it from the Transmission System, fire detection and firefighting equipment and emergency communication and audible alarm circuits.



ICL Power (Pvt.) Ltd. (ICLPPL)

"Installation 37.2 MW Cogeneration Power Plant adjacent to Ittehad Chemicals Limited (ICL)"

REPORT ON INITIAL ENVIRONMENTAL EXAMINIATION (IEE)

January-2024

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Quality Control Sheet

QUALITY CONTROL SHEET							
DOCUMENT	**Report on Initial Environmental Examination (IEE)**						
PROJECT	**"Installation 37.2 MW Cogeneration Power Plant adjacent to Ittehad Chemicals Limited (ICL)"**						
CODE							
AUTHOR	INITIALS	AR					
	DATE	20/01/2024					
VERIFIED	INITIALS	NA					
	DATE	29/01/2024					
RECIPIENT	Mr. Sohail (HSE Manager)						
NOTES							

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Preamble

This document encompasses; Initial Environmental Examination Report of the 37.2 MW Cogeneration Power Plant adjacent to Ittehad Chemicals Limited (ICL) for its submission to Punjab Environment Protection Agency; an obligatory requirement prior to commencement of works.

List of Abbreviations

AC	Alternate Current
CC	Construction Constructer
CFU	Colony forming Unit
DC	Direct Current
EMMP	Environmental Management and Monitoring Plan
EMP	Environmental Management plan
GHG	Green House Gas Emissions
GW	Gigawatt
KW	Kilowatt
LDL	Low Detection Limit
MJ Sq.m	Megajoule/Square Meter
MSWs	Municipal Solid Wastes
MU	Measurement Uncertainty
MW	Megawatt
N. A	Not Available
NGVS	No Guideline Value Set
NTU	Nephelometric Turbidity Unit
O.H. R	Over Head Reservoir
OH & S	Occupational Health and Safety
Pak-EPA	Pakistan Environmental Protection Agency
PAPs	Project Affected Persons
PEPA	Punjab Environmental Protection Act
PEQS	Punjab Environment Quality Standards
PM	Particulate matter
PPEs	Personal protective equipment's
SC	Supervision Consultant
SMWW	Standard Methods for the examination of Water and Wastewater
SWM	Solid Waste Management
TCU	True Color Unit
TDS	Total Dissolved
TMA	Tehsil Municipal Authority
W.H. O	World Health Organization

EXECUTIVE SUMMARY

ICL Power (Pvt.) Ltd. (ICLPPL) is interested in technology that is the latest and proven. The 10.9 MPa, 540 °C system is identified with assumptions of 37.2 MW gross output, 30tph net extraction, as offering a significantly superior return on investment. This configuration strikes a balance between substantial fuel savings and a modest increase in capital investment.

The project being proposed is a non-linear, with a name ***Installation 37.2 MW Biomass Cogeneration Power Plant Adjacent to Ittehad Chemicals Limited (ICL).*** The total area for this project encompasses 20 acres.

The current project falls under Schedule- I, Section B **ENERGY,** Sub section 05 (***Waste-to-Energy Generation Projects)*** of IEE/EIA Regulation-2022 as per section 12 of Environmental Protection Act and thus requires Initial Environmental Examination (IEE).

ES-1.1 Identification of Project and Proponent

ICL Power (Pvt) Ltd. Kala Shah Kaku is the developer of the proposed project Construction/installation of 37.2 MW Biomass Cogeneration Power Plant Adjacent to Ittehad Chemicals Limited (ICL).

ES-1.2 Details of Consultants

Asian Consulting Engineeirngs (ACEs) Pvt. Ltd. is providing their services to conduct environmental assessment for the project. ACEs is an independent consulting company working in the field of water and environment. The company provides consulting services and sustainable solutions for infrastructure projects, industrial projects and social development projects. The environmental team deploy for the project consists of following:

ES-2. Table 0-1, Environmental Impacts Assessment Team

Sr. No.	Team Member	Position Held	Qualifications
1	Aleem Butt	Chief Environmentalist Team Leader- EIA	M.Phil. Environmental Sciences, Government College University (GCU), Lahore M.Sc. Environmental Sciences, Punjab University (PU), Lahore

Sr. No.	Team Member	Position Held	Qualifications
			NEBOSH, Lead Auditor
2	Noman Ashraf	Environmental Specialist	M.Phil. Environmental Sciences, Government College University (GCU), Lahore PGD, Environmental Law University of the Punjab, Lahore
3	Nimra Nawaz	Environmental Specialist	M.Phil. Environmental Sciences, University of Engineering and Technology (UET) Lahore
4	Ayesha Rasheed	Environmentalist	M.Phil Environmental Sciences, Government College University (GCU), Lahore
5	Sajjad Hussain	Chief Chemist	M.Phil. Chemistry Government College University (GCU), Lahore
6	Hafsa Mehmood	Environmentalist	BS Hons Environmental Sciences, Government College University (GCU), Lahore PGD, Environmental Law University of the Punjab, Lahore
7	Sadia Serwer	Environmentalist	BS Hons Environmental Sciences, Government College University (GCU), Lahore
8	Engr. Umair Tallat	Deputy Manager Field Operations	M.S. Environmental Engineering, NUST, Islamabad
9	Asma Butt	Sociologist	M.Sc. Sociology, University of the Punjab, Lahore
10	Muhammad Abbas	Monitoring Officer	M.S. Environmental Sciences, Punjab University (PU), Lahore

The contact details for the company are given as under-:

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ES-2.1 Brief Outline Project

ICL Power (Pvt.) Ltd. (ICLPPL) is the "Installation of a 37.2 MW Biomass Cogeneration Power Plant Adjacent to Ittehad Chemicals Limited (ICL)" project in Kala Shah Kaku, Punjab, Pakistan. The project involves the installation of a biomass cogeneration power plant with major processes during installation including feedstock handling and storage, fuel processing, power generation system installation, electrical systems, and grid connection. The estimated cost of the project is 16 million USD, with 25% equity and 75% debt financing. The project site covers an area of 20 acres, and a standby generator with a capacity of 2.5 MW will be installed. Biomass, specifically agricultural waste, has been selected as the fuel for power generation, with various biomass types including bagasse, rice husk, wood chips, and others. The production capacity parameters include a plant efficiency of 24.09% (based on net capacity), 21.26% (based on gross capacity), and a power capacity factor of 91.32% (based on gross capacity). The project aims to be completed within approximately 12 months after obtaining the necessary No Objection Certificate (NOC). During the construction phase, 25 persons will be employed, increasing to 125 persons during the operational phase. The use of biomass as fuel aligns with the project's goal to provide a cost-effective and sustainable alternative for energy production while addressing environmental concerns.

ES-2.2 Impacts and Mitigation Measures

Table 0-2, Anticipated Environmental Impacts and Mitigation Measures

Sr. No.	Anticipated impacts	Mitigation measures
01	**Land Use** *The mobilization of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labor camps for human resource to avoid environmental impact and public inconvenience. These locations shall comply with the local laws and regulations and need approval from*	• Choose a site for construction equipment and material storage that is not only compliant with local regulations but also strategically located to minimize transportation distances and associated environmental impacts. • Adhere to the requirement of being at least 500 meters away from populated areas, water bodies, natural flow paths, agricultural lands, important ecological

Sr. No.	Anticipated impacts	Mitigation measures
	authorities to utilize these facilities (access roads, telecommunication, and pipe borne water supply). The selection of temporary lands shall be made in such a way that it is at least 500 meters away from nearby populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats and residential areas. *The total land allocated for the Project is 20 acres. At the Project site, there has been an absence of the following since the existing site is in vacant industrial area.* • *Any green field, wetland or protected area.* • *There are no re-settlements issues and therefore, there is no threat to the existing land use or degradation, and there is no net impact on the land use.*	habitats, and residential areas to reduce potential disturbances. • Plan the layout of construction equipment storage, material yards, and labor camps efficiently to minimize the footprint and disturbance to the surrounding environment. • Establish buffer zones between construction activities and sensitive areas to mitigate potential impacts. These buffer zones can act as protective barriers against environmental disturbances. • Utilize construction equipment that meets modern environmental standards, reducing emissions and noise pollution. This includes the use of electric or hybrid vehicles, where feasible.
02	**Soil Cover** *As the construction activities for the main plant units of project would be confined in the land, the impact on soil will be minimal and confined. Only cutting and filling is required during construction. No adverse impact on soil in the surrounding area is anticipated as the area.*	• To prevent soil erosion during construction, it is important to use techniques such as silt fences, erosion control blankets, and vegetative cover. This helps retain the topsoil and reduces sedimentation in nearby water bodies. • It's also crucial to follow best construction practices by minimizing soil disturbance through proper grading techniques, avoiding over-excavation, and using equipment with low ground pressure. • Preserving existing vegetation where possible and replanting native vegetation after construction can

Sr. No.	Anticipated impacts	Mitigation measures
		stabilize the soil, prevent erosion, and contribute to restoring natural ecosystems. • Prioritizing preservation and stockpiling of topsoil during construction process supports future vegetation growth when backfilling or grading. • Implementing phased construction minimizes overall footprint of activities at any given time while allowing restoration of completed areas. Establish buffer zones around sensitive areas like water bodies to minimize potential soil disturbance for ecological habitat preservation. • Soil stabilization techniques such as geotextiles or binders can be utilized in cut/fill areas to promote stability. Additionally installing sedimentation basins or traps helps capture suspended sediments before water discharge off-site thus preserving water quality. • Regular monitoring should evaluate post-construction conditions early on whereas strict adherence ensures compliance with environmental regulations preventing negative impacts.
03	**Solid Waste** *Solid waste during the construction phase consists primarily of scrapped building materials, excess concrete and cement, rejected components and materials, packing and shipping materials (pallets,*	• A waste inventory of various waste generated will be prepared and periodically updated. • The excavated material generated will be reused for site filling and leveling operation to the maximum extent possible.

Sr. No.	Anticipated impacts	Mitigation measures
	crates, Styrofoam, plastics etc.) and human waste.	• The scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers. • Food waste and recyclables viz. paper, plastic, glass etc will be stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through waste handling agency.
04	**Air Quality Impacts** *Particulate matter in the form of dust would be the predominant pollutant affecting the air quality during the construction phase. Dust will be generated mainly during excavation, back filling and hauling operations along with transportation activities. The main source of gaseous emission during the construction phase is movement of equipment and vehicles at site. Equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO2, NOX, and particulate matter. The impact is reversible, marginal and temporary in nature. Also, Ambient Air has also been monitored before the baseline studies.*	• A high boundary wall of green dust control cloth will prevent the dust generated due to construction activities going outside the project area. • Ensuring that diesel generators are fitted with standard emissions controls as specified by the manufacturer and generators are serviced and maintained in accordance with manufacturers specifications.
05	**Noise Impacts** *The major noise generating sources during the construction phase are vehicular traffic, construction equipment like dozer, scrapers, concrete mixers, cranes, generators, pumps, compressors, rock drills, pneumatic*	• To minimize the impact on nearby communities, construction schedules have been optimized and vehicular traffic will be routed away from the nearest settlement away from the boundary of power plant site.

Sr. No.	Anticipated impacts	Mitigation measures
	tools, vibrators etc. The operation of this equipment will generate noise ranging between 75 – 90 dB (A).	• Also, the noise level is substantially lower near the plant boundary due to attenuation caused over the distance.
06	**Soil and Water Quality** *During operation there is a risk of soil and water contamination due to spills or leaks of fuels and oils from the backup diesel generators and associated fuel handling and storage as well as from oil filled transformers and other electrical equipment.*	• Sealing and bunding of areas where spills and leaks could occur, including containing fuel and oil storage and handling areas, and equipment such as generators and fuel pumps; oil separation on drainage outlets and sumps and training of operators. Oil and fuel spill kits will be provided on site during construction and operation. Generators, transformers and fuel storage, handling and pumping area to have spill containment in the form of impervious base and bund walls and oil water separation on outlets. • Where the backup diesel generators are to be on the same site as the existing diesel power station ("brownfield site"), any existing contamination can be improved with the development of the project and the smaller quantities of fuel and the more up to date equipment. • Where the backup diesel generators are to be on a new site separate from the existing power station ("greenfield site"), the former power station that will be left will generally have soil contamination and waste materials which will need to be managed or remediated to ensure no contaminants leave the site to protect public and environmental health.
07	**Ecological Impact**	-

Sr. No.	Anticipated impacts	Mitigation measures
	The project site is barren roof therefore no impact on project site. Thus, the site development works would not lead to any significant loss of important species or ecosystems and hence no mitigation measures are required.	
08	**Biological Environment** *Construction/installation of the project will not require any cutting or land clearing and hence there will be no impacts on listed, rare, endangered, vulnerable or threatened species of flora or fauna or communities as there are none potentially affected by the project.*	-
09	**Socioeconomic Environment** *Construction stage impacts on the socioeconomic environment include both positive (beneficial) and negative impacts.*	The measure for negative impacts includes: • In relation to influx of outside workers include establishing a protocol for community relations, educating workers on this, the grievance redress mechanism and communicable disease prevention. • Any temporary use of land or restriction of access required for the construction period will be agreed with the provincial / town administration and landowners and subject to consultation with affected people. • Public information and signage, fencing of the site and access control, supervision of equipment movement outside the site, managing noise, air emissions and waste (refer Physical Environment section), prevent mosquito breeding on site by preventing water

Sr. No.	Anticipated impacts	Mitigation measures
		ponding, install and properly manage toilet and washing facilities for workers. • Occupational Health and Safety mitigation measures will include requiring that Solomon Power's safety requirements are fully implemented and complied with. The contractor will be required to prepare a health and safety plan describing how safety will be managed for the project. Health and safety mitigation will include but necessarily be limited to training and induction of workers, ongoing identification, prevention and management of risks and hazards, safe working method statements, incident response, compliance, protective equipment and first aid and medical facilities.
10	***Potential Impacts from Biomass Burning*** *Emissions from burning biomass, specifically wood in power generation processes, comprise of gases and particles. These include particulate matter and gases such as carbon monoxide, carbon dioxide, oxides of nitrogen, volatile organic compounds, sulphur oxides and a range of trace species including polyaromatic hydrocarbons. The low sulphur content of wood means that SOx is not likely to be a concern from wood combustion. Particulate matter emissions are particularly concerning since the use of wood as a heating fuel may have led to a net negative impact on air quality in terms of PM. It has*	• Utilize advanced combustion technologies such as boiler design consists traveling grate which is old proven technology and has the ability to enhance combustion efficiency and reduce emissions. • Install effective emission control devices such as electrostatic precipitators or fabric filters to capture and remove particulate matter from flue gases. • Operate biomass combustion systems under optimal conditions, including proper air-to-fuel ratios and temperature control, to minimize the formation of pollutants.

Sr. No.	Anticipated impacts	Mitigation measures
	been suggested that 96% of the PM produced during wood combustion is in the PM10 size fraction and 93% in PM2.5.	• Ensure the use of dry and well-seasoned biomass as fuel, as moisture content significantly impacts combustion efficiency and emissions. Proper biomass storage and handling practices are essential. • Implement regular maintenance and cleaning of combustion systems to prevent the buildup of ash and other deposits, which can lead to increased emissions. • For larger-scale biomass plants, consider implementing SCR or SNCR technologies to reduce nitrogen oxide (NOx) emissions by promoting chemical reactions that convert NOx into less harmful substances. • Explore alternative and cleaner biomass feedstocks with lower emissions, or consider cofiring biomass with other fuels to reduce overall emissions.
11	***Impacts on Air quality and Climate change*** *The large-scale cultivation of biomass crops can lead to deforestation and changes in land use, which can contribute to climate change.* *The efficiency of biomass power plants varies depending on technology and feedstock. Inefficient combustion processes can lead to higher emissions.* *The use of biomass for energy may compete with food production, especially if the same crops are used for both purposes.*	• Sustainable practices and careful land management are crucial to minimizing these impacts. • Advanced technologies such as gasification and co-firing with coal can improve efficiency and reduce emissions. • Striking a balance between food and energy needs is crucial for sustainable biomass use. • Proper emission control technologies must be in place to minimize these impacts.

Sr. No.	Anticipated impacts	Mitigation measures
	Combustion of biomass can release particulate matter and other pollutants that affect air quality.	
12	**Noise Impact** *During plant operations, there would be no significant noise generated activity expected. There might be use of machinery during maintenance of plant, but the activity will be restricted to day time. The noise generated will not exceed 65 db(A) which is the permissible limit for residential areas as per PEQs for noise.*	• Installation of noise barriers around the plant perimeter. • Schedule noisy activities during daytime hours, taking into consideration local regulations. • Maintain and lubricate equipment regularly to reduce noise.
13	***Water Usage and Quality*** *Biomass facilities require water for cooling, steam generation, and emissions control. The specific technology used in the plant determines the amount of water needed. Growing biomass feedstocks may also need water for irrigation, potentially affecting local water resources. Discharging effluents from the facility containing pollutants can impact water quality if not managed properly. Heated water discharged into rivers or other bodies of water for cooling purposes can alter local temperatures and affect aquatic ecosystems. Installing a biomass plant could result in changes in land use that impact surface runoff and potentially lead to changes in water quality as runoff carries soil particles, nutrients, and contaminants. Cultivating dedicated biomass crops using fertilizers and pesticides affects natural ecosystems and drainage patterns.*	• Implementing water recycling and reuse systems within the biomass plant can reduce overall water consumption. • Employing effective treatment systems for effluents can minimize the impact on water quality. • Adhering to best management practices during construction, operation, and biomass crop cultivation can help minimize negative impacts on water resources.

Sr. No.	Anticipated impacts	Mitigation measures
14	**Land Use and Habitat Disruption** *The installation of a biomass plant can significantly impact land use and habitat disruption. The conversion of natural habitats or agricultural land for biomass plant sites, coupled with the cultivation of dedicated biomass crops, can lead to habitat fragmentation, deforestation, and disruption of ecosystems. Construction activities and the associated infrastructure development can disturb soil, contribute to erosion, and displace wildlife, while the introduction of invasive species may alter local plant communities. The noise, pollution, and changes in land use can collectively pose threats to biodiversity and ecological balance, highlighting the importance of careful site selection, comprehensive environmental assessments, and the implementation of mitigation measures to minimize adverse effects on land and habitats.*	• Careful site selection to minimize ecological impact prioritizing brownfield sites or areas with lower biodiversity value. • Implementing buffer zones around sensitive habitats can help protect wildlife, and incorporating wildlife corridors can mitigate habitat fragmentation. • Post-construction, effective restoration and reclamation plans should be employed to rehabilitate disturbed areas and restore habitats. • Utilizing sustainable biomass feedstock sources, such as agricultural residues, and employing agroforestry practices can reduce the need for dedicated land conversion. • Additionally, engaging in ongoing monitoring and adaptive management practices can help identify and address any unforeseen impacts on land use and habitats, ensuring a more sustainable integration of biomass energy solutions.
15	**Transportation Impact** *The installation of a biomass plant can have notable impacts on transportation, primarily related to the sourcing and transportation of biomass feedstocks to the facility. Increased traffic may be observed as biomass feedstocks are transported to the plant, potentially leading to changes in local traffic patterns and road infrastructure.*	• Efficient logistics planning and the establishment of designated transportation routes can help minimize disruptions. • Additionally, biomass plant locations should be strategically chosen to reduce transportation distances and associated carbon emissions. • Engaging in sustainable sourcing practices, like sourcing feedstocks locally or promoting the use of existing

Sr. No.	Anticipated impacts	Mitigation measures
		transportation infrastructure, can contribute to mitigating the overall impact on transportation systems while supporting the plant's operational needs.
16	**Community Health and Safety** *The installation of a biomass plant can impact community health and safety through potential air and noise pollution. Emissions from biomass combustion may release particulate matter and pollutants, posing respiratory risks to nearby residents and compromising local air quality. The noise generated during plant operations, construction, and transportation activities can lead to disturbances, affecting the well-being of the surrounding community.*	• Implementing effective emissions control technologies such as electrostatic precipitators or baghouses to minimize particulate matter and pollutant emissions. • Regular monitoring of air quality both on-site and in surrounding areas can help ensure compliance with regulatory standards and identify any potential health risks early on. • Additionally, noise abatement measures such as sound barriers or operational restrictions during sensitive hours can help mitigate the impact of plant-related noise on nearby residents. • Comprehensive community engagement and transparent communication regarding plant operations, emissions data, and safety protocols are essential for building trust and addressing community concerns. • Investing in community health programs and conducting regular health assessments can help monitor and address any potential health impacts over time, ensuring the well-being of the surrounding community.
17	**Ash Disposal** The disposal of ash generated from biomass plant operations can have several impacts,	• Mitigation measures for ash disposal from biomass plants involve adopting responsible practices to minimize

Sr. No.	Anticipated impacts	Mitigation measures
	including environmental and public health concerns. Ash contains residual minerals and elements that are concentrated during the combustion process, and improper disposal can lead to the following: If ash is not properly managed, it can be disposed of in landfills or used inappropriately, leading to soil contamination. The accumulation of heavy metals and other pollutants in the soil can have long-term effects on plant growth and soil quality. Improper disposal or storage of ash can result in leaching of contaminants into groundwater or nearby water bodies. This can compromise water quality, affecting aquatic ecosystems and potentially posing risks to human health if the contaminated water is used for drinking or irrigation. During ash handling and disposal, the release of airborne particulate matter can occur, contributing to air pollution. Inhaling these particles may have respiratory health implications for nearby communities. The direct application of ash to land, if not properly controlled, may alter the nutrient balance in ecosystems, affecting plant and microbial communities. This can lead to unintended ecological consequences.	environmental and public health impacts. These measures include: • Explore opportunities for recycling ash by incorporating it into construction materials or using it as a soil amendment in a controlled and regulated manner. This can reduce the need for landfill disposal and provide potential benefits for agriculture or other applications. • Implement advanced technologies in biomass combustion and ash handling processes to minimize the concentration of harmful elements in the ash. This can include technologies like electrostatic precipitators or scrubbers to capture pollutants before they are released. • If landfill disposal is necessary, ensure that the landfill is designed and managed according to environmental regulations. Implement proper liner systems, leachate collection, and monitoring systems to prevent the leaching of contaminants into the soil and groundwater. • Community Engagement: Engage with the local community to address concerns and provide transparent information about ash disposal practices. Building trust through open communication can help alleviate fears and ensure that the community is informed about the measures in place to protect their health and the environment. • Invest in research and development efforts to find innovative and sustainable

Sr. No.	Anticipated impacts	Mitigation measures
		solutions for ash management. This may involve exploring new technologies, best practices, and alternative uses for ash that are environmentally friendly. • Establish comprehensive monitoring programs to track the environmental impact of ash disposal. Regularly report findings to relevant authorities and the public, demonstrating a commitment to transparency and accountability.

ES-2.3 Proposed Monitoring Plan

The objective of the monitoring plan is to provide framework for the implementation of the proposed mitigation measures during construction and operational phases of the proposed project. Proposed mitigation measures will be implemented by Construction Constructer (CC), Supervision Consultant (SC) and ICL Power (Pvt) Ltd.

Environmental monitoring has been proposed for construction and operation phase of the project. During construction phase, Construction Contractor will be responsible for monitoring of all environmental parameters (ambient air, noise level and water quality). Contractor will also be responsible for implementation of mitigation measures proposed in EMP while Supervision Consultant will monitor the compliance of EMP by the contractor. He will also be responsible for submitting annual EMP compliance report. One comprehensive report will be prepared and submitted at the end of the project construction phase to Project Director-FSE, whereas, one report will be submitted by FSE to Pak EPA during the operational phase.

Table 0-3, Proposed Monitoring plan for construction and operational phases

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Water Quality	• Near the project area (Seepage water underground)	Discrete grab sampling and laboratory testing of water samples.	• Sampling and laboratory testing should be done on Monthly basis during the

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
			construction and annually during the operational stage. • Metal analysis
Noise Levels	• Construction site • Nearby area due to track movement	Noise meter	• On fortnight basis throughout the construction period. • Annually during the operational stage.
Ambient Air	• Construction site Ambient Air	Monitoring of ambient air quality in ppb.	• Monthly monitoring of air pollution parameters including PM, NO_x, SO_x, CO, during the construction period, and annually during the operation stage only for ambient air.

SECTION - 1: INTRODUCTION

Biomass-Renewable Energy from Plants and Animals

Biomass is renewable organic material that comes from plants and animals. Biomass was the largest source of total annual United States energy consumption until the mid-1800s. Biomass continues to be an important fuel in many countries, especially for cooking and heating in developing countries. The use of biomass fuels for transportation and for electricity generation is increasing in many developed countries as a means of avoiding carbon dioxide emissions from fossil fuel use. In 2022, biomass provided nearly 5% of total primary energy use in the United States.

Biomass contains stored chemical energy from the sun. Plants produce biomass through photosynthesis. Biomass can be burned directly for heat or converted to renewable liquid and gaseous fuels through various processes.

Biomass sources for energy include:

- Wood and wood processing wastes like firewood, wood pellets, and wood chips, lumber and furniture mill sawdust and waste, and black liquor from pulp and paper mills
- Agricultural crops and waste materials such as corn, soybeans, sugar cane, switchgrass, woody plants, algae, crop and food processing residues
- Biogenic materials in municipal solid waste for instance paper, cotton, and wool products, and food, yard, and wood wastes
- Animal manure and human sewage

Converting biomass to energy

Biomass is converted to energy through various processes, including:

- Direct combustion (burning) to produce heat
- Thermochemical conversion to produce solid, gaseous, and liquid fuels
- Chemical conversion to produce liquid fuels
- Biological conversion to produce liquid and gaseous fuels

1. Direct combustion is the most common method for converting biomass to useful energy. All biomass can be burned directly for heating buildings and water, for industrial process heat, and for generating electricity in steam turbines.

2. Thermochemical conversion of biomass includes pyrolysis and gasification. Both are thermal decomposition processes in which biomass feedstock materials are heated in closed, pressurized vessels called gasifiers at high temperatures. They mainly differ in the process temperatures and amount of oxygen present during the conversion process.

- **Pyrolysis** entails heating organic materials to 800–900°F (400–500 °C) in the near complete absence of free oxygen. Biomass pyrolysis produces fuels such as charcoal, bio-oil, renewable diesel, methane, and hydrogen.
- **Hydrotreating** is used to process bio-oil (produced by fast pyrolysis) with hydrogen under elevated temperatures and pressures in the presence of a catalyst to produce renewable diesel, renewable gasoline, and renewable jet fuel.
- **Gasification** entails heating organic materials to 1,400–1700°F (800–900°C) with injections of controlled amounts of free oxygen and/or steam into the vessel to produce a carbon monoxide and hydrogen rich gas called synthesis gas or syngas. Syngas can be used as a fuel for diesel engines, for heating, and for generating electricity in gas turbines. It can also be treated to separate the hydrogen from the gas, and the hydrogen can be burned or used in fuel cells. The syngas can be further processed to produce liquid fuels using the Fischer–Tropsch process.

3. A chemical conversion process known as transesterification is used for converting vegetable oils, animal fats, and greases into fatty acid methyl esters (FAME), which are used to produce biodiesel.

4. Biological conversion includes fermentation to convert biomass into ethanol and anaerobic digestion to produce renewable natural gas. Ethanol is used as a vehicle fuel. Renewable natural gas also called biogas or biomethane is produced in anaerobic digesters at sewage treatment plants and at dairy and livestock operations. It also forms in and may be captured from solid waste landfills. Properly treated renewable natural gas has the same uses as fossil fuel natural gas.

Biomass provided about 5% of U.S. energy in 2022

In 2022, biomass accounted for 5% of total United States primary energy consumption, equal to about 4,930 trillion British thermal units (TBtu) (or 4.9 quadrillion Btu). The types, amounts, and the percentage shares of total biomass energy consumption in 2022 were:

- Biofuels-2,419 TBtu (**49%**)
- Wood and wood waste-1,984 TBtu **(43%)**
- Municipal solid waste, animal manure, and sewage-411 TBtu(**8%**)

The industrial sector is the largest consumer of biomass for energy in the United States. The amounts in TBtu and percentage shares of total United States biomass energy use by consuming sector in 2022 were:

- Industrial-2,266 TBtu **(46%)**
- Transportation-1,565 TBtu **(32%)**
- Residential-539 TBtu **(11%)**
- Electric power-413 TBtu **(8%)**
- Commercial-147 TBtu **(3%)**

The industrial sector account for the largest amounts, in terms of energy content, and largest percentage shares of total annual United States biomass consumption. The wood products and paper industries use biomass in combined heat and power plants for process heat and to generate electricity for their own use. Liquid biofuels (ethanol and biomass-based diesel) account for most of the transportation sector's biomass consumption.

The transportation sector accounted for the second-highest amount and percentage share of biomass (as biofuels) consumption in 2022.

The residential and commercial sectors use firewood and wood pellets for heating. The commercial sector also consumes, and in some cases, sells renewable natural gas produced at municipal sewage treatment facilities and at waste landfills.

The electric power sector uses wood and biomass-derived wastes to generate electricity for sale to the other sectors.

The United States is a net exporter of biomass energy

On an energy content basis, United States total biomass energy exports exceeded total biomass energy imports in 2022.

Densified biomass fuels (wood pellets and other densified biomass fuels) have become a United States export product in recent years. In 2022, the United States exported about 8.8 million tons of wood fuel pellets.

ICL Power (Pvt.) Ltd. (ICLPPL) is interested in technology that is latest and proven. The 9.8 MPa, 480 C system is identified with assumptions of 37.2 MW gross output, 30tph net extraction, as offering a significantly superior return on investment. This configuration strikes a balance between substantial fuel savings and a modest increase in capital investment.

1.1 Screening of project

The current project falls under Schedule- I, Section B **ENERGY,** Sub section 05 (***Waste-to-Energy Generation Projects)*** of IEE/EIA Regulation-2022 as per section 12 of Environmental Protection Act and thus requires Initial Environmental Examination (IEE).

1.2 Purpose of Report

Punjab Environmental Protection Act (PEPA), 1997 (Amended 2012) requires the proponents of every development project in the country to submit either an Initial Environmental Examination or Environmental Impact Assessment to the concerned environmental protection agency.

The IEE/EIA Regulations 2022 issued under PEPA 1997 (Amended 2012) provides separate lists for the projects requiring IEE or EIA. Since the total power generation capacity of proposed project is less than 100 MW, therefore IEE study is performed.

Both guidelines provide separate lists for the projects requiring IEE or EIA. This Initial Environmental Examination (IEE) report has been prepared in accordance with the provisions in the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2022. According to these regulations, an IEE is required for projects falling in any category listed in Schedule-I of the regulations, and an EIA is required for projects listed in Schedule-II of the regulations.

In the context of the scope of the project, the IEE report has addressed the following objectives, where applicable;

The purpose of Initial Environmental Examination (IEE) is to identify the reasonably foreseeable environmental and social effects of the activities that will be conducted under this project;

- Category of the project consistent with Pakistan Environmental Protection Act, 1997

- Highlight baseline environmental and social conditions of the project area along with identification of environmentally sensitive area and concerned stakeholders
- Protection of human health, cultural properties and biodiversity including endangered species and sensitive ecosystems
- Major hazards; Occupational health and safety; Fire prevention and life safety
- Socio-economic impacts; Land use: Land acquisition; Involuntary resettlement
- Impacts on indigenous peoples and communities; if applicable
- Cumulative impacts of existing, proposed and anticipated future projects
- Efficient production, delivery and use of energy; and Pollution prevention and waste minimization, pollution controls (liquid effluent and air emissions) and solid and chemical waste management.
- GHG reduction potential.

1.3 Identification of Project and Proponent

The proposed Project consists of the **"Installation 37.2 MW Biomass Cogeneration Power Plant Adjacent to Ittehad Chemicals Limited (ICL)"** with project and proponent detail is given as under:

Table 1-1, Project and Proponent Detail

Proponent & Developer	ICL Power (Pvt.) Ltd. (ICLPPL)
Name of project	Installation 37.2 MW Biomass Cogeneration Power Plant Adjacent to Ittehad Chemicals Limited (ICL)."
Location/ Address of the site	Kala Shah Kaku, Punjab Pakistan.
Nature/ Feature of the project	Installation of Biomass Cogeneration Power Plant.
Major process during installation	Feedstock Handling and Storage, Fuel Processing, Power Generation System Installation, Electrical Systems and Grid Connection.
Estimated cost of project	16 million USD (25% equity and 75% dept).
Area of the project	20 acres
Details of Standby Generator	One generated will be installed with 2.5 MW capacity.
Production Details	

<table>
<tr><td>Fuel type</td><td>Biomass (Agricultural Waste) is selected as fuel for this project. Biomass emerges as a promising, cost-effective, and sustainable alternative with the potential to address both energies needs and environmental concerns.

The following types of biomass are selected for power generation that are readily available in Pakistan.
• Bagasse
• Rice Husk
• Rice Straw
• Corn Cob (Red)
• Wood Chips
• Cotton Stalks
• Maize Husk
• Corn Cob (White)
• Corn Stalks
• Brassica
• Mustard Straw
• Wheat Straw
• Sugarcane Trash
•</td></tr>
<tr><td>Production Capacity</td><td><table>
<tr><th>Parameter</th><th>Value (%)</th></tr>
<tr><td>Plant Efficiency (Based on Net Capacity)</td><td>28.00</td></tr>
<tr><td>Plant Efficiency (Based on Gross Capacity)</td><td>25.00</td></tr>
<tr><td>Power Capacity Factor (Based on Gross Capacity)</td><td>91.32</td></tr>
</table></td></tr>
<tr><td>Project completion duration</td><td>Approximately 12 months after obtaining NOC.</td></tr>
<tr><td colspan="2">Labor/Workers Details</td></tr>
<tr><td>Construction Phase</td><td>25 persons</td></tr>
<tr><td>Operational Phase</td><td>125 persons</td></tr>
</table>

1.4 Details of Consultants

Asian Environmental Services (AES) Pvt. Ltd. is providing their services to conduct environmental assessment for the project. ACEs is an independent consulting company working in the field of water and environment. The company provides consulting services and sustainable solutions for infrastructure projects, industrial projects and social development projects. The environmental team deploy for the project consists of following:

Table 1-2, Environmental Impacts Assessment Team

Sr. No.	Team Member	Position Held	Qualifications
1	Aleem Butt	Chief Environmentalist Team Leader- EIA	M.Phil. Environmental Sciences, Government College University (GCU), Lahore M.Sc. Environmental Sciences, Punjab University (PU), Lahore NEBOSH, Lead Auditor
2	Noman Ashraf	Environmental Specialist	M.Phil. Environmental Sciences, Government College University (GCU), Lahore PGD, Environmental Law University of the Punjab, Lahore
3	Nimra Nawaz	Environmental Specialist	M.Phil. Environmental Sciences, University of Engineering and Technology (UET) Lahore
4	Ayesha Rasheed	Environmentalist	M.Phil Environmental Sciences, Government College University (GCU), Lahore
5	Sajjad Hussain	Chief Chemist	M.Phil. Chemistry Government College University (GCU), Lahore
6	Hafsa Mehmood	Environmentalist	BS Hons Environmental Sciences, Government College University (GCU), Lahore PGD, Environmental Law University of the Punjab, Lahore
7	Sadia Serwer	Environmentalist	BS Hons Environmental Sciences, Government College University (GCU), Lahore
8	Engr. Umair Tallat	Deputy Manager Field Operations	M.S. Environmental Engineering, NUST, Islamabad
9	Asma Butt	Sociologist	M.Sc. Sociology, University of the Punjab, Lahore
10	Muhammad Abbas	Environmentalist	MPhil Environmental Sciences, Punjab University (PU), Lahore

The contact details for the company are given as under-:

Asian Environmental Services (AES) Pvt. Ltd.

Tel: +92 42 35450914-5 | **Fax:** +92 42 35450916 | **Mobile:** +92 03214271101

E-mail: aleem.butt@asiancon.com

Address: C-3, Jhelum Block, Green Forts-II | Lahore | Pakistan

1.5 Nature, Size and Location of The Project

The nature of the project is non-linear which is going to be installed on 20 acres of land at kala Shah Kaku Punjab Pakistan. The details of production capacity are given below:

Parameter	Value (%)
Plant Efficiency (Based on Net Capacity)	28.00
Plant Efficiency (Based on Gross Capacity)	25.00
Power Capacity Factor (Based on Gross Capacity)	91.32

The location map of the project is given below:

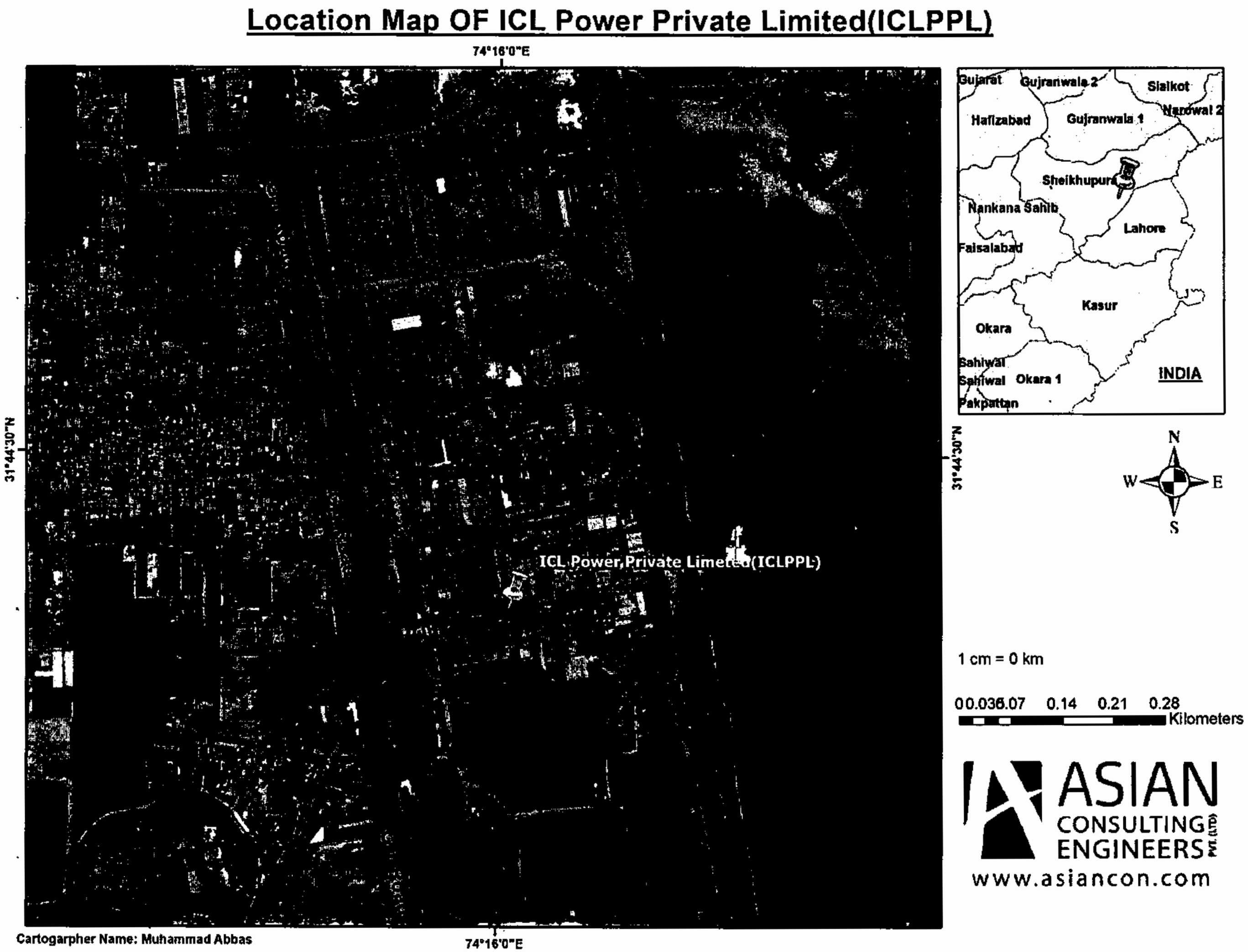


Figure 1-1, Location Map of Project Site

SECTION - 2: DESCRIPTION OF THE PROJECT

This chapter provides an overview of project including its silent features, location, components and various phases.

2.1 Type and category of project

The project being proposed is a non-linear, with a name ***Installation 37.2 MW Biomass Cogeneration Power Plant Adjacent to Ittehad Chemicals Limited (ICL).*** The total area for this project encompasses 20 acres.

The current project falls under Schedule- I, Section B **ENERGY,** Sub section 05 (***Waste-to-Energy Generation Projects)*** of IEE/EIA Regulation-2022 as per section 12 of Environmental Protection Act and thus requires Initial Environmental Examination (IEE).

2.2 Objectives of the project

The objectives of the proposed Project are:

- Produce electricity sustainably using biomass as a renewable resource, reducing reliance on fossil fuels
- Mitigate climate change impact by utilizing carbon-neutral biomass and balancing emissions with the carbon absorbed during plant growth
- Address environmental concerns by providing a responsible disposal solution for organic waste to contribute to cleaner ecosystems
- Create jobs in biomass production, harvesting, and plant operation to support rural economies and sustainable practices
- Reduce reliance on imported fuels by using locally sourced biomass to enhance energy security and diversify the energy mix
- Adhere to regulations by implementing pollution control measures for minimizing the environmental impact of biomass power generation.

2.3 Study of alternatives

Site Selection Alternatives:

- Evaluate the ecological sensitivity of potential sites, considering factors like biodiversity, wetlands, and rare or endangered species. Avoid areas with high ecological value or implement measures to minimize impacts on sensitive ecosystems.

- Assess the biodiversity of candidate sites to minimize disruption to diverse plant and animal species. Protecting biodiversity may involve avoiding habitats with high species richness or implementing conservation measures.
- Proximity to Sensitive Habitats: Consider the proximity of the biomass power plant to sensitive habitats such as wetlands, water bodies, or wildlife reserves. Minimize adverse impacts on these areas and implement buffer zones to protect sensitive ecosystems.

Biomass Feedstock Alternatives:

- Evaluate the environmental impact of different biomass feedstocks. Consider factors such as land-use change, water consumption, and pesticide use associated with each feedstock.
- Assess the sustainability of biomass sources by considering factors like regrowth rates, soil health, and overall ecosystem resilience. Prioritize feedstocks that align with sustainable and responsible land management practices.

Technology Alternatives:

- Evaluate the environmental impacts of different biomass conversion technologies. Consider emissions, resource consumption, and waste generation associated with combustion, gasification, or anaerobic digestion.
- Compare the energy efficiency of different technologies to maximize the conversion of biomass into electricity while minimizing resource inputs.
- Assess the emissions profiles of each technology, considering criteria pollutants (particulate matter, nitrogen oxides, sulfur dioxide) and greenhouse gas emissions.

Transportation Alternatives:

- Analyze the emissions associated with different transportation methods for delivering biomass feedstock. Consider the carbon footprint of transport and select options that minimize greenhouse gas emissions.
- Assess the potential traffic impacts on local communities and infrastructure. Choose transportation routes and methods that minimize disruptions and congestion.
- Identify and mitigate potential disturbances along transportation routes, such as habitat fragmentation or soil erosion, to minimize environmental impacts.

Waste Management Alternatives:

- Explore alternative methods for managing ash and other by-products from biomass combustion. Consider options such as recycling ash for agricultural use, ensuring proper disposal, or exploring beneficial reuses to minimize environmental impacts.

Air Quality Control Alternatives:

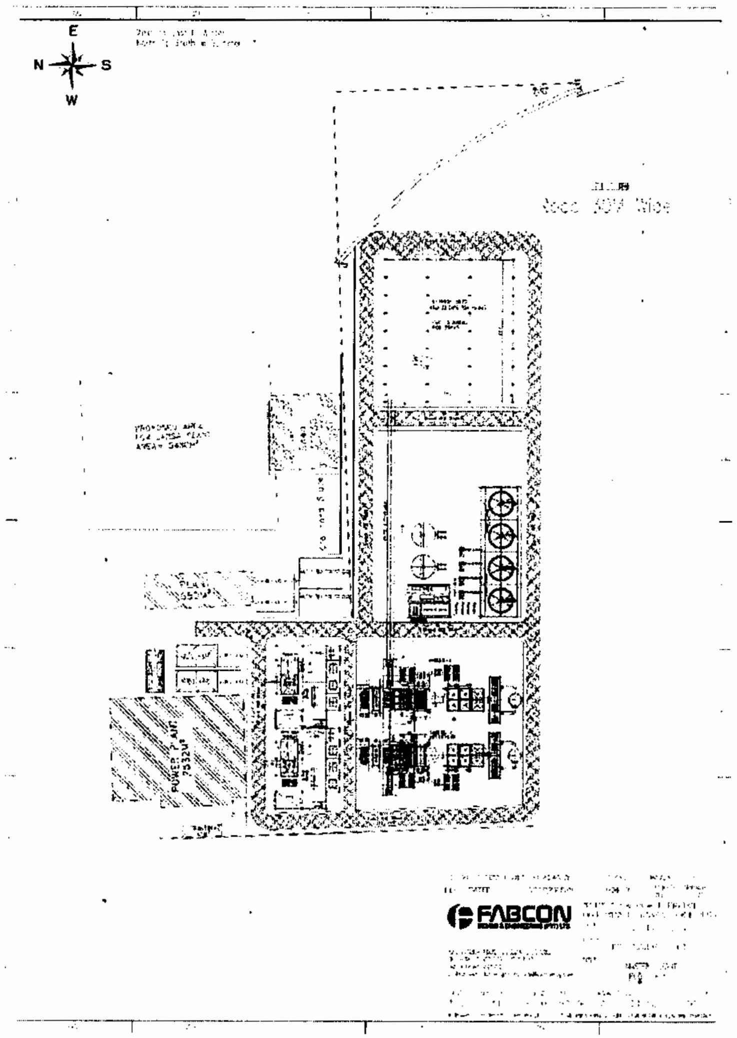
- Particulate Matter, Nitrogen Oxides, Sulfur Dioxide: Evaluate different air quality control technologies to minimize emissions of pollutants. Consider technologies such as electrostatic precipitators, scrubbers, or catalytic converters to meet environmental standards.

Water Use and Discharge Alternatives:

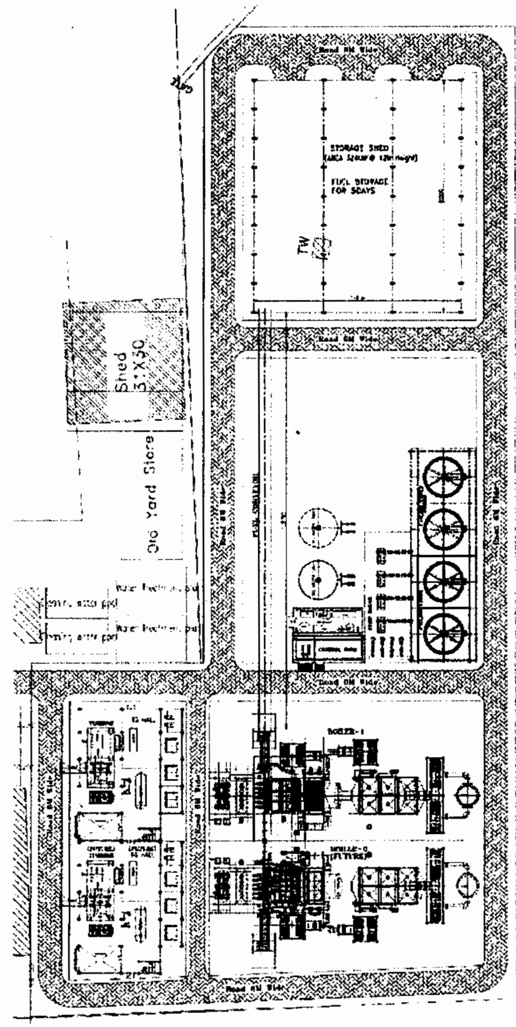
- Assess water consumption during plant operation and explore water-saving technologies. Implement measures to minimize water use and promote water efficiency.
- Evaluate options for wastewater discharge, considering potential impacts on local water resources, aquatic ecosystems, and water quality. Implement treatment measures to meet regulatory standards.

2.4 Location and Site Layout of the project

The proposed project is located at Kala Shah Kaku, Punjab Pakistan. The surroundings of the project comprise of commercial area. The coordinates of the project are 3144'23.81"**N** 74° 16'1.07"**E**. The layout of the project site is given below in Figure 2-1.



Master Layout



Plant Layout

Figure 2-1, Layout of The Project Site

2.5 Land Use Plan

The plant is located at Kala Shah Kaku, Punjab Pakistan, adjacent to existing Ittehad Chemical Plant. Total designated area is approximately 20 acres of land which include power plant area and biomass storage as well.

2.6 Road access

The project site is located along Grand Trunk Road (N5), which is one of South Asia's oldest and longest major roads. It connects the project site, as shown in Figure 2.1 below.

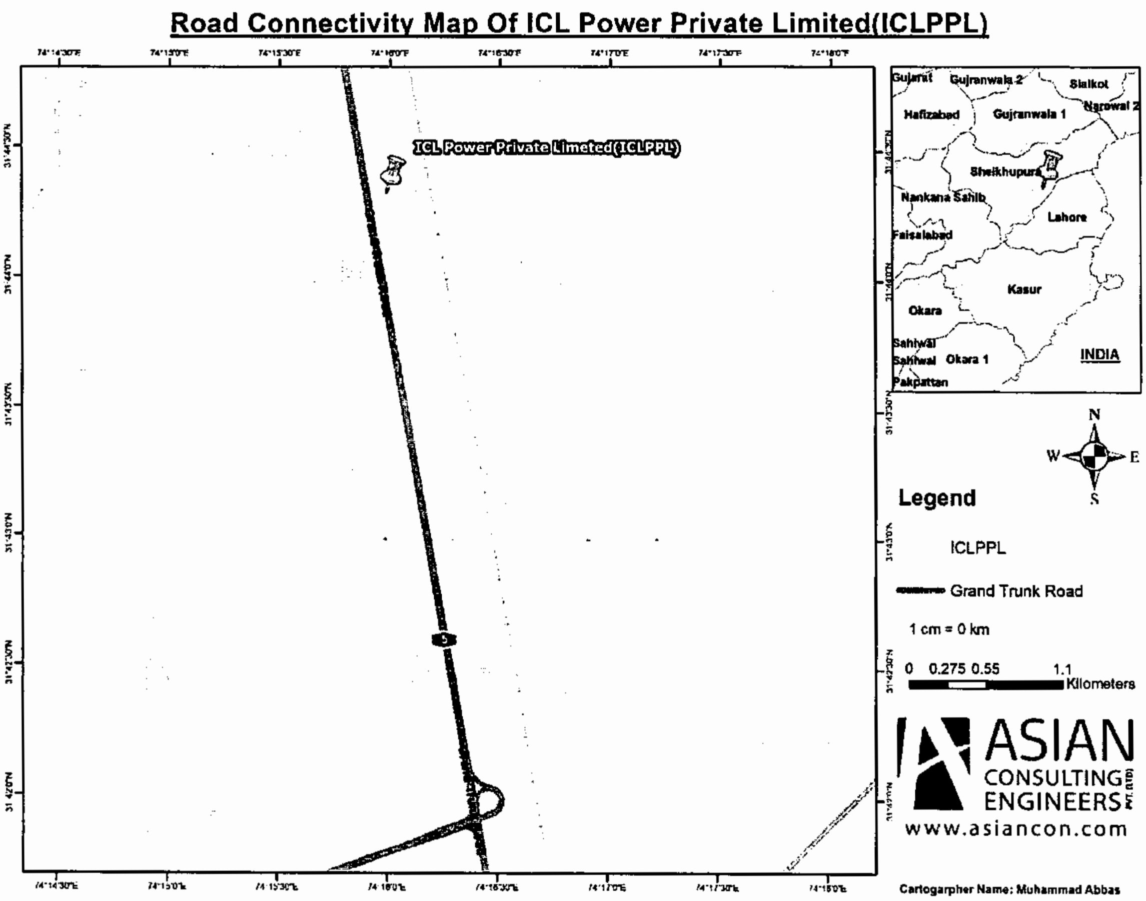


Figure 2-2, Road Connectivity Map of Project Site

2.7 Vegetation feature on site

The project site is situated next to Ittehad Chemicals in an industrial area where the land has already been cleared. This means that there will be no need to cut down any trees, herbs, or shrubs on the property. Additionally, this offers a great advantage in terms of minimizing environmental impact and preserving the existing natural landscape.

2.8 Cost and magnitude of the project

The capital cost of the project is about approximately 16 million USD. Building a biomass facility can take anywhere from 12 months, depending on the size of the facility, the availability of resources, and the permitting and approval process.

2.9 Schedule of implementation

Creating a detailed schedule of implementation for a biomass plant involves considering various stages and activities. Below is a generic outline of a schedule for implementing a biomass plan:

1. **Project Development Phase**
    - Conduct feasibility studies and site assessments.
    - Engage with stakeholders, including local communities and regulatory bodies.
    - Develop a preliminary design of the biomass plant.
    - Secure necessary land and environmental permits.
2. **Detailed Engineering and Design**
    - Detailed design.
    - Finalize technology selection and process design.
    - Develop detailed construction plans.
    - Obtain detailed construction permits.
3. **Equipment Procurement**
    - Issue requests for proposals (RFPs) to suppliers.
    - Evaluate bids and select equipment suppliers.
    - Finalize contracts with suppliers.
    - Procure major equipment components.
4. **Site Preparation and Infrastructure**
    - Clear the construction site.
    - Develop necessary infrastructure (roads, utilities, etc.).
    - Begin foundation work for the plant.
5. **Construction**
    - Mobilize construction teams and equipment.
    - Begin structural and mechanical construction.
    - Install major equipment components.
    - Complete civil and electrical works.
    - Conduct quality assurance and control.

6. **Commissioning**
    - Test individual components and systems.
    - Conduct performance testing and optimization.
    - Obtain necessary approvals from regulatory bodies.
    - Develop operating and maintenance procedures.
7. **7. Operational Readiness**
    - Train plant operators and maintenance staff.
    - Implement safety procedures.
    - Conduct final inspections and tests.
    - Secure final regulatory approvals.

8. Commercial Operation

- Initiate commercial operations.
- Monitor and optimize plant performance.
- Address any initial operational issues.
- Establish ongoing maintenance and monitoring programs.

ITTEHAD CHEMICALS LIMITED
2 x 17MW CO-GENERATION, HIGH PRESSURE, POWER PLANT
(MASTER SCHEDULE FOR ENGINEERING, PROCUREMENT, CONSTRUCTION AND COMMISSIONING)

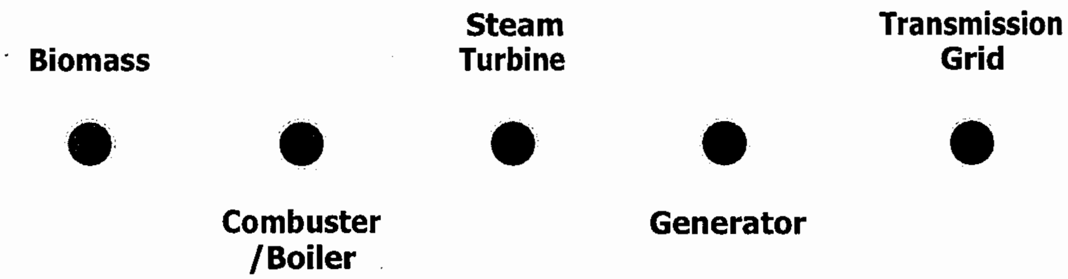
ACTIVITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CIVIL CONSTRUCTION INCLUDING ENGINEERING AND CONSTRUCTION																		
Civil Foundations of Equipment																		
Water Treatment Plant	■	■	■	■	■													
Extraction Condensing Steam Turbine																		
Electric Generator and Allied Equipment with Steam Turbines	■	■	■	■	■	■	■	■										
Envoimmental Protection Equipment																		
Boiler Island		■	■	■	■	■												
Cooling Tower																		
Diesel Generators		■	■															
Air Compressor																		
Plant Auxiliaries and Utilities		■	■	■	■													
Buildings and Infrastructure																		
Mosque																		
Admin Building				■	■	■												
RO Building																		
Turbine House Building and CCR Room			■	■	■	■	■											
Workshop Utilities Building																		
Main Gate, Roads and Boundary Wall		■	■	■	■	■	■	■	■	■	■	■						
MECHANICAL EQUIPMENT - ENGINEERING, PROCUREMENT, MANUFACTURING AND INSTALLATION																		
RO Plant	■	■	■	■	■	■	■	■										
Extraction Condensing Steam Turbine																		
Electric Generator and Allied Equipment with Steam Turbines	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
Envoimmental Protection Equipment																		
Boiler Island	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
Cooling Tower																		
Diesel Generators					■	■	■	■	■	■								
Air Compressor																		
Fire Fighting System							■	■	■	■								
Air Conditioning of Rooms																		
Overhead Crane							■	■	■	■								
Plant Auxiliaries and Utilities																		
Electrical and Mechanical Workshop Equipment							■	■	■	■								
Interconnecting Pipeline, Valves and Fittings																		
Insulation and Cladding									■	■	■	■	■	■	■			
ELECTRICAL & INSTRUMENTATION EQUIPMENT - ENGINEERING, PROCUREMENT AND INSTALLATION																		
Panels/Switch Gears																		
Motor Control Centers / Panels						■	■	■	■	■	■	■	■	■				
MV Switch Gear																		
LV Switch Gear						■	■	■	■	■	■	■	■	■				
Drives																		
Electric Motors																		
Geared Motors				■	■	■	■	■	■	■	■	■	■	■				
Variable Speed Drives																		
Cables																		
Control Cables							■	■	■	■	■	■	■	■				
HT Power Cables																		
MV Power Cables							■	■	■	■	■	■	■	■				
LV Power Cables																		
Earthing Cables							■	■	■	■	■	■	■	■				
Erection/Hook Ups																		
Cable Trays																		
Wiring Accessories										■	■	■	■	■				
Cable Glands																		
Transformers				■	■	■	■	■	■	■	■	■	■	■				
Earthing System																		
Lighting System										■	■	■	■	■				
Instrumentation and Control																		
Distributed Control System (DCS)																		
Sensors, Transmitters, Detectors, Analyzers						■	■	■	■	■	■	■	■	■				
COMMISSIONING AND TRIAL																		
Commissioning of Equipment																		
Commissioning of Equipment															■	■	■	
Final Test Reports of Power Plant																		
Final Test Reports of Power Plant / COD																		

2.10 Description of the Project

The current project is the installation of biomass power plant. The details of its working technology selection, fuel options, emissions compliance and infrastructure plans are given below:

2.10.1 How does it work?

In a direct combustion system, biomass is burned in a combustor or furnace to generate hot gas, which is fed into a boiler to generate steam, which is expanded through a steam turbine or steam engine to produce mechanical or electrical energy. In a direct combustion system, processed biomass is the boiler fuel that produces steam to operate a steam turbine and generator to make electricity.



2.10.2 Technology, Size of Plant, Number of Units

Selection of High-Pressure Technology:

ICL Power (Pvt.) Ltd. (ICLPPL) is interested in technology that is the latest and proven. The 9.8 MPa, 480 °C system is identified with assumptions of 37.2 MW gross output, 30tph net extraction, as offering a significantly superior return on investment. This configuration strikes a balance between substantial fuel savings and a modest increase in capital investment.

The broad parameters of the project are:

Project Capacity	1 x 37.2 MW
Construction Period	12 Months
Boiler Capacity	1 x 190 TPH, 109 bar(g), 540 C
Turbine Capacity	1 x 37.2 MW Extraction/Condensing
Total Net Power Generation	**34 MW**

Specifications of Extraction Condensing Steam Turbine are as follows:

Power Output	1 x 37.2 MW
Type	Extraction Condensing

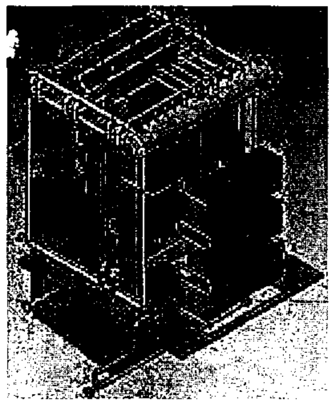
Power Output	1 x 37.2 MW
Steam Extraction	30TPH @ 10 bar (g)
Stage	Multistage, Nozzle Governed
Steam Inlet Pressure	109 bar(g)
Steam Inlet Temperature	540 °C

Specifications of Generator are as follows:

Voltage Level	11000 V
Frequency	50 Hz
Power Factor	0.8
Insulation Class	F

Specifications of Boiler are as follows:

The biomass fired boiler is a hanging structure natural circulating boiler with single drum and consisting of a rigid water-cooled frame for supporting the heating surfaces and steam drum. The boiler is provided with a membrane wall construction which is water cooled and fully gastight. Due to the welded construction, its water-cooled frame and low wall thickness of the steam drum the boiler can react very fast to load changes and can be started relative fast compared to other types of boilers.



Boiler has following key parameters

Type	Single Drum Membrane Type
Evaporation Capacity	190 TPH
Steam Pressure	100 Bar(g)
Steam Temperature	540 °C + 5 °C
Grate	Reciprocating Grate
Fuel	Biomass (Agriculture Waste)
Feed Water Temperature	210°C
Boiler Efficiency on LCV	88%

Boiler Efficiency on LCV	145°C

Projected HMBD of the Power Plant:

The heat and Mass Balance Diagram (HMBD) is the graphical representation of the heat and mass balance of a steam turbine-based power plant system. The use of HMBD is for knowing steam quantity during a power cycle, Turbine power output, sizing of the de-superheater, and quantity of steam going into the process. The diagram is given below:

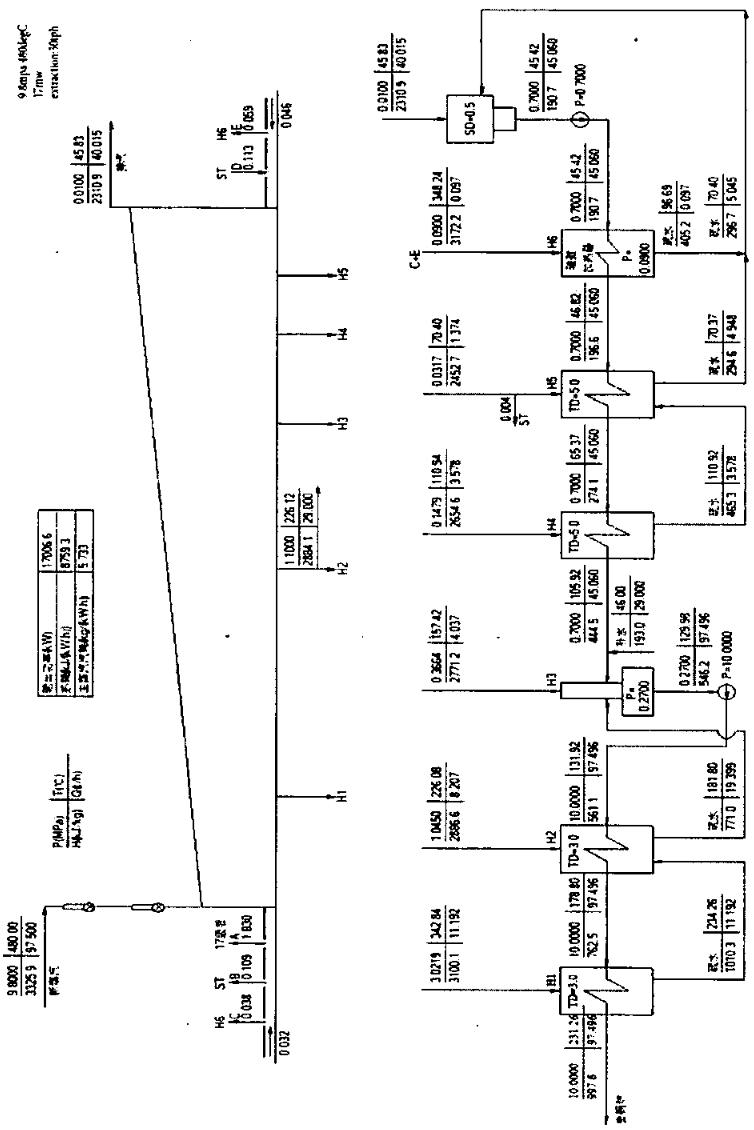


Figure 2-3, Graphical Representation of heat and Mass Balance Diagram (HMBD)

2.10.3 Fuel: Type, Imported/Indigenous, Supplier, Logistics, Pipelines energy

Biomass (Agricultural Waste) is selected as fuel for this project. Biomass emerges as a promising, cost-effective, and sustainable alternative with the potential to address both energies needs and environmental concerns.

Selected Types of Biomass Fuel

The following types of biomasses are selected for power generation that are readily available in Pakistan.

Bagasse	Rice Husk	Rice Straw	Corn Cob (Red)	Corn Cob (White)
Corn Stalks	Brassica	Mustard Straw	Wood Chips	Cotton Stalks
	Wheat Straw	Sugarcane Trash	Maize Husk	

Seasonal Availability Chart for Biomass of Pakistan

fuel	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Red corn cob					■	■	■					
White corn cob	■	■									■	■
Mustard husk			■	■								
Seasme husk								■	■	■		
Rice husk										■	■	■
Bagasse											■	■
Rape seed	■		■	■								
Sunflower sticks	■	■	■									
Cotton stalk								■	■	■	■	■
Rice straw										■	■	■
Rice brawn										■	■	■
Eucalyptus										■	■	
Wood saw dust	■	■	■	■	■	■	■	■	■	■	■	■
Wood chips	■	■	■	■	■	■	■	■	■	■	■	■
Wood pellets	■	■	■	■	■	■	■	■	■	■	■	■

Annual production potential of crop residue in Pakistan

The annual production potential of crop residue biomass and their use is given as follow:

Biomass Residues	Theoretical Potential	Technical Potential	Past Annual Usage (%)
Bagasse	11,790	4,224	35.8
Rice husk	1,288	557	43.2

Biomass Residues	Theoretical Potential	Technical Potential	Past Annual Usage (%)
Corn cob	599	67	11.2
Corn husk	400	45	11.3
Cotton stalk	25,865	2,764	10.7
Wheat straw	16,323	2,604	16.0
Rice straw	6,438	2,784	43.2
Sugarcane trash	4,716	1,690	35.8
Maize stalk	2,270	256	11.3
Total	69,689	14,991	21.5

2.10.4 Transportation Modes

Biomass transportation primarily utilizes tractor trolleys, trucks, or similar road-based transport modes in Pakistan due to their accessibility and suitability for local roads.

2.10.5 Accessibility

Pakistan's road network supports the movement of biomass from local sources to power generation facilities, ensuring relatively easy access and transport feasibility.

2.10.6 Supply Chain Management

Biomass resources are locally abundant, reducing transportation distances and fostering a dependable and consistent supply chain.

2.10.7 Logistics and Efficiency

The chosen modes of transportation offer efficient delivery of biomass quantities, with regular and well-managed schedules to maintain a steady supply. Biomass transportation accounts for proper handling practices, and maintaining quality and quantity standards during transit and storage at the facility.

2.10.8 Emissions Values

The Management of ICL Power (Pvt.) Ltd. (ICLPPL) is committed to providing safe, healthy and pollution-free environment to its employees as well as surroundings. We shall strive to create pollution-free environment. We shall comply with all regulatory requirements imposed by the Pakistan Environment Law (PEQS)

To implement Environment Policy, ICLPPL shall:

- Comply with relevant environmental Law and Regulations.
- Comply with Punjab Environmental Quality Standards (PEQS)
- Ensure that all the activities of the company should according to company environment policy.
- Setting objectives and targets for continual improvement in environmental conditions.
- Ensure for provision of the safe working environment and to save all employees from illness and accident.
- Provide appropriate environment training/information to all employees.
- Require every employee to exercise personal responsibility in preventing harm to themselves, to others, and to the environment.
- Promote awareness and give due recognition to performance in the area of Health, Safety, and Environment.
- Shall monitor and treat all kinds of liquid effluents from plants before their disposal.
- Shall monitor and treat all gaseous emissions for safe and prescribed levels of CO, SOx, NOx and particulates.

2.10.9 Cooling Water Source Utilization and Discharge Compliance

The proposed power generation facility aims to utilize tube wells as the primary source for obtaining the cooling water required for operational processes. The utilization of tube wells for sourcing cooling water and the discharge process planned for the power generation facility aims to not only fulfill operational requirements but also strictly adhere to the environmental standards set by PEQS. This commitment to environmental responsibility ensures minimal impact on local ecosystems and underscores our dedication to sustainable operations.

Tube Wells Utilization:

The choice to utilize tube wells for sourcing cooling water stemmed from their cost-effectiveness, reliability, and feasibility in accessing groundwater resources. Tube wells offer a dependable and controllable means to obtain ample cooling water essential for the power- uninterrupted functioning of the generation process.

Discharge Process and Compliance with PEQS:

At ICLPPL the discharge of used cooling water back into the environment follows a comprehensive process aligned with environmental regulations and best practices.

The discharged water undergoes treatment via an advanced Effluent Treatment Plant (ETP) before being reintroduced into the environment.

- Cooling water utilized in our operations is systematically collected and channelled through our ETP for treatment before discharge.
- Our ETP utilizes advanced technology to treat used cooling water to the extent that it meets Semi-Commercial Use Standards, as prescribed by regulatory bodies, including PEQS
- The treatment process involves several stages, including filtration, biological and chemical treatment, and disinfection, ensuring the removal of contaminants and impurities from the water.
- Compliance with PEQS is a primary focus during the treatment process, ensuring that the discharged water meets quality standards acceptable for semi-commercial applications like water supply to colonies or similar purposes.

2.10.10 Infrastructure Overview - Roads, Staff Colony, and Amenities

The holistic infrastructure plan, encompassing administrative buildings, healthcare facilities, landscaping, roads, and strategically positioned security check posts, reflects our commitment to fostering a conducive work environment while ensuring operational efficiency and compliance with safety standards.

Road Network Overview for Power Generation Facility

- The road network within the facility premises shall be planned to be a grid-style layout that shall ensure efficient access to different sections of the power generation site.
- Roads shall be constructed with sufficient width to accommodate smooth vehicular movement, including space for heavy-duty vehicles.
- Entry and exit points shall be strategically placed to optimize access and traffic flow.
- Curves and turns shall be engineered with broader angles to accommodate larger vehicles and ensure safe manoeuvrability.
- Emergency response routes will be designated and marked for quick access by fire trucks, ambulances, and other emergency vehicles.
- Roadside signage and clear markings will aid emergency services in navigating the premises swiftly.

Administrative Buildings Overview

- The administrative buildings within the power generation facility shall serve as operational hubs and shall supporting a range of functions critical for effective management, operations, and workforce coordination.
- Their design and functionalities shall be tailored to meet the diverse administrative needs of the facility while emphasizing efficiency, functionality, and sustainability.

Medical Centre/First-Aid Station

The medical center/first-aid station shall be strategically available for easy access during emergencies.

It shall be equipped to handle basic medical needs and initial emergency responses.

Protocols shall be placed to manage emergency situations until professional medical assistance arrives.

Security Check Posts:

- Security check posts shall be strategically positioned at entry and exit points, perimeter boundaries, and critical access areas within the facility.
- These posts shall serve as checkpoints to monitor and the entry and exit of personnel, vehicles, and materials shall be regulated
- Surveillance cameras shall be installed to monitor activities and record footage for security purposes.

2.11 Restoration & Rehabilitation Plan

There will be no need of any restoration/rehabilitation as the project site is already owned by proponent and an agricultural area. No one will have to leave or no land acquisition would be required.

2.11.1 Government Approvals

The proponent has obtained planning permission from District council, Lahore. The project is seeking to be approved from different Government agencies and for these approvals; NOC/Environmental Approval is required from EPD.

SECTION - 3: DESCRIPTION OF ENVIRONMENT

For any development project, the prevailing environmental conditions need to be assessed prior to the stages of planning, designing and execution of the project. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures, which forms the basis for the implementation of the proposed project interms of prevailing environmental and social conditions in the study area.

The existing environmental conditions of the proposed project have been considered with respect to physical, biological and socio-economic aspects. The Study Area is selected on the basis of the Project's potential environmentaland social impacts on the local resources. Information has been collected from variety of sources, including published literature, field observations and surveys, conducted specifically for this study. Consultations were also held with the general public and stakeholders of the project area in order to seek the public opinion on the implementation of the proposed Project.

3.1 Physical resources

3.1.1 Topography

Topography of Sheikhupura City is flat. The area is a part of Rachna Doab and consists of sub-recent sediments brought by spill channel from the river Chanab. There are some old channel levees remnants and old basins filled up with clay materials. The material is probably of Late Pleistocene Age derived from mixed calcareous sedimentary and metamorphic rocks of Lower Himalayas. The area of the Sheikhupura District is comprised of the fluvial deposits of Ravi River.

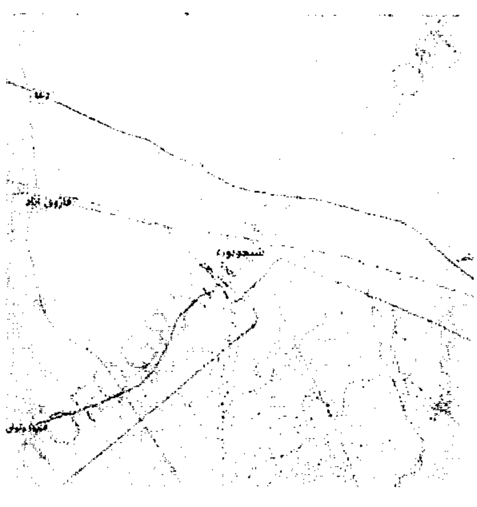


Figure 3-1, Topographic Map of the City

3.1.2 GEOGRAPHY& GEOLOGY

Sheikhupura lays 31°42'51.16"North latitude and 73°59'3.49"Easr longitude. The city is well connected with its surrounding big urban centers like Lahore (35 km) Faisalabad (94 km), Sargodha (143 km) and Gujranwala (54 km). Sheikhupura is also a railway junction. The area is a part of Rachna Doab, and consists of some recent sediment brought by spill channel from River Chenab.

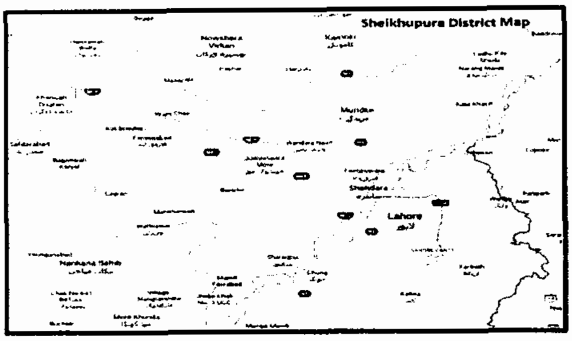


Figure 3-2, Map Showing the Area of District Sheikhupura

There are some old channel levee remnants and old basins filled up with clay materials. It is probably of Late Pleistocene Age derived from mixed calcareous, sedimentary and metamorphic rocks of the lower Himalayas. District Sheikhupura is spread over an area of 3,241km^2 and comprises 05 tehsils such as; Sheikhupura, Ferozewala, Sharaqpur Sharif, Muridke and Safdarabad.

3.1.3 Seismology

According to Seismic Zoning of Pakistan, the project area lies in Zone 2A and represents minor to moderate damage due to earthquakes.

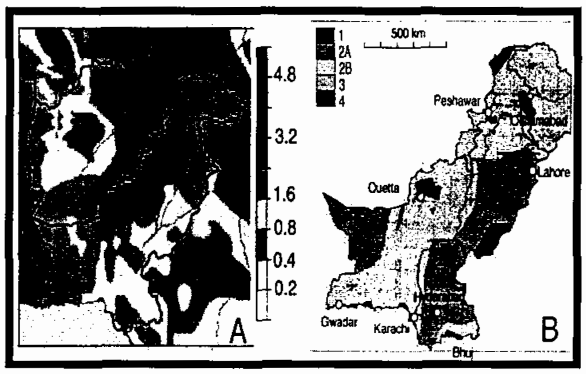


Figure 3-3, Seismic Zone of Pakistan (Geological Survey of Pakistan)

3.1.4 Soil

The soil in the project area is cohesion less and is of alluvial type deposited by Ravi River. The types of soil layers that are present below the ground level includes: silt, silty clay, silty sand, poorly graded sand with silt and lean clay.

3.1.5 Climate

The District Sheikhupura has extreme climate conditions and summer season starts from April and continues till October. During the summer season, temperature ranges from 30°C to 48°C. The winter season starts from November and continues till March. December and January are the coldest months with a mean minimum temperature of about 3-5°C. The dust storms occur occasionally during the hot season, June, July and August.

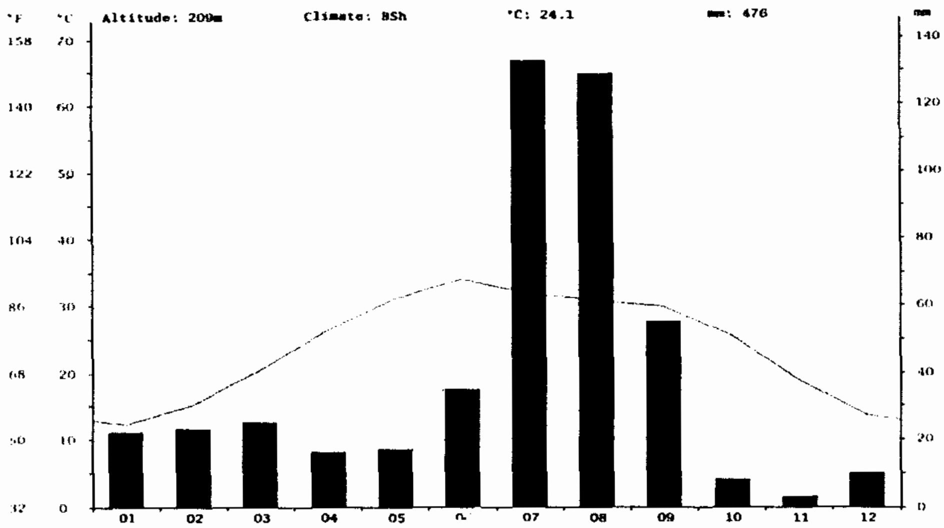


Figure 3-4, Annual Mean Temperature (Geological Survey of Pakistan)

Rainy weather alternates with oppressive weather. The rainfall is 500 mm per annum. In the recent year, the maximum average precipitation occurred in September and it was around 50-100mm.

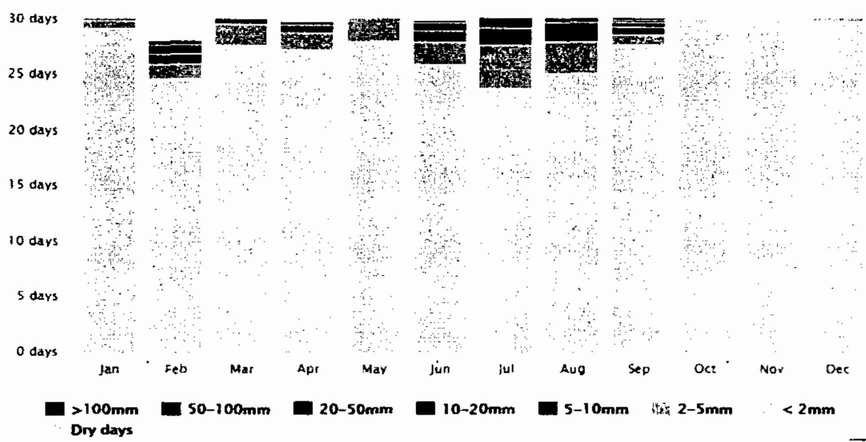


Figure 3-5, Annual Mean Precipitation (Geological Survey of Pakistan)

The average daily wind speed was highest in July which was 38 km/h. In recent years, the maximum sustained wind speed has reached 38 km/h.1 The diagram shows how many days within one month can be expected to reach certain wind speeds. Monsoons create steady strong winds on the Tibetan Plateau from December to April, but calm winds from June to October. The wind speed directly affects the dispersion and transport of plume. So, the greater is the wind speed, the greater will be the dispersion and the distance at which plume strikes the ground and the lesser will be the pollution concentration.

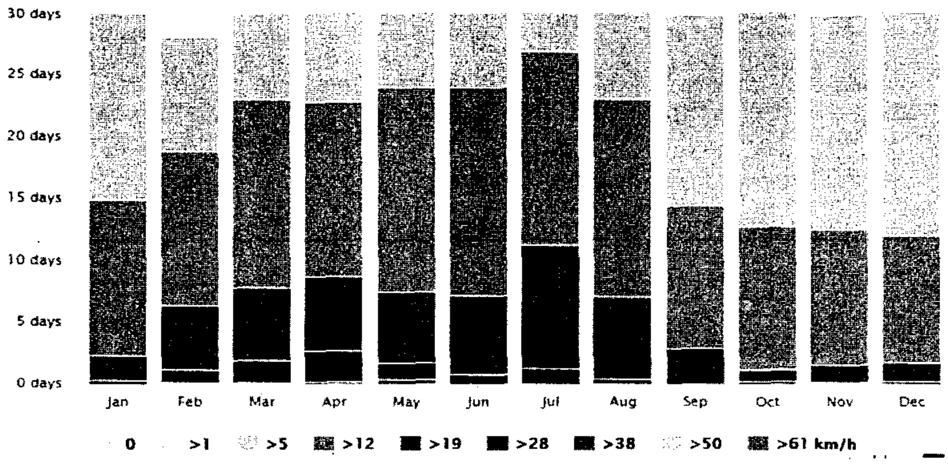


Figure 3-6, Average Wind Speed (Geological Survey of Pakistan)

3.1.6 Water resources

The main source of the water consumption is the ground water. It is being used in the study area for industrial and domestic purposes.

To check the quality of the water in the area, ground water was collected and analysed. The ground water will be extracted through boring. The detail of the water quality of the project area is given below:

Table 3-1, Ground Water Analysis Results

Ground Water Analysis Results					
Parameter	**Analysis Method**	**PEQS**	**Result**	**MU (CL95%)**	**Remarks**
Lab Analysis					
Color*	SMWW 2120 C	≤ 15 TCU	0	N.A.	Optimal
Taste*	SMWW 2160 C	Non-Objectionable	Non-Objectionable	N.A.	Optimal
Odor*	SMWW 2150 B	Non-Objectionable	Non-Objectionable	N.A.	Optimal
Turbidity*	SMWW 2130 B	< 5 NTU	0	N.A.	Optimal
Total Hardness (as $CaCO_3$) **	SMWW 2340 C	< 500 mg/L	164	± 5.1421	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	< 1000 mg/L	649	± 8.0226	Optimal
pH**	SMWW 4500 H^+ B	6.5- 8.5	7.73	± 0.04	Optimal

Ground Water Analysis Results					
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	<0.005	N.A.	Optimal
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	<0.005	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	0.7 mg/L	<0.0035	N.A.	Optimal
Boron (B)	SMWW 3113 B	0.3 mg/L	<0.02	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	<0.006	N.A.	Optimal
Chloride (Cl^-) **	SMWW 4500 Cl^- B	< 250 mg/L	167	± 1.73	Optimal
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3111 B	2.0 mg/L	<0.164	N.A.	Optimal
Cyanide (CN^-)*	SMWW 4500 CN^- F	≤ 0.05 mg/L	0	N.A.	Optimal
Fluoride (F^-)**	SMWW 4500 F^- C	≤ 1.5 mg/L	0.309	± 0.0491	Optimal
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	<0.005	N.A.	Optimal
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/L	<0.015	N.A.	Optimal
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	<0.02	N.A.	Optimal
Nitrate (NO_3^-) **	SMWW 4500 NO_3^- D	≤ 50 mg/L	18.8	± 1.001	Optimal
Nitrite (NO_2^-) *	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01	N.A.	Optimal
Residual Chlorine (Cl_2) *	SMWW 4500 Cl^- B	0.5 mg/L	0	N.A.	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 D	NGVS mg/L	0	N.A.	Optimal
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.048	N.A.	Optimal
Microbiological Analysis					
Total Coliforms*	SMWW 9222 B	0 CFU/ 100 mL	0	N.A.	Optimal
Fecal Coliforms *	SMWW 9222 D	0 CFU/ 100 mL	0	N.A.	Optimal

Note: *All parameters are well within PEQS.*

3.1.7 Ambient Air Quality

The primary source of air pollution at the project sites is the vehicular emissions, industries and the key pollutants likely to be found at project proposed locations are Carbon Monoxide (CO), Oxides of Nitrogen (NOx), Sulfur Dioxide (SOx) and Particulate Matter (PM). In order to determine the air quality of the area, Laboratory had the requisite air sampling device and expertise for collection of samples.

The monitored parameters included Carbon mono-oxide (CO), Nitrogen oxides (NOx), Sulphur oxides (SOx), Particulate Matter (PM_{10}). The monitoring was carried out for a period of 24 hours and results are presented in Table 2, and reports are attached as **Annexure-III.**

Table 3-2, Ambient Air Quality Results

Parameters	Units	Monitoring Duration	LDL	Average Obtained Concentration	PEQS	Remarks
Nitrogen Dioxide (NO_2) *	μg/m³	24Hours	1.00	20.55	80.0	Optimal
Nitrogen Oxide (NO)*	μg/m³	24Hours	1.00	17.81	40.0	Optimal
NO_x*	μg/m³	24Hours	1.00	38.31	120.0	Optimal
Sulphur Dioxide (SO_2) *	μg/m³	24Hours	1.00	31.61	120.0	Optimal
Carbon Monoxide (CO)*	mg/m³	24Hours	0.01	1.22	05.0	Optimal
Particulate Matter (PM_{10}) *	μg/m³	24Hours	1.00	**196**	150.0	High
Particulate Matter ($PM_{2.5}$) *	μg/m³	24Hours	1.00	**51**	35.0	High
Total Particulate Matter (TSP)	μg/m³	24Hours	1.00	259	500.0	Optimal

Note: *All parameters of ambient air quality are well within PEQS except Particulate matter (Both PM $_{10}$ & $_{2.5}$).*

3.1.8 Noise

Noise level of the project area was monitored at project site using digital sound meter and the results are presented in below mentioned table and reports are attached as **Annexure-III.**

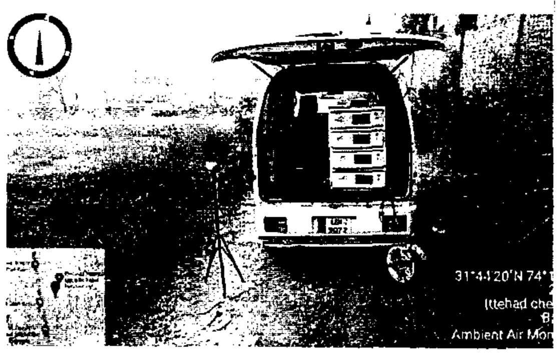
Table 3-3, Noise Levels at Project Site

Sr. No.	Time	Noise dB(A)		PEQS
1	12:00	60	Day Time	75
2	13:00	58		
3	14:00	61		
4	15:00	57		
5	16:00	62		
6	17:00	55		
7	18:00	58		
8	19:00	59		
9	20:00	55		

Sr. No.	Time	Noise dB(A)		PEQS
10	21:00	51		
11	22:00	45	Night Time	65
12	23:00	40		
13	00:00	39		
14	01:00	38		
15	02:00	38		
16	03:00	39		
17	04:00	40		
18	05:00	39		
19	06:00	38		
20	07:00	40	Day Time	75
21	08:00	41		
22	09:00	45		
23	10:00	49		
24	11:00	53		

Note: *The results show that the noise levels are well within PEQS.*

Ground Water Analysis



Amnient Air Moniroring

Figure 3-7, Pictorial Evidences of Environmental Monitoring

3.2 Ecological resources

3.2.1 Flora

The project site is situated next to Ittehad Chemicals in an industrial area where the land has already been cleared. This means that there will be no need to cut down any trees, herbs, or shrubs on the property. Additionally, this offers a great advantage in terms of minimizing environmental impact and preserving the existing natural landscape.

3.2.2 Fauna

For study of fauna in the project area, field guides and books were consulted. On the other hand, field observations were conducted along with the interviews of local community members about the fauna of the area. The equipment used in field included; cameras, binoculars and GPS device (wherever required). It is important to note that there is a number of factors which can change the findings of such survey. It may be pointed out that the pattern of seasonal migration of small birds varies depending upon each species. The proposed site has a fresh water aquatic body namely Degh Nala (located at the distance of 0.7 km from the project area) having no life, hence there is no freshwater aquatic life in the study area. During the construction activity in project area, no important biological feature will be damaged or disturbed.

The fauna commonly found in District Sheikhupura includes; Hares, Falcon, Eagle, Quail, Starling, Jungle Pigeon, Russian Sparrow, Doves, King Fisher, Parrot, Crow and Local Sparrow. Commonly found mammals in the area include; dogs, cats, horses, house-rats, squirrels, porcupines and bats. However, Small Indian Mongoose and Indian Palm Squirrel are also found in the District Sheikhupura. The list of the mammals along with their scientific names, observed in the study area are enlist in the **Table** 3-4 below.

Table 3-4, Mammals of Study Area

Sr. No.	Common Name	Scientific Name
1	Rat	*Rattus*
2	Bat	*Chiroptera*
3	SmallIndian Mongoose	*Herpestesjavanicus*
4	Indian PalmSquirrel	*Funambuluspalmarum*
5	Porcupines	*Erethizondorsatum*
6	Squirrels	*Sciuridae*

The commonly found birds' species include; House Sparrow, Crow and some of them are mentioned below with scientific names:

Table 3-5, Birds of Study Area

Sr. No.	Common Name	Scientific Name
1	HouseSparrow	*Passerdomesticus*
2	HouseCrow	*Corvussplenders*
3	Pigeon	*Columbidae*

Sr. No.	Common Name	Scientific Name
4	Bulbul	*Pycnonotidae*
5	Teetar	*Francolinusfrancolinus*
6	Parrot	*Psittaciforms*
7	Titodi	*Vanellusindicus*

Table 3-6, Reptiles of Study Area

Sr. No.	Common Name	Scientific Name
1	Snake	*Serpentes*
2	SpinyTailed Lizard	*Uromastixhardwickii*
3	Fingered Toed Lizard	*Acanthodactyluscantoris*
4	Earthworm	*Lumbricina*

- The amphibians commonly seen around the project area, especially during the rainy season includes;

Table 3-7, Amphibians of Study Area

Sr. No.	Common Name	Scientific Name
1	Common Frog	*Ranatemporaria*
2	IndusValley Toad	*Bufostomaticus*

A large number of insects are present due to open fields in the project site. Few of these insects are known to cause diseases in local population. Following is a list of commonly observed insects at the site:

Table 3-8, Insects in Study Area

Sr. No.	Common Name	Scientific Name
1	Black Ants	*Paratracheaiognicornis*
2	Dragon Fly	*Dragon Fly*
3	HouseFlies	*Muscadomestica*
4	Butter Flies	*Parnassiusbalucha*
5	HoneyBees	*Apismellifera*
6	Wasps	*Anagyruspseudococci*
7	Grasshopper	*Melanoplusdifferentialis*
8	Mosquito	*Anophlesesp.*

No endangered species are found at the site. The area has not been identified as ecologically sensitive area by wildlife department.

3.3 Socio-economic and cultural features

This section deals with the socio-economic and cultural conditions of the project area. During the desk/ office study, available reports/ documents were comprehensively studied.

The basic objectives of the social surveys were to:

- Get the primary data from the various sources.
- Informed people about objective and purpose of the proposed project.
- Identify the potential impacts associated with the implementation of the proposed project.
- Get feedback from community about project related social issues.
- And address the mitigation measures about the social issues in the report.

This section provides collective information about the existing socio-economic and environmental condition of the project area within the AOI. The different types of socio-economic aspects were covered such as; demographic profile, occupation, education and health facilities. This data helped in identifying major interventions for the development of Environmental Management and Monitoring Plan (EMMP). The study also helped to assess the positive or adverse impacts on local community. The major occupation of the people in the study area is agriculture and the detail of crops, being sown in this specific area is given below:

A) Cultivated Crops

The main crops that are being cultivated in the study area includes; Rice, Wheat, Fodder Crops as well as the seasonal crops grown in the region. District Sheikhupura is famous for best Basmati rice production in the world.

B) Livestock

People in the study area have common livestock which include; Cows, Buffalos, Sheep, Goats and Hens. However, there is no proper cattle or poultry farm observed within the study area.

C) Lab Reports of Environmental Analysis

Testing of different parameters was done from a certified laboratory in order to check the quality of different environmental parameters. The copy of the lab reports of these parameters (ambient air analysis, water quality analysis and noise) is attached at **ANNEXURE-III.**

D) Site Suitability for Project

The project site is in industrial area where industrial activities are already going on. The proposed land already has less vegetation, so land is most suitable for our proposed project.

SECTION - 4: MITIGATIONS POTENTIAL ENVIRONMENTAL IMPACTS AND

General

This section presents the overall impacts (either beneficial or adverse) of pre-construction/design, construction and operation phases of the proposed Project on the physical, ecological and socio-economic environment of the project site. In addition, it also covers the mitigation measures of the potential adverse environmental and social impacts.

Impacts of the proposed project were identified on the basis of detailed review and analysis of secondary data available for all environmental parameters in Project Area, site surveys and expert opinion on prevailing site conditions and sensitive receptors.

Methods for Evaluation of Impacts

For the assessment of environmental as well as social potential impacts, following tools were used for:

- Project Interaction Matrix
- Checklists
- Overlays

Project Interaction Matrix

Interaction matrix is a two-dimensional matrix wherein the project actions are placed along one axis (i.e., along y-axis) and on the other axis there are different environmental parameters likely to be affected by the proposed project actions grouped into categories i.e., Physical, Ecological & Socio-economic Environment. Interaction matrix is used in this project due to the following reasons:

- It provides cause-effect relationship between the project actions and resulting consequences impacts.
- It provides nature (+ve or –ve) and weighting of different impacts.
- It provides cumulative impacts of a project.

Matrix grouped project actions into temporal phases. For the impact assessment, project interaction matrix is used by dividing the project action into different phases (Preconstruction, construction and operation). The environmental impacts are divided into three main categories including physical, ecological and socio-economic domains. The environmental impacts of the project actions are identified and weighed into the following categories:

+3	=	Extremely Beneficial
+2	=	Potentially Positive
+1	=	Slightly Positive
0	=	Insignificant
-1	=	Slightly Negative
-2	=	Potentially Negative
-3	=	Extremely Negative

The assignment of significance is based on the previous knowledge and professional judgment of IEE team experts. The project impact matrix has been developed and attached in **Annexure-VI.** It may be noted that the environmental parameters, which are not related to the implementation of the projects, have not been considered in the matrix.

Checklist

The assignment of significance is based on the previous knowledge and professional judgment of IEE team experts. The project Checklist has been developed for "without" and "with mitigation" is attached as **Annexure V.** It may be noted that the environmental parameters, which are not related to the implementation of the projects, have not been considered in the matrix.

Overlays

In order to identify the spatial based (location based) impacts, overlays are used. An overlay is based on a set of transparent maps each of which represents the spatial distribution of environmental characteristics (for example susceptibility to erosion). Information for an array of variables is collected for the standard geographical units within the area of influence (AOI) and recorded in a series of maps typically one for each parameter. These maps are overlaid to produce a composite map. The resulting composite maps characterize the area's physical, ecological, socio-economic and other relevant characteristics relative to the location of the proposed Project.

Characteristics of Impacts

The predicted impacts have been characterized; various aspects of the impacts include:

- Nature (direct/indirect)
- Duration of impact (Short term, medium term, long term)
- Geological extend (local, regional)
- Timing (Project phase)
- Reversibility of impact (Reversible/Irreversible)
- Likelihood of the impact (certain, likely, unlikely, rare)
- Impact consequence severity (major, moderate, minor)
- Significance of impact (High, medium, low)

The above aspects of environmental characterization are defined in **Table** 4-1.

Table 4-1, Impact Characterization

Nature	**Direct:** The environmental parameter is directly changed by the project. **Indirect:** The environmental parameter changes as a result of change in another parameter
Duration of Impacts	**Short-term:** lasting only for the duration of the project such as noise from the construction activities. Medium-term: Lasting for a period of few months to a year after the project before naturally reverting to the original condition such as loss of vegetation due to clearing of campsite, contamination of soil or water by fuels or oil. **Long-term:** lasting for a period much greater than medium term impact before naturally reverting to the original condition such as loss of soil due to soil erosion.
Geographical Extent	Local, regional (spatial dimension)
Timing	**Construction and Operation**
Reversibility of Impact	**Reversible:** when a receptor resumes its pre-project condition. **Irreversible:** when a receptor does not or cannot resume its pre-project condition.
Likelihood of the Impact	Almost Certain: Impact expected to occur under most circumstances. **Likely:** Impact will probably occur under most circumstances. **Possibly:** Impact may possibly occur at some time. **Unlikely:** Impact could occur at some time.

	Rare: Impact may occur but only under exceptional circumstances.
Impact Consequences severity	**Major:** When an activity causes irreversible damage to a unique environmental feature; causes a decline in abundance or change in distribution over more than one generation of an entire population of species of flora and fauna: has long term effects (period of years) on socioeconomic activities of significance on regional level. **Moderate:** When an activity causes long-term (period of years), reversible damage to a unique environmental feature; causes reversible damage or change in abundance or distribution over one generation of a population of flora or fauna: have short-term effects (period of years) on socioeconomic activities of significance on regional level. Minor: When an activity causes short-term (period of a few months), reversible damage to a unique environmental feature; slight reversible damage to a few species of flora or fauna within a population over a short period; has short-term (period of months) effects on socioeconomic activities of local significance. Negligible: when no measurable damage to physical, socioeconomic, or biological environment above the existing level of impact occurs.
Significance of Impact	Categorized as **High, Medium, Low** Based on the consequence, likelihood, reversibility, geographical extent, and duration: level of public concern: and conformance with legislative of statutory requirements.

The impact characterization due to Design, Location, Construction and operational phase is given in their respective sections.

Risk Assessment

Risk assessment is done for construction phase which will describe the potential impacts/hazards so that the precautions/control may adopt accordingly, **Table** 4-2 and **Table** 4-3

Table 4-2, Severity of Risk during construction of the proposed project

Risk Magnitude/ severity	Assigned Values	Probability/ Likelihood	Assigned Values
Low	1	Highly Unlikely	1
Medium	2	Unlikely	2
High	3	Possible	3

Extreme	4	Likely	4
Catastrophic	5	Very likely	5

Table 4-3, Risk assessment

Hazard	Source	Duration Hours/day	Severity's (S)	Likelihood (L)	Risk amount S*L
Noise	Generators and excavation	8	2	4	8
Dust	Excavation and transportation of construction materials	8	3	4	12
Vibration	Excavation	8	2	3	6
Falling objects	Construction activities	8	4	2	8
Ergonomics	No proper posture for Work	8	3	3	9
Work load	Continues work	8	2	3	6
Temperature	Sunlight during summer	8	3	4	12
Fire	Flammable materials, electrical short circuit	8	3	4	12
Work at height	----	During work	3	4	12
Air pollution	Vehicles and generator	During their working	3	5	15

Likelihood → / Severity ↓	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	[illegible]
4	4	8	12	[illegible]	[illegible]
5	5	10	[illegible]	[illegible]	[illegible]

Green color boxes (1-5): Low risk and unlikely to cause health impact.

Yellow color boxes (6-12):	Noticeable risk. It has potential to cause medium impacts.
Red color boxes (15-25):	High risk & cause high level health impacts.

Controls

Almost all the risks, which can occur in this project during both construction and operational phase do not fall in high-risk area except air pollution. But there is still need of controls which are given below:

- Generator should put at such place where its noise does not disturb the community as well as the workers during construction, during operation it should place on the top of the building and should place in closed canopy.
- New technology generator should be used and its proper maintenance to avoid the air emission.
- Regular tuning of construction vehicles and generators.
- To avoid the dust water should sprinkle after specific duration.
- PPE should be provided to workers.
- Job rotation to avoid work pressure.
- Proper holdings, controls and use of PPEs for safe work at height.

POTENTIAL IMPACT GENERATION ACTIVITIES

The construction and operation phase of the proposed project comprises various activities each of which may have an impact on environmental parameters. The impacts of the project are envisaged during the design and planning, during pre-construction phase, construction phase.

During the construction phase, the following activities may have impacts on environment:

- Project Development Phase
- Detailed Engineering and Design
- Equipment Procurement
- Site Preparation and Infrastructure
- Construction and Commissioning
- Commercial Operation

The activities can be divided into two categories, viz. sub-structural and super-structural work. Moreover, construction work will involve cutting of trenches, excavation, concreting etc. All these activities attribute to dust pollution. The super-structural work will involve steel work, concrete work, masonry work etc. and will involve operation of large construction equipment like cranes, concrete mixers, hoists, welding sets etc. There may be emission of dust and gases as well as noise pollution from these activities.

Mechanical erection work involves extensive use of mechanical equipment for storage, transportation, erection and on-site fabrication work. These activities may generate some air contaminants and noise pollution. The electrical activities are less polluting in general. Potential Impacts and Mitigation Measures (for construction and operation phase) is given in **Annexure-IV.**

4.1 IMPACTS DURING PLANNING AND DESIGN PHASE

The location of the project site is adjacent to Ittehad Chemicals, already an industrialized area eliminates the need for further land clearing. This scenario presents significant benefits in terms of land preservation and minimizing environmental impact. The absence of trees, herbs, or shrubs on the property eliminates concerns related to deforestation, habitat disruption, or disturbance to local ecosystems. This unique aspect of the project site not only aligns with sustainable practices but also contributes to the preservation of the existing natural landscape. The absence of resettlement or rehabilitation requirements further streamlines the pre-construction phase, eliminating potential challenges associated with community displacement and the disruption of established settlements. As a result, the project can proceed with minimal interference with the natural land, allowing for a more efficient and environmentally conscious development process.

4.2 IMPACTS DURING CONSTRUCTION PHASE

4.2.1 Impact on Land Use

The mobilization of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labor camps for human resource to avoid environmental impact and public inconvenience. These locations shall comply with the local laws and regulations and need approval from authorities to utilize these facilities (access roads, telecommunication, and pipe borne water supply). The selection of temporary lands shall be made in such a way that it is at least 500 meters away from nearby populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats and residential areas.

The total land allocated for the Project is 20 acres. At the Project site, there has been an absence of the following since the existing site is in agricultural area.

- Any green field, wetland or protected area.
- There are no re-settlements issues and therefore, there is no threat to the existing land use or degradation, and there is no net impact on the land use.

Mitigation Measures

- Choose a site for construction equipment and material storage that is not only compliant with local regulations but also strategically located to minimize transportation distances and associated environmental impacts.
- Adhere to the requirement of being at least 500 meters away from populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats, and residential areas to reduce potential disturbances.
- Plan the layout of construction equipment storage, material yards, and labor camps efficiently to minimize the footprint and disturbance to the surrounding environment.
- Establish buffer zones between construction activities and sensitive areas to mitigate potential impacts. These buffer zones can act as protective barriers against environmental disturbances.
- Utilize construction equipment that meets modern environmental standards, reducing emissions and noise pollution. This includes the use of electric or hybrid vehicles, where feasible.

4.2.2 Impact on Soil Cover

As the construction activities for the main plant units of project would be confined in the land, the impact on soil will be minimal and confined. Only cutting and filling is required during construction. No adverse impact on soil in the surrounding area is anticipated as the area.

Mitigation Measures

- To prevent soil erosion during construction, it is important to use techniques such as silt fences, erosion control blankets, and vegetative cover. This helps retain the topsoil and reduces sedimentation in nearby water bodies.

- It's also crucial to follow best construction practices by minimizing soil disturbance through proper grading techniques, avoiding over-excavation, and using equipment with low ground pressure.
- Preserving existing vegetation where possible and replanting native vegetation after construction can stabilize the soil, prevent erosion, and contribute to restoring natural ecosystems.
- Prioritizing preservation and stockpiling of topsoil during construction process supports future vegetation growth when backfilling or grading.
- Implementing phased construction minimizes overall footprint of activities at any given time while allowing restoration of completed areas. Establish buffer zones around sensitive areas like water bodies to minimize potential soil disturbance for ecological habitat preservation.
- Soil stabilization techniques such as geotextiles or binders can be utilized in cut/fill areas to promote stability. Additionally installing sedimentation basins or traps helps capture suspended sediments before water discharge off-site thus preserving water quality.
- Regular monitoring should evaluate post-construction conditions early on whereas strict adherence ensures compliance with environmental regulations preventing negative impacts

4.2.3 Impact on Solid Waste

Solid waste during the construction phase consists primarily of scrapped building materials, excess concrete and cement, rejected components and materials, packing and shipping materials (pallets, crates, Styrofoam, plastics etc.) and human waste. During the construction there will be generation of garbage, for which designated practices of solid waste disposal shall be followed.

Solid waste disposal will be done as follows;

- A waste inventory of various waste generated will be prepared and periodically updated.
- The excavated material generated will be reused for site filling and leveling operation to the maximum extent possible.
- The scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers.

- Food waste and recyclables viz. paper, plastic, glass etc will be stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through waste handling agency.

The complete details of scrap metal will be given as; scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers as per to manage the solid waste handling team. A separate yard area will be allocated for storing the waste material as per the required industrial practice. Also approved contractor will be hired for the recycling of waste appropriately during construction phase. Waste handling agency will be hired at the start of project construction to manage the waste generating during the construction and operational phase of the plant and the practices used for handling the waste disposal to manage proper waste management through different mechanisms like, make a proper dumping site for the disposal of waste, handling of waste or discharge water through point sources. The wastes which are recyclable are sold to the external contractors and the non-hazardous waste will be dumped through municipal waste collection system and services. The solid waste will be dumped away from the project site and where nearby no settlements or any other affected environment is present. It may the proper dumping site that is used for local municipality.

There are some solid wastes in the project site, including the packing material for the equipment, like the wooden pallets and carton boxes. Solid waste management plan will be followed third party EPA certified contractor will be hired for disposal of solid waste (No Impact).

4.2.4 Air Quality Impacts

As the proposed project is already within an industrial area, the impact during construction is expected to be minimal. Particulate matter in the form of dust would be the predominant pollutant affecting the air quality during the construction phase. Dust will be generated mainly during excavation, back filling and hauling operations along with transportation activities. The main source of gaseous emission during the construction phase is movement of equipment and vehicles at site. Equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO_2, NO_X, and particulate matter. The impact is reversible, marginal and temporary in nature. Also, Ambient Air has also been monitored before the baseline studies. The reports of the analysis are attached in **Annexure III.**

Mitigation Measures

- A high boundary wall of green dust control cloth will prevent the dust generated due to construction activities going outside the project area.
- Ensuring that diesel generators are fitted with standard emissions controls as specified by the manufacturer and generators are serviced and maintained in accordance with manufacturers specifications.

4.2.5 Noise Impacts

The major noise generating sources during the construction phase are vehicular traffic, construction equipment like dozer, scrapers, concrete mixers, cranes, generators, pumps, compressors, rock drills, pneumatic tools, vibrators etc. The operation of this equipment will generate noise ranging between 75 - 90 dB (A).

Mitigation Measures

- To minimize the impact on nearby communities, construction schedules have been optimized and vehicular traffic will be routed away from the nearest settlement away from the boundary of power plant site.
- Also, the noise level is substantially lower near the plant boundary due to attenuation caused over the distance.

Overall, the impact of generated noise on the environment during construction period is insignificant, reversible and localized in nature.

4.2.6 Impact on Soil and Water Quality

During operation there is a risk of soil and water contamination due to spills or leaks of fuels and oils from the backup diesel generators and associated fuel handling and storage as well as from oil filled transformers and other electrical equipment.

Mitigation Measures

- Sealing and bunding of areas where spills and leaks could occur, including containing fuel and oil storage and handling areas, and equipment such as generators and fuel pumps; oil separation on drainage outlets and sumps and training of operators. Oil and fuel spill kits will be provided on site during construction and operation. Generators, transformers and fuel storage, handling and pumping area to have spill containment in the form of impervious base and bund walls and oil water separation on outlets.
- Where the backup diesel generators are to be on the same site as the existing

diesel power station ("brownfield site"), any existing contamination can be improved with the development of the project and the smaller quantities of fuel and the more up to date equipment.

- Where the backup diesel generators are to be on a new site separate from the existing power station ("greenfield site"), the former power station that will be left will generally have soil contamination and waste materials which will need to be managed or remediated to ensure no contaminants leave the site to protect public and environmental health.
- Water may be required on occasions for washing panels. This is expected to be a rare occurrence as the panels are installed with a tilt to allow self-cleaning during rainfall. Water runoff from panels during washing will infiltrate and evaporate and not generate wastewater.

4.2.7 Ecological Impact

The project site is barren land therefore no ecological impacts on project site. Thus, the site development works would not lead to any significant loss of important species or ecosystems.

4.2.8 Impacts on the Biological Environment

Construction/installation of the project will not require any cutting or land clearing and hence there will be no impacts on listed, rare, endangered, vulnerable or threatened species of flora or fauna or communities as there are none potentially affected by the project.

4.2.9 Impacts on the Socioeconomic Environment

Construction stage impacts on the socioeconomic environment include both positive (beneficial) and negative impacts.

Positive impacts include the employment, business and economic benefits arising from the purchase of goods and services. While most of the larger cost items will be imported, there will be national and local content in their transport and handling, and in local labour, contractors, equipment suppliers and local people and businesses providing support to workers such as accommodation, food and other services.

During construction there will be potential negative social impacts from the disruption and inconvenience from influx of outside workers, potential for disease transmission, public safety, construction noise, dust and air emissions and waste disposal. The numbers of outside workers involved in each project will be relatively small so the related impact will be manageable.

Mitigation Measures

- In relation to influx of outside workers include establishing a protocol for community relations, educating workers on this, the grievance redress mechanism and communicable disease prevention.
- Any temporary use of land or restriction of access required for the construction period will be agreed with the provincial / town administration and landowners and subject to consultation with affected people.
- Public information and signage, fencing of the site and access control, supervision of equipment movement outside the site, managing noise, air emissions and waste (refer Physical Environment section), prevent mosquito breeding on site by preventing water ponding, install and properly manage toilet and washing facilities for workers.
- Occupational Health and Safety mitigation measures will include requiring that Solomon Power's safety requirements are fully implemented and complied with. The contractor will be required to prepare a health and safety plan describing how safety will be managed for the project. Health and safety mitigation will include but necessarily be limited to training and induction of workers, ongoing identification, prevention and management of risks and hazards, safe working method statements, incident response, compliance, protective equipment and first aid and medical facilities.

4.3 IMPACTS DURING OPERATION PHASE

Various activities of operation and maintenance phase and their probable impacts on various sectors of environment are presented in table below.

Potential Impacts from Biomass Burning

Emissions from burning biomass, specifically wood in power generation processes, comprise of gases and particles. These include particulate matter and gases such as carbon monoxide, carbon dioxide, oxides of nitrogen, volatile organic compounds, sulphur oxides and a range of trace species including polyaromatic hydrocarbons. The low sulphur content of wood means that SO_x is not likely to be a concern from wood combustion. Particulate matter emissions are particularly concerning since the use of wood as a heating fuel may have led to a net negative impact on air quality in terms of PM. It has been suggested that 96% of the PM produced during wood combustion is in the PM_{10} size fraction and 93% in $PM_{2.5}$.

Mitigation Measures

- Utilize advanced combustion technologies such as fluidized bed combustion or gasification systems, which can enhance combustion efficiency and reduce emissions.
- Install effective emission control devices such as electrostatic precipitators or fabric filters to capture and remove particulate matter from flue gases.
- Operate biomass combustion systems under optimal conditions, including proper air-to-fuel ratios and temperature control, to minimize the formation of pollutants.
- Ensure the use of dry and well-seasoned wood as fuel, as moisture content significantly impacts combustion efficiency and emissions. Proper wood storage and handling practices are essential.
- Implement regular maintenance and cleaning of combustion systems to prevent the buildup of ash and other deposits, which can lead to increased emissions.
- For larger-scale biomass plants, consider implementing SCR or SNCR technologies to reduce nitrogen oxide (NOx) emissions by promoting chemical reactions that convert NOx into less harmful substances.
- Explore alternative and cleaner biomass feedstocks with lower emissions, or consider cofiring biomass with other fuels to reduce overall emissions.

4.3.1 Impacts on Air quality and Climate change

Biomass power plants play a role in both energy production and addressing climate change. Biomass is considered a renewable energy source because it comes from organic materials such as wood, crop residues, and organic waste. These materials can be replenished over time.

The combustion of biomass releases carbon dioxide (CO_2) into the atmosphere. However, since the plants that make up biomass absorb CO_2 during their growth, the process is considered carbon-neutral in theory. This means that the CO_2 released during combustion is roughly equal to the amount absorbed during the plant's growth, creating a closed carbon cycle.

Some biomass sources, such as agricultural residues and organic waste, can emit methane if left to decompose in landfills. Utilizing these materials in biomass power plants can reduce methane emissions.

Challenges and Considerations

- The large-scale cultivation of biomass crops can lead to deforestation and changes in land use, which can contribute to climate change.
- The efficiency of biomass power plants varies depending on technology and feedstock. Inefficient combustion processes can lead to higher emissions.
- The use of biomass for energy may compete with food production, especially if the same crops are used for both purposes.
- Combustion of biomass can release particulate matter and other pollutants that affect air quality.

Mitigation measure

- Sustainable practices and careful land management are crucial to minimizing these impacts.
- Advanced technologies such as gasification and co-firing with coal can improve efficiency and reduce emissions.
- Striking a balance between food and energy needs is crucial for sustainable biomass use.
- Proper emission control technologies must be in place to minimize these impacts.

4.3.2 Noise Impact

During plant operations, there would be no significant noise generated activity expected. There might be use of machinery during maintenance of plant, but the activity will be restricted to day time. The noise generated will not exceed 65 db(A) which is the permissible limit for residential areas as per PEQs for noise.

Mitigation measure

- Installation of noise barriers around the plant perimeter.
- Schedule noisy activities during daytime hours, taking into consideration local regulations.
- Maintain and lubricate equipment regularly to reduce noise.

4.3.3 Water Usage and Quality

Biomass facilities typically need water for various purposes such as cooling, steam generation, and emissions control. The amount of water required depends on the specific technology used in the plant. Growing biomass feedstocks like crops or forestry residues may also require water for irrigation, which could affect local water resources. Discharging effluents from the biomass facility containing pollutants can impact water quality if not properly managed. Additionally, heated water discharged back into rivers or other bodies of water for cooling purposes can alter local temperatures and affect aquatic ecosystems.

Installing a biomass plant might require changes in land use, impacting surface runoff and potentially leading to changes in water quality as runoff carries soil particles, nutrients, and contaminants. Construction activities associated with installing a biomass plant may contribute to soil erosion and sedimentation that affects nearby bodies of water.

Cultivating dedicated biomass crops using fertilizers and pesticides can lead to agricultural runoff that impacts the quality of nearby bodies of waters besides affecting natural ecosystems and drainage patterns.

In addition, combustion from biomasses release pollutants into the air which leads to acid rain; subsequently affecting acidity levels in bodies where it falls thereby potentially disrupting aquatic lifecycles.

Mitigation measure

- Implementing water recycling and reuse systems within the biomass plant can reduce overall water consumption.
- Employing effective treatment systems for effluents can minimize the impact on water quality.
- Adhering to best management practices during construction, operation, and biomass crop cultivation can help minimize negative impacts on water resources.

4.3.4 Land Use and Habitat Disruption

The installation of a biomass plant can significantly impact land use and habitat disruption. The conversion of natural habitats or agricultural land for biomass plant sites, coupled with the cultivation of dedicated biomass crops, can lead to habitat fragmentation, deforestation, and disruption of ecosystems. Construction activities and the associated infrastructure development can disturb soil, contribute to erosion, and displace wildlife, while the introduction of invasive species may alter local plant communities. The noise, pollution, and changes in land use can collectively pose threats to biodiversity and ecological balance, highlighting the importance of careful site selection, comprehensive environmental assessments, and the implementation of mitigation measures to minimize adverse effects on land and habitats.

Mitigation measure

- Careful site selection to minimize ecological impact prioritizing brownfield sites or areas with lower biodiversity value.
- Implementing buffer zones around sensitive habitats can help protect wildlife, and incorporating wildlife corridors can mitigate habitat fragmentation.
- Post-construction, effective restoration and reclamation plans should be employed to rehabilitate disturbed areas and restore habitats.
- Utilizing sustainable biomass feedstock sources, such as agricultural residues, and employing agroforestry practices can reduce the need for dedicated land conversion.
- Additionally, engaging in ongoing monitoring and adaptive management practices can help identify and address any unforeseen impacts on land use and habitats, ensuring a more sustainable integration of biomass energy solutions.

4.3.5 Transportation Impact

The installation of a biomass plant can have notable impacts on transportation, primarily related to the sourcing and transportation of biomass feedstocks to the facility. Increased traffic may be observed as biomass feedstocks are transported to the plant, potentially leading to changes in local traffic patterns and road infrastructure.

Mitigation measure

- Efficient logistics planning and the establishment of designated transportation routes can help minimize disruptions.
- Additionally, biomass plant locations should be strategically chosen to reduce transportation distances and associated carbon emissions.
- Engaging in sustainable sourcing practices, like sourcing feedstocks locally or promoting the use of existing transportation infrastructure, can contribute to mitigating the overall impact on transportation systems while supporting the plant's operational needs.

4.3.6 Community Health and Safety

The installation of a biomass plant can impact community health and safety through potential air and noise pollution. Emissions from biomass combustion may release particulate matter and pollutants, posing respiratory risks to nearby residents and compromising local air quality. The noise generated during plant operations, construction, and transportation activities can lead to disturbances, affecting the well-being of the surrounding community.

Mitigation measure

- Implementing effective emissions control technologies such as electrostatic precipitators or baghouses to minimize particulate matter and pollutant emissions.
- Regular monitoring of air quality both on-site and in surrounding areas can help ensure compliance with regulatory standards and identify any potential health risks early on.
- Additionally, noise abatement measures such as sound barriers or operational restrictions during sensitive hours can help mitigate the impact of plant-related noise on nearby residents.
- Comprehensive community engagement and transparent communication regarding plant operations, emissions data, and safety protocols are essential for building trust and addressing community concerns.
- Investing in community health programs and conducting regular health assessments can help monitor and address any potential health impacts over time, ensuring the well-being of the surrounding community.

4.3.7 Ash Disposal

The disposal of ash generated from biomass plant operations can have several impacts, including environmental and public health concerns. Ash contains residual minerals and elements that are concentrated during the combustion process, and improper disposal can lead to the following:

If ash is not properly managed, it can be disposed of in landfills or used inappropriately, leading to soil contamination. The accumulation of heavy metals and other pollutants in the soil can have long-term effects on plant growth and soil quality.

Improper disposal or storage of ash can result in leaching of contaminants into groundwater or nearby water bodies. This can compromise water quality, affecting aquatic ecosystems and potentially posing risks to human health if the contaminated water is used for drinking or irrigation.

During ash handling and disposal, the release of airborne particulate matter can occur, contributing to air pollution. Inhaling these particles may have respiratory health implications for nearby communities.

The direct application of ash to land, if not properly controlled, may alter the nutrient balance in ecosystems, affecting plant and microbial communities. This can lead to unintended ecological consequences.

Mitigation measure

- Mitigation measures for ash disposal from biomass plants involve adopting responsible practices to minimize environmental and public health impacts. These measures include:
- Explore opportunities for recycling ash by incorporating it into construction materials or using it as a soil amendment in a controlled and regulated manner. This can reduce the need for landfill disposal and provide potential benefits for agriculture or other applications.
- Implement advanced technologies in biomass combustion and ash handling processes to minimize the concentration of harmful elements in the ash. This can include technologies like electrostatic precipitators or scrubbers to capture pollutants before they are released.
- If landfill disposal is necessary, ensure that the landfill is designed and managed according to environmental regulations. Implement proper liner systems, leachate collection, and monitoring systems to prevent the leaching of contaminants into the soil and groundwater.
- Community Engagement: Engage with the local community to address concerns and provide transparent information about ash disposal practices. Building trust through open communication can help alleviate fears and ensure that the community is informed about the measures in place to protect their health and the environment.
- Invest in research and development efforts to find innovative and sustainable solutions for ash management. This may involve exploring new technologies, best practices, and alternative uses for ash that are environmentally friendly.

- Establish comprehensive monitoring programs to track the environmental impact of ash disposal. Regularly report findings to relevant authorities and the public, demonstrating a commitment to transparency and accountability.

SECTION - 5: ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM

5.1 Environmental management plan

This Section provides an overall approach for managing and monitoring the environmental issues and describes the institutional framework and reporting mechanism to implement the Environmental Management Plan (EMP) for the said project. The EMP has been prepared with the following objectives:

- Provide the details of the project impacts along with the proposed mitigation measures, and a corresponding implementation schedule.
- Define the roles and responsibilities of the project proponent, contractor, and supervisory consultants in order to effectively communicate environmental issues among them.
- Frame a monitoring mechanism, reporting frequency, auditing mechanism and identifying monitoring parameters to ensure that all the mitigation measures are completely and effectively implemented.
- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies.

5.2 EMP Reporting and review procedures

The EMP has been divided into the following sections:

- Review of regulatory requirements and applicable standards
- Mitigation Management Matrix (MMM)
- Institutional Arrangements for Implementing the EMP
- Environmental Monitoring Plan
- Training program

5.3 Mitigation management matrix (MMM)

This matrix identifies the environmental impacts of multipurpose project during the Pre-Construction/Design Phase, construction and operation stages and establishes the linkages between the environmental and social impacts, mitigation strategy and the agencies responsible for execution. The MMM presented in **Table** 5-1 identifies the following:

- The mitigation measures recommended in IEE.

- The person/organization directly responsible for adhering to or executing the required mitigation measures.
- The person/organization responsible for ensuring and monitoring adherence to the mitigation measures.
- The parameters which will be monitored to ensure compliance with the mitigation measures.
- The timing at which the mitigation or monitoring has to be carried out.

Table 5-1, Mitigation Management Matrix

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
Pre-Construction Phase					
01	• The location of the project site is adjacent to Ittehad Chemicals (whick is already an industrial area) and is already owned by the proponent. So, there is no need of any resettlement or rehabilitation.				
Construction Phase					
Physical Impacts					
02	**Land Use** *The mobilization of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labor camps for human resource to avoid environmental impact and public inconvenience. These locations shall comply with the local laws and regulations and need approval from*	• Choose a site for construction equipment and material storage that is not only compliant with local regulations but also strategically located to minimize transportation distances and associated environmental impacts. • Adhere to the requirement of being at least 500 meters away from populated areas, water bodies, natural flow paths, agricultural lands, important	CC	SC and ICLPPL	• Data acquisition • Pre-processing, • Analysis/classification, • Product generation and Documentation.

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	authorities to utilize these facilities (access roads, telecommunication, and pipe borne water supply). The selection of temporary lands shall be made in such a way that it is at least 500 meters away from nearby populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats and residential areas. *The total land allocated for the Project is 20 acres. At the Project site, there has been an absence of the following since the existing site is in agricultural area.* • *Any green field, wetland or protected area.* • *There are no re-settlements issues and therefore, there is no threat to the existing land use or*	ecological habitats, and residential areas to reduce potential disturbances. • Plan the layout of construction equipment storage, material yards, and labor camps efficiently to minimize the footprint and disturbance to the surrounding environment. • Establish buffer zones between construction activities and sensitive areas to mitigate potential impacts. These buffer zones can act as protective barriers against environmental disturbances. • Utilize construction equipment that meets modern environmental standards, reducing emissions and noise pollution. This includes the use of			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	degradation, and there is no net impact on the land use.	electric or hybrid vehicles, where feasible.			
03	**Soil Cover** *As the construction activities for the main plant units of project would be confined in the land, the impact on soil will be minimal and confined. Only cutting and filling is required during construction. No adverse impact on soil in the surrounding area is anticipated as the area.*	• To prevent soil erosion during construction, it is important to use techniques such as silt fences, erosion control blankets, and vegetative cover. This helps retain the topsoil and reduces sedimentation in nearby water bodies. • It's also crucial to follow best construction practices by minimizing soil disturbance through proper grading techniques, avoiding over-excavation, and using equipment with low ground pressure.	CC	SC and ICLPPL	• Equipment washing method and frequency to be regulated/controlled. • Vegetation to control erosion. • Placement of solid waste storage containers at camp sites. • Collection and disposal into LWMC containers.

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		• Preserving existing vegetation where possible and replanting native vegetation after construction can stabilize the soil, prevent erosion, and contribute to restoring natural ecosystems. • Prioritizing preservation and stockpiling of topsoil during construction process supports future vegetation growth when backfilling or grading. • Implementing phased construction minimizes overall footprint of activities at any given time while allowing restoration of completed areas. Establish buffer zones around sensitive areas like water bodies to minimize potential soil			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		disturbance for ecological habitat preservation. • Soil stabilization techniques such as geotextiles or binders can be utilized in cut/fill areas to promote stability. Additionally installing sedimentation basins or traps helps capture suspended sediments before water discharge off-site thus preserving water quality. • Regular monitoring should evaluate post-construction conditions early on whereas strict adherence ensures compliance with environmental regulations preventing negative impacts.			
04	**Solid Waste**	• A waste inventory of various waste generated will be prepared and periodically	CC	SC and ICLPPL	• Placement of solid waste storage containers at project site.

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	Solid waste during the construction phase consists primarily of scrapped building materials, excess concrete and cement, rejected components and materials, packing and shipping materials (pallets, crates, Styrofoam, plastics etc.) and human waste.	updated. • The excavated material generated will be reused for site filling and leveling operation to the maximum extent possible. • The scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers. • Food waste and recyclables viz. paper, plastic, glass etc will be stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through waste handling agency.			• Collection and disposal by Contractor.

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
05	**Air Quality Impacts** *Particulate matter in the form of dust would be the predominant pollutant affecting the air quality during the construction phase. Dust will be generated mainly during excavation, back filling and hauling operations along with transportation activities. The main source of gaseous emission during the construction phase is movement of equipment and vehicles at site. Equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO2, NOX, and particulate matter. The impact is reversible, marginal and temporary in nature. Also, Ambient Air has also been*	• A high boundary wall of green dust control cloth will prevent the dust generated due to construction activities going outside the project area. • Ensuring that diesel generators are fitted with standard emissions controls as specified by the manufacturer and generators are serviced and maintained in accordance with manufacturers specifications.	CC	SC and ICLPPL	• Maintenance of Vehicles • Water Sprinkling • Filled Vehicles covered with tarpaulin

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	monitored before the baseline studies.				
06	**Noise Impacts** *The major noise generating sources during the construction phase are vehicular traffic, construction equipment like dozer, scrapers, concrete mixers, cranes, generators, pumps, compressors, rock drills, pneumatic tools, vibrators etc. The operation of this equipment will generate noise ranging between 75 – 90 dB (A).*	• To minimize the impact on nearby communities, construction schedules have been optimized and vehicular traffic will be routed away from the nearest settlement away from the boundary of power plant site. • Also, the noise level is substantially lower near the plant boundary due to attenuation caused over the distance.	CC	SC and ICLPPL	• Timings of the construction vehicles
07	**Soil and Water Quality** *During operation there is a risk of soil and water contamination due to spills or leaks of fuels and oils from the backup diesel generators and*	• Sealing and bunding of areas where spills and leaks could occur, including containing fuel and oil storage and handling areas, and equipment such as generators and fuel pumps; oil	CC	SC and ICLPPL	• Environmental Monitoring of Soil and Water

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	associated fuel handling and storage as well as from oil filled transformers and other electrical equipment.	separation on drainage outlets and sumps and training of operators. Oil and fuel spill kits will be provided on site during construction and operation. Generators, transformers and fuel storage, handling and pumping area to have spill containment in the form of impervious base and bund walls and oil water separation on outlets. • Where the backup diesel generators are to be on the same site as the existing diesel power station ("brownfield site"), any existing contamination can be improved with the development of the project and the smaller quantities of			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		fuel and the more up to date equipment. • Where the backup diesel generators are to be on a new site separate from the existing power station ("greenfield site"), the former power station that will be left will generally have soil contamination and waste materials which will need to be managed or remediated to ensure no contaminants leave the site to protect public and environmental health.			
08	**Ecological Impact** *The project site is barren roof therefore no impact on project site. Thus, the site development works would not lead to any significant loss of important species or ecosystems*	-	CC	SC and ICLPPL	--

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	and hence no mitigation measures are required.				
09	**Biological Environment** *Construction/installation of the project will not require any cutting or land clearing and hence there will be no impacts on listed, rare, endangered, vulnerable or threatened species of flora or fauna or communities as there are none potentially affected by the project.*	-	CC	SC and ICLPPL	--
10	**Socioeconomic Environment** *Construction stage impacts on the socioeconomic environment include both positive (beneficial) and negative impacts.*	The measure for negative impacts includes: • In relation to influx of outside workers include establishing a protocol for community relations, educating workers on this, the grievance redress mechanism and	CC	SC and ICLPPL	• Employment records of contractors

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		communicable disease prevention. • Any temporary use of land or restriction of access required for the construction period will be agreed with the provincial / town administration and landowners and subject to consultation with affected people. • Public information and signage, fencing of the site and access control, supervision of equipment movement outside the site, managing noise, air emissions and waste (refer Physical Environment section), prevent mosquito breeding on site by preventing water ponding, install and properly			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		manage toilet and washing facilities for workers. • Occupational Health and Safety mitigation measures will include requiring that Solomon Power's safety requirements are fully implemented and complied with. The contractor will be required to prepare a health and safety plan describing how safety will be managed for the project. Health and safety mitigation will include but necessarily be limited to training and induction of workers, ongoing identification, prevention and management of risks and hazards, safe working method statements, incident response, compliance, protective			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		equipment and first aid and medical facilities.			
Operational phase					
11	***Potential Impacts from Biomass Burning*** *Emissions from burning biomass, specifically wood in power generation processes, comprise of gases and particles. These include particuiate matter and gases such as carbon monoxide, carbon dioxide, oxides of nitrogen, volatile organic compounds, sulphur oxides and a range of trace species including polyaromatic hydrocarbons. The low sulphur content of wood means that SOx is not likely to be a concern from wood combustion. Particulate matter emissions are particularly*	• Utilize advanced combustion technologies such as fluidized bed combustion or gasification systems, which can enhance combustion efficiency and reduce emissions. • Install effective emission control devices such as electrostatic precipitators or fabric filters to capture and remove particulate matter from flue gases. • Operate biomass combustion systems under optimal conditions, including proper air-to-fuel ratios and temperature	ICLPPL	Punjab-EPA	Regular Environmental Monitoring air quality

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	concerning since the use of wood as a heating fuel may have led to a net negative impact on air quality in terms of PM. It has been suggested that 96% of the PM produced during wood combustion is in the PM10 size fraction and 93% in PM2.5.	control, to minimize the formation of pollutants. • Ensure the use of dry and well-seasoned wood as fuel, as moisture content significantly impacts combustion efficiency and emissions. Proper wood storage and handling practices are essential. • Implement regular maintenance and cleaning of combustion systems to prevent the buildup of ash and other deposits, which can lead to increased emissions. • For larger-scale biomass plants, consider implementing SCR or SNCR technologies to reduce nitrogen oxide (NOx) emissions by promoting chemical			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		reactions that convert NOx into less harmful substances. • Explore alternative and cleaner biomass feedstocks with lower emissions, or consider cofiring biomass with other fuels to reduce overall emissions.			
12	***Impacts on Air quality and Climate change*** *The large-scale cultivation of biomass crops can lead to deforestation and changes in land use, which can contribute to climate change.* *The efficiency of biomass power plants varies depending on technology and feedstock. Inefficient combustion processes can lead to higher emissions.*	• Sustainable practices and careful land management are crucial to minimizing these impacts. • Advanced technologies such as gasification and co-firing with coal can improve efficiency and reduce emissions. • Striking a balance between food and energy needs is crucial for sustainable biomass use.	ICLPPL	Punjab-EPA	Regular Environmental Monitoring of air

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	The use of biomass for energy may compete with food production, especially if the same crops are used for both purposes. *Combustion of biomass can release particulate matter and other pollutants that affect air quality.*	• Proper emission control technologies must be in place to minimize these impacts.			
13	**Noise Impact** *During plant operations, there would be no significant noise generated activity expected. There might be use of machinery during maintenance of plant, but the activity will be restricted to day time. The noise generated will not exceed 65 db(A) which is the permissible limit for residential areas as per PEQs for noise.*	• Installation of noise barriers around the plant perimeter. • Schedule noisy activities during daytime hours, taking into consideration local regulations. • Maintain and lubricate equipment regularly to reduce noise.	ICLPPL	Punjab-EPA	Regular Environmental Monitoring of noise.
14	***Water Usage and Quality***	• Implementing water recycling and reuse systems within the	ICLPPL	Punjab-EPA	Regular Environmental Monitoring of water quality

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	Biomass facilities require water for cooling, steam generation, and emissions control. The specific technology used in the plant determines the amount of water needed. Growing biomass feedstocks may also need water for irrigation, potentially affecting local water resources. Discharging effluents from the facility containing pollutants can impact water quality if not managed properly. Heated water discharged into rivers or other bodies of water for cooling purposes can alter local temperatures and affect aquatic ecosystems. Installing a biomass plant could result in changes in land use that impact surface runoff and potentially lead to changes in water quality as runoff carries soil particles,	biomass plant can reduce overall water consumption. • Employing effective treatment systems for effluents can minimize the impact on water quality. • Adhering to best management practices during construction, operation, and biomass crop cultivation can help minimize negative impacts on water resources.			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	nutrients, and contaminants. Cultivating dedicated biomass crops using fertilizers and pesticides affects natural ecosystems and drainage patterns.				
15	**Land Use and Habitat Disruption** *The installation of a biomass plant can significantly impact land use and habitat disruption. The conversion of natural habitats or agricultural land for biomass plant sites, coupled with the cultivation of dedicated biomass crops, can lead to habitat fragmentation, deforestation, and disruption of ecosystems. Construction activities and the associated infrastructure development can disturb soil, contribute to erosion, and displace wildlife, while the introduction of*	• Careful site selection to minimize ecological impact prioritizing brownfield sites or areas with lower biodiversity value. • Implementing buffer zones around sensitive habitats can help protect wildlife, and incorporating wildlife corridors can mitigate habitat fragmentation. • Post-construction, effective restoration and reclamation plans should be employed to rehabilitate disturbed areas and restore habitats.	FES	--	Soil Analysis

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	invasive species may alter local plant communities. The noise, pollution, and changes in land use can collectively pose threats to biodiversity and ecological balance, highlighting the importance of careful site selection, comprehensive environmental assessments, and the implementation of mitigation measures to minimize adverse effects on land and habitats.	• Utilizing sustainable biomass feedstock sources, such as agricultural residues, and employing agroforestry practices can reduce the need for dedicated land conversion. • Additionally, engaging in ongoing monitoring and adaptive management practices can help identify and address any unforeseen impacts on land use and habitats, ensuring a more sustainable integration of biomass energy solutions.			
16	**Transportation Impact** *The installation of a biomass plant can have notable impacts on transportation, primarily related to*	• Efficient logistics planning and the establishment of designated transportation routes can help minimize disruptions.	ICLPPL	Punjab-EPA	Regular Environmental Monitoring of air

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	the sourcing and transportation of biomass feedstocks to the facility. Increased traffic may be observed as biomass feedstocks are transported to the plant, potentially leading to changes in local traffic patterns and road infrastructure.	• Additionally, biomass plant locations should be strategically chosen to reduce transportation distances and associated carbon emissions. • Engaging in sustainable sourcing practices, like sourcing feedstocks locally or promoting the use of existing transportation infrastructure, can contribute to mitigating the overall impact on transportation systems while supporting the plant's operational needs.			
17	**Community Health and Safety** *The installation of a biomass plant can impact community health and safety through potential air and noise pollution. Emissions from biomass combustion may release*	• Implementing effective emissions control technologies such as electrostatic precipitators or baghouses to minimize particulate matter and pollutant emissions.	ICLPPL	Punjab-EPA	• Occupational Health and Safety • Emergency Response Preparedness

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	particulate matter and pollutants, posing respiratory risks to nearby residents and compromising local air quality. The noise generated during plant operations, construction, and transportation activities can lead to disturbances, affecting the well-being of the surrounding community.	• Regular monitoring of air quality both on-site and in surrounding areas can help ensure compliance with regulatory standards and identify any potential health risks early on. • Additionally, noise abatement measures such as sound barriers or operational restrictions during sensitive hours can help mitigate the impact of plant-related noise on nearby residents. • Comprehensive community engagement and transparent communication regarding plant operations, emissions data, and safety protocols are essential for building trust and addressing community concerns.			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		• Investing in community health programs and conducting regular health assessments can help monitor and address any potential health impacts over time, ensuring the well-being of the surrounding community.			
18	**Ash Disposal** The disposal of ash generated from biomass plant operations can have several impacts, including environmental and public health concerns. Ash contains residual minerals and elements that are concentrated during the combustion process, and improper disposal can lead to the following: If ash is not properly managed, it can be disposed of in landfills or used inappropriately, leading to soil	• Mitigation measures for ash disposal from biomass plants involve adopting responsible practices to minimize environmental and public health impacts. These measures include: • Explore opportunities for recycling ash by incorporating it into construction materials or using it as a soil amendment in a controlled and regulated manner. This can reduce the need for landfill disposal and	ICLPPL	Punjab-EPA	Regular Environmental Monitoring of ash content

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	contamination. The accumulation of heavy metals and other pollutants in the soil can have long-term effects on plant growth and soil quality. Improper disposal or storage of ash can result in leaching of contaminants into groundwater or nearby water bodies. This can compromise water quality, affecting aquatic ecosystems and potentially posing risks to human health if the contaminated water is used for drinking or irrigation. During ash handling and disposal, the release of airborne particulate matter can occur, contributing to air pollution. Inhaling these particles may have respiratory health	provide potential benefits for agriculture or other applications. • Implement advanced technologies in biomass combustion and ash handling processes to minimize the concentration of harmful elements in the ash. This can include technologies like electrostatic precipitators or scrubbers to capture pollutants before they are released. • If landfill disposal is necessary, ensure that the landfill is designed and managed according to environmental regulations. Implement proper liner systems, leachate collection, and monitoring systems to prevent the leaching			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
	implications for nearby communities. The direct application of ash to land, if not properly controlled, may alter the nutrient balance in ecosystems, affecting plant and microbial communities. This can lead to unintended ecological consequences.	of contaminants into the soil and groundwater. • Community Engagement: Engage with the local community to address concerns and provide transparent information about ash disposal practices. Building trust through open communication can help alleviate fears and ensure that the community is informed about the measures in place to protect their health and the environment. • Invest in research and development efforts to find innovative and sustainable solutions for ash management. This may involve exploring new technologies, best practices,			

Sr. No.	Anticipated impacts	Mitigation measures	Responsibility		Actions/Monitoring parameters/Monitoring methods
			Execution	Monitoring	
		and alternative uses for ash that are environmentally friendly. • Establish comprehensive monitoring programs to track the environmental impact of ash disposal. Regularly report findings to relevant authorities and the public, demonstrating a commitment to transparency and accountability.			

CC *Construction Contractor*

SC *Supervision Contractor*

ICL PPL *ICL Power (Pvt) Ltd.*

5.4 Schedule for Implementation and Environmental Budget

Project Development Phase

- Conduct feasibility studies and site assessments.
- Engage with stakeholders, including local communities and regulatory bodies.
- Develop a preliminary design of the biomass plant.
- Secure necessary land and environmental permits.

Detailed Engineering and Design

- Detailed design.
- Finalize technology selection and process design.
- Develop detailed construction plans.
- Obtain detailed construction permits.

Equipment Procurement

- Issue requests for proposals (RFPs) to suppliers.
- Evaluate bids and select equipment suppliers.
- Finalize contracts with suppliers.
- Procure major equipment components.

Site Preparation and Infrastructure

- Clear the construction site.
- Develop necessary infrastructure (roads, utilities, etc.).
- Begin foundation work for the plant.

Construction

- Mobilize construction teams and equipment.
- Begin structural and mechanical construction.
- Install major equipment components.
- Complete civil and electrical works.
- Conduct quality assurance and control.

Commissioning

- Test individual components and systems.
- Conduct performance testing and optimization.

- Obtain necessary approvals from regulatory bodies.
- Develop operating and maintenance procedures.

Operational Readiness

- Train plant operators and maintenance staff.
- Implement safety procedures.
- Conduct final inspections and tests.
- Secure final regulatory approvals.

Commercial Operation

- Initiate commercial operations.
- Monitor and optimize plant performance.
- Address any initial operational issues.
- Establish ongoing maintenance and monitoring programs.

Institutional Arrangements for Implementation of EMP

The main institutions involved in the implementation and management of EMP will be as follows:

- ICL Power (Pvt.) Limited.
- Supervisory Consultants (SC)
- Construction Contractor (CC)
- Punjab Environmental Protection Agency (Punjab-EPA)

An estimated EMP cost would be 200'000/-.

5.5 Roles and responsibilities

The key organizations will have the following roles and responsibility during the construction and operation stages:

Construction stage

During the construction stage, Construction Contractor (CC) will be mainly responsible for the execution of the mitigation measures. Supervisory Consultants (SC) will be responsible for the monitoring of the compliance with top management as defined in mitigation management matrix.

Operation stage

During the operational stage of the project, role of CC and SC will gradually decrease. During this phase of the project, implementation of recommendations of EMP and its supervision will be the responsibility of project proponent. and Punjab-EPA as defined in mitigation management matrix.

5.6 Environmental Monitoring Plan

A monitoring report is to be submitted to the EPA after completion of construction, followed by annual monitoring reports during operation.

Objectives

The objectives of the environmental monitoring during the construction and operation stages are as follows:

- To check compliance with the requirements of the EMP by monitoring activities of the project contractors. This will be called Activity Monitoring.
- To monitor actual impacts of the project activities on physical, ecological and socioeconomic receptors of the Project Area so that any impacts not anticipated in the EMP or impacts which exceed the levels anticipated in the EMP can be identified and appropriate mitigation measures can be adopted in time. This objective will be achieved through effects monitoring.

To achieve these objectives, the following monitoring program will be implemented.

Table 5-2, Environmental Monitoring Protocol for Construction and Operational Phase

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Water Quality	• Near the project area (Seepage water underground)	Discrete grab sampling and laboratory testing of water samples.	• Sampling and laboratory testing should be done on Monthly basis during the construction and annually during the operational stage. • Metal analysis
Noise Levels	• Construction	Noise meter	• On fortnight basis

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
	site • Nearby area due to track movement		throughout the construction period. • Annually during the operational stage.
Ambient Air	• Construction site Ambient Air	Monitoring of ambient air quality in ppb.	• Monthly monitoring of air pollution parameters . including PM, NO_x, SO_x, CO, during the construction period, and annually during the operation stage only for ambient air.

5.7 Training Programs

Environmental training for construction period will form part of the environmental management system. The training will be directed towards all personnel for general environmental awareness.

Objectives

The key objective of the training program is to ensure that the requirements of the EMP are clearly understood and followed throughout the Project.

Roles and Responsibilities

Proponent will be responsible for conducting environmental training to all the Project personnel on potential environmental issues of the Project through Contractor, who will be responsible to arrange training and ensure the presence of targeted staff. Proponent will prepare a Project specific training manual for this purpose. Contractors on their part will be required to provide induction training/briefing to all their staff at the time of their recruitment and before the start of any activity in the Project Area. This will be followed by training arranged by the Proponent to all the targeted staff.

Training Log

A training log will be maintained by the SC. The training log will include;

- Topic
- Date, time and location
- Trainer
- Participants

SECTION - 6: PUBLIC AND STAKEHOLDER CONSULTATION

Public consultation is a systematic process, which provides an opportunity for planners, citizens, managers and selected representatives to share their experience, knowledge and concerns and perceptions about any proposed development.

The consultation process with various stakeholders of Asian Consulting Engineering Pvt. Ltd. has been carried out to involve community and other stakeholders at earlier stages. Information dissemination during public consultation is fundamental to successful conclusion of the project. This chapter describes the objectives and details of the consultative process adopted; its outcome and the conclusions drawn thereafter.

Public consultation has been done during the planning and design phases of the project with Government departments, line agencies, NGOs and affected persons of the project area; concerns and suggestions thereafter have been taken into account and included where appropriate. The consultative process to date has been effective in addressing the concerns over the project operational impacts.

6.1 Objectives of Consultation

Public consultation plays a vital role in studying the effects of any development project on stakeholders and in its successful implementation and execution. It affords an opportunity to exchange knowledge with those who as members of the society are concerned with the project, immediately or remotely. Referring particularly to a project related to environmental assessment, involvement of public is all the more essential, as it leads to better and more acceptable decision-making.

- The objectives of the stakeholder and public consultation conducted in project area were;
- To apprise the project community and stakeholders about project interventions and potential impacts;
- To record the community concerns and recommendations regarding the project;
- To address/incorporate those recommendations in the project design to the extent possible and;
- To share the mitigation measures with the local communities.

6.2 Proponent's Environment Management Team

Possible impacts and mitigation measures related to the subject project were discussed with the developer and his management team. They assured to take all suggested mitigation measures to control any discrepancy arose by the project and to make the project environmentally friendly.

6.3 Responsible Authority

The Environmental Protection agency shall be the responsible authority for the site inspection and provision of environmental approval for the project.

6.4 Environmental Practitioner and Expert

The Asian team have endeavoured to hold consultative sessions with a number of prominent stakeholders (Project Proponent, Government departments, line agencies, NGOs and affected persons of the Project Area) to evince their views on the project and their opinions, suggestions, understanding on various issues and concerns. The consultations aimed specifically at:

- Dissemination of Project information through discussions, education and liaison.
- Eliciting the comments and feedback on the project.
- Documentation of information narrated by the stakeholders.
- Documentation of mitigation measures proposed by the stakeholders.
- Incorporation of public concerns and their addresses in the IEE/ EMMP.

6.5 Identification of Main Stakeholders (Including other department and Agencies)

Among all stakeholders some major stakeholders were identified in the proposed Project Area. **Table** 6-1 contains the list of major stakeholders and their apprehensions.

Table 6-1, Major Stakeholders and their Apprehensions in the Project Area

Issues	Concerns raised by community	Remarks
Health Care Facilities	Healthcare centers particularly for women and children Schools	Basic health unit is available in the area with very little facilities, A dispensary may be provided.

Issues	Concerns raised by community	Remarks
Employment	Provision of semi-skilled and unskilled jobs for local labor in the project construction period.	Unskilled jobs will be given to local's people where possible. Training will be provided.
Safety of Community	Comply with the traffic management rules.	Proper traffic management will be resorted to during the construction period.
Drinking water	Community member rated Safe drinking water at highest priority during our survey.	As part of the social development program ICL Pvt. Ltd. shall provide the safe drinking water through RO filter plant to nearby communities
Educational Facility	Unavailability of Teachers, and School (Primary and Secondary) Vocational training	NGO working in social sector and proponent shall provide the required facilities for the local peoples.

6.6 Consultation Meetings and Formal & Informal Group Discussions (Including Affected and Wider Community)

Consultation meetings regarding project impacts, their magnitude and mitigation measures were held with the, local residents, shop owners, shop keepers(renters), customers, pedestrians, road users, students and general public to know their concerns regarding proposed project.

Scoping sessions were conducted with the local residents, shop keepers, customers, road users, students and pedestrians. These sessions were carried out at various location of the proposed project. Socio-economic survey is attached as **Annexure VII.**

Generally, it was found that people were already aware of the proposed project. After the meetings, majority of the respondents including local residents and other stakeholders were in favor of the project site. Although this project will be beneficial in terms of Biomass helps reduce the amount of GHG that give more impact to global warming and climate change, but some concerns/suggestions raised by stakeholders are given which are shown below:

Concerns/Suggestions of the Stakeholders

The most commonly raised concerns during the meetings are listed below:

- Installation of biomass plant should be completed in time without any delay as per project timeline.
- Exposure of noise and dust pollution will cause disturbance and health & safety issues to the local residents and other stakeholders throughout the construction stage due to the movement of construction machinery and transportation of construction materials. The effects of noise and dust pollution on the local residents should be minimized by making necessary arrangements. Dust pollution should be controlled by water sprinkling on regular basis.
- Impact on local ecosystems and concerns about biomass cultivation.
- Biomass Technology efficiency and Long-term maintenance requirements and operational reliability.
- Due to the movement of loaded trucks during the construction period of proposed project, congestion on the access road will increase. Proper diversion route rather than access road should be clearly defined to avoid traffic blockage during the entire construction period.
- During construction period local residents, road users and pedestrians will face difficulties while moving to places in the vicinity of proposed project Area. Appropriate diversion plan should be developed to avoid the disruption of all the people due to use of heavy machinery in day timings and should avoid disturbance for the local residents living in the project vicinity.
- Local residents should be given priority for jobs during the construction phase.
- Due to the construction of the proposed project, public utilities will be disturbed. Arrangements should be made to minimize the disruption of public utilities or they may be rehabilitated on priority basis to reduce the impacts.
- Increase in traffic and safety hazards will create problems to local population and surrounding communities. Accordingly, a detailed Health and Safety Plan (HSE Plan) must be developed to mitigate the construction and operation risks of the proposed project on the local residents and surrounding communities.
- Solid waste produced during construction should be disposed off timely and properly.
- Construction material and asphalt plant should be located outside the residential

area.

- The labor camps should be away from the populated area to avoid privacy issues.
- Local residents should be given priority for unskilled jobs during construction phase.
- The batching plant should be installed at distance from the residential area.
- Good quality construction machinery may be used to reduce noise and pollution issue.

Figure 6-1, Pictorial Evidences of Public Consultation

6.7 Mitigation Measures Proposed by IEE Consultants for Addressing the Stakeholder's Concerns

The contractors and design consultants may include the following environmental and safety provisions in the project design in order to protect the surrounding communities from the anticipated impacts of pre and post construction activities:

1. Significant efforts including change in design should be adopted to minimize the physical and economical displacement / disturbance of the local residents;
2. If physical displacement is unavoidable, occupants should be given

compensation as per law;

3. Local residents should be given priority while hiring during construction phase of the proposed project;
4. Construction machinery should be placed at adequate locations away from the sensitive areas to minimize the impacts related to the noise;
5. Project facilities should be located outside the existing residential areas.; In order to avoid restricting the daily movement of the local stakeholders, construction vehicles should remain confined within their designated areas of movement;
6. The utilities to be shifted due to the implementation of the proposed project should be rehabilitated on priority basis to minimize the impacts on the stakeholders;
7. Solid waste generated during construction at site should be disposed of safely at the waste disposal sites approved by the contractor; and
8. All necessary measures should be taken to ensure the safety of traffic during construction, including barricades (including signs boards, pavement markings, flags, and lights). All such barricades will be set up to facilitate the local traffic.

SECTION - 7: CONCLUSION

Prime benefit of the Project will be the replacement of conventional power generation with renewable energy. Biomass power plant will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

Impacts are manageable and can be managed cost effectively - Environmental impacts are less likely to result from the proposed Power project. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures have been specified for those minor impacts to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes.

The proposed project will have number of positive impacts and negligible negative impacts to the existing environment as follows:

- Significantly improvement in the economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.
- The Project Area does not fall under any sensitive, protected area.
- No threatened / Near-Threatened species of wildlife was recorded in the Project Area.
- There is no need of removal of trees for the project, which is the main positive impact to the proposed project area.
- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration are the short-term negative impacts due to proposed project with mitigations being properly taken care.
- The project will not entail physical or economic displacement and no Indigenous Peoples will be affected.

Based on the environmental and social assessment and surveys conducted for the Project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions are being made in the Project to cover the environmental mitigation and monitoring requirements, and their associated costs. Adequate provisions are being made Foundation Solar Energy (Pvt) Ltd. to cover the environmental mitigation and monitoring requirements, and their associated costs.

An environment and social analysis have been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. The impact analysis, found that due to careful consideration of environmental and social aspects during route and site selection by Foundation Solar Energy (Pvt) Ltd, no major adverse impacts are expected. There is no adverse impact on the migration of habitat, any natural existing land resources and effect in the regular life of people.

The environment and social impact associated with project is limited to the extent of construction phase and can be mitigated through a set of recommended measures and adequate provision for environment and social impacts which cover monitoring, measuring and mitigation.

EMP has been prepared. Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor was carefully selected after undergoing an options assessment. This enabled the right of way alignment to bypass nearby areas and important water supplies and resources.

From this perspective, the project is expected to have a small "environmental footprint". No endangered or protected species of flora or fauna are reported near project sites.

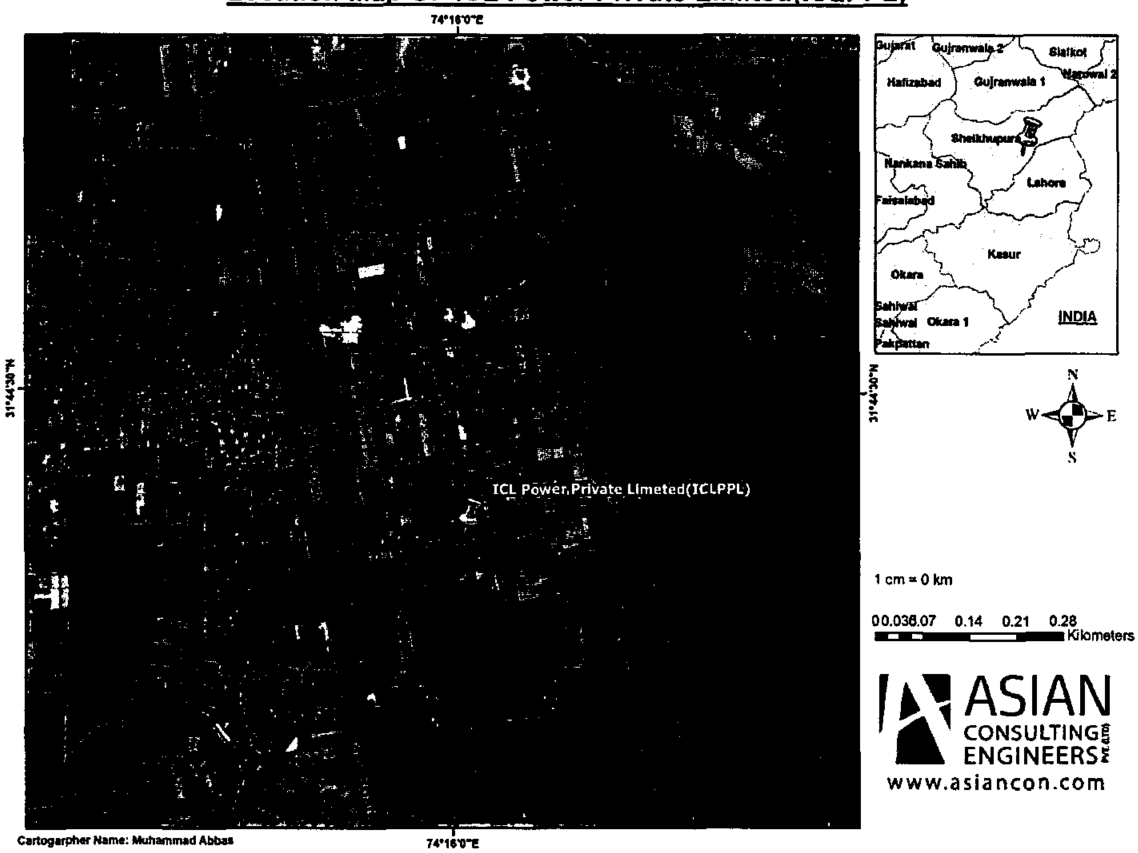
Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. The Project is not considered highly sensitive or complex. Mitigation measures related to construction, as specified in the ESMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed project has limited adverse environmental and social impact which can be mitigated following the ESMP & shall be pollution free Renewable source of Power.

ANNEXURES

ANNEXURE – I: COMPANY REGISTRATIO

ANNEXURE – II: MASTER LAYOUT PLAN GOOGLE MAP

Location Map OF ICL Power Private Limited(ICLPPL)



ANNEXURE – III: ENVIRONMENTAL MONITORING REPORTS

ASIAN ENVIRONMENTAL SERVICES

BASELINE ENVIRONMENTAL MONITORING & ANALYSIS REPORT

ICL POWER PVT. LTD (ICLPPL), KALA SHAH KAKU

- Ambient Air Monitoring
- Noise Level Monitoring
- Drinking Water Analysis

Reference No.: AES-ENV-IC-11/2024

Dated: 26 January, 2024

Asian Environmental Services Pvt. Ltd.
has prepared this report as per prerequisites of client
Any other individual using the content of this document shall do so at their own liability
The client is responsible for lawful usage of this reported data.

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ASIAN ENVIRONMENTAL SERVICES

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[illegible] Environmental Services

LAHORE

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ASIAN ENVIRONMENTAL SERVICES

Location for Ambient Air Monitoring-01
OUTER WALL WORKSHOP, ITTEHAD CHEMICALS
Kala Shah Kaku

ASIAN ENVIRONMENTAL SERVICES

Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-RC-11-2024-AA-01	**Monitoring Point**	Outer Wall workshop, Ittehad Chemicals, FSK
Date of Monitoring	19-01-2024 to 20-01-2024	**Monitoring Coordinates**	31°44'20" N 74°15'59" E
Validation Officer	Mr. Ameer Hamza (Research Officer Punjab EPA)		

Sr. No.	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1	12:00	2.14	20.20	15.43	35.77	35.23
2	13:00	1.79	19.74	[illegible]	37.42	35.52
3	14:00	1.39	22.40	17.86	42.2	[illegible]
4	15:00	3.17	23.55	19.97	47.92	29.84
5	16:00	2.29	[illegible]	[illegible]	41.26	32.42
6	17:00	2.01	20.39	22.36	42.80	32.89
7	18:00	[illegible]	25.30	24.44	44.80	35.54
8	19:00	[illegible]	[illegible]	[illegible]	[illegible]	28.50
9	20:00	[illegible]	14.74	[illegible]	46.37	29.79
10	21:00	[illegible]	18.44	[illegible]	43.74	[illegible]
11	22:00	[illegible]	[illegible]	[illegible]	54.49	44.79
12	23:00	[illegible]	[illegible]	[illegible]	[illegible]	42.39
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	2.14	[illegible]	[illegible]	[illegible]	[illegible]
23	10:00	[illegible]	25.44	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	21.35	[illegible]	[illegible]
Average Concentration		**1.22**	**17.83**	[illegible]	**34.31**	**31.61**

Monitored By

Reviewed By
(TM)

Approved By
(QM / Chief Chemist)

ASIAN ENVIRONMENTAL SERVICES

LAB ISO 17025

Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-IC-11-2024-AA-01	**Monitoring Point**	Outer Wall workshop, Ittehad Chemicals, CSK
Date of Monitoring	19-01-2024 to 20-01-2024	**Monitoring Coordinates**	31°44'20" N 74°15'39" E
Validation Officer	Mr. Ameer Hamza (Research Officer Punjab EPA)		

Parameters	Units	Monitoring Duration	LDL	Average Obtained Concentration	PEQS	Remarks
Nitrogen Dioxide (NO_2) *	µg/m³	24Hours	1.00	20.55	80.0	Optimal
Nitrogen Oxide (NO)*	µg/m³	24Hours	1.00	17.6[illegible]	40.0	Optimal
NO_x*	µg/m³	24Hours	1.00	38.31	120.0	Optimal
Sulphur Dioxide (SO_2) *	µg/m³	24Hours	1.00	31.6[illegible]	120.0	Optimal
Carbon Monoxide (CO)*	mg/m³	24Hours	0.01	1.22	05.0	Optimal
Particulate Matter (PM_{10}) *	µg/m³	24Hours	1.00	194	150.0	High
Particulate Matter ($PM_{2.5}$) *	µg/m³	24Hours	1.00	51	35.0	High
Total Particulate Matter (TSP)	µg/m³	24Hours	1.00	[illegible]	500.0	Optimal

*Parameters are approved from Punjab Environmental Protection Agency

Abbreviations

LDL= Lower Detection Limit; PEQS= Punjab Environmental Quality Standards; µg/m³ - [illegible]

Remarks

Optimal - [illegible] Range; Mitigated - [illegible]; High - [illegible]

Low = [illegible]

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Reviewed By
(TM)

Approved By
(QM/Chief Chemist)

Page 1 of 5

Document No. AES/AMR/[illegible]

ASIAN ENVIRONMENTAL SERVICES

Noise Monitoring Report

Monitoring Details

Reference Number	AES-ENV-IC-[illegible]-2024-AA-0[illegible]	**Monitoring Point**	Outer Wall workshop, [illegible] Chemicals KSK
Date of Monitoring	19-01-2024 to 20-01-2024	**Monitoring Coordinates**	31°[illegible] N [illegible] E
Validation Officer	[illegible] (Innovation Officer Punjab EPA)		

Sr. No.	Time	Noise dB(A)	PEQS	
1	12:00	60		
2	13:00	[illegible]		
3	14:00	[illegible]		
4	15:00	47		
5	16:00	[illegible]	Day Time	[illegible]
6	17:00	55		
7	18:00	[illegible]		
8	19:00	[illegible]		
9	20:00	[illegible]		
10	[illegible]	[illegible]		
11	22:00?	[illegible]		
12	23:00?	[illegible]		
13	00:00?	[illegible]		
14	01:00?	[illegible]		
15	02:00?	[illegible]	Night Time	45
16	03:00?	[illegible]		
17	04:00?	[illegible]		
18	05:00?	[illegible]		
19	06:00?	[illegible]		
20	[illegible]	[illegible]		
21	08:00?	[illegible]		
22	[illegible]	[illegible]	Day Time	[illegible]
23	[illegible]	[illegible]		
24	[illegible]	[illegible]		

Monitored By

Reviewed By (TM)

Approved By (Chemist)

ASIAN ENVIRONMENTAL SERVICES

GROUND WATER ANALYSIS REPORT

Sample Detail			
Reference No.	AES-ENV-ICL-11/2024-GW-02	Reporting Date	26-01-2024
Nature of Sample	Ground Water	Sampling Method Reference	AES/LMS/GSP-014
Grab/Composite	Grab	Sample Collected by	AES
Sampling Date	19-01-2024	Sample Receiving Date	22-01-2024
Analysis Completion Date	25-01-2024	Lab Temp & Humidity	24°C & 50%
Ambient Temperature & Humidity at the Time of Sampling			11°C & 72%
Sample ID	AES-ENV-GW-02/2024	Sampling Location	Pumping Station
Client Detail	ICL Power Pvt. Ltd (ICLPPL), Kala Shah Kaku	Validation Officer	Mr. Amaar Hamza (Research Officer Punjab EPA)

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Lab Analysis					
Color*	SMWW 2120 C	≤15 TCU	[illegible]	N.A.	[illegible]
Taste*	SMWW 2160 C	Non-objectionable	Non-objectionable	N.A.	Optimal
Odor*	SMWW 2150 B	Non-objectionable	Non-objectionable	N.A.	Optimal
[illegible]	SMWW 2130 B	<5 NTU	[illegible]	[illegible]	[illegible]
Total Hardness as CaCO3	SMWW 2340 C	<500 mg/l	[illegible]	± 5.42	Optimal
Total Dissolved Solids (TDS)	SMWW 2540 C	<1000	[illegible]	± 32%	[illegible]
pH	SMWW 4500 H+ B	6.5-8.5	[illegible]	0.04	[illegible]
[illegible]	SMWW 3111 B	≤0.2	[illegible]	[illegible]	[illegible]
Antimony (Sb)	SMWW 3114 B	≤0.005	[illegible]	[illegible]	[illegible]
Arsenic (As)	SMWW 3114 B	≤0.05	[illegible]	[illegible]	[illegible]
Barium (Ba)	SMWW 3111 B	[illegible]	[illegible]	[illegible]	[illegible]
Boron (B)	SMWW 3113 B	0.3	[illegible]	[illegible]	[illegible]
Cadmium (Cd)	SMWW 3113 B	0.01	[illegible]	[illegible]	[illegible]
Chloride (Cl)	SMWW 4500 Cl B	<250	[illegible]	± 1.73	[illegible]
Chromium (Cr)	SMWW 3113 B	≤0.05	[illegible]	[illegible]	[illegible]
Copper (Cu)	SMWW 3111 B	2.0	[illegible]	[illegible]	[illegible]
Cyanide (CN)	SMWW 4500 CN F	≤0.05	[illegible]	[illegible]	[illegible]
Fluoride (F)	SMWW 4500 F C	≤1.5	[illegible]	[illegible]	[illegible]
Lead (Pb)	SMWW 3114 B	≤0.05	[illegible]	[illegible]	[illegible]
[illegible]	SMWW 3113 B	≤0.5	<0.05	[illegible]	[illegible]
[illegible]	SMWW 3114 B	≤0.001	<0.0	[illegible]	Optimal
Nickel	SMWW 3113 B	≤0.02	<0.02	N.A.	Optimal
Nitrate	SMWW 4500 NO3 D	≤50	8.8	± 1.061	[illegible]
Nitrite (NO2)	SMWW 4500 NO2 B	≤3.0	[illegible]	N.A.	[illegible]
Selenium	SMWW 3114 B	0.01	<0.01	N.A.	[illegible]

26-01-2024

Document No: AES/LMS/FRM-115, Date of Issue 07 Jan, 2020, [illegible]

Page 1 of 2

ASIAN ENVIRONMENTAL SERVICES

GROUND WATER ANALYSIS REPORT

Sample Detail			
Reference No.	[illegible]	Reporting Date	[illegible]
Nature of Sample	[illegible]	Sampling Method Reference	[illegible]
Grab/Composite	[illegible]	Sample Collected by	[illegible]
Sampling Date	[illegible]	Sample Receiving Date	[illegible]
Analysis Completion Date	[illegible]	Lab Temp & Humidity	[illegible]
Ambient Temperature & Humidity at the Time of Sampling			[illegible]
Sample ID	[illegible]	Sampling Location	[illegible]
Client Detail	[illegible]	Validation Officer	[illegible]

Ground Water Analysis Results					
Parameter	Analysis Method	PEQS	Result	[illegible]	Remarks
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Microbiological Analysis					
[illegible]				[illegible]	[illegible]
[illegible]				[illegible]	[illegible]

[illegible]

Abbreviations

[illegible]

Remarks

[illegible]

Report Disclaimer

- [illegible]
- [illegible]

Analyzed By 26/6/24

Reviewed By (TM) 26-6-2024

Approved By (QM ...)

------------End of Report------------

[illegible]

[illegible]

ANNEXURE – IV: PROJECT IMPACT MATRIX

Project Impact Matrix

Environmental Component ↓ Project Component	Land Acquisition	Downstream Water Users	Air Quality	Noise	Soil Contamination	Aesthetic	Liquid and Solid Waste	Material Quarries and Borrow Pits	Surface Water	Irrigation Water	Wastewater	Soil	Flora	Fauna	Livestock Grazing	Fishery	Mobility of Locals	Cultural Issues	Water Ponds	Gender Issues	Health & Safety of Workers	Archeological/Historical and Religious Sites	Security Situation	Human Health	Ground Water	Agriculture	Drinking Water	Livelihood	Employment Opportunities	Economic Uplift
A. Pre-Construction	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Project Location	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B. Construction Phase	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Land Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soil Cover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Quality Impacts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Noise Impacts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soil and Water Quality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ecological Impact	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biological Environment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Socioeconomic Environment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Operational Phase	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Air Quality Impacts (Climate change)	0	0	[redacted]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Noise Impact	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water quality and Cleaning	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0

Ecology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Visual Impact	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transmission Lines during Operation Phase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biological Environment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Socio-economic impacts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Beneficial	Impact Significance	Adverse
	Low	-1
	Medium	
	High	

0	Insignificant or no impact

ANNEXURE –V: CHECKLIST

SCREENING CHECKLIST

Adverse Impact -, Significant Adverse --, Beneficial Impact +, Highly Beneficial ++, No Impact 0

Sr. No.	Main Environmental Parameters	Baseline Conditions	With Project			
			During Construction without Mitigation	During Operation without Mitigation	During Construction with Mitigation	During Operation with Mitigation
1	**Atmosphere**					
a	Ambient Air	0	--	--	-	-
b	Primary Pollutants	0	--	--	-	-
c	Secondary Pollutants	0	-	--	0	-
d	Noise	0	--	--	-	-
e	Vibration	0	-	0	-	0
2	**Climate**					
a	Temperature	0	0	-	0	-
b	Precipitation	0	0	0	0	0
c	Relative Humidity	0	0	0	0	0
e	Evaporation	0	0	0	0	0
3	**Water Resources**					
a	Surface Water	0	-	--	0	-
	Rivers	0	-	--	0	-
	Streams	0	-	--	0	-
	Springs	0	0	0	0	0
	Wetland	0	0	0	0	0
	Flow	0	-	-	-	-
	Quality	0	--	-	0	0
	Usage	0	-	-	0	0
	Sediments	0	0	0	0	0
	Chemicals	0	-	0	0	0
	Pollution	0	-	0	0	0
	Erosion	0	-	0	0	0

Sr. No.	Main Environmental Parameters	Baseline Conditions	With Project			
			During Construction without Mitigation	During Operation without Mitigation	During Construction with Mitigation	During Operation with Mitigation
b	Ground Water					
	Sources	0	-	-	0	-
	Depth	0	-	-	-	-
	Quantity	0	-	-	-	-
	Potential Extraction	0	-	-	-	-
	Usage	0	-	-	-	-
	Domestic Supply	0	0	0	0	0
	Industrial Water Supply	0	0	--	0	-
	Irrigation	0	0	0	0	0
	Hydropower Generation	0	0	0	0	0
	Quality	0	-	-	0	-
4	**Land Resources**					
a	Topography	0	-	0	0	0
b	Soil	0	-	0	0	0
c	MajorLand use	0	0	0	0	0
5	**Ecological Environment**					
a	Terrestrial Ecology					
	Flora	0	--	0	-	+
	Fauna	0	--	0	-	+
b	Aquatic Ecology					
	Aquatic Flora	0	--	0	-	0
	Aquatic Fauna	0	--	0	-	0
	Fisheries	0	-	0	0	0
c	Wildlife	0	-	0	0	+
d	Forestry	0	0	0	0	0
e	Beneficial Plants and Animals	0	0	0	0	+
f	Endangered Species	0	0	0	0	0
6	**Socio-economic**					

Sr. No.	Main Environmental Parameters	Baseline Conditions	With Project During Construction without Mitigation	During Operation without Mitigation	During Construction with Mitigation	During Operation with Mitigation
	Environment					
a	Institutional and Administrative Setup	0	0	0	0	+
b	Demography	0	0	0	0	0
c	Gender issues	0	-	-	0	0
d	Social Equity	0	0	0	0	0
e	Settlement Patterns	0	-	0	0	0
f	Land Holdings & Titling	0	-	0	0	++
g	Common Resource Rights	0	0	0	0	0
h	Fish	0	0	0	0	0
i	Wood	0	0	0	0	0
j	Grazing	0	0	0	0	0
k	Fodder	0	-	0	-	0
l	Domestic Energy and Fuel	0	0	0	0	0
m	Domestic Water Supply	0	0	0	0	0
n	Sanitation	0	-	0	0	0
o	Health	0	-	--	0	-
p	Waterborne Disease	0	-	-	0	+
q	Common Diseases	0	0	0	0	0
r	Mental Health	0	0	0	0	++
s	Human Nutrition	0	0	0	0	0
t	Education & Literacy	0	0	0	0	+
u	Cultural & Historical Sites	0	0	0	0	0
v	Religious Sites	0	0	0	0	0
w	Aesthetics	0	-	-	0	+
x	Landscape	0	-	-	0	++
y	Livelihood	0	--	0	0	++
z	Agriculture	0	-	0	-	0
	Livestock	0	0	0	0	0

Sr. No.	Main Environmental Parameters	Baseline Conditions	With Project			
			During Construction without Mitigation	During Operation without Mitigation	During Construction with Mitigation	During Operation with Mitigation
	Forestry	0	0	0	0	0
	Fisheries	0	0	0	0	0
	Industry	0	0	0	++	++
	Other Cash Income	0	+	+	+	++
7	**Transport, Infrastructure & Communication**					
a	Roads	0	-	+	0	++
b	Tracks	0	-	+	0	++
c	Bridges	0	0	0	0	++
d	Pedestrian Tracks	0	-	+	0	++
e	Navigation	0	0	0	0	0
f	Energy and Power	0	-	0	0	++
g	Telecommunication	0	0	0	0	++
8	**Natural Risks and Hazards**					
a	Earthquake	0	0	0	0	0
b	Landslides	0	0	0	0	0
c	Storms	0	0	0	0	0
d	Floods	0	0	0	0	0
e	Erosion	0	0	0	0	0
f	Drought	0	0	0	0	0
g	Human Disease	0	0	0	0	0
h	Pollution	0	--	0	-	--
i	Social Instability	0	0	0	0	+
j	Economic Instability	0	+	+	0	++
k	Political Instability	0	0	0	0	0
9	**External Constraints**					
a	Upstream Constraints	0	0	0	0	0
b	Upstream Impacts	0	0	0	0	0
c	Downstream Constraints	0	0	-	0	0

Sr. No.	Main Environmental Parameters	Baseline Conditions	With Project: During Construction without Mitigation	With Project: During Operation without Mitigation	With Project: During Construction with Mitigation	With Project: During Operation with Mitigation
d	Downstream Impacts	0	0	-	0	0

ANNEXURE – VI: SOCIO-ECONOMIC PERFORMA

SOCIO-ECONOMIC BASE LINE SURVEY

1. Name of Interviewer:____________________ 2. Date: __________

3. Village Name: ______________________________

DEMOGRAPHIC PROFILE

4. Union Council/Tehsil: ______________________________

5. Name of Respondent: ______________________________

6. Respondent's Father Name: ______________________________

7. Gender of Respondent:_______a. Male_____b. Female 8. Age of Respondent: a. 15-25 b. 26-35 c. 36-45 d. 46 & Above

9. What is your Education Level? a. Illiterate b. Primary c. Middle d. Matric e. Intermediate f. Bachelors g. Above Bachelors

10. What is your Occupation?

a. Business b. Government job c. Private job d. Farmer e. Unemployed

11. What is your Marital Status? a. Married b. Unmarried

12. What is your primary Language (i.e., the one you speak most of the time)?

____

13. What is your Caste? ______________

14. What is your Religion? ______________

15. What type of your family system?________a. Joint_______b. Nuclear ______

16. Total number of Family Members (Adult) living with you?

____

a. Male __________

b. Female __________

c. Total __________

17. How many Children's you have (upto 10 years)?

____

a. Male __________

ECONOMIC PROFILE

b. Female ____________

c. Total ______________

18. What are the major sources of your household income?

a. Service

____

b. Agriculture

____

c. Business

____

d. Labor

____

e. Livestock f. Any other

____

19. What is distance of your office/work place from your house?

____

a. 1-10 Km ______ b. 11-20 Km _____ c. 21-30 Km _____ d.30 Km& Above ______

20. Approximately what is your Family Monthly Income?

____

a. Less than Rs. 20,000 b. Rs. 21,000-40,000 c. Rs. 41,000-60,000 d. Rs. 61,000-80,000 e. More than Rs. 80,000

21. Approximately how much is your Family Monthly Expenditure?

a. Less than Rs. 20,000 b. Rs. 21,000-40,000 c. Rs. 41,000-60,000 d. Rs. 61,000-80,000 e. More than Rs. 80,000

22. How many of your family members are in age (16-65)?

____

23. How many of your family members in age (16-65) are employed?

24. Status of ownership (In case of shop keeper/business owner)?

a. Owner b. Renter

25. Respondent per day income

26. What are your normal working hours?

HOUSING PROFILE

27. Status of Ownership: a. Resident Owner b. Resident Tenant

28. Total Area of the House: a. Kanal ________

29. Total Living Rooms (No.): ________________

b. Marla ______________________________________

30. Type of Construction: a. Katcha b. Semi Pacca c. Pacca

31. Present Value Rs. ______________________________

32. SOCIAL AMENITIES PRESENT IN HOUSE (Tick)

Social Amenities	Available	Satisfactory	Non-Satisfactory	No Access
Electricity	☐	☐	☐	☐
Sui Gas	☐	☐	☐	☐
Water Supply	☐	☐	☐	☐
Telephone	☐	☐	☐	☐
Sewerage/Drainage	☐	☐	☐	☐

33. What are the sources of water for your domestic use?

a. Public Water Supply/Tube-well b. Hand Pumps / Electric Motor ________________

c. Bore Hole d. Any other ________________

34. What is your land holding in acres?

35. What is the source of water used for irrigation purpose?

a. Tube well ____________

b. Canal ____________

c. Any Other ____________

36. Are you satisfied with the water quality and quantity? a. Yes b. No

37. What are the major crops in this area?

____

a. ____

b. ____

c. ____

d. ____

38. What are the major common diseases in the area?

a. ____

b. ____

c. ____

d. ____

39. Facilities in or nearby the proposed project area

Facilities	Yes	No	No. of Institutions	Name	Distance from Proposed Project
Education Institutions					
Health Institutions					
Religious Place (Mosque / Shrine / Graveyard)					

Recreational Place					
Historical /Archeological Monument					

40. Is there any protected site in this area? a. Yes b. No

If yes, then Name________________________________

Place ________________________________

Significance ________________________________

41. Specify the existing Non -Government Organizations (NGOs) in your area and state of their area of work? Name of Organization____________Area of interest ______________ ______________

42. WOMEN PARTICIPATION AND DECISION MAKING IN DIFFERENT ACTIVITIES (Tick)

Activities	Participation	Decision Making
Household activities		
Child caring		
Farm/crop/Livestock rearing		
Working woman		
Sale & Purchase of properties		
Social obligations (marriage, birthday & other functions)		
Local representation (council political gathering		

RESPONDENT'S VIEWS ABOUT PROJECT

43. PERCEPTIONS OF RESPONDENTS FOR ACTION ASSOCIATED WITH THE PROJECT

Possible impacts/effects of the Project (Tick)

	Increase	Decrease
Employment opportunities		
Recreational facilities		
Living standard		
Income generating activities		
Other specify		

44. Do you know about the proposed project? a. Yes b. No

45. Is your land or any asset being acquired due to the implementation of this proposed project?

a. Yes b. No If yes, please give details ____________________

46. In your opinion, should this Project be implemented here? a. Yes b. No

47. In your opinion, how will you be affected by construction of this project?

____

48. In your opinion, how will you be affected by operation of this project?

49. Would you like to be associated with the project as a worker?

a. Yes b. No

50. What protective measures do you suggest to safeguard your interests?

Protective Measures	Response
Project should complete well in time	
If any private land is acquired then proper compensation should bepaid	
Harmful effects on workers during construction should be minimize	
Implementation of HSE plan for a safe working environment	
Local residents should be given priority of jobs	

Provision of basic facilities in project area (please specify)	
Any Other (Please Specify)	
No Response	

51. Contact #

Interviewer Views:

Name & Signature of Interviewer:

ANNEXURE – VII: REFERENCES

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- Schedule I of Punjab Environmental Protection Act 1997 (Amended 2012)
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- Guideline for the Environmental Assessment
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- National Resettlement Policy and Ordinance
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- National Environmental Quality Standards (Self-monitoring and reporting by the industry)
- Labor laws
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- The Land Acquisition act, 1894
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- Bhutyal, Ruchika & Langer, Seema. (2015). CURRENT STATUS OF FISH FAUNA OF RIVER CHENAB, IN KISHTWAR DISTRICT, J&K. Asian Academic Research Journal of Multidisciplinary.
- Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag). ISBN 978-3-906484-57-0

ANNEXURE – VIII: GLOSSARY

Agency	A business or organization providing a particular service on behalf ofanother business, person, or group.
Compliance	Acting according to certain accepted standards
Conservation	Official supervision of rivers, forests, and other natural resources in
Construction Waste	Waste generated from the buildings and construction industry and
Consultant	A person who provides professional advice or services to companies for fee.
Cultural Heritage	Valued objects and qualities such as historic buildings and cultural
Demographic	A single vital or social statistic of a human population, as the number
Drainage	Natural or artificial removal of surface and sub-surface water from anarea.
Endangered species	A species of animal or plant that is seriously at risk of extinction.
Environment	Relationship of natural world (human beings, animals and plants) with physical surroundings (air, land, water).
Fauna	All the animal life in a particular region or period
Flora	All the plant life in a particular region or period
Impact	The action of one object coming forcibly into contact with another.
Proponent	A person who advocates a theory, proposal, or course of action.
Regulations	An authoritative rule
Rehabilitation	To restore to a condition of good health, ability to work, or the like.
Resettlement	The settlement of people in a different place.
Screening	The display of a motion picture
Seismic Hazards	A seismic hazard is the probability that an earthquake will occur in a given geographic area, within a given window of time, and with ground motion intensity exceeding a given threshold.
Stakeholder	A stakeholder is a party that has an interest in a company, and can either affect or be affected by the business. The primary stakeholders in a typical corporation are its investors, employees and customers.
Stakeholders	A person or organization with an interest or concern in something

ANNEXURE – IX: LIST OF EIA TEAM

Sr. No.	Team Member	Position Held	Qualifications
1	Aleem Butt	Chief Environmentalist Team Leader- EIA	M.Phil. Environmental Sciences, Government College University (GCU), Lahore M.Sc. Environmental Sciences, Punjab University (PU), Lahore NEBOSH, Lead Auditor
2	Noman Ashraf	Environmental Specialist	M.Phil. Environmental Sciences, Government College University (GCU), Lahore PGD, Environmental Law University of the Punjab, Lahore
3	Nimra Nawaz	Environmental Specialist	M.Phil. Environmental Sciences, University of Engineering and Technology (UET) Lahore
4	Ayesha Rasheed	Environmentalist	M.Phil Environmental Sciences, Government College University (GCU), Lahore
5	Sajjad Hussain	Chief Chemist	M.Phil. Chemistry Government College University (GCU), Lahore
6	Hafsa Mehmood	Environmentalist	BS Hons Environmental Sciences, Government College University (GCU), Lahore PGD, Environmental Law University of the Punjab, Lahore
7	Sadia Serwer	Environmentalist	BS Hons Environmental Sciences, Government College University (GCU), Lahore
8	Engr. Umair Tallat	Deputy Manager Field Operations	M.S. Environmental Engineering, NUST, Islamabad
9	Asma Butt	Sociologist	M.Sc. Sociology, University of the Punjab, Lahore
10	Muhammad Abbas	Monitoring Officer	M.S. Environmental Sciences, Punjab University (PU), Lahore

ICL POWER (PVT.) LIMITED

ICL power (Pvt) LTd. Is registered in SECP dated second day of January 2024 under the Companies Act, 2017 (XIX of 2017) with Corporate Unique Identification No. 0248153.
It is newly establishment and has not completed time period of one year from its day of registration. Annual report is not avialbel and will be printed, published and made aviable after one year of registration and establishment.

NEPRA Letter - point # 3(4)©(iii)

ITTEHAD POWER (PVT.) LIMITED

Authorized Capital	Rs. 10,000,000
Paid up Capital	Rs. 1,000,000

NEPRA Letter - point # Point 3(4)©(iv)

ICL POWER (PVT.) LIMITED

Sr. No.	Name	Shareholding	%age
1	Ittehad Chemicals Limited (Holding Company)	99,998	100.00
2	Mr. Waqas Siddiq Khatri (Nominee Director)	1	0.00
3	Mr. Ahmed Mustafa (Nominee Director)	1	0.00
	Grand Total	**100,000**	**100.00**

26 LONG TERM FINANCING

Secured:			
Banking Companies			
Samba Bank Limited-TERF	26.1	282,637	378,148
The Bank of Punjab	26.2	173,016	224,734
Allied Bank Limited - LTF	26.3	129,000	100,000
		584,653	702,882
Other Financial Institutions			
Pak Libya Holding Company (Private) Limited	26.4	119,322	173,572
Pak Brunei Investment Company Limited	26.5	66,667	133,333
Pak Brunei Investment Company Limited	26.6	68,750	96,250
Pak Libya Holding Company (Private) Limited	26.7	175,000	200,000
		429,739	603,155
		1,014,392	1,306,037
Less: Current portion shown under current liabilities	34	(431,977)	(367,552)
		582,415	938,485

26.1 The Company has obtained this loan under the scheme of Temporary Economic Refinance Facility (TERF) to the extent of Rs. 495 million. This finance is secured against 667 million ranking charge over fixed assets of the Company inclusive of 25% margin. This carries mark up at SBP TERF rate plus 3% per annum. The loan is repayable in sixteen (16) equal quarterly installments starting from 1 year (grace period) after initial draw down.

26.2 The Company has obtained this loan to the extent of Rs. 313.717 million. The SBP has approved Rs. 246.144 million under Temporary Economic Refinance Facility (TERF). So, the remaining amount of Rs.67.573 million is treated as demand finance. This finance is secured against the specific charge of Rs. 440 million. These carry mark up at SBP rate 4% plus 1% spread of Bank per annum under TERF and for the remaining amount carry 6 month KIBOR plus 1.5% per annum.The loan is repayable in Ten (10) equal semi- annual installments having grace period of six months after the disbursement date.

26.3 The Company has obtained this loan to the extent of Rs. 200 million. This finance is secured against specific charge over present and future fixed assets (Land, Building and Machinery) with 25% risk margin. This carries mark up at the rate of six months KIBOR plus 1% per annum payable on semi -annual basis from the date of disbursement. The loan is repayable in eight (8) equal semi-annual installments having a grace period of one year after the date of disbursement.

26.4 The Company has obtained this loan under long term finance facility to the extent of Rs. 217 million. This finance is secured against ranking charge convertible / upgraded to first pari passu charge inclusive of 25% margin on all present and future fixed assets of the Company and carries mark up at 3 months KIBOR plus 1.5% per annum. The loan is repayable in sixteen (16) equal quarterly installments starting from 15th month from the first drawdown.

26.5 The Company has obtained this loan under long term finance facility to the extent of Rs. 300 million. This finance is secured against hypothecation / mortgage charge over all present and future fixed assets of the Company with 25% margin and carries mark up at three months average KIBOR plus 1.40%. The loan was disbursed in January, 2019 and is repayable in nine equal semi-annual installments commencing from February, 2020.

26.6 The Company has obtained this loan under long term finance facility to the extent of Rs. 110 million. This finance is secured against first pari passu hypothecation and mortgage charge on all moveable and immovable fixed assets of the Company. This carries mark up at 3 months KIBOR plus 1.40% per annum. The loan is repayable in sixteen (16) equal quarterly instalments with 1st installment falling due at the end of 15th month from the disbursement date.

26.7 The Company has obtained this loan under long term finance facility to the extent of Rs. 200 million. This finance is secured against ranking charge of Rs. 267 million, inclusive of 25% margin on all fixed assets of the Company, convertible to 1st Pari Passu charge. This carries mark up at the rate of 3 months KIBOR plus 1.50% per annum payable on quarterly basis. The loan is repayable in sixteen (16) equal quarterly installments on quarterly basis. First installment will fall due at the end of 12th month from the date of first draw down.

	Note	2024	2023
		(Rupees in thousand)	
27 LONG TERM DIMINISHING MUSHARAKA			
Secured;			
Banking Companies			
The Bank of Punjab - TAQWA	27.1	87,500	262,500
The Bank of Punjab - TAQWA	27.2	103,061	208,191
Al-Baraka Bank (Pakistan) Limited	27.3	-	106,875
		190,561	577,566
Less: Current portion shown under current liabilities	34	(190,561)	(387,005)
		-	190,561

27.1 This finance has been obtained from an Islamic Financial Institution and is secured against first exclusive charge over imported plant and machinery and carries mark up at six months average KIBOR plus 1.25%. This finance was disbursed during the prior year in various tranches and are repayable in eight semi annual equal instalments with the one year grace period commencing from February, 2020.

27.2 This finance has been obtained under the Islamic mode of financing and secured against exclusive charge over imported plant and machinery and carries mark up at six months average KIBOR plus 1.25%. This finance was disbursed from May, 2018 to January, 2019 in different tranches and are repayable in eight semi annual equal instalments commencing from December,

27.3 This finance has been obtained under the Islamic mode of financing and secured against specific exclusive charge over imported plant and machinery and carries mark up at six months average KIBOR plus 1.40%. This finance is disbursed during the previous year in various tranches with a grace period of six months.

	Note	2024	2023
		(Rupees in thousand)	
33 SHORT TERM BORROWINGS			
Secured			
Banking companies			
Running finances - Conventional			
MCB Bank Limited	33.1	359,922	205,396
Askari Bank Limited	33.1	30,823	120,035
The Bank of Punjab	33.1	197,166	193,928
Samba Bank Limited	33.1	344,567	213,432
Habib Metro Bank Limited	33.1	-	47,437
Soneri Bank Limited	33.1	-	-
Allied Bank Limited	33.1	-	45,823
		932,478	826,051
Term finance			
Conventinal			
Askari Bank Limited	33.2	150,000	-
Pak Brunei Investment Company Limited	33.2	200,000	200,000
		350,000	200,000
Shariah			
Bank Al-Falah Limited	33.2	266,000	-
Faysal Bank Limited (Istisna)	33.2	150,000	288,000
Al-Baraka Bank (Pakistan) Limited	33.2	246,000	-
MCB Islamic Bank Ltd (Istisna)	33.2	249,970	-
		911,970	288,000
Un-secured			
Related Party			
Ittehad Developers	33.3	100,000	-
		2,294,448	1,314,051

33.1 Short term running finance facilities have been obtained from various banks aggregated to Rs. 1,220 million (2023: Rs. 1,520 million) and carry mark-up ranging from one month KIBOR plus 0.75% to three months KIBOR plus 1.25% per annum (2023: one month KIBOR plus 1% to three months KIBOR plus 1.25% per annum) on utilized limits. These facilities are secured against first pari passu charge over present and future current assets of the Company and hypothecation charge over stores, spares and stocks of chemicals.

33.2 Term finance facilities have been obtained from various banks aggregated to Rs. 1,700 million (2023: Rs. 1,125 million) and carry mark-up ranging from matching KIBOR plus 0.65% to 1.00% per annum (2023: matching KIBOR plus 0.70% to 1.00% per annum) on utilized limits. These facilities are secured against ranking and first pari passu charge over present and future current assets of the Company.

33.3 The interest free loan has been obtained from related party aggregated to Rs. 100 million (2023: Nil) to meet the working capital of the Company.

33.4 The maximum amount due from Ittehad Developers at the end of any month during the year was Rs. 100 million (2023: Nil).

33.5 Financing/credit facilities available

At the reporting date, the following financing facilities had been negotiated and were available.

Aggregate facilities for opening of letters of credit and short term loan amounting to Rs. 5,695 million (2023: Rs. 5,885 million) are available to the Company.

ICL POWER (PRIVATE) LIMITED
STATEMENT OF FINANCIAL POSITION
AS AT JUNE 30, 2024

	Notes	June 30 2024 (Rupees)
ASSETS		
NON CURRENT ASSETS		
Capital work in progress	6	9,660,424
CURRENT ASSETS		
Bank balances in current account		99,606
TOTAL ASSETS		9,760,030
EQUITY AND LIABILITIES		
SHARE CAPITAL AND RESERVES		
Authorized share capital (1,000,000 Ordinary shares of Rs. 10/- each)		10,000,000
Issued, subscribed and paid-up share capital (100,000 Ordinary shares of Rs. 10/- each fully paid in cash)		1,000,000
Accumulated loss		(221,545)
		778,455
NON CURRENT LIABILITIES		-
CURRENT LIABILITIES		
Payable to related parties	7	8,881,575
Audit fee payable		100,000
		8,981,575
TOTAL EQUITY AND LIABILITIES		9,760,030
CONTINGENCIES AND COMMITMENTS	8	

The annexed notes from 1 to 17 form an integral part of these financial statements.

BDO

CHIEF EXECUTIVE **DIRECTOR**

ICL POWER (PRIVATE) LIMITED
STATEMENT OF PROFIT OR LOSS
FOR THE PERIOD FROM JANUARY 02, 2024 TO JUNE 30, 2024

	Notes	For the period from January 02, 2024 to June 30, 2024 (Rupees)
Sales		-
Cost of sales		-
Gross profit		-
Administrative expense	9	(220,675)
Financial charges		(870)
		(221,545)
Loss before taxation		(221,545)
Taxation		-
Loss after taxation		(221,545)

The annexed notes from 1 to 17 form an integral part of these financial statements.

BDO

CHIEF EXECUTIVE **DIRECTOR**

ICL POWER (PRIVATE) LIMITED
STATEMENT OF COMPREHENSIVE INCOME
FOR THE PERIOD FROM JANUARY 02, 2024 TO JUNE 30, 2024

	For the period from January 02, 2024 to June 30, 2024 (Rupees)
Loss after taxation for the period	(221,545)
Other comprehensive income	-
Total comprehensive loss for the period	(221,545)

The annexed notes from 1 to 17 form an integral part of these financial statements.

BDO

CHIEF EXECUTIVE **DIRECTOR**

ICL POWER (PRIVATE) LIMITED
STATEMENT OF CASHFLOWS
FOR THE PERIOD FROM JANUARY 02, 2024 TO JUNE 30, 2024

	For the period from January 02, 2024 to June 30, 2024 (Rupees)
CASH FLOWS FROM OPERATING ACTIVITIES	
Loss before tax	(221,545)
Net cash flow before working capital changes	(221,545)
Increase in current liabilities	8,981,575
Net cash generated from operating activities	8,760,030
CASH FLOWS FROM INVESTING ACTIVITIES	
Additions in capital work in progress	(9,660,424)
Net cash used in investing activities	(9,660,424)
CASH FLOWS FROM FINANCING ACTIVITIES	
Proceeds from issuance of ordinary shares	1,000,000
Net cash generated from financing activities	1,000,000
Net increase in cash and cash equivalents	99,606
Cash and cash equivalents at the beginning of the period	-
Cash and cash equivalents at end of the period	99,606

The annexed notes from 1 to 17 form an integral part of these financial statements.

BDO

CHIEF EXECUTIVE **DIRECTOR**

ICL POWER (PRIVATE) LIMITED
STATEMENT OF CHANGES IN EQUITY
FOR THE PERIOD FROM JANUARY 02, 2024 TO JUNE 30, 2024

	Issued, subscribed and paid-up share capital	Accumulated loss	Total
	---------- Rupees ----------		
Balance as at January 02, 2024.	-	-	-
Issuance of ordinary shares	1,000,000	-	1,000,000
Loss for the period	-	(221,545)	(221,545)
Other comprehensive income for the period	-	-	-
Total comprehensive loss for the period	-	(221,545)	(221,545)
Balance as at June 30, 2024.	1,000,000	(221,545)	778,455

The annexed notes from 1 to 17 form an integral part of these financial statements.

BDO

CHIEF EXECUTIVE **DIRECTOR**

ICL POWER (PRIVATE) LIMITED
NOTES TO THE FINANCIAL STATEMENTS
FOR THE PERIOD FROM JANUARY 02, 2024 TO JUNE 30, 2024

1 LEGAL STATUS AND NATURE OF BUSINESS

ICL Power (Private) Limited, is a Private Limited Company incorporated in Pakistan under the Companies Act, 2017 on January 2, 2024, as company limited by shares. The Company is engaged in the business of generating and providing of electricity. The Company is a wholly owned subsidiary of Ittehad Chemicals Limited (A company listed on Pakistan Stock Exchange).

2 GEOGRAPHICAL LOCATION AND ADDRESSES OF BUSINESS UNITS

The registered office of the Company is situated at 39, Empress Road, Lahore.

3 BASIS OF PREPARATION

3.1 Statement of compliance

These financial statements have been prepared in accordance with the accounting and reporting standards as applicable in Pakistan. The accounting and reporting standards applicable in Pakistan comprise of :

- International Financial Reporting Standards (IFRS) issued by the International Accounting Standards Board (IASB) as notified under the Companies Act , 2017; and

- Provisions of and directives issued under the Companies Act, 2017.

Where provisions of and directives issued under the Companies Act, 2017 differ from the IFRS Standards, the provisions of and directives issued under the Companies Act, 2017 have been followed.

3.2 Accounting convention

These financial statements have been prepared under the historical cost convention except as otherwise stated in respective accounting policies.

Critical accounting estimates and judgements

The preparation of financial statements in conformity with the approved accounting standards requires the use of certain critical accounting estimates. It also requires the management to exercise its judgment in the process of applying the Company's accounting policies. Estimates and judgments are continually evaluated and are based on historical experience and other factors, including expectations of future events that are believed to be reasonable under the circumstances. Currently there is no area, where any assumption and estimate significant to the Company's financial statements is required.

3.3 Functional and presentation currency

These financial statements are presented in Pak Rupees, which is the Company's functional and presentation currency.

4 APPLICATION OF NEW STANDARDS, AMENDSMENTS AND INTERPRETATIONS TO PUBLISHED APPROVED ACCOUNTING AND REPORTING STANDARDS

4.1 New accounting standards, amendments and IFRS interpretations that are effective for the year ended June 30, 2024

The following stantdards, amendments and interpretations are effective for the year ended June 30, 2024. These standards, amendments and interpretations are either not relevant to the Company's operations or did not have significant impact on the financial statements other than certain additional disclosures.

	Effective date (annual periods beginning on or after)
Amendmends to IAS 1 'Presentation of Financial Statements' and IFRS Practice	January 01, 2023
Amendments to IAS 8 'Accounting Policies, Changes in Accounting Estimates and Errors' - Definition of Accounting Estimates	January 01, 2023
Amendments to IAS 12 'Income Taxes' - Deferred Tax related to Assets and Liabilities arising from a single transaction	January 01, 2023
Amendments to IAS 12 'Income Taxes' - Temporary exception to the requirements regarding deferred tax assets and liabilities related to pillar two income taxes	January 01, 2023

The Company adopted the narrow-scope amendments to the International Accounting Standard (IAS) 1, Presentation of Financial Statements which have been effective for annual reporting periods beginning on or after 1 January 2023. Although the amendments did not result in any changes to accounting policy themselves, they impacted the accounting policy information disclosed in the financial statements.

The amendments require the disclosure of 'material' rather than 'significant' accounting policies. The amendments also provide guidance on the application of materiality to disclosure of accounting policies, assisting the Company to provide useful entity-specific accounting policy information that users need to understand other information in the financial statements.

4.2 New accounting standards, amendments and interpretations that are not yet effective

The following standards, amendments and interpretations are only effective for accounting periods, beginning on or after the date mentioned against each of them. These standards, amendments and interpretations are either not relevant to the Company's operations or are not expected to have significant impact on the Company's financial statements other than certain additional disclosures.

Amendments to IFRS 7 'Financial Instruments: Disclosures' - Supplier finance arrangements	January 01, 2024
Amendments to IFRS 7 'Financial Instruments: Disclosures' - Amendments regarding the classification and measurement of financial instruments	January 01, 2026
Amendments to IFRS 9 'Financial Instruments' - Amendments regarding the classification and measurement of financial instruments	January 01, 2026
Amendments to IFRS 16 'Leases' - Amendments to clarify how a seller-lessee subsequently measures sale and leaseback transactions	January 01, 2024
Amendmends to IAS 1 'Presentation of Financial Statements' - Classification of liabilities as current or non-current	January 01, 2024
Amendmends to IAS 1 'Presentation of Financial Statements' - Non-current liabilities with covenants	January 01, 2024
Amendments to IAS 7 'Statement of Cash Flows' - Supplier finance arrangements	January 01, 2024
Amendmends to IAS 21 'The Effects of Changes in Foreign Exchange Rates' - Lack of Exchangeability	January 01, 2025
IFRS 17 Insurance Contracts	January 01, 2026

IFRS 1 'First-time Adoption of International Financial Reporting Standards' has been issued by IASB effective from July 01, 2009. However, it has not been adopted yet locally by Securities and Exchange Commission of Pakistan (SECP).

IFRS 18 'Presentation and Disclosures in Financial Statements' has been issued by IASB effective from January 01, 2027. However, it has not been adopted yet locally by SECP.

IFRS 19 'Subsidiaries without Public Accountability: Disclosures' has been issued by IASB effective from January 01, 2027. However, it has not been adopted yet locally by SECP.

IFRS 17 - 'Insurance contracts' has been notified by the IASB to be effective for annual periods beginning on or after January 1, 2023. However SECP has notified the timeframe for the adoption of IFRS - 17 which will be adopted by January 01, 2026.

5 MATERIAL ACCOUNTING POLICIES

The principal accounting policies applied in the presentation of these financial statements are set out below:

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5.1 Capital work in progress

Capital work-in-progress are stated at cost less impairment losses, if any, and consists of expenditure incurred, advances made and other costs directly attributable to operating fixed assets in the course of their construction and installation. Cost also includes applicable borrowing costs. Transfers are made to relevant operating fixed assets category as and when assets are available for use intended by the management.

5.2 Taxation

Income tax expense comprises current and deferred tax. Income tax expense is recognized in the statement of profit and loss except to the extent that it relates to items recognized directly in equity, in which case it is recognized in equity.

a) Current

The charge for current taxation is based on taxable income at the current rate of taxation after taking into account applicable tax credits, rebates and exemptions available, if any or minimum tax, which ever is higher. Tax calculation is made in accordance with the relevant provisions of Income Tax Ordinance 2001.

b) Deferred

Deferred tax is accounted for using the balance sheet liability method on all temporary differences between the carrying amounts of assets and liabilities for financial reporting purposes and the amounts used for taxation purposes.

Deferred tax liabilities are generally recognized for all taxable temporary differences and deferred tax assets are recognized to the extent that it is probable that taxable profit will be available in future years against which the deductible temporary differences, unused tax losses and tax credits can be utilized.

Deferred tax is calculated based on tax rates that have been enacted or substantively enacted upto the reporting date and are expected to apply to the periods when the differences reverse. Deferred tax for the year is charged or credited to the statement of profit and loss account.

5.3 Levy

The amount calculated on taxable income using the notified tax rate is recognized as current income tax expense for the year in statement of profit or loss. Any excess of expected income tax paid or payable for the year under the Ordinance over the amount designated as current income tax for the year, is then recognized as a levy.

5.4 Trade and other payables

Trade and other payables are obligations to pay for goods and services that have been acquired in the ordinary course of business from suppliers. Accounts payable are classified as current liabilities if payment is due within one year. If not, they are presented as non-current liabilities.

Liabilities for trade and other amounts payable are carried at cost which is the fair value of the consideration to be paid in the future for goods and services received, whether or not billed to the Company and subsequently measured at amortised cost. Exchange gains and losses arising on transaction in respect of liabilities in foreign currency are added to the carrying amount of the respective liabilities.

5.5 Cash and cash equivalents

For the purposes of cash flow statement, cash and cash equivalents consist of balances with bank.

5.6 Financial instruments

5.6.1 Financial assets

The Company classifies its financial assets in the following categories: at fair value through profit or loss, fair value through other comprehensive income and amortized cost. The classification depends on the purpose for which the financial assets were acquired. Management determines the classification of its financial assets at initial recognition. All the financial assets of the Company as at statement of financial position date are carried at amortized cost.

Amortized cost

A financial asset is measured at amortized cost if it meets both the following conditions and is not designated as at fair value through profit or loss:

(i) it is held with in a business model whose objective is to hold assets to collect contractual cash flows; and
(ii) its contractual terms give rise on specified dates to cash flows that are solely payments of principal and interest on the principal amount outstanding.

Debt Instrument - FVOCI

A debt investment is measured at FVOCI if it meets both of the following conditions and is not designated as at FVTPL:

- it is held within a business model whose objective is achieved by both collecting contractual cash flows and selling financial assets;
- its contractual terms give rise on specified dates to cash flows that are solely payments of principal and interest on the principal amount outstanding.

These assets are subsequently measured at fair value. Interest income calculated using the effective interest method, foreign exchange gains and losses and impairment are recognized in profit or loss. Other net gains and losses are recognized in OCI. On derecognition, gains and losses accumulated in OCI are reclassified to profit or loss.

Equity Instrument - FVOCI

On initial recognition of an equity investment that is not held for trading, the Company may irrevocably elect to present subsequent changes in the investment's fair value in OCI. This election is made on an investment-by-investment basis.

These assets are subsequently measured at fair value. Dividends are recognized as income in profit or loss unless the dividend clearly represents a recovery of part of the cost of the investment. Other net gains and losses are recognized in OCI and are never reclassified to profit or loss.

Fair value through profit or loss (FVTPL)

All financial assets not classified as measured at amortized cost or FVOCI as described above are measured at FVTPL.

On initial recognition, the Company may irrevocably designate a financial asset that otherwise meets the requirements to be measured at amortized cost or at FVOCI as at FVTPL if doing so eliminates or significantly reduces an accounting mismatch that would otherwise arise.

These assets are subsequently measured at fair value. Net gains and losses, including any interest or dividend income, are recognized in profit or loss.

Impairment

The Company recognizes loss allowances for ECLs on:

- financial assets measured at amortized cost;
- debt investments measured at FVOCI; and
- contract assets.

The Company recognizes loss allowance for Expected Credit Losses (ECLs), except for the following, which are measured at 12-month ECLs, on financial assets measured at amortized cost and contract assets. The Company measures loss allowance at an amount equal to lifetime ECLs.

- debt securities that are determined to have low credit risk at the reporting date; and
- other debt securities and bank balances for which credit risk (i.e. the risk of default occurring over the expected life of the financial instrument) has not increased significantly since initial recognition.

12-month ECLs are the portion of ECLs that result from default events that are possible within the 12 months after the reporting date (or a shorter period if the expected life of the instrument is less than 12 months).

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Lifetime ECLs are those that result from all possible default events over the expected life of a financial instrument. The maximum period considered when estimating ECLs is the maximum contractual period over which the Company is exposed to credit risk.

At each reporting date, the Company assesses whether the financial assets carried at amortized cost are credit-impaired. A financial asset is credit-impaired when one or more events that have detrimental impact on the estimated future cash flows of the financial assets have occurred.

Loss allowances for financial assets measured at amortized cost are deducted from the gross carrying amount of the assets. The gross carrying amount of a financial asset is written off when the Company has no reasonable expectations of recovering a financial asset in its entirety or a portion thereof.

When determining whether the credit risk of a financial asset has increased significantly since initial recognition and when estimating ECLs, the Company considers reasonable and supportable information that is relevant and available without undue cost or effort. This includes both quantitative and qualitative information and analysis, based on the Company's historical experience and informed credit assessment and including forward-looking information.

The Company applies the IFRS 9 simplified approach to measure the expected credit losses which uses a lifetime expected loss allowance. Loss allowances for trade receivables and contract assets are always measured at an amount equal to lifetime ECLs. Lifetime ECLs are the ECLs that result from all possible default events over the expected life of a financial instrument. Management uses actual credit loss experience over a past years to base the calculation of ECL.

At each reporting date, the Company assesses whether financial assets carried at amortized cost and debt securities at FVOCI are credit impaired. A financial asset is 'credit-impaired' when one or more events that have a detrimental impact on the estimated future cash flows of the financial asset have occurred.

5.6.2 Financial liabilities

All financial liabilities are recognized at the time when the Company becomes a party to the contractual provisions of the instrument.

5.6.3 Recognition and measurement

All financial assets and liabilities are initially measured at cost, which is the fair value of the consideration given and received respectively. These financial assets and liabilities are subsequently measured at fair value, amortized cost or cost, as the case may be. The particular measurement methods adopted are disclosed in the individual policy statements associated with each item.

5.6.4 Derecognition

The financial assets are de-recognized when the Company loses control of the contractual rights that comprise the financial assets. The financial liabilities are de-recognized when they are extinguished i.e. when the obligation specified in the contract is discharged, cancelled or expired.

5.7 Offsetting of financial assets and financial liabilities

A financial asset and a financial liability is offset and the net amount is reported in the balance sheet if the Company has a legally enforceable right to set-off the recognized amounts and intends either to settle on a net basis or to realize the asset and settle the liability simultaneously.

5.8 Related party transactions

Transactions and contracts with the related parties are based on the policy approved by the Board. These prices are determined in accordance with the methods prescribed in the Companies Act, 2017.

5.9 Contingencies

A contingent liability is disclosed when the Company has a possible obligation as a result of past events, existence of which will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of the Company; or the Company has a present legal or constructive obligation that arises from past events, but it is not probable that an outflow of resources embodying economic benefits will be required to settle the obligation, or the amount of the obligation cannot be measured with sufficient reliability.

5.10 Share capital

Share capital is classified as equity and recognized at the face value. Incremental costs, net of tax, directly attributable to the issue of new shares are shown as a deduction in equity.

		Note	June 2024 Rupees
6	**CAPITAL WORK IN PROGRESS**		
	Advances	6.1	9,660,424

6.1 This includes mobilizaton advance to Fabcon Design and Engineering (Private) Limited.

7	**PAYABLE TO RELATED PARTIES**		
	Ittehad Chemicals Limited	7.1	8,881,575

7.1 This amount includes Rs. 8.00 million for mobilizaton advance to Fabcon Design and Engineering (Private) Limited and other expneses paid by the Holding Company (Ittehad Chemicals Limited) on behalf of the Company.

7.2 The maximum amount due to Ittehad Chemicals Limited at the end of any month during the period was Rs. 8.88 million (2023: Nil).

8 CONTINGENCIES AND COMMITMENTS

8.1 Contingencies

There were no contingencies at the reporting date.

8.2 Commitments

There were no commitments at the reporting date.

		For the period from January 02, 2024 to June 30, 2024 Rupees
9	**ADMINISTRATIVE EXPENSE**	
	Fee and Subscription	95,675
	Other Expenses	25,000
	Auditors' remuneration	100,000
	BDO	220,675

10 RELATED PARTY TRANSACTIONS

10.1 Related parties with whom company had transactions

The related parties comprise of related group companies, local associated companies and directors.

Party name	**Relations**	**Basis of relation**
Ittehad Chemicals Limtied	Holding Company	Holding Company

10.2 Transactions with related parties

Party name	**Nature of transaction**	**For the period from January 02, 2024 to June 30, 2024 (Rupees)**
Ittehad Chemicals Limtied	Advance obtained	8,881,575

10.3 Disclosure of balances between the Company and related parties

	As at June 30, 2024
Ittehad Chemicals Limited	8,881,575

11 REMUNERATION OF CHIEF EXECUTIVE AND DIRECTORS

The aggregate amount charged in the financial statements for the period as remuneration to chief executive and directors is Rupees Nil.

12 NUMBER OF EMPLOYEES

The total number of employees and average number of employees as a June 30, 2024 is Nil.

13 FINANCIAL INSTRUMENTS

13.1 Financial risk management

The Company has exposures to the following risks from its use of financial instruments:

- Credit risk
- Liquidity risk
- Market risk

BDO

The Company's risk management policies are established to identify and analyse the risks faced by the Company, to set appropriate risk limits and controls, and to monitor risks and adherence to limits. Risk management policies and systems are reviewed regularly.

13.1.1 Credit risk

Credit risk represents the accounting loss that would be recognized at the reporting date if the counter party fail completely to perform as contracted and arise principally from bank balance. The carrying amount of financial assets represents the maximum credit exposure before any credit enhancements. The maximum exposure to credit risk at the reporting date is as follows:

	June 2024 Rupees
Bank balance	99,606

13.1.2 Liquidity risk

Liquidity risk is the risk that the Company will not be able to meet its financial obligations as they fall due. The Company's approach to managing liquidity is to ensure as far as possible to always have sufficient liquidity to meet its liabilities when due, under both normal and stressed conditions, without incurring unacceptable losses or risking damage to the Company's reputation.

Payable to related parties	8,881,575
Audit fee payable	100,000
	8,981,575

13.1.3 Market risk

Market risk is the risk that the value of the financial instrument may fluctuate as a result of changes in market interest rates or the market price due to a change in credit rating of the issuer or the instrument, change in market sentiments, speculative activities, supply and demand of securities, and liquidity in the market. The company is not exposed to any currency or interest risk.

13.2 Amortized cost

Financial assets	
Cash and bank balances	99,606
Financial liabilities	
Payable to related parties	8,881,575
Audit fee payable	100,000
	8,981,575

13.3 There are no financial instruments and non-financial assets held by the Company which are measured at fair value as of June 30, 2024.

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14 CAPITAL MANAGEMENT

The Board's policy is to maintain a strong capital base so as to maintain investor, creditor and market confidence and to sustain future development of the business. The Board of Directors monitor the return on capital, which the Company defines as net profit after taxation divided by total shareholders' equity. The Board of Directors also monitor the level of dividend to ordinary shareholders. There were no changes to the Company's approach to capital management during the period and the Company is not subject to externally imposed capital requirements.

15 CORRESPONDING FIGURES / NON ADJUSTING EVENT AFTER REPORTING DATE

15.1 Corresponding figures have been rearranged and reclassified, wherever necessary for the purpose of comparison and better presentation. However, no significant reclassification has been made during the period.

15.2 Subsequent to the balance sheet date, ICL Power Private Limited has entered into the agreement with Etihad Alloys Private Limited for the purchase of plant and machinary amounting to Rs.1,590 million plus government duties, if any.

16 DATE OF AUTHORIZATION FOR ISSUE

The financial statements were authorized for issue on October 02, 2024 by the Board of Directors of the Company.

17 GENERAL

Figures have been rounded off to the nearest Rupee unless stated otherwise.

CHIEF EXECUTIVE **DIRECTOR**

UBL AlliedBank Bank Alfalah

August 16, 2024

Mr. Muhammad Asif Khan
Chief Financial Officer
ICL Power (Private) Limited
39 Empress Road,
Lahore.

SUBJECT: SYNDICATED FINANCE FACILITY OF UP TO PKR 5,400 MILLION FOR ICL POWER (PRIVATE) LIMITED

Dear Sir,

We understand that ICL Power (Private) Limited (hereinafter referred to as "IPL" or the "Company"), a wholly owned subsidiary of Ittehad Chemicals Limited ("ICL" or the "Holding Company"), intends to raise financing of up to PKR 5,400 Million to fund setup of a Biomass Power Plant of 37.2 MW at ICL's plant site located at Kala Shah Kaku, District Sheikhupura, Punjab, Pakistan ("Purpose" or the "Project").

In this regard, United Bank Limited ("UBL"), Allied Bank Limited ("ABL") and Bank Alfalah Limited ("BAFL") (hereinafter referred to as the "**Mandated Lead Advisors & Arrangers**" or the "**MLAAs**") are pleased to submit an indicative offer as per the attached Indicative Term Sheet, to arrange a Syndicated Term Finance Facility ("STFF") of up to PKR 5,400 Million with an equivalent sublimit of Syndicated Letter of Credit Facility ("LC") (hereinafter referred to as the "Facility") on the terms and conditions outlined in this Proposal (this letter should be read in conjunction with the Indicative Term Sheet, both documents collectively referred to as the "Offer" or "Proposal").

By accepting delivery of this Proposal, you agree that this Proposal is for your confidential use only and that neither its existence nor the terms hereof will be disclosed by you to any person other than your officers, directors, employees, accountants, legal counsel and other advisors and even then only, on a strict need-to-know basis. Your obligations hereunder with respect to confidentiality shall survive the expiration or termination of this Proposal. It is to be noted that the Offer remains subject to satisfactory due diligence, regulatory approvals, Shariah approval (if required), satisfactory legal opinions and internal credit approvals of the MLAAs.

If this Proposal represents a basis satisfactory to you to proceed further, please indicate your acceptance of the provisions hereof, by signing the Proposal and returning it to the undersigned. This Offer is open for your acceptance till August 23, 2024 after which it may be extended at our discretion. We look forward to working with you to a successful conclusion of this Facility. Should you have any queries please do not hesitate to contact any of the undersigned.

Yours truly,

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For & on behalf of Mandated Lead Advisors and Arrangers

We accept the above terms and conditions for and on behalf of ICL Power (Private) Limited

Authorized Signatory

Enclosed: Indicative Term Sheet

ICL POWER (PVT) LTD. 39-Empress Road, Lahore.

Authorized Signatory

UBL AlliedBank Bank Alfalah

ICL POWER (PRIVATE) LIMITED

SUMMARY OF INDICATIVE TERMS AND CONDITIONS

The terms and conditions set forth in this Proposal are intended for discussion purposes only and do not constitute a commitment, or undertaking on the part of Mandated Lead Advisors & Arrangers (MLAAs) to deliver such a commitment by themselves or third parties and are subject, among other things, to the final expression of the terms of the Facility as set forth in definitive agreements and/or confirmations and internal credit approvals of the participating institution(s) including but not limited to credit, legal, Shariah and/or compliance approvals. This proposal does not give rise to any liability on the part of the MLAAs and should be construed in accordance with relevant laws and Shariah Principles. This proposal is neither an offer nor the solicitation of an offer to enter into such transactions. Any financing commitment remains subject to detailed due diligence and approvals from respective credit authorities, absence of material adverse changes in the Company as well as in the Holding Company and/or the financial markets, and completion of satisfactory documentation and any other requirements appropriate to transactions of this nature as provided in this document, or requested through subsequent correspondence or as further detailed in the Facility Documents.

BORROWER/OBLIGOR	ICL Power (Private) Limited ("IPL" or the "Company")
HOLDING COMPANY	Ittehad Chemicals Limited ("ICL" or the "Holding Company")
SPONSORS	The existing shareholders of the Holding Company namely Muhammad Siddique Khatri, Abdul Sattar Khatri, Waqas Siddiq Khatri, Farhana Abdul Sattar Khatri and Ahmed Mustafa having an aggregate shareholding of ~20.89% in the Holding Company as on 30 June 2023.
MANDATED LEAD ADVISORS & ARRANGERS ("MLAAs")	United Bank Limited ("UBL") Allied Bank Limited ("ABL") Bank Alfalah Limited ("BAFL") *The Mandated Lead Advisors and Arrangers may at their sole discretion share this role or award additional roles to other banks or financial institutions provided it does not result in any additional cost to the Company.*
FACILITY/TRANSACTION	Syndicated Finance Facilities in the following manner: (i) Syndicated Term Finance Facility ("STFF"); and (ii) Syndicated Letter of Credit Facility – Sight (Foreign/Local) ("LC") as sublimit of the STFF facility. STFF and LC to be collectively referred to as "Facility" or "Transaction". The Facility/Transaction may be structured as conventional facility or in combination of conventional and Islamic facilities.
PURPOSE	The proceeds from the Facility will be utilized to finance setup of a Biomass Power Plant of 37.2 MW at ICL's plant site located at Kala Shah Kaku, District Sheikhupura, Punjab, Pakistan ("Purpose" or the "Project").
PROJECT COST	The total cost of the Project is estimated at PKR 7,200,000,000/- (Pak Rupees Seven Billion Two Hundred Million only) including interest capitalization. The cost of the Project will be funded in a debt- to-equity ratio of 75:25 which will be maintained throughout the Tenor of the Facility. For abundant clarity, Sponsors /Holding Company will fund at least 25% of the total Project Cost of IPL.
COMMERCIAL OPERATIONS DATE	The Project is expected to achieve Commercial Operations Date ("COD") within Eighteen (18) months from the Facility Effective Date ("FED").
FACILITY AMOUNT	(i) STFF of up to PKR 5,400,000,000/- (Pak Rupees Five Billion Four Hundred Million only) on best effort basis. (ii) LC Facility of up to PKR 5,400,000,000/- (Pak Rupees Five Billion Four Hundred Million only), as a sublimit of the STFF

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	facility, on best effort basis. Facility Amount under STFF and LC collectively shall not exceed PKR 5,400,000,000/- (Pak Rupees Five Billion Four Hundred Million only) at any point in time during the Tenor of the Facility. Exhaustive LC terms and conditions to be decided later upon receipt of LC details from the Company.
FINANCIERS	Banks / Financial Institutions including but not limited to the MLAAs.
TENOR	Up to Six (06) Years, inclusive of Grace Period, starting from the date of first Drawdown.
GRACE PERIOD	Up to Eighteen (18) Months, starting from the date of first Drawdown.
LC TENOR	Up to Eighteen (18) Months from the first LC opening date.
DRAWDOWN/DISBURSEMENT	In bullet or in multiple tranches during the Availability Period.
FACILITY EFFECTIVE DATE	The Facility Effective Date ("FED") is a date on which the conditions precedent for the Facility, as specified in the Facility Documents, are satisfied or waived. If the FED is not achieved within one (1) month of signing of the Facility Documents, the Facility will expire, unless such expiry date is extended by the Financiers in writing. In the event the Facility Effective Date is not extended and the Facility is cancelled, any and all fees due and billed by the MLAAs in accordance with this Indicative Term Sheet and/ or the executed Facility Documents shall be on account of the Company and if already paid, shall be non-refundable.
AVAILABILITY PERIOD	Earlier of: (i) achievement of COD; or (ii) Eighteen (18) Months from FED. Any amounts undrawn on the expiry of the Availability Period will stand cancelled.
MARK-UP RATE	Base Rate plus 1.~~65~~% per annum. 1.50%
BASE RATE	Base rate is defined as the average three months Karachi Inter Bank Offered Rate ("KIBOR") prevailing on the Base Rate setting date. The Base Rate will be set for the first time on the first disbursement date and then on the immediately preceding day before the start of each three months period. The "KIBOR" rates used for reference will be taken from Reuters page "KIBOR", as published at 11.30 a.m. Pakistan Standard Time by the Financial Markets Association (FMA). The daily average of the three months 'Ask Rate' will be used. In the event this rate is not published on Reuters on the rate fixing date or if less than 8 banks provide their rates for the KIBOR fixing, the FMA or other relevant market body will be contacted for the relevant fixing rate. The agreement is based on the premise that KIBOR rates continue to be a true representation of banks' cost of funds and therefore continue to be a realistic benchmark for pricing a facility of this nature. Should for any reason any material adverse event occurs which ceases or materially inhibits the ability of KIBOR rates to act as a benchmark, then the Financiers shall be entitled, as they deem fit, to substitute this profit

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	and Irrevocable Debit Authority to be issued by ICL in favor of the Accounts Banks, on the said collection accounts maintained with the Accounts Banks. • Lien along-with right of set-off and Irrevocable Debit Authority to be issued by IPL in favor of the Agent Bank, either on Debt Service Reserve Account ("DSRA") maintained in form of a profit bearing account or on TDRs / government securities placed with the Agent Bank (**"DSRA Security"**). The DSRA Security will be funded by 1/6th of the total instalment amount (principal + markup), assuming that STFF facility is fully drawn, at the end of every quarter commencing form first Disbursement, for next 6 quarters i.e. during the Grace Period. Funds to be maintained till final settlement of the Facility. Alternatively, a DSRA SBLC to be provided by ICL in favor of Agent Bank by at least AA rated bank, as acceptable to the Financiers, equal to the amount of one instalment (principal + interest) assuming the STFF facility is fully drawn prior to first Disbursement. • Lien along-with right of set-off over a non-profit bearing Debt Payment Account ("DPA") to be maintained by IPL with the Agent Bank. The DPA will be funded by the amount of upcoming instalment at least 15 business days prior to upcoming instalment due date, throughout the Tenor of The Facility. The DPA balance will be reset to zero at each instalment date. • Pledge of ~~100%~~ 51% shares of IPL. • ~~Personal Guarantees of sponsor directors of IPL.~~ • Corporate Guarantee of ICL. Any other security required by the Financiers to achieve successful financial close of the Transaction. **LC Security:** In addition to the above security, the security for LC shall be lien over import documents.
SECURITY AGENT	Bank Alfalah Limited
SECURITY AGENCY FEE	PKR 1,500,000/- (excluding all applicable government taxes and duties), payable to Security Agent on execution of Facility Documents for first year and PKR 1,000,000/- (excluding all applicable government taxes and duties) subsequently at each anniversary thereof over the remaining Tenor of the Facility.
ADVISORY & ARRANGEMENT FEE 1.25	~~1.5%~~ flat of the total Facility Amount (excluding all applicable government taxes and duties) payable by the Company as follows: - 50% at the time of execution of Facility documents; - Remaining 50% prior to FED.
SHARIAH STRUCTURING AGENT	Bank Alfalah Limited
SHARIAH STRUCTURING FEE	PKR 1,000,000 (excluding all applicable government taxes and duties), payable to Shariah Structuring Agent on execution of Facility Documents.
OTHER LC CHARGES	Other LC related charges including, but not limited to, documents

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	handling, SWIFT/Telex/Fax/Courier charges etc. which shall be based on LC Issuing Banks' Schedule of Charges and shall be payable by the Company at actual.
PREPAYMENT/ EARLY PAYMENT	Prepayment will be allowed through Company's own operating cashflows (not through bank borrowings) after giving a thirty (30) days prior notice to the Agent Bank. The notice once given shall be irrevocable. Prepayment will be subject to the following: ▪ Prepayment penalty of 0.75% of the amount being prepaid. ▪ Prepayments must be in multiples of PKR 500 million; ▪ Prepayment is exercisable after expiry of three-year period from the date of first Drawdown; ▪ Prepayment to be allowed on Mark-up Payment dates; ▪ Prepayments will be applied in reverse order; and ▪ Any amounts prepaid cannot be redrawn.
FACILITY STRUCTURE	The Facility Structure will be finalized after due diligence by MLAAs in consultation with the Company and will be subject to compliance with relevant laws and applicable legal, regulatory and Shariah principles.
ENTITY CREDIT RATING	• ICL to provide credit rating report by any credit rating company approved by Securities and Exchange Commission of Pakistan ("**SECP**") on annual basis and should maintain at least its existing credit rating of A-/A-2 (long term/short term) by VIS over the Tenor of the Facility. • IPL to provide credit rating report by any credit rating company approved by Securities and Exchange Commission of Pakistan ("**SECP**") on annual basis after achievement commencing 3 months after first Disbursement.
INSURANCE	The Company shall insure and always keep insured all its assets (and all additions thereto) against all reasonable risks to the satisfaction of the Financiers.
CONDITIONS PRECEDENT	Conditions Precedent to the Disbursement of the Facility to be incorporated in the Facility Documents and shall include, but not be limited to, the following: 1. A certified true copy of a resolution passed by the Board of Directors of the Company authorizing acceptance of the Facility on the terms and conditions set out in this Proposal and granting of authority to an authorized officer or officers to execute and deliver the Facility Documents or any other document or notice in connection therewith; 2. Internal credit and Shariah approvals of the Financiers; 3. Execution and delivery of all Facility Documents to the satisfaction of the Financiers; 4. Creation and perfection of Security to the satisfaction of the Financiers and the Transaction Legal Counsel; 5. Compliance with all applicable State Bank of Pakistan Prudential Regulations and Foreign Exchange Manual/ SECP /Competition Commission of Pakistan/ Government of Pakistan laws and regulations and other covenants mutually agreed between the Financiers and the Company. Any and all waivers required from

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	State Bank of Pakistan or any other regulatory body by the Financiers to participate in the Facility to be obtained by the Company. 6. Comprehensive insurance/Takaful of all assets of the Company provided as security to the Financiers under the Facility, from an insurance/Takaful company acceptable to the Financiers, up to the Facility Amount with relevant margin duly endorsed in favour of the Security Agent as co-loss payee; 7. A copy of the valuation report from a valuator acceptable to and in form and substance satisfactory to the Financers, encapsulating the valuation of all Security assets. 8. The Company will ensure that all consents, approvals, registrations and authorizations, Government and / or corporate, that are required, to be in place are in place and in full force and effect; 9. The Company will confirm that there are no litigations or arbitration proceedings pending against it, nor has there been any adverse order or orders affecting the proposed financing by any competent court of law or arbitrator in the name of the Company, which may have a material adverse effect on the proposed Facility; 10. The Company will provide detailed feasibility/business plan and financial projections of the Company, covering the Tenor of the Facility to the satisfaction of the Financiers, duly signed by the authorized signatory of the Company; 11. Due-diligence of the regulatory approvals, corporate approvals, financing/business plan and the progress thereon, by the Financiers up to their entire satisfaction; 12. Submission of the documents including but not limited to the following: i. SECP certified Memorandum & Articles of Association (or equivalent identification documents) of the Company; ii. Board Resolution of Company authorizing the Company to avail the Facility and for authorized signatories; iii. SECP certified: • Certificate of Incorporation • Certificate of Commencement of Business; • Form 29/9; and • Form A; iv. List of authorized signatories with specimen signatures, duly certified by the Company Secretary; v. List of directors, duly certified by the Company Secretary; vi. CNIC copies of all directors and authorized signatories, duly attested by the Company Secretary; vii. Duly filled, signed and stamped Borrower's Basic Fact Sheet; viii. Loan Application Form; ix. Undertaking for Appropriate Utilization of Funds; and x. Any other KYC documents as may be required by the Financiers. 13. Receipt of a satisfactory legal opinion from the Transaction Legal Counsel, confirming inter alia the validity, enforceability and binding effect of the obligations of the Company under the Facility

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	legal documents, in form and substance acceptable to the Financiers; 14. Company to ensure compliance with all Pakistani laws and legislations (as applicable) with respect to environmental and social impact of the Project. 15. Payment of all fees, costs and expenses (including but not limited to Advisory & Arrangement Fee, Agency Fee, Security Agency Fee, Shariah Structuring Fee, Transaction Legal Counsel Fee etc.) 16. If required, the Company to arrange for any NOCs necessary for the perfection of Security. 17. Compliance with all covenants, including but not limited to Financial Covenants. 18. Corporate Guarantee by the Holding Company to fund all cost overruns with respect to the Project. 19. An off-take/power purchase agreement between IPL and ICL with minimum revenue payments to IPL to ensure timely servicing of debt obligations of IPL until complete settlement of the Facility. 20. Evidence in form of Auditor's certificate to be provided for the equity contribution in the Project in accordance to the debt to equity ratio of 75:25. 21. Any other conditions precedent that the Financiers deem necessary.
FINANCIAL COVENANTS	Financial Covenants (both positive and negative), applicable to both the Company and the Holding Company, are to be mutually agreed upon in the Facility Documents which shall include, but will not be limited to the following: 1. Current Ratio of at least 1:1 to be maintained by both the Company and the Holding Company throughout the Tenor of the Facility; 2. Adjusted Leverage of less than 2.5x to be maintained by the Holding Company throughout the Tenor of the Facility; 3. Total Debt to Equity Ratio of the Company not to exceed 80:20 throughout the Tenor of the Facility; 4. Long Term Debt to Equity Ratio of the Company not to exceed 75:25 throughout the Tenor of the Facility; 5. Interest Coverage Ratio of greater than 1.5x to be maintained by both the Company and the Holding Company throughout the Tenor of the Facility; 6. Debt Service Coverage Ratio of greater than 1.5x to be maintained by both the Company and the Holding Company throughout the Tenor of the Facility; All ratios are to be calculated based on latest audited financial accounts of the Company and the Holding Company. Dividend pay-out will only be allowed in case each of the Company and the Holding Company is not in breach of any of the covenants under the Facility, including but not limited to Financial Covenants, and no event of default is persisting in any of the Company's and the Holding Company's financing facilities. For abundant clarity, Financial Covenants stipulated above are indicative and are strictly subject to internal approvals of the Financiers.
OTHER COVENANTS	1. Any cost overruns in the Project are to be borne by the Holding

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	Company and/or the Sponsors. 2. The Company will ensure achievement of COD within eighteen (18) months from FED. 3. The Holding Company will retain complete ownership of the Company and will not sell any shareholding in the Company without prior written approval of the Financiers. 4. Any change in shareholding of Sponsors in the Holding Company will require prior written approval of the Financiers. 5. The Sponsors will retain management control of the Holding Company and IPL throughout the Tenor of the Facility and any change in the management control of ICL and IPL will require prior written approval of the Financiers. 6. Any change in corporate structure of the Holding Company including but not limited to merger, acquisition, unbundling and spin off will require prior written approval of the Financiers. 7. The Company and the Holding Company will not sell, transfer, grant, lease or otherwise dispose of all or any part of assets provided as Security under the Facility without prior written approval of the Financiers. 8. The Company will provide progress report of the Project on quarterly basis till commissioning of the Project and subsequently audited/reviewed financial accounts of the Company on quarterly basis. 9. The Company and the Holding Company will arrange fresh valuation report (upon invalidity of last valuation report submitted to the Financiers) from a valuator acceptable to and in the form and substance satisfactory to the Financers, encapsulating the valuation of all Security assets. 10.The Company will provide stock report on monthly basis, including details of receivable ageing, in form acceptable to the Financiers. 11.The Holding Company and the Company will not create, incur, assume or suffer to exist any encumbrance whatsoever upon or with respect to the assets provided under Security, which may rank superior to, or pari passu with the Security created or to be created in favor of the Financiers under the Facility; without prior written approval of the Financiers. 12.An Auditors certificate to be provided for the equity contribution in the Project in accordance to the debt to equity ratio of 75:25 at the time of COD. 13.MLAAs shall have the first right of refusal for any working capital facilities required by IPL in future.
OTHER TERMS & CONDITIONS	1. During the currency of the Facility, the Company will comply with covenants (positive and negative) as agreed and set out in the Facility Documents; 2. Disbursements will be subject to all regulatory approvals; 3. All levies, duties, surcharges, taxes etc. other than withholding taxes of whatsoever nature, imposed by the Federal and / or Provincial Government shall be on the account of the Company. 4. The Company, at its own expense, will engage an independent technical advisor/consultant, on behalf of Financiers, for technical evaluation of the Project's progress and preparation of project

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	progress reports in form and substance satisfactory to the Financers till commissioning of the Project. 5. Any other terms and conditions that Financiers may deem fit shall be included in Facility Documents.
Event of Default	The Events of Default will be usual and customary for a transaction of this type, and shall include, without limitation, the following: a) Failure to make payments under any Facility Document; b) Breach of Financial Covenants, Other Covenants, representation or warranty in any Facility Document; c) Termination, suspension, repudiation or revocation of any Facility Document or any consents; d) Illegality, invalidity or unenforceability of any Facility Document or any Facility Document ceases to be in full force or effect; e) Invalidity of Financiers' security or material diminution in the value of any Security; f) Any cross default in respect of the Company and the Holding Company; g) Modification in corporate structure and/or shareholding of Sponsors of the Company as well as the Holding Company, without prior written approval of the Financiers. The events of default (other than payment default) will be subject to an appropriate remedy/ cure period of 30 days as governed in Facility Documents. Exceptions and qualifications (including those relating to materiality and reasonableness) will be agreed upon and included where appropriate in Facility Documents. MLAAs and/or the Financiers would have the right to identify other reasonable events if required as a result of legal/technical due-diligence. The detailed list of Events of Default shall be incorporated in Facility Documents.
Representations, Covenants and Indemnities	Facility Documents shall incorporate usual and appropriate indemnities, representations and covenants in favor of Financiers.
Out-of-Pocket Expenses	All out of pocket expenses including but not limited to traveling, accommodation, utilities, printing, advertisements etc. and all expenses incurred by the MLAAs in connection to the Facility shall be on account of the Company, whether or not the transaction contemplated herein is executed. The out-of-pocket expenses will be capped at PKR 1,000,000/-. Out-of-pocket expenses do not include fees payable for professional services of valuators, legal counsel, technical advisor/consultant and credit rating agency or any other fees, charges including taxes, levies, duties including stamp duties and surcharges etc.
Sell Down	The Financiers may sell-down all or part of the Facility Amount to any other financial institution of their choice without the Company's consent. The Company will execute all such documents as may be reasonably required and cooperate in all matters related to such sell-down. All costs, expenses and other charges will be on account of the concerned financial institution(s).
Material Adverse Event	The Company hereby agrees that from the date of signing of this

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	Proposal document till the execution of the Facility Documents, the MLAAs reserve the right to terminate the Offer or renegotiate the terms and conditions, if in their opinion: (a) any material adverse change has occurred in any of the business conditions (financial or otherwise), operations, performance, properties or prospects of the Company as well as the Holding Company; (b) any change in any circumstances/conditions (including the continuation of any existing conditions) in the banking, loan, syndication, financial or capital markets generally that materially impair the arrangement of the Facility; and (c) any material adverse change having occurred in the market for loans and debt securities of Pakistan.
PAYMENTS	All payments under or pursuant to this Offer will be paid within a period of 14 business days from the date of invoice under the Facility.
TAXATION	Under the terms of this Facility, payment of principal, mark-up, fees and all other amounts payable by the Company are to be made free and clear of taxes, withholding and duties of any nature whatsoever (other than taxes directly related to the Income of Financiers) to the end. The payment in each case to Financiers will be grossed up in the event any such deduction or withholding is required to be made from any such payment so that Financiers will receive the amount they would have received had no such deduction been made. In the event the Company is required by any applicable law, to deduct any tax from payments being made to the Financiers, the Company shall provide to the Financiers original copies of the tax challans, duly made out in their name, in respect of the tax so deducted, within a period of seven (7) business days from the date on which such deduction is made.
INFORMATION	The Company will supply to the MLAAs, information that is required, in the opinion of the MLAAs, including but not limited to, detailed financial projections. The financial projections shall include the projected balance sheet, profit and loss statement, statement of cashflows, financial ratios and shall also include a demand & supply analysis. The Company will also provide all other information required by the MLAAs to produce a detailed Information Memorandum for distribution to potential Financiers on a selective and confidential basis. The Company shall take responsibility for the accuracy and completeness of the information to be furnished by the Company in the Information Memorandum. Senior Management of the Company will be available for meetings with prospective Financiers to assist in the placement process, if required.
MARKET FLEX	The Company hereby agrees that MLAAs have the right to change, at any time prior to the signing of the Facility Documents, any or all of the terms, structure, tenor and pricing of the Facility, if such changes, in the judgment of MLAAs, are advisable to ensure successful arrangement of the Facility. If MLAAs determines that such changes are reasonable, MLAAs will consult with the Company for a period of five (5) business days about such changes. If the Company does not accept such changes during this period, MLAAs will be entitled to terminate this Offer.
CLEAR MARKET	To ensure an orderly and effective arrangement of the Facility, until the Disbursement of the Facility (as determined by the MLAAs), the Company agrees that it will not syndicate or issue, announce or authorize the announcement of the syndication or issuance of any

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	financing facility (excluding those transactions/negotiations necessary to undertake routine business in Pakistan) or financial instruments (including renewals thereof) without the prior consent of the MLAAs which consent shall not be unreasonably withheld. The Company also agrees that MLAAs will act as sole arranger of this Facility and that no additional agents, co-agents or arranger(s) will be appointed or other titles conferred, without the prior written consent of the MLAAs.
INDEMNIFICATION	The Company hereby indemnifies and agrees to hold harmless the Financiers, each of their affiliates and each of their respective officers, directors, employees, agents, advisors and representatives (each an "**Indemnified Party**") from and against any and all claims, damages, losses, liabilities, costs and expenses (hereinafter collectively referred to as "**Claim**"), joint or several, that may be incurred by or awarded against any Indemnified Party, in each case arising out of or in connection with or relating to the Offer or the Facility except to the extent such Claim has resulted from such Indemnified Party's gross negligence or willful misconduct.
CO-OPTION	The MLAAs reserve the right to co-opt any financial institution(s), of their own choice in order to successfully close the mandate. The co-option would be at the expense of the MLAAs and would not affect the overall cost of the Transaction to the Company. The Company also agrees that it will not award any other roles or titles to any other party in respect of the Facility.
OTHER CHARGES	All other charges including but not limited to taxes, levies, stamp duties, excise duties etc. are to be paid at actual by the Company.
CONFIDENTIALITY	The contents of this Indicative Term Sheet are for your confidential use only and that neither its existence nor the terms hereof will be disclosed by you to any other person.
GOVERNING LAW	The Facility shall be subject to the laws of Islamic Republic of Pakistan and non-exclusive jurisdiction of the Pakistani Courts.
VALIDITY	The above-mentioned terms and conditions of this Offer are valid if accepted by August 23, 2024 unless extended by the MLAAs.

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END OF SUMMARY OF INDICATIVE TERM SHEET

ICL POWER (PVT) LTD. 39-Empress Road, Lahore.

Operating and Financial Highlights

	Unit	2024	2023	2022	2021	2020	2019
PROFIT AND LOSS							
Sales	Rs. in mln	24,315	24,268	15,681	11,124	8,857	6,644
Gross Profit	Rs. in mln	4,811	4,994	2,065	1,886	1,182	1,379
Operating Profit	Rs. in mln	2,988	3,089	993	1,093	496	756
Profit / (loss) before tax	Rs. in mln	2,370	2,680	764	980	78	505
Profit after tax	Rs. in mln	1,386	1,826	415	657	61	405
EBITDA	Rs. in mln	3,677	3,709	1,508	1,606	1,069	1,248
Earning per share - Basic and Diluted	Rs.	13.86	18.26	4.15	6.57	0.72	4.78
BALANCE SHEET							
Operating Fixed assets (NBV)	Rs. in mln	8,505	6,323	6,298	5,723	5,872	6,335
Current Assets	Rs. in mln	7,778	6,828	5,706	3,805	2,968	2,915
Current Liabilities	Rs. in mln	6,570	6,215	5,775	3,639	2,508	3,461
Long Term Liabilities	Rs. in mln	1,409	1,773	1,909	1,797	2,579	2,012
Share capital	Rs. in mln	1,000	1,000	1,000	847	847	847
Shareholders' Equity (Excluding revaluation Surplus)	Rs. in mln	6,415	5,312	3,789	3,482	3,081	3,031
Shareholders' Equity (with revaluation Surplus)	Rs. in mln	9,288	6,704	5,181	4,874	4,054	4,504
INVESTOR INFORMATION							
Gross Profit Margin	%	19.79	20.58	13.17	16.95	13.34	20.75
Net Profit Margin	%	5.70	7.53	2.64	5.90	0.69	6.10
Return on Equity (Excluding revaluation Surplus)	%	24%	40%	[illegible]	20.01	1.99	14.05
Return on Equity (with revaluation Surplus)	%	17%	31%	8	15	1.5	11
Price Earning Ratio Restated		3.40	2.14	7.20	4.91	36.60	5.64
Net Asset Per Share	Rs.	64.15	53.12	37.89	41.11	36.38	35.78
Long -Term Debt to Equity Ratio		0.19	0.37	0.51	0.51	0.60	0.66
Current Ratio		1.18	1.10	0.99	1.05	1.18	0.84
Quick Ratio		0.74	0.66	0.53	0.64	0.74	0.50
Interest Coverage Ratio		4.09	5.49	3.01	4.85	1.03	2.96
Debtor Turnover	No. of Times	9.41	14.40	10.28	11.25	13.05	11.81
Inventory Turnover	No. of Times	6.64	7.06	5.11	5.91	6.95	4.40
Dividend Payout	%	25.26	23.27	24.12	30.45	139.31	-
Bonus Shares	%			18.06%	-	-	-
Dividend Per Share	Rs.	3.50	4.25	1.00	2.00	1.00	-

3	04.10.24	Issued for Review	MA		HJ		SMU			
2	30.09.24	Issued for Review	MA		HJ		SMU			
1	05.07.24	Issued for Review	MA		HJ		SMU			
0	16.01.24	Issued for Review	MA		HJ		SMU			
Rev	**Date**	**Description**	Initial	Signature	Initial	Signature	Initial	Signature	Initial	Signature
			Prepared by		**Checked by**		**Approved by**		**Client Approval**	

Buyer:	**ICL POWER (PVT.) LTD.**		
Consultant : FABCON	**FABCON DESIGN AND ENGINEERING (PVT.) LTD.**		
PROJECT	**37.2MW CO-GENERATION POWER PLANT**		
DOCUMENT TITLE	**TECHNICAL FEASIBILITY OF POWER PLANT**		
DOCUMENT NO.	**FDE-IPL-TF-003**	**SHEET**	**REV.**
		1 OF 36	**3**

Table of Contents

1. Introduction

1.1 Project Overview

ICL Power (Pvt.) Ltd. (IPL) a private power generation company limited is going to install 37.2MW Cogeneration Power project adjacent to Ittehad Chemicals Limited (ICL) at Kala Shah Kaku, Punjab Pakistan. The Project consists of 37.2MW condensing and extraction steam turbine along with high pressure and high-temperature steam generator.

ICL Power (Pvt.) Ltd. (IPL) has hired Fabcon Design and Engineering (Pvt.) Ltd., as the Project Consultant, to provide the engineering and supervision of procurement, manufacturing, installation, construction, and commissioning services for the co-generation power project.

1.2 Document Scope

The document offers a comprehensive feasibility report aiming to secure a Power Generation License, focusing on establishing a biomass-fired power plant in Pakistan. It outlines key project objectives, evaluating meteorological, seismic, and biomass factors. Detailed analysis covers plant capacity, technology, construction needs, staffing, and resource procurement, including demobilization and site restoration considerations. Operational aspects emphasize health, safety, and environmental standards, prioritizing personnel training. Extensive coverage spans fuel supply, infrastructure, and facility specifications, encompassing design basis, control systems, security, and electrical infrastructure. Detailed examination extends to water treatment, civil design, and electrical aspects, addressing equipment selection, layouts, protections, and safety measures.

1.3 Definition and Abbreviations

1.3.1 Definitions

Buyer:	ICL Power (Pvt.) Ltd. (IPL). In this document the word Buyer and IPL are interchangeable and mean the same.
Consultant:	Fabcon Design and Engineering (Pvt.) Ltd. (FDE). In this document the word Consultant and FDE are interchangeable and mean the same.
Vendor:	Means any and all persons, firms, partnerships, companies, bodies, entities, or a combination thereof including sub-vendors who are providing equipment, material, and services to perform duties specified by IPL.
Project:	37.2MW Biomass Fired Cogeneration Power Plant

1.4 Project Location

The plant is located at Kala Shah Kaku, Punjab Pakistan, adjacent to existing Ittehad Chemical Plant. Total designated area is approximately 20 acres of land which include power plant area and biomass storage as well.

Location Map

1.5 Project Activities

The proposed project shall involve the following activities:

• Construction and Commissioning Activities

• Operation Activities

2. Project Details and Prospective

2.1 General

ICL Power (Pvt.) Ltd. (IPL) a private power generation company limited is going to install a 37.2MW Cogeneration Power project adjacent to Ittehad Chemicals Limited (ICL) at Kala Shah Kaku, Punjab Pakistan. ICL Power (Pvt.) Ltd. (IPL) has hired Fabcon Design and Engineering (Pvt.) Ltd., as the Project Consultant, to provide the engineering and supervision of procurement, manufacturing, installation, construction, and commissioning services for the co-generation power project.

The description set out herein below is intended to be an indicative broad outline only; and may change by evolving Project needs.

2.2 Meteorology

Meteorological data sourced from the Kala Shah Kaku, Punjab Pakistan has been utilized to establish the fundamental climatic conditions of the project area and its vicinity. Over the past five years, data was gathered from the Pakistan Meteorology Department's station in Kala Shah Kaku, offering a comprehensive view of the area's climate patterns. The annual rainfall figures between 2009 and 2013 ranged from 1 to 243.1 mm, showcasing significant variation. Monthly minimum temperatures oscillated between 3.5 and 28.6°C, with mean values falling within the range of 16.6 to 41.9°C. Relative humidity in the project area fluctuates from 19 to 70. Wind speed averages between 0.4 and 7.6 Knots every month.

2.3 Water Source

The project area lies in the district of Kala Shah Kaku; the groundwater table normally exists 40 to 50 ft below the ground level. Tube wells shall be utilized for sourcing cooling water from groundwater resources. The choice to utilize tube wells for sourcing cooling water stemmed from their cost-effectiveness, reliability, and feasibility in accessing groundwater resources.

2.4 Seismic Condition

Pakistan lies on an active seismic belt of Earth. Seismic observations indicate that hundreds of shocks originate every year. Mostly, these seismic waves are of low intensity and do not have a significant effect. According to the seismic zones of UN-Habitat, the project area falls under Zone 2A.

2.5 Fuel (Biomass)

Biomass (agricultural waste) available locally shall be used for the project. A comprehensive analysis of the designated biomass is outlined in this report.

2.6 Capacity of the Plant at Reference Conditions

The Project has the following design ratings at reference site conditions based on the LHV of the biomass:

Parameter	Units	Value
Plant Efficiency (Based on Net Capacity)	%	23.13
Plant Efficiency (Based on Gross Capacity)	%	26.60
Power Capacity Factor (Based on Used Capacity)	%	80.65
Power Capacity Factor (Based on Installed Capacity)	%	92.74

2.7 Description of the Plant

2.7.1 Proposed Plant Projected Specifications

The broad parameters of the project are:

Installed Capacity	:	37,200 kW
Turbine Capacity	:	37.2 MW Extraction/Condensing
Boiler Type	:	Single Drum Membrane Type Travelling/Step/Vibratory Grate Biomass Fired (to be decided yet) Boiler
Boiler Installed Capacity	:	190 TPH, 110 Bar(g), 543 °C
Fuel	:	Biomass (Locally Available)
Construction Period	:	18 Months
Project Operational Capacity	:	34,500 kW
Total Net Power Generation	:	30,000 kW
Boiler Operational Capacity	:	152 TPH (132 TPH + 20TPH)
For 34,500 kW Generation	:	132 TPH
For Process Steam (via PRDS)	:	20 TPH
Total Process Steam (after PRDS)	:	24~26 TPH

2.7.2 Major Systems of The Proposed Plant

The major systems of the proposed plant include biomass handling and processing system;

- Fuel preparation system
- Fuel handling and conveying system

- Fuel feeding system
- Single Drum Membrane Type Steam Generator
- Extraction-Condensing Steam Turbine
- Electrical Power Generator
- Flue Gas Treatment System
- Cooling Water System
- Ash Handling System
- Utilities and Waste Management System
- Boiler Feed Water Treatment System
- Fire Fighting System

2.7.3 Technology Description of the Proposed Power Plant

ICL Power (Pvt.) Ltd. (IPL) is interested in technology that is the latest and proven. The 11.0 MPa, 543 °C system is identified with assumptions of **37.2MW** gross output, **30tph** net extraction, as offering a significantly superior return on investment. This configuration strikes a balance between substantial fuel savings and a modest increase in capital investment.

Specifications of Extraction Condensing Steam Turbine are as follows:

Gross Power Output	:	37.2MW
Type	:	Extraction Condensing
Stage	:	Multistage, Nozzle Governed
Nominal Steam Inlet Pressure	:	104 Bar(g)
Nominal Steam Inlet Temperature	:	535 °C

Specifications of Generator are as follows:

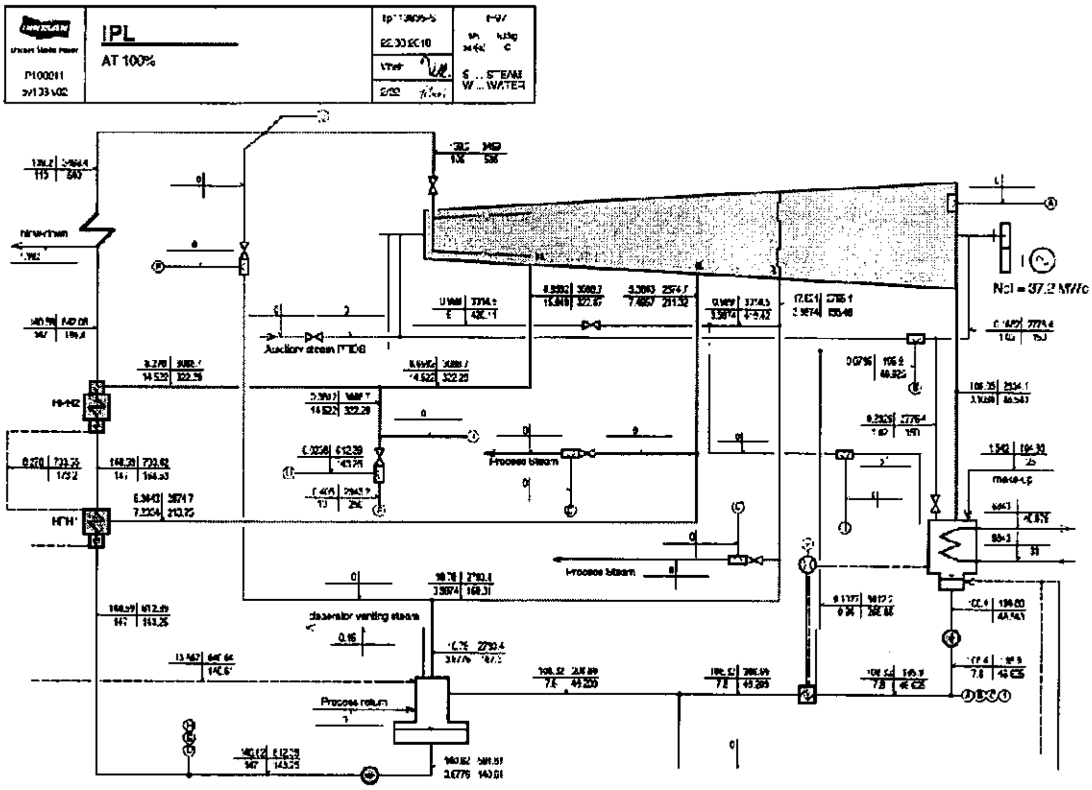
Voltage Level	:	11000 V
Frequency	:	50 Hz
Power Factor	:	0.8
Insulation Class	:	F

Specifications of Boiler are as follows:

The biomass-fired boiler is a top-supported natural circulating boiler with a single drum and consisting of a rigid water-cooled frame for supporting the heating surfaces and steam drum. The boiler is provided with a membrane wall construction which is water-cooled and fully gastight. Due to the welded construction, its water-cooled frame, and low wall thickness of the steam drum the boiler can react very fast to load changes and can be started relatively fast compared to other types of boilers.

The boiler has following key parameters

Type	:	Single Drum Membrane Type
Evaporation Capacity	:	190 TPH
Steam Pressure	:	110 Bar(g)
Steam Temperature	:	543 °C ± 3 °C
Grate	:	Travelling/Step/Vibratory Grate
Draft	:	Balanced
Furnace Type	:	Membrane type water-cooled
Fuel	:	Biomass (Agriculture Waste)
Feed Water Temperature	:	196°C
Boiler Efficiency on LCV	:	88%
Flue Gas Temperature	:	145°C



The process steam shall be deduced from PRDS station directly from boiler.

Plant Operational Hours

The plant operates 24 hours a day, ensuring continuous production throughout the year. With round-the-clock operations, the plant functions for approximately 8,000 hours annually. This consistent schedule allows for efficient resource utilization, maximizes productivity, and supports the plant's commitment to meeting high production demands. The operation's reliability and extended hours are essential in maintaining the plant's output and ensuring that it can meet its yearly goals effectively.

2.8 Power Plant Construction

The proposed power plant shall take approximately 18 months for construction installation and commissioning. IPL plans to start the construction activity for the proposed power plant by the start of Aug 2024 and expected to commission/operation shall be started by the end of January 2026.

Typical activities that are conducted during civil construction are listed below:

- Construction camp setup and mobilization of contractors
- Excavation for foundations
- Laying of foundations
- Masonry work
- Concrete work
- Asphalt work (pavement, roads, etc.)
- Finishing (plastering, painting, etc.)

The power plant and ancillary equipment, brought to the site by road in sections, shall be erected on-site and commissioned. Typical activities that are conducted during plant erection are listed below:

- Site fabrication (equipment/pipe supports, equipment assemblies, etc.)
- Placement of the vessels and equipment (Steam turbine) on the foundations
- Laying of pipes; Welding, joining, etc.
- Electrical installation (cabling, switchgear, transformers, etc.)
- Instrument installation (field instruments, control room instruments, instrument cabling, etc.) and painting etc.

2.8.1 Resources Consumption and Supplies

2.8.1.1 Staffing

It is expected that around 150-200 skilled and unskilled personnel shall be required during construction activities of the project. Local people shall also be hired for unskilled and semi-skilled work during project activities.

2.8.1.2 Water & Electricity Sourcing

Water required during the peak construction period shall be taken from a groundwater well(s). Potable water collected for the power plant shall meet NEQS for drinking water and WHO guidelines. Electricity from the WAPDA shall be the primary source during the construction, testing, and commissioning phase and afterward. Other supplies required during the construction phase include office and camp supplies.

2.8.1.3 Construction Material Sourcing

During the construction, a large amount of construction material shall be required. This shall include steel, cement, sand, and aggregates for road and pavement construction. Construction materials shall be mainly procured from the Punjab.

2.8.2 Demobilization and Site Restoration

On completion of the construction and commissioning phase, the construction contractor shall demobilize the site and construction camp. Temporary infrastructure shall be decommissioned, and sites shall be restored. This shall involve:

- Removing the temporary construction camp
- Closing all the temporary waste pits
- Removing all waste and leftover construction materials from the site
- Leveling and restoration of areas.

2.9 Power Plant Operations

A brief description of the whole process of the power plant (IPL) is mentioned below,

The proposed power plant shall be a Biomass-Fired Power Plant

- A biomass storage shed shall be constructed at the project site.
- Highly refined quality water is fed into the boiler to avoid internal scaling. Exhaust gases shall be passed through ESP/Bag Filter to minimize its corrosively for ambient air.
- Superheated steam @ P: 11.0 MPa & T: 543°C shall be produced to generate power through extraction-condensing type steam turbine generators (STG).
- Low-pressure exhaust steam is passed through a Water-Cooled Condenser (WCC) equipped with Cooling Tower for cold water supplies.
- Bottom ash shall be disposed-off by landfill.
- The proposed power plant shall produce about 276,000 MW gross power output annually.

2.10 Health, Safety, and Environmental Management Standards

The construction and operational phase of the project shall have to meet the requirements of health, safety, and environmental standards and HSE Policy of IPL. IPL standards highlight commitment on prioritizing health and safety of all its employees, contractors and visitors involved in its activities and confer overriding commitment towards minimizing impact of its activities on the natural environment. Moreover, the following procedures and arrangements shall be done during all phases of project activities.

- Personal Protective equipment (PPE's)
- Complete first Aid Facility
- Fire Protection & Prevention
- Emergency preparedness plan and procedures. Safety measures for excavation/openings
- Proper House Keeping
- Maintenance & Equipment Inspections
- Electricity Safety;
- Safe usage of Hand & Power Tools
- Standard Scaffoldings & Ladders
- Proper hoisting, cranes & lifting etc.
- Standard welding procedures
- Safe handling of hazardous materials: Chemicals & Gas Cylinders
- Safe working above ground levels
- Necessary Weather Protection Measures
- Safe working at confined places
- Avoid working at fragile roofing & materials
- Strict compliance of 'Warning signs
- Proper Waste Management plan and procedures

2.11 Training & Development

The contractor shall provide training, including on-site and training in the English language, so that such training is complete before the commencement date, for suitably qualified and experienced O&M personnel by Progress Event schedule, to provide such personnel with the knowledge required to operate the Power Station in accordance with the O&M manuals, the manufacturer's instructions and guidelines, and the level of competence of a reasonable and prudent operator. The contractors shall undertake to train at site installation, operation and maintenance of the offered plant equipment's, engineering personnel selected by the owner. The period and nature of training for the individual personnel shall be agreed upon mutually between the contractors and the owner covering the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable by the owner.

- Training on flue gas analyzers, as well as other Steam Generators/Turbine Generators/related E & I system equipment including related electrical areas such as generators and excitation systems.
- Training for special packages for various PLC/DCS-based systems.

The contractors shall provide the training equipment and materials during the training period. All the software, films, video CDs, transparencies, notes, etc. used in the training program shall remain the property of the owner at the end of the agreement.

The contractor's supervisory and erection personnel deputed to site works shall continuously and intensively instruct and train the Owner's personnel engaged in the erection or operation and maintenance of the plant at the site during erection, testing, and commissioning as well as during operation and maintenance. This shall cover all aspects of site work on the plant including special instructions and care required in attending to various jobs, whether or not they are incorporated in the relevant manuals.

3. Fuel Supply

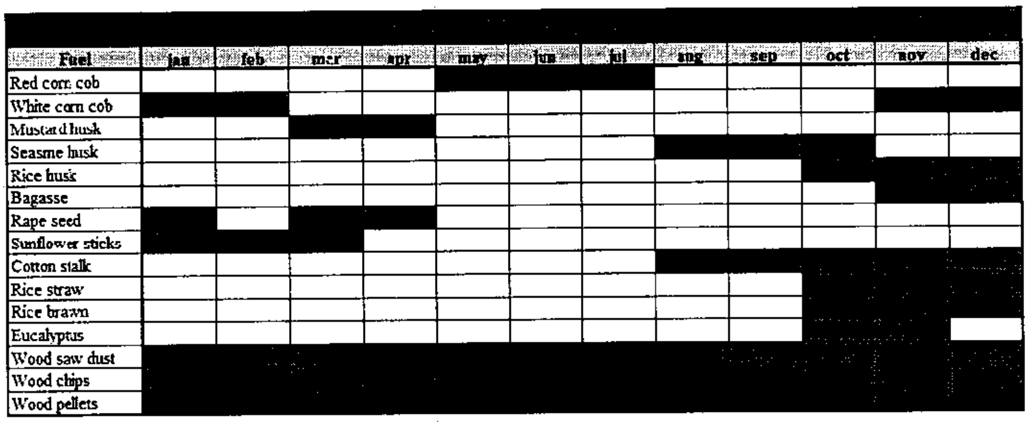
Biomass (Agricultural Waste) is selected as fuel for this project. Biomass emerges as a promising, cost-effective, and sustainable alternative with the potential to address both energies needs and environmental concerns. A possibility of burning local coal up to 20% in the boiler shall be studied during the detail design.

3.1 Selected Types of Biomass Fuel

The following types of biomasses are selected for power generation that are readily available in Pakistan.

1- Bagasse
2- Rice Husk
3- Rice Straw
4- Corn Cob (Red)
5- Corn Cob (White)
6- Corn Stalks
7- Brassica
8- Mustard Straw
9- Wood Chips
10- Cotton Stalks
11- Wheat Straw
12- Sugarcane Trash
13- Maize Husk

3.2 Seasonal Availability Chart for Biomass of Pakistan



3.3 Annual production potential of crop residue in Pakistan

The annual production potential of crop residue biomass and their use is given as follow (1000Mton/year):

Biomass Residues	Theoretical Potential	Technical Potential	Past Annual Usage (%)
Bagasse	11,790	4,224	35.8
Rice husk	1,288	557	43.2
Corn cob	599	67	11.2
Corn husk	400	45	11.3
Cotton stalk	25,865	2,764	10.7
Wheat straw	16,323	2,604	16.0
Rice straw	6,438	2,784	43.2
Sugarcane trash	4,716	1,690	35.8
Maize stalk	2,270	256	11.3
Total	69,689	14,991	21.5

3.4 Composition of Biomass (Proximate and Ultimate Analysis).

The proximate analysis and ultimate analysis of Pakistan's crop residues-based biomass are given as follows:

Parameter	Unit	Corn Cob	Corn Stover	Corn Stalk	Wheat Straw	Rice Husk	Brassica	Bagasse	Coal Foreign
Specific Energy									
Gross Calorific Value	kJ/KG	14856	14912	16206	16670	16126	15072	10249	23550.75
Net Calorific Value	kJ/KG	12526	13972	14185	14777	14816	14053	8360	22776.19
Proximate Analysis (ar)									
Total Moisture	%	15	7.58	13.17	8.61	11	11	48	8
Volatile Matter	%	75	65.68	59.83	70.41	66	65	84.79	21
Ash	%	3.2	13.13	11.52	8.65	18	12	2.91	7.5
Fixed Carbon	%	13.92	13.61	17	16.11	17	22	11.82	36
Total Sulfur	%	0.15	0.31	0.18	0.21	0.17	0.16	0.02	0.33
Ultimate Analysis (ar)									
Carbon (C)	%	42.7	38.36	48.23	43.11	38	42.79	49.2	58.5
Hydrogen (H)	%	6.49	6.65	8.18	5.81	6	6.06	4.69	3
Nitrogen (N)	%	0.25	0.57	0.81	0.63	0.8	0.84	0.18	0.9
Oxygen (O)	%	50.41	40.85	31.08	50.45	37	40	43	4
Ash Fusion Temp. (reducing)									
Initial deformation Temp	°C	970	990	990	920	>1500	1080	1100	1150
Spherical (Softening) Temp	°C	1000	1000	1000	990	>1500	1240	1240	1210
Hemispherical Temp	°C	1030	1040	1040	1061	>1500	1275	1270	1200
Fluid Temperature	°C	1100	1070	1100	1100	>1500	1305	1352	1250
Ash Analysis (db)									
Silica (SiO2)	%	63.6	58.8	67.02	41.52	95.4	17.2	73	38.5
Alumina (Al2O3)	%	5.85	8.81	2.15	1.01	0.1	7.9	6.7	16.5
Manganese (Mn3O4)	%	2.11	3.65	3.68	1.98	0.3	9.6	3.2	0.01
Calcium (CaO)	%	3.5	6.83	6.78	8.08	0.4	34	2.8	0.1
Iron (Fe2O3)	%	2.95	4.23	1.01	0.7	0.1	1.5	6.3	1
Phosphate (P2O5)	%	2.42	1.35	0.94	4.45	0.5	1.5	4	0.1
Sodium (Na2O)	%	0.45	1.26	0.4	0.6	-	0.5	1.1	0.1
Potassium (K2O)	%	8.42	10.56	5.24	31.9	1.8	17.7	2.4	0.2
Titanium (TiO2)	%	0.6	0.31	0.13	0.07	-	0.3	-	0.5
Sulfate (SO3)	%	1.14	0.57	2.42	3.33	-	7.5	0.4	-
Other Impurities	%	8.96	3.64	10.23	6.36	1.4	2.3	0.1	-

3.5 Biomass Transport Feasibility Matrix

Preprocess-sing steps (for transport purposes)		Feedstock density (kg/m3) and moisture content (%)						LHV (MJ/kg)		
		Raw (loose) feedstock		Baled/ Bundled		Chopped/Chipped		Raw feedstock	Baled/ Bundled	Chopped
		Density	Moisture %	Density	Moisture %	Density	Moisture %			
Wheat straw	Baling	40	0.1	175	0.1	n/a	n/a	14.4	14.4	n/a
Cotton stalks	Bundling or Chipping	55	0.125	160	0.125	300	0.125	15	15	15
Rice straw	Baling	30	0.105	155	0.105	n/a	n/a	12.5	12.5	n/a
Maize stalks	Bundling or Baling	60	0.16	230	0.16	n/a	n/a	13	13	n/a
Sugarcane trash	Baling	32	0.24	155	0.24	n/a	n/a	12.6	12.6	n/a
Rice husk	N/A	145	0.115	n/a	n/a	n/a	n/a	13.5	n/a	n/a
Corn cob	N/A	132	0.176	n/a	n/a	n/a	n/a	14	n/a	n/a
Maize husk	N/A	30	0.119	n/a	n/a	n/a	n/a	11.6	n/a	n/a
Bagasse	Baling	120	0.5	n/a	n/a	n/a	n/a	7.5	n/a	n/a

3.5.1 Transportation Modes

Biomass transportation primarily utilizes tractor trolleys, trucks, or similar road-based transport modes in Pakistan due to their accessibility and suitability for local roads.

3.5.2 Accessibility

Pakistan's road network supports the movement of biomass from local sources to power generation facilities, ensuring relatively easy access and transport feasibility.

3.5.3 Supply Chain Management

Biomass resources are locally abundant, reducing transportation distances and fostering a dependable and consistent supply chain.

3.5.4 Logistics and Efficiency

The chosen modes of transportation offer efficient delivery of biomass quantities, with regular and well-managed schedules to maintain a steady supply. Biomass transportation accounts for proper handling practices and maintaining quality and quantity standards during transit and storage at the facility.

4. Information Regarding Infrastructure

The holistic infrastructure plan, encompassing administrative buildings, healthcare facilities, landscaping, roads, staff colonies, and strategically positioned security check posts, reflects our commitment to fostering a conducive work environment while ensuring operational efficiency and compliance with safety standards.

4.1 Road Network Overview for Power Generation Facility

- The road network within the facility premises is planned to be a grid-style layout that shall ensure efficient access to different sections of the power generation site.
- Roads shall be constructed with sufficient width to accommodate smooth vehicular movement, including space for heavy-duty vehicles.
- Entry and exit points shall be strategically placed to optimize access and traffic flow.
- Curves and turns shall be engineered with broader angles to accommodate larger vehicles and ensure safe maneuverability.
- Emergency response routes shall be designated and marked for quick access by fire trucks, ambulances, and other emergency vehicles.
- Roadside signage and clear markings shall aid emergency services in navigating the premises swiftly.

4.2 Administrative Buildings Overview

- The administrative buildings within the power generation facility shall serve as operational hubs and shall support a range of functions critical for effective management, operations, and workforce coordination.
- Their design and functionalities shall be tailored to meet the diverse administrative needs of the facility while emphasizing efficiency, functionality, and sustainability.

4.3 Staff Housing Plan Overview

- The accommodation capacity shall be designed to house both single and family units, considering the diverse needs of the workforce.
- Adequate water and electricity in all units shall be provided.
- The housing plan shall ensure easy access to essential services and facilities within the facility.
- Security measures shall be implemented to safeguard the staff colony, including surveillance and controlled entry/exit points.

4.4 Medical Center/First-Aid Station

- The medical center/first-aid station shall be strategically located within the facility for easy access during emergencies.
- It shall be equipped to handle basic medical needs and initial emergency responses.

- Protocols shall be placed to manage emergency situations until professional medical assistance arrives.

4.5 Security Check Posts:

- Security check posts shall be strategically positioned at entry and exit points, perimeter boundaries, and critical access areas within the facility.
- These posts shall serve as checkpoints to monitor and the entry and exit of personnel, vehicles, and materials shall be regulated
- Surveillance cameras shall be installed to monitor activities and record footage for security purposes.

5. The Type, Technology, Model, Technical Details and Design of Facilities

5.1 Principle on Unit Selection:

- The main equipment is EU origin and reliable design with latest technology.
- The main and auxiliary equipment has advanced technology, good quality, high reliability and availability
- The unit has high efficiency. The project is a newly built project. At this stage, one unit of 37.2 MW shall be installed, however, the present operational capacity shall be 34.5 MW.

5.2 Main Equipment and Parameters

Specifications of Extraction Condensing Steam Turbine are as follows:

Power Output	:	37.2MW
Type	:	Extraction Condensing
Stage	:	Multistage, Nozzle Governed
Nom Steam Inlet Pressure	:	104 Bar(g)
Nom Steam Inlet Temper.	:	535 °C

Specifications of Generator are as follows:

Voltage Level	:	11000 V
Frequency	:	50 Hz
Power Factor	:	0.8
Insulation Class	:	F

Specifications of Boiler are as follows:

Type	:	Single Drum Membrane Type
Evaporation Capacity	:	190 TPH
Steam Pressure	:	110 Bar(g)
Steam Temperature	:	543 °C ± 3 °C
Grate	:	Travelling/Step/Vibratory
Fuel	:	Biomass (Agriculture Waste)
Feed Water Temperature	:	196°C
Boiler Efficiency on LCV	:	88%
Flue Gas Temperature	:	145°C

5.3 I & C Design Scope

This design scope includes the thermal control of boiler and its auxiliary system, turbine and its auxiliary system, deaerator& feed water system, circulating water systematic.

5.4 Level of I & C

5.4.1 Control Mode

This term project uses a DCS monitoring system control method to control and regulate the boiler system, turbine system and auxiliary system. According to the arrangement of plant, some system shall set DCS remote I/O stations, such as Circulating water pump system, Fuel oil pump system, etc.

The balance of plant shall adopt PLC control or on-site control mode and the PLC control system shall communicate with plant DCS system.

The unit is monitored and controlled via mouse/keyboard and LCD in the central control room. For safety and reliability, emergency measures are considered against "DCS" failure, that is, some hard-manual operations are reserved (for example, MFT push button, Drum emergency water releasing valve push button, emergency stop turbine push button, AC lube oil pump start/stop push button, DC lube oil pump start/stop push button, etc.).

The DCS network of unit covers:

- Control of Boiler and Its Auxiliary System
- Control of Turbine and Its Auxiliary System
- Control of Auxiliary System (Deaerator & Feed Water System, Etc)

Electrical System

- Circulating Water System (DCS Remote I/O Station)
- Fuel Oil Pump System (DCS Remote I/O Station)

The PLC System shall cover

- Fuel Handing System
- Air Compress System
- Cooling Tower System
- Water Treatment System;

5.5 Arrangement of Central Control Room and Electronic Equipment Room

Based on the arrangement of thermal equipment and auxiliary production equipment in the main building, one Central Control Room (CCR) and one Electrical Equipment Room (EER) shall be adopted for the main building thermal system.

5.5.1. Arrangement of Central Control Room

DCS operator stations, Electrical station, printer console supervising screen, etc. are arranged in the central control room which is on 8.00mfloor.

The DCS station mainly houses LCD (not less than 24 inches) and, mouse/keyboard for the DCS.

Steam drum water level TV, steam drum electrical contact water level gauge, DCS graphic display screen, plant CCTV video display screen, and LED display screen are set on the supervising screen.

5.5.2 Arrangement of Electronic Equipment Room

The DCS cabinets, I &C power supply cabinets, turbine cabinet, Electrical system cabinets, etc. are set in the electronic equipment Room. DCS engineer station and printers are set in the engineer station room.

5.6 I & C Automation Function

A set of DCS shall be provided for Units in the project. Power supplies shall be respectively provided according to Turbine, Boiler, Electrical, and Auxiliary System (deaerator &feed water system, etc.)

The automation function of DCS mainly consists of the following systems:

- Data Acquisition System (DAS)
- Modulating Control System (MCS)
- Sequential Control System (SCS)

The DCS shall be designed to achieve high levels of reliability by dual redundancy and provide self-diagnostics. Any single component failure shall not affect the operation of other parts of the system. The system parameters, alarm, and self-diagnostic function shall be highly displayed on LCD and printed out.

5.7 Distributed Control System (DCS)

The hardware system shall be implemented using field-proven experiential, 0 advanced, reliable digital technology of the microprocessor-based distributed control type.

All control processors and I/O modules in the system shall be of standardized, modular, plug-in construction and shall clearly show the identification of all components and have applicable LCD diagnostic indications.

All modules in the system shall be capable of on-line removal and replacement. Guidance and interlocks shall be provided to prevent the operated modules and other modules from damage and faults during removal or insertion of the modules. Module addresses shall not be position dependent, but modules shall function in any slot of a cabinet.

The number of types and sizes of modules shall be kept to a minimum to reduce the extent and cost of spare parts required. All DCS modules should be anti-corrosive coating.

5.7.1 Processor Modules

Processor functions in the distributed processing units shall be functionally dedicated to enhance the reliability of system. The functional processor modules shall utilize the process information gathered by the I/O processing functions to implement both modulating control and digital control.

If RAM is used it shall be backed up by batteries to support storage. Batteries shall be replaceable without interfering with equipment operation and the loosing of data.

All CPU load shall not exceed 60% load. A processor module shall be able to be removed, modified or restarted without affecting operation of other processor modules.

Upon failure of one processor module, the system shall automatically switch to the redundant processor module in a bump less fashion and alarm the fault at the Operator Station. The redundant processor module shall have parallel access to the system and shall continuously receive all changes (including those in configuration in the controlling processor module) and update itself while in the backup state.

5.7.2 Process Input / Output (I/O)

The I/O processing system shall be as smart as is practical to reduce control system processing load and shall perform functions such as scanning, data setting, digitalization inputs and outputs, linearization, cold junction compensation for thermocouple, process point quality checking and conversion of engineering units, etc. All signals of input and output shall be processed by independent devices.

The detection of Open circuit, break circuit and input signal over the technical system permission for thermocouple, RTD and 4-20mA signal shall be provided. Each function shall be performed during the point is scanned.

A power failure of a processor module shall not cause pulse inputs to lose readings accumulated at the time of the power failure and shall not limit the ability of accumulator for acquisition reading.

The signal processing for the thermocouples, RTDs, transducer inputs in a redundant scheme shall be performed in separate modules. No individual I/O module failure should result in any other equipment failure or trip.

5.7.3 System Cabinet

The system cabinets shall contain all controllers, I/O modules, power supplies, Foreign Device Interfaces, Network Interface Modules, Network Processor Modules etc. System cabinets and termination cabinets shall be capable of accepting cable entry from the bottom. All cabinets shall have front and rear access only.

All components within the cabinets shall be pre-wired to terminal blocks or utilize cable connectors.

Termination facilities for thermocouple extension wire shall include reference junction temperature compensation.

All system cabinets shall be of standard.

5.7.4 Engineering System

The engineering system is a part of the overall plant control system that shall be operated from a workstation based located in the Engineering room.

The engineering system shall be designed as a single engineering system that enables the engineer to access all system configurations with a uniform user graphic interface. The licenser of the hardware supply shall make the software development for the engineering and diagnostic systems.

The engineering system shall enable us to perform all detail engineering for commissioning, modification updating, documentation and on-line self-diagnostic routines.

5.8 Security Monitoring System

Information and security monitoring system includes CCTV, Access Control System, Fire detection and alarm system, supervisory information system (SIS).

5.8.1 CCTV

CCTV shall be installed for the project. The system includes 50 monitoring points (the biomass handling system is excluded). The CCTV subsystem shall be placed in the following areas:

- Turbine House Subsystem
- High Temperature Flame Monitoring Camera
- Central Control Building Subsystem
- BOP Subsystem
- Security Subsystem

All cabinets for these areas shall be placed at the local EER.

5.8.2 Fire Detection and Alarm System

A fire detection and alarm system shall be set for the project. The system shall be designed following the Pakistan fire code, and local-related design specifications shall be taken as a reference. Fire detection and fire alarm zone comprise the main powerhouse zone, BOP zone, and non-plant area. A central control panel shall be provided in CCR, and sub-panels shall be provided in the zone of the turbine house, water treatment plant zone, coal handling zone, and non-plant zone. The central control panel and sub-panel shall be interconnected to form a looped network. The control and alarm console shall be installed in CCR.

5.9 Turbine Digital Electro-Hydraulic Control System (DEH)

A digital electro-hydraulic control system (DEH) shall be supplied by Turbine manufacturer and choose Woodward (505) brand.

5.10 Turbine Emergency Trip System (ETS)

The turbine emergency trip function shall be implemented via PLC and shall be supplied by Turbine manufacturer.

5.11 Field Instrument

All field instruments and control system including process switch, transmitter, gauge for pressure, thermometer, level, flow, temperature and specialties, etc., primary elements for flow, temperature, shall be supplied for normal control, protection, monitoring of the boiler, turbine and generator. All field instruments shall be NEMA4X standards. All process connections with field instruments should be through Stainless Steel tubing and fittings.

5.11.1 Pressure measurement

The transmitter shall be smart type based on HART protocol. Pressure and difference pressure sensing elements shall be non-hysteresis type unless otherwise specified. The transmitter shall be 2-wire type and output signal shall be 4-20mA. All pressure gauges should be provided with isolation valves. The process switches for pressure, temperature, flow shall be of snap acting, single-pole, double-throw type (SPDT), able to switch 15 amps, continuous at 250 V ac or more and 0.5 amp continuous at 110Vdc or more.

5.11.2 Temperature Measurement

The primary element of temperature measurement shall be of the thermocouple, resistance temperature detector (3-wire) or thermometer.

Thermocouples (Type K) and Resistance Thermometer Detectors (RTD) are the most commonly used. All Temperature measurement gauges should be provided with separate thermowells.

5.11.3 Flow Measurement

Flow measurement device shall adopt orifice plate, vortex flow meter, wing air flow measurement device and other types.

All flow transmitters should be provided with 3-way manifold valve block assembly.

5.11.4 Level Measurement

Level measurement device shall adopt differential head type, ultrasonic type, capacitance type, magnetic type, bi-color water indicator type and others type level meter.

5.12 Cable and Cable Tray

- Cable tray shall select hot-dip galvanizing type.
- All power and control cables for 400/220 VAC should be PVC/SWA/PVC, and Armored copper Cables of 1000 Volts.
- Computer cables should be sub shielded and total shielded copper cables of size 1.3 to 1.5mm2. The thermocouple shall select extension cables.
- All instrument Cables should be shielded by twisted pair 99.9%copper cable.

5.13 Configuration of Main Monitoring and Control Equipment

1. This project shall adopt state-of-the-art DCS control system, since it has high cost/ performance ratio, and can fully utilize system functions. Besides, it can also prolong unit service life, save operation and maintenance expense.

Consequently, the producing cost can be reduced, and production managing level and market competitiveness can be improved.

2. Main L & C Equipment

    - Transmitters with internationally recognized brand (smart type) shall be adopted.
    - Critical logic switches of pressure, level, flow and temperature shall adopt internationally recognized brands.
    - Critical analyzers shall adopt internationally recognized brands.
    - High temperature & pressure sampling valve, drain valve shall adopt imported product.

3. Actuator

    Internationally recognized brands shall be adopted for automatic adjusting elements and critical actuators. Intelligent integrated electric actuators shall be selected.

5.14 I & C Laboratory

The laboratory equipment shall be configured according to the requirement of I & C system. Special maintenance and testing equipment shall be supplied together with individual automatic system.

6. Basic Design of Balance of Plant

6.1 Water Treatment System

The water source for this project is well water.

6.1.1 Water Source Quality

Water analysis reports have been provided; the data is as follows:

TESTS	Unit	Pakistan Standards	Results			
			Tubewell # 19-A	Tubewell # 21-A	Tubewell # 22	Tubewell # 23-C
Color	TCU	≤ 15.0	< 15.0	< 10.0	< 10.0	< 15.0
Taste	TEXT	Non objectionable/ acceptable	PASS	PASS	PASS	PASS
Oduor	TEXT	Non objectionable /acceptable	PASS	PASS	PASS	PASS
pH	-	6.5 - 8.5	8.1	8.0	7.9	7.0
Turbidity	NTU	< 5.0	6.3	1.2	2.9	9.0
TOTAL HARDNESS (as CaCO3)	mg/l	< 500.0	230.0	145.0	206.0	250.0
TDS	mg/l	Max. 1000	910.0	812.0	950.0	1080.0

6.1.2 Water Treatment System

System Function

- To provide make-up water with its quality meeting the requirement of unit's safe and good operation.
- To provide high purity water to the places such as laboratories, sampling and any other system where high purity water is used as well.
- To provide high purity water for equipment cleaning, washing, testing and protecting when shut off, etc.

6.2 Description of System

a. System Flow Process

The principal flow diagram of water treatment system is as follows:

Well water → raw water tank → dual media filter → cartridge filter → first stage RO → ROP buffer tank → second stage RO → middle water reservoir tank → EDI device → Demin Water storage tank → using point.

b. System Scope

In this project, water treatment system is comprised of the following: • ROP pre-treatment system

- ROP (first stage ROP +second stage ROP)
- EDI system
- ROP Chemical dosing system
- Output of water treatment system
- Output of system: 30m3/h
- Quality of demineralized water

The quality of water treatment plant outlet water is as follows:

- Conductivity: 0.2ps/cm (25°C)
- Silica dioxide: 20pg/1
- PH: 8.8-9.3

c. Operating and Controlling

The whole water treatment system shall be operated automatically. Reverse osmosis equipment shall be shut down and turned into chemical cleaning step when either of following condition exists:

- Pressure drop of film exceeds the preset value.
- Desalination ratio of film is less than the present value.
- Water output is less than the present value.
- When either of following phenomenon occurs, reverse osmosis device shall be shut down

d. Equipment Location

In this project, the equipment and control & instrument panel shall be located in the new building.

e. Chemical Dosing System for Turbine and Boiler Plant

- To maintain water chemical condition of thermal system and prevent scaling & corrosion.
- To maintain appropriate pH value in feed water to prevent corrosion by injecting ammonia to Demine. Water pump outlet pipeline.
- To remove residual oxygen in feed water by injecting hydrazine to deaerator water tank's downstream.
- To improve pH value in boiler water and prevent residual hardness depositing in boiler by injecting phosphate.

f. System Scope

Chemical dosing system consists of the followings:

- Ammonia injecting in DM water system
- Hydrazine injecting in feed water system
- Phosphate injecting in boiler water system

6.3 Design condition

a. Chemicals:

Hydrazine: liquid with concentration of 40 %(m/m), stored in barrel

Ammonia: liquid with concentration of 30%, stored in steel bottle

Tri-sodium phosphate: crystal with concentration of >951/c)/o

b. System Description

Each unit shall be equipped with one set of chemical dosing equipment which includes one set of ammonia dosing equipment, one set of hydrazine dosing equipment and one set of tri-sodium phosphate dosing equipment.

c. Ammonia Injecting in DM Water System

Liquid ammonia in steel bottle shall vaporize and be rationally injected into the agitating solution tank through transfer pump and measuring tank, then diluted to the concentration of 3%, finally pumped to DM water pump's outlet pipeline. PH value of DM water shall be controlled to be 8.8-9.3 by ammonia injection.

d. Hydrazine Injecting in Feed Water System

Concentrated hydrazine solution stored in barrel shall be rationally injected into the agitating solution tank through transfer pump and measuring tank, then diluted to the concentration of 0.3%, finally pumped into deaerator water tank downstream. Residual oxygen in feed water shall be controlled to be less than the limited value to weaken oxygen corrosion by hydrazine injection.

e. Phosphate Injecting in Boiler Water System

Solid and powder phosphate is dissolved in agitating solution tank and diluted to the concentration of 1%, then pumped into steam drum. Phosphate dosage shall be controlled by controlling P043- content.

f. Operating and Controlling

In this project, ammonia and hydrazine metering pump's dosage can be regulated by frequency. Ammonia solution dosage in DM water shall be adjusted by water flow and PH value of DM water. Hydrazine dosage in feed water shall be regulated by feed water flow. Phosphate dosage shall be controlled by manually.

g. Cooling Water Dosing System

The Cooling Water dosing system includes ant scale dosing system and dosing system. Ant scale dosing system shall be supplied for Cooling Water. In this system, one solution tank and two dosing pumps shall be supplied for cooling water. During the normal operation, one dosing pump operates and one standby. Dosing system shall be supplied for Cooling Water. In this system, one solution tank and two dosing pumps shall be supplied for cooling water. During the normal operation, one use and one standby.

h. Steam & Water Sampling System

Steam & water sampling and analyzing system are located in the main building. Chemical laboratory, analysis instruments and equipment in the project, chemical laboratory rooms shall be designed to perform the following operations:

Water analysis: this is the chemical and physical analysis of water used in the steam power plant cycle process, especially the analysis of characteristics which may destruct and/or decrease the unit performance, such as: conductivity, PH, hardness, alkalinity, silica content, ammonium, oxygen, phosphate, iron, copper, sodium, etc.

i. Biomass Analysis and Sample Preparation

This is the chemical and physical analysis of Biomass used in steam power plants, in order to shop Equipment, know the unit performance, handling characteristics and the constituents which can aggravate unit performance such as: heat value, water content, ash, volatile matter,

j. Lubricating Oil Analysis:

This is the chemical and physical analysis of lubricating oils used in steam power plants, in order to determine the performance of the oils. The analysis shall establish the oil properties and composition including carbon residue, flash point, specific weight, neutrality, viscosity, surface tension, Sulphur content etc.

k Flue Gas Analysis

This is the chemical and physical analysis of the flue gas in order to know the combustion quality and content of undesirable substances in the gas, e.g. dew point, content of O2, CO2, CO, SO2, and NOx.

6.4 Basic Design Of Electrical System

6.4.1 Design Scope of Electric Part

The scope of design includes all the electrical system of generator and auxiliary in the plant. The interface between the power plant and the outgoing lines shall be defined at the outgoing feeder line gantry for connection line and ten feeder lines.

6.4.2 Main Equipment Data

a. Main Data of Generator

- Rated output 5 OMVA
- Number of phases 3

- Rated voltage 11 kV
- Rated power factor 0.8
- Rated frequency 50Hz
- Rated current 2624A
- Direct axis sub transient reactance 11.7% (saturated)
- Short circuit ratio >0.55
- Efficiency >98.2%
- Insulation class (Applied according to temperature rise of insulation: class B)
- Speed 3000r/m
- Excitation system brush-less excitation type
- Cooling system air cooling system

The excitation control equipment shall consist of an automatic voltage regulator (AVR) (with power factor controller). The AVR shall as a minimum, be of the dual auto channel type with manual control device and appropriate auto/manual changeover circuits.

6.4.3 Electric Connections

The generator shall be connected to the 11kV switchgear via non-segregated phase bus bar. The grounding transformer shall be set at the neutral point of the generator. The 11kV bus is single bus. The low voltage bus including bus A, common bus and standby bus is from 3 set LV PDC transformers. The outgoing lines from 11kV bus are ten feeder lines and 1 connection line.

a. Excitation Transformer

The excitation system is brush-less excitation type.

b. Current Transformer

In order to meet the requirements of measurement, protection, energy metering and voltage regulation, the outlet side of generator are 3 groups CT equipped respectively.

c. Generator Circuit Breaker

The Generator Circuit Breaker is installed at 11kV switchgear. The switchgear is metal armoring draw out cabinet.

d. Generator Neutral Point Grounding Equipment

The neutral point of generator is earthed through a distributed transformer whose secondary winding is loaded by a resistance.

6.4.4 Electric Equipment Layouts

a. 11kV and 0.4kV Switchgear

The 11kV distribution equipment is set on 0.00m floor inside plant building. MCC is located on 0.00m floor of the plant building.

b. Generator Output System and Excitation Equipment

The 11kV bus bar is drawn out from output termination of the generator and Exciting transformer, then connect to Generator C.B switchgear through the no segregated phase bus. Exciting transformer, Neutral point equipment cubicle and excitation equipment cubicle are located in generator outlet chamber.

6.4.5 Cabling

Cables shall have copper conductors with extruded insulation/bedding/over sheath and be of the following or equivalent types MV single core and multicore power cables shall have XLPE insulation rated for restricted earth fault current, PVC bedding, galvanized steel or aluminum wire armor, PVC over sheath.

The over sheath of single core power cables shall have a suitable semiconducting coating applied for over sheath testing.

LV single core and multicore power cables shall be 600/1000V rating having either XLPE or PVC insulation, PVC bedding, galvanized steel or aluminum wire armor, PVC over sheath. The over sheath of single core power cables shall have a suitable semi-conducting coating applied for over sheath testing. Earthing cables shall be single core, PVC insulated colored as appropriate. Bare copper may also be used.

Fire resisting cable tested to the highest test temperature shall be used for essential circuits required to remain functional in the event of a fire. This shall include the trip circuits necessary to safely, shut down the plant and isolate it from the Transmission System, fire detection and firefighting equipment and emergency communication and audible alarm circuits.

7. Fuel Consumption

Biomass has emerged as a vital renewable energy source, especially in countries with abundant agricultural residues. Presently boiler is design on Bagasse (sugarcane residue), therefore, this chapter explores bagasse consumption characteristics, the operational efficiency of biomass thermal plants, and the environmental implications of their use. However, discussing bagasse consumption shall ensure the maximum fuel consumption of all the biomasses as it has lowest calorific value. The fuel consumptions of the rest of the fuels shall be studied during boiler detail design.

Bagasse is cellulose, hemicellulose, and lignin, contributing to their energy content.

Bagasse typically contains about 50% moisture and has a calorific value of approximately 1,800 kcal/kg.

Biomass thermal power plants convert organic materials into energy through combustion. The process involves feeding biomass into a furnace, where it is burned to produce steam. This steam drives turbines, generating electricity. Key components affecting fuel consumption include:

- **Furnace Design**: Influences combustion efficiency and heat transfer.
- **Boiler Efficiency:** Determines how effectively fuel is converted into usable energy.
- **Feedstock Handling Systems:** Impact logistics and fuel preparation, affecting overall consumption.

Fuel consumption can be measured in terms of specific fuel consumption (SFC), typically expressed in kg/kWh. Several factors influence SFC:

- **Moisture Content:** Higher moisture leads to increased fuel consumption due to the energy needed to evaporate water.
- **Combustion Technology:** Advanced technologies, such as fluidized bed combustion, enhance efficiency and reduce SFC.

In a typical biomass thermal power plant, bagasse can be utilized interchangeably or in combination. Seasonal variations in availability affect the choice of fuel and can lead to fluctuations in consumption rates. Biomass combustion has a lower carbon footprint compared to fossil fuels, primarily because the CO2 emitted during combustion is offset by the CO2 absorbed during the growth of the plants. However, emissions such as particulate matter, nitrogen oxides, and sulfur dioxide are still concerns. Proper emission control technologies are essential to mitigate these effects and comply with environmental regulations.

The biomass supply chain presents challenges, including:

- **Logistical Issues:** Transporting bulk biomass can be costly and inefficient.
- **Storage and Handling:** Biomass fuels are bulky and require appropriate storage solutions to prevent degradation.

Technological innovations, such as biomass densification and improved combustion systems, can enhance efficiency and lower costs. Policies promoting biomass use, including subsidies and incentives for sustainable practices, can further bolster the industry. Bagasse and rice husk are crucial biomass resources in thermal power generation. Understanding their consumption patterns and optimizing the combustion process can significantly enhance the efficiency and sustainability of biomass thermal power plants. Continued research and investment in technology are essential to overcoming existing challenges and maximizing the potential of biomass energy. For Ittehad power generation case, the consumption is as follows:

7.1 Bagasse Consumption

Hourly Bagasse Consumption	62 tph
Daily Bagasse Consumption	1,479 tpd
Annual Bagasse Consumption	492,845 t

Note:
Daily operation hours are taken as 24 and annual operation hours are taken and annual 8,000 hours.

8. Water Consumption

Water is a critical resource in thermal power plants, playing a vital role in cooling, steam generation, and process operations. This chapter examines water consumption in a 37.2 MW thermal power plant equipped with a 190 tons per hour (TPH) boiler. Understanding the water requirements and management strategies is essential for ensuring operational efficiency and sustainability.

Water Consumption in Thermal Power Plants

In a thermal power plant, water is primarily used for:

- **Steam Generation:** Water is heated in the boiler to produce steam, which drives the turbine.
- **Cooling:** Water removes excess heat from the condensate and other systems, ensuring optimal operational temperatures.
- **Feedwater Treatment:** Water quality is crucial for boiler efficiency; thus, treatment processes require additional water.

Water Consumption Metrics

Water consumption in thermal power plants can be quantified in terms of:

- **Specific Water Consumption (SWC):** This metric, usually expressed in liters per kWh, helps assess water efficiency.
- **Cooling Water Requirements:** Based on the cooling system (once-through, recirculating, or hybrid), the water needs can vary significantly.

Water Balance on Operational Parameters

In a 37.2 MW thermal power plant with a 190 TPH boiler, a typical water balance might look like this:

8.1 Boiler Feedwater:

For a boiler operating at 152 TPH, the required water quantity is calculated based on the steam generation rates. Since the steam turbine generator (STG) is running in fully condensing mode, the condensate return from the STG is 100%, amounting to 152 TPH.

Additionally, 26 TPH of process steam is generated through the pressure-reducing and de-superheating station (PRDS) directly from the boiler's superheater outlet, where the steam is reduced from 110 barg, 525°C to 10 barg saturated steam at a flow rate of 20 TPH.

To achieve this, a cooling water spray line using feedwater at 110 barg, 130°C is added, with a flow of approximately 4 to 6 TPH. The total process steam supplied at 10 barg is therefore around 24 to 26 TPH.

This process steam has a condensate recovery rate of 30%, which means about 21 TPH is required as raw water makeup for the water treatment plant.

8.2 Cooling Water:

Cooling water consumption depends on the cooling method used. In a cooling tower system, water loss occurs due to evaporation, drift, and blowdown, and these factors must be considered.

At 100% operational capacity, the total cooling water requirement for the condenser is 6,843 TPH, while the total water required for the cooling system is 7,425 TPH. Given the cooling tower losses of 3%, approximately 223 TPH of makeup raw water is needed to compensate for these losses.

8.3 Total Water Consumption:

The total water consumption of the plant is determined by combining both the boiler and cooling system requirements, resulting in an overall water usage of approximately 244 TPH.

8.4 Environmental Considerations

Efficient water management is crucial to minimize the environmental impact. Strategies include:

- **Water Recycling:** Utilizing treated wastewater for non-potable applications within the plant.
- **Zero Liquid Discharge Systems:** Implementing technologies that minimize water discharge and promote recycling.

Water consumption is a significant aspect of operating a thermal power plant. For a 37 MW facility with a 190 TPH boiler, understanding the water balance and implementing efficient management practices are essential for sustainability. As water scarcity becomes increasingly relevant, focusing on conservation and innovative water use strategies will ensure the plant operates efficiently while minimizing its environmental footprint.

Groundwater for the plant operations will be extracted from the underlying groundwater aquifer through a network of tube wells. This volume of water will play a crucial role in maintaining the efficiency and functionality of several critical systems within the plant.

The primary use of the extracted water will be to replace the water lost in the cooling tower blowdown, a process essential to regulating the temperature of machinery and maintaining optimal plant performance.

Additionally, the water will be utilized for other key functions, including:

- Demineralized water generation for plant operations, which is vital for high-purity applications and preventing corrosion in equipment.
- Horticultural irrigation, ensuring the upkeep of green spaces and landscaping within the plant premises, contributing to environmental aesthetics and cooling.

Overall, this groundwater will be integral not only to core plant operations but also to supporting auxiliary systems that maintain both the facility's efficiency and the well-being of its staff.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COVER PAGE

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Manage Model

General Assumptions	Here you will add raw materials required for power generation
Fuel Requirement	Here you will manage raw materials required for power generation
110 Bar(G)	Here you can change Power Plant with 110 BAR(G) System & on BAGGASSE Cost
Loan Schedule	Here you see loan repayment schedule

Reports

Executive Summary	Here you see the NPV, IRR, Payback Period and Financial Ratios
Income Statement	Here you see the income and expenditures of the project
Cash Flow Statement	Here you see the cash flows on yearly basis of the project
Depreciation Schedule	Here you see the depreciation of the project after it becomes ready for use

BIO MASS FINANCIAL FEASIBILITY
GENERAL ASSUMPTIONS

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Plant Assumptions

Description	Variables
Plant Capacity MW	37.20
Plant Capacity MW - Current Level	30.00
Power Plant to be operated at (Current Level)	80.65%
Plant Cost	6,000,000,000
No. of Working Days	333
Hours per Day	24
Plant Running Hrs /Annum	8,000
MW to KWH Factor	1,000
Gross Electricity Generation (KWH)	240,000,000
Internal Cons./ Auxiliaries	9.90%
Internal Consumption (KWH)	23,760,000
Steam Extraction (MT/HR)	22
Steam available for supply (MT)	176,000

Income Statement Assumptions

Description	
Electricity rate to ICL (Rs./KWH)	32.00
Inflation	5.00%
Steam Average rate (Rs./M.T)	1,310
Workers Profit Participation	5%
Workers Welfare Fund	2%
Fuel Cost of Power (Rs./KWH) (with Mix)	24.01
Fuel Cost of Power (Rs./KWH) (Only Bagasse)	24.03
Production O/H (Insurance) (On plant value)	0.30%
Admin & General Expenses	50,000,000

Working Capital Requirement

Description	
Fuel Cost Per Hour	569,835
Hr per Day	24
WC requirement-For Inventory Days	45
WC requirement-For Inventory	615,421,800
WC requirement-For Advance Payments Days	40
WC requirement-For Advance Payments	547,041,600

Working Capital Markup%

KIBOR+/- *-1.50%*

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
3M KIBOR	20.21%	18.71%	17.21%	15.71%	14.21%	12.71%	11.21%	9.71%	8.21%	6.71%	5.21%	3.71%
Spread	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%
Markup%	20.96%	19.46%	17.96%	16.46%	14.96%	13.46%	11.96%	10.46%	8.96%	7.46%	5.96%	4.46%
Markup	244 M	226 M	209 M	191 M	174 M	156 M	139 M	122 M	104 M	87 M	69 M	52 M

Other Assumptions

Description	
Exchange Rate	300
Discount Rate	18%
Management Fee% (@ Loan)	1%
Commissioning Period - Years	1.5

ICL Goes Green

Net Present Value & Internal Rate of Return

		Commissioning Period		Operational Period									
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Discount Rate	18%												
Discount Factor	1	0.85	0.72	0.61	0.52	0.44	0.37	0.31	0.27	0.23	0.19	0.16	0.14
Undiscounted Cash Flows	0	(5,907,047,504)	(62,563,882)	903,253,769	1,244,148,879	1,610,696,568	1,997,302,613	2,282,881,417	2,411,622,959	2,546,610,346	2,688,109,682	2,822,744,247	2,981,309,935
Terminal Value	0												24,079,811,016
Total Cash Flows	0	(5,907,047,504)	(62,563,882)	903,253,769	1,244,148,879	1,610,696,568	1,997,302,613	2,282,881,417	2,411,622,959	2,546,610,346	2,688,109,682	2,822,744,247	27,061,120,952
Present Value	0	(5,005,972,461)	(44,932,406)	549,748,130	641,718,151	704,050,314	739,863,881	716,653,625	641,583,744	574,148,763	513,602,243	457,056,038	3,713,314,169
Present Value of Cash Flows	**4,200,834,191**												
Net Present Value (NPV)	**4,200,834,191**												
Internal Rate of Return (IRR)	**28%**												

Payback Period

Undiscounted Cash Flows	0	(5,907,047,504)	(62,563,882)	903,253,769	1,244,148,879	1,610,696,568	1,997,302,613	2,282,881,417	2,411,622,959	2,546,610,346	2,688,109,682	2,822,744,247	2,981,309,935
Cumulative Cash Flows	0	(5,907,047,504)	(5,969,611,386)	(5,066,357,616)	(3,822,208,738)	(2,211,512,170)	(214,209,557)	2,068,671,860	4,480,294,820	7,026,905,165	9,715,014,848	12,537,759,094	15,519,069,030
Payback Period After Commissioning	**4.09 Years**												
Payback Period at Year 0	**5.59 Years**												

Ratios

Gross Profit%	18.42%	19.67%	20.74%	21.66%	22.44%	23.12%	23.70%	24.20%	24.63%	24.99%
Net Profit After Tax%	2.83%	7.64%	12.19%	16.45%	19.17%	19.98%	20.68%	21.30%	21.72%	22.22%
Total Gener. Cost /KWH (With 22TPH steam gener.)(Rs.)	29.74	30.75	31.86	33.06	34.37	35.77	37.28	38.88	40.60	42.42
Total Admin. Cost /KWH (With 22TPH steam gener.)(Rs.)	0.25	0.27	0.28	0.30	0.31	0.33	0.34	0.36	0.38	0.40
Total Fin. Exp Capital Cost /KWH (With 22TPH steam gener.)(Rs.)	4.39	3.24	1.99	0.66	0.00	0.00	0.00	0.00	0.00	0.00
Total Fin. Exp WC /KWH (With 22TPH steam gener.)(Rs.)	0.97	0.88	0.80	0.72	0.64	0.56	0.48	0.40	0.32	0.24
Total Cost Before Tax /KWH (With 22TPH steam gener.)(Rs.)	35.42	35.36	35.29	35.26	35.82	37.23	38.75	40.37	42.16	43.99
Total Cost After Tax/KWH (With 22TPH steam gener.)(Rs.)	35.42	35.36	35.29	35.26	35.82	37.23	38.75	40.37	42.16	43.99

COMMISSIONING PERIOD

BIO MASS FINANCIAL FEASIBILITY
INCOME STATEMENT

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		Commissioning Period		Operational Period									
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
	Income Statement Parameters												
	Operational Level		81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%
	Gross Electricity Generation (KWH)		120,000,000	240,000,000	240,000,000	240,000,000	240,000,000	240,000,000	240,000,000	240,000,000	240,000,000	240,000,000	240,000,000
	Internal Consumption (KWH)		11,880,000	23,760,000	23,760,000	23,760,000	23,760,000	23,760,000	23,760,000	23,760,000	23,760,000	23,760,000	23,760,000
	Electricity available for supply (KWH)		108,120,000	216,240,000	216,240,000	216,240,000	216,240,000	216,240,000	216,240,000	216,240,000	216,240,000	216,240,000	216,240,000
	Steam available for supply (MT)		88,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000
	Revenue												
	Electricity Rate	*32.00*	*33.60*	*35.28*	*37.04*	*38.90*	*40.84*	*42.88*	*45.03*	*47.28*	*49.64*	*52.12*	*54.73*
	Electricity (At LESCO rate)		3,632,832,000	7,628,947,200	8,010,394,560	8,410,914,288	8,831,460,002	9,273,033,003	9,736,684,653	10,223,518,885	10,734,694,830	11,271,429,571	11,835,001,050
	Steam Average rate (Rs./M.T)	*1,310*	*1,376*	*1,444*	*1,516*	*1,592*	*1,672*	*1,756*	*1,843*	*1,935*	*2,032*	*2,134*	*2,241*
	Steam		121,044,000	254,192,400	266,902,020	280,247,121	294,259,477	308,972,451	324,421,073	340,642,127	357,674,233	375,557,945	394,335,842
	Total	**0**	**3,753,876,000**	**7,883,139,600**	**8,277,296,580**	**8,691,161,409**	**9,125,719,479**	**9,582,005,453**	**10,061,105,726**	**10,564,161,012**	**11,092,369,063**	**11,646,987,516**	**12,229,336,892**
	Variable Cost												
Select Fuel Type Bagasse	*Fuel Cost (Rs./KWH)*	*24.03*	*25.23*	*26.49*	*27.82*	*29.21*	*30.67*	*32.20*	*33.81*	*35.50*	*37.28*	*39.14*	*41.10*
	Fuel Cost-Power		2,728,156,418	5,729,128,477	6,015,584,901	6,316,364,146	6,632,182,354	6,963,791,471	7,311,981,045	7,677,580,097	8,061,459,102	8,464,532,057	8,887,758,660
	Total	**0**	**2,728,156,418**	**5,729,128,477**	**6,015,584,901**	**6,316,364,146**	**6,632,182,354**	**6,963,791,471**	**7,311,981,045**	**7,677,580,097**	**8,061,459,102**	**8,464,532,057**	**8,887,758,660**
	Fixed Cost												
	Maintenance & Other Operating Cost		0	0	0	0	0	0	0	0	0	0	0
	Management Fee	48,000,000	0	0	0	0	0	0	0	0	0	0	0
	Production O/H (Insurance)		10,739,021	21,478,042	21,478,042	21,478,042	21,478,042	21,478,042	21,478,042	21,478,042	21,478,042	21,478,042	21,478,042
	Depreciation		357,967,367	680,137,997	612,124,197	550,911,777	495,820,600	446,238,540	401,614,686	361,453,217	325,307,895	292,777,106	263,499,395
	Total	**48,000,000**	**368,706,388**	**701,616,039**	**633,602,239**	**572,389,819**	**517,298,642**	**467,716,582**	**423,092,728**	**382,931,259**	**346,785,937**	**314,255,148**	**284,977,437**
	Total Manufacturing Cost	**48,000,000**	**3,096,862,806**	**6,430,744,516**	**6,649,187,140**	**6,888,753,966**	**7,149,480,995**	**7,431,508,053**	**7,735,073,773**	**8,060,511,356**	**8,408,245,039**	**8,778,787,205**	**9,172,736,097**
	Gross Profit	**(48,000,000)**	**657,013,194**	**1,452,395,084**	**1,628,109,440**	**1,802,407,443**	**1,976,238,484**	**2,150,497,400**	**2,326,031,984**	**2,503,649,656**	**2,684,124,024**	**2,868,200,311**	**3,056,600,795**
	Total Gener. Cost /KWH (With 22TPH steam gener.)(Rs.)		28.64	29.24	30.75	[illegible]	31.06	34.37	[illegible]	[illegible]	[illegible]	40.82	42.42
	Operating Expenses												
	Selling & Distribution Expenses		0	0	0	0	0	0	0	0	0	0	0
	Admin & General Expenses		26,250,000	55,125,000	57,881,250	60,775,313	63,814,078	67,004,782	70,355,021	73,872,772	77,566,411	81,444,731	85,516,968
	Total	0	26,250,000	55,125,000	57,881,250	60,775,313	63,814,078	67,004,782	70,355,021	73,872,772	77,566,411	81,444,731	85,516,968
	Operating Profit	**(48,000,000)**	**630,763,194**	**1,397,270,084**	**1,570,228,190**	**1,741,632,131**	**1,912,424,406**	**2,083,492,618**	**2,255,676,932**	**2,429,776,884**	**2,606,557,613**	**2,786,755,580**	**2,971,083,827**
	Other Expenses												
	Workers Profit Participation @5%		0	11,982,587	33,943,323	56,916,476	80,638,132	98,638,178	107,948,887	117,355,377	126,895,907	135,873,638	145,961,898
	Workers Welfare Fund @2%		0	4,553,383	12,898,463	21,628,261	30,642,490	37,482,508	41,020,577	44,595,043	48,220,445	51,631,982	55,465,521
	Financial Expenses on Capital cost		565,364,791	948,839,914	700,020,246	429,398,078	143,194,197	-28,301,568	-24,894,477	-21,487,386	-18,080,295		
	Financial Expense on Working Capital		113,107,689	208,778,427	191,341,476	173,904,525	156,467,574	139,030,623	121,593,672	104,156,721	86,719,770	69,282,819	51,845,868
	Total	0	678,472,480	1,174,154,311	938,203,508	681,847,340	410,942,393	246,849,741	245,668,659	244,619,756	243,755,826	256,788,439	253,273,287
	Net Profit Before Tax	**(48,000,000)**	**(47,709,285)**	**223,115,773**	**632,024,681**	**1,059,784,790**	**1,501,482,014**	**1,836,642,877**	**2,010,008,274**	**2,185,157,128**	**2,362,801,787**	**2,529,967,141**	**2,717,810,540**
Select Tax Type	*PBT Margin*		-1%	3%	8%	12%	16%	19%	20%	21%	21%	22%	22%
Tax Exempt	**Income Tax**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Net Profit After Tax	**(48,000,000)**	**(47,709,285)**	**223,115,773**	**632,024,681**	**1,059,784,790**	**1,501,482,014**	**1,836,642,877**	**2,010,008,274**	**2,185,157,128**	**2,362,801,787**	**2,529,967,141**	**2,717,810,540**
	PAT Margin		-1%	3%	8%	12%	16%	19%	20%	21%	21%	22%	22%
	Total Admin. Cost /KWH (With 22TPH steam gener.)(Rs.)		0.24	0.25	0.27	0.28	0.30	0.31	0.33	0.34	0.36	0.38	0.40
	Total Fin. Exp Capital Cost /KWH (With 22TPH steam gener.)(Rs.)		5.23	4.39	3.24	1.99	0.66	0.00	0.00	0.00	0.00	0.00	0.00
	Total Fin. Exp WC /KWH (With 22TPH steam gener.)(Rs.)		1.05	0.97	0.88	0.80	0.72	0.64	0.56	0.48	0.40	0.32	0.24
	Total Cost Before Tax /KWH (With 22TPH steam gener.)(Rs.)		35.16	35.42	35.36	35.29	35.26	35.82	37.23	38.75	40.37	42.16	43.99
	Total Cost After Tax/KWH (With 22TPH steam gener.)(Rs.)		35.16	35.42	35.36	35.29	35.26	35.82	37.23	38.75	40.37	42.16	43.99

BIO MASS FINANCIAL FEASIBILITY
CASH FLOW STATEMENT

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ICL Goes Green

	Commissioning Period		Operational Period									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Cash Flow From Operations Activities												
Net Profit Before Tax	(48,000,000)	(47,709,285)	223,115,773	632,024,681	1,059,784,790	1,501,482,014	1,836,642,877	2,010,008,274	2,185,157,128	2,362,801,787	2,529,967,141	2,717,810,540
Add: Depreciation	0	357,967,367	680,137,997	612,124,197	550,911,777	495,820,600	446,238,540	401,614,686	361,453,217	325,307,895	292,777,106	263,499,395
Tax Paid	0	0	0	0	0	0	0	0	0	0	0	0
Net Cash Flow From Operations Activities	**(48,000,000)**	**310,258,081**	**903,253,769**	**1,244,148,879**	**1,610,696,568**	**1,997,302,613**	**2,282,881,417**	**2,411,622,959**	**2,546,610,346**	**2,688,109,682**	**2,822,744,247**	**2,981,309,935**
Cash Flow From Investing Activities												
Additions to capital work in progress	(5,859,047,504)	(372,821,963)										
Long term deposits & investments												
Net Cash OutFlow From Investing Activities	**(5,859,047,504)**	**(372,821,963)**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Cash Flow From Financing Activities												
Long term borrowings - Proceeds	4,588,000,000	212,000,000										
Long term borrowings - Payments		(250,000,000)	(900,000,000)	(1,200,000,000)	(1,600,000,000)	(2,004,617,254)		0	0	0		
Equity Injected	1,271,047,504	160,821,963										
Net Cash Flow From Financing Activities	**5,859,047,504**	**122,821,963**	**(900,000,000)**	**(1,200,000,000)**	**(1,600,000,000)**	**(2,004,617,254)**	**0**	**0**	**0**	**0**	**0**	**0**
Net increase/(decrease) in cash and cash equivalents	**(48,000,000)**	**60,258,081**	**3,253,769**	**44,148,879**	**10,696,568**	**(7,314,640)**	**2,282,881,417**	**2,411,622,959**	**2,546,610,346**	**2,688,109,682**	**2,822,744,247**	**2,981,309,935**
Cash and cash equivalents at the beginning of the period	**0**	**(48,000,000)**	**12,258,081**	**15,511,851**	**59,660,729**	**70,357,297**	**63,042,657**	**2,345,924,074**	**4,757,547,033**	**7,304,157,379**	**9,992,267,061**	**12,815,011,307**
Cash and cash equivalents at the end of the period	**(48,000,000)**	**12,258,081**	**15,511,851**	**59,660,729**	**70,357,297**	**63,042,657**	**2,345,924,074**	**4,757,547,033**	**7,304,157,379**	**9,992,267,061**	**12,815,011,307**	**15,796,321,243**

BIO MASS FINANCIAL FEASIBILITY
LOAN SCHEDULE

Assumptions

Project Financing Mix	Unit	Amount
Total Project Investment	PKR	6,000,000,000
Equity	%age	20%
Financing	%age	80%
Loan Amount - Withdrawal	PKR	4,800,000,000
Equity Amount	PKR	1,200,000,000

Loan Assumptions	Unit	Amount
Grace Period	Years	1.5
No. of Repayments (max 34)	Quarterly	20
Loan period	Years	6.5

Loan Summary	Unit	Amount
Total Interest - Capitalisation	PKR	927,477,867
Loan Amount - Withdrawal	PKR	4,800,000,000
Total Loan Amount - Finaced thru Consortium	PKR	5,727,477,867

Equity Summary	Unit	Amount
Total Interest - Paid in Grace Period	PKR	231,869,467
Equity Injected	PKR	1,200,000,000
Total Equity Required	PKR	1,431,869,467

Total Project Cost	Unit	Amount	%age
Total Loan Amount	PKR	5,727,477,867	80%
Total Equity	PKR	1,431,869,467	20%
Total Project Cost	PKR	7,159,347,334	100%

Expected Outflow

Months	Year	Amount
Month - 1	Year 1	218,000,000
Month - 2	Year 1	285,000,000
Month - 3	Year 1	367,000,000
Month - 4	Year 1	750,000,000
Month - 5	Year 1	400,000,000
Month - 6	Year 1	800,000,000
Month - 7	Year 1	870,000,000
Month - 8	Year 1	400,000,000
Month - 9	Year 1	380,000,000
Month - 10	Year 1	400,000,000
Month - 11	Year 1	490,000,000
Month - 12	Year 1	375,000,000
Month - 1	Year 2	250,000,000
Month - 2	Year 2	15,000,000
Month - 3	Year 2	-
Month - 4	Year 2	-
Month - 5	Year 2	-
Month - 6	Year 2	-
Total		6,000,000,000

Loan Markup%

Year	3M KIBOR	Spread	Markup%
Year 1	20.21%	1.25%	21.46%
Year 2	18.71%	1.25%	19.96%
Year 3	17.21%	1.25%	18.46%
Year 4	15.71%	1.25%	16.96%
Year 5	14.21%	1.25%	15.46%
Year 6	12.71%	1.25%	13.96%
Year 7	11.21%	1.25%	12.46%
Year 8	9.71%	1.25%	10.96%
Year 9	8.21%	1.25%	9.46%
Year 10	6.71%	1.25%	7.96%

Loan Schedule

Loan Withdraw @Start of the period	Year	Quarterly	Opening Balance	Mark up	Mark up Capitalisation	Principal Repayment	Closing Balance		
696,000,000	1	Qtr 1	696,000,000	37,340,400	29,872,320		725,872,320		
1,560,000,000	1	Qtr 2	2,285,872,320	122,637,050	98,109,640		2,383,981,960		
1,320,000,000	1	Qtr 3	3,703,981,960	198,718,632	158,974,906		3,862,956,866		
1,012,000,000	1	Qtr 4	4,874,956,866	261,541,436	209,233,149		5,084,190,014		
212,000,000	2	Qtr 1	5,296,190,014	264,279,882	211,423,905		5,507,613,920		
0	2	Qtr 2	5,507,613,920	274,829,935	219,863,948		5,727,477,867		
	2	Qtr 3	5,727,477,867	285,801,146		125,000,000	5,602,477,867	250,000,000	125,000,000
	2	Qtr 4	5,602,477,867	279,563,646		125,000,000	5,477,477,867		
	3	Qtr 1	5,477,477,867	252,785,604		225,000,000	5,252,477,867	900,000,000	225,000,000
	3	Qtr 2	5,252,477,867	242,401,854		225,000,000	5,027,477,867		
	3	Qtr 3	5,027,477,867	232,018,104		225,000,000	4,802,477,867		
	3	Qtr 4	4,802,477,867	221,634,354		225,000,000	4,577,477,867		
	4	Qtr 1	4,577,477,867	194,085,062		300,000,000	4,277,477,867	1,200,000,000	300,000,000
	4	Qtr 2	4,277,477,867	181,365,062		300,000,000	3,977,477,867		
	4	Qtr 3	3,977,477,867	168,645,062		300,000,000	3,677,477,867		
	4	Qtr 4	3,677,477,867	155,925,062		300,000,000	3,377,477,867		
	5	Qtr 1	3,377,477,867	130,539,520		400,000,000	2,977,477,867	1,600,000,000	400,000,000
	5	Qtr 2	2,977,477,867	115,079,520		400,000,000	2,577,477,867		
	5	Qtr 3	2,577,477,867	99,619,520		400,000,000	2,177,477,867		
	5	Qtr 4	2,177,477,867	84,159,520		400,000,000	1,777,477,867		
	6	Qtr 1	1,777,477,867	62,033,978		501,154,313	1,276,323,554	2,004,617,254	501,154,313
	6	Qtr 2	1,276,323,554	44,543,692		501,154,313	775,169,241		
	6	Qtr 3	775,169,241	27,053,406		501,154,313	274,014,927		
	6	Qtr 4	274,014,927	9,563,121		501,154,313	-227,139,386		
	7	Qtr 1	-227,139,386	-7,075,392		0	-227,139,386		
	7	Qtr 2	-227,139,386	-7,075,392		0	-227,139,386		
	7	Qtr 3	-227,139,386	-7,075,397		0	-227,139,386		
	7	Qtr 4	-227,139,386	-7,075,392		0	-227,139,386		
	8	Qtr 1	-227,139,386	-6,223,619		0	-227,139,386		
	8	Qtr 2	-227,139,386	-6,223,619		0	-227,139,386		
	8	Qtr 3	-227,139,386	-6,223,619		0	-227,139,386		
	8	Qtr 4	-227,139,386	-6,223,619		0	-227,139,386		
	9	Qtr 1	-227,139,386	-5,371,846		0	-227,139,386		
	9	Qtr 2	-227,139,386	-5,371,846		0	-227,139,386		
	9	Qtr 3	-227,139,386	-5,371,846		0	-227,139,386		
	9	Qtr 4	-227,139,386	-5,371,846		0	-227,139,386		
	10	Qtr 1	-227,139,386	-4,520,074		0	-227,139,386		
	10	Qtr 2	-227,139,386	-4,520,074		0	-227,139,386		
	10	Qtr 3	-227,139,386	-4,520,074		0	-227,139,386		
	10	Qtr 4	-277,139,386	-4,520,074		0	-227,139,386		
END									
4,800,000,000				*3,853,400,836*	*927,477,867*	*5,954,617,254*			
						-3950000000			
						2,004,617,254			

BIO MASS FINANCIAL FEASIBILITY

PROJECT COST

ICL Goes Green

Assumptions

Description	Local Currency	Foreign Currency	Total
Land	-	-	-
Civil Works	500,000,000	-	500,000,000
Consultancy and Engineering	195,900,000	-	195,900,000
Plant & Machinery	2,000,000,000	2,384,000,000	4,384,000,000
Transportation	40,000,000	30,000,000	70,000,000
Erection & Installation	250,000,000	-	250,000,000
Furniture/Fixtures & Vehicles	-	-	-
Interest during Construction	-	-	-
Pre Operating & Startup Expense	246,000,000	-	246,000,000
Provision of Escalation (5%)	61,595,000	120,700,000	182,295,000
Contigencies (3%)	98,805,000	73,000,000	171,805,000
	3,392,300,000	2,607,700,000	6,000,000,000

BIO MASS FINANCIAL FEASIBILITY
DEPRECIATION SCHEDULE

Back to Menu

ICL Goes Green

Assumptions

Description	Unit	Amount
Total Project Investment	PKR	6,000,000,000
Equity		1,200,000,000
Loan		4,800,000,000
Mark up Capitalise - Financed		927,477,867
Mark up Capitalise - Equity		231,869,467
Book Value	PKR	7,159,347,334
Depreciation Method		WDV
Depreciation Rate	%age	10%

Depreciation Schedule

Year	Opening Balance	Depreciation Expense	Closing Balance
1	7,159,347,334	715,934,733	6,443,412,601
2	6,443,412,601	644,341,260	5,799,071,341
3	5,799,071,341	579,907,134	5,219,164,207
4	5,219,164,207	521,916,421	4,697,247,786
5	4,697,247,786	469,724,779	4,227,523,007
6	4,227,523,007	422,752,301	3,804,770,707
7	3,804,770,707	380,477,071	3,424,293,636
8	3,424,293,636	342,429,364	3,081,864,272
9	3,081,864,272	308,186,427	2,773,677,845
10	2,773,677,845	277,367,785	2,496,310,061
11	2,496,310,061	249,631,006	2,246,679,055
12	2,246,679,055	224,667,905	2,022,011,149
13	2,022,011,149	202,201,115	1,819,810,034
14	1,819,810,034	181,981,003	1,637,829,031
15	1,637,829,031	163,782,903	1,474,046,128
		5,685,301,207	

BIO MASS FINANCIAL FEASIBILITY
FUEL REQUIREMENT

ICL Goes Green

Assumptions

Description	Unit	Factor/Amount
Steam per MW @ 22TPH extraction		4.50
Power Generation Gross	MW	30.00
Steam Flowrate	TPH	135.00
Heat at 110 bars @ 543 C hg	kcal/kg	828.09
Heat per hour	kCal	111,792,150
Parasitic load	%age	10%
load available	%age	90%
kCal feed water @190 celcius	celcius	193
Feed Water	kCal	26,044,335

Fuel Cost per KWH

Description	Unit	Bagasse	Rice Husk	Mustard Straw	Corn Cob
LHV	kcal/kg	1,861	3,051	3,720	3,426
Boiler Efficiency	%age	85.00%	87.00%	89.00%	88.00%
Cons per hour	TPH	54	32	26	28
Cons Per day	TPD	1,301	775	622	683
Cons Per Month	TPM	39,029	23,259	18,648	20,478
Fuel cost /Maund	PKR	420	750	700	800
Fuel cost /ton	PKR	10,500	18,750	17,500	20,000
Fuel cost per hour	PKR	569,177	605,707	453,240	568,831
Fuel cost/ton of steam	PKR	4,216	4,487	3,357	4,214
Fuel cost/kwh	PKR	21.08	22.43	16.79	21.07
Mix		*50%*	*30%*	*10%*	*10%*
Avg Fuel Cost (with Mix)		21.06			
Avg Fuel Cost (only Bagasse)		21.08			
Maint. Cost, Operating & Water Make up Cost		2.95			
Fuel Cost of Power (Rs./KWH) (with Mix) (incl. Maint. Cost, O		**24.01**			
Fuel Cost of Power (Rs./KWH) (Only Bagasse) (incl. Maint. Co		**24.03**			
Fuel Cost of Power (per Hr) (with Mix)		**568,508**			
Fuel Cost of Power (per Hr) (Only Bagasse)		**569,177**			

BIO MASS FINANCIAL FEASIBILITY
POWER PLANT WITH 110 BAR(G) SYSTEM & ON BAGGASSE

ICL Goes Green

Assumptions

Description	Unit	Factor/Amount
Power Plant Capacity (Gross) BP STG	kw	30,000
Working Hours	hours	8,000
Total Project Investment	Rs.	6,000,000,000
Operating And Maintenance Cost	Rs./Year	600,000,000
Bagasse Rate	Rs./tons	10,500
Make Up Water Rate	Rs./tons	200
Steam Required By STG	TPH	135
Steam Available For Process Steam	TPH	22

Fuel Calculation

Description	Unit	Amount
Fuel Consumption Per Hour	TPH	54
Fuel Cost Per Hour	Rs./Hr	569,835
Total Steam Generated	TPH/Annum	1,080,000
Total Fuel Consumption	TPH/Annum	434,160
Total Fuel Cost	Rs./Year	4,558,680,000
Steam Rate (Direct fuel method)-W/O STEAM EXTRACTION	Rs./tons	4,221

Results Per Annum Electricity Unit Cost

Description	Unit	Amount
Total Power Generation In a Year-Gross	KWH/Year	240,000,000
Auxiliaries- Power Used for Power Plant @9.9%	KWH/Year	23,760,000
Net Power Available for Process	KWH/Year	216,240,000
Fuel Cost Per Annum	Rs./Year	4,558,680,000
Make Up Water Cost (25% Of Demand)	Rs./ Year	38,016,000
Operating And Maintenanve Cost	Rs./Year	600,000,000
Total Plant Running Cost	Rs./Year	5,196,696,000
Per Unit Cost Per Annum	Rs./ KWh	24

E-STAMP

ID : PB-SKP-C08B70D786823BF8
Type : Low Denomination
Amount : Rs 100/-

Scan for online verification

سہیل احمد اشٹام فروش
PB-SKP-1345

1038

Description : CERTIFICATE OR OTHER DOCUMENT - 19
Applicant : ITTHAD CHIMCL LTD [35202-0891555-9]
Representative From : MUBASHAR RASHEED
Agent : Self
Address : SKP
Issue Date : 2-Oct-2024 10:15:43 AM
Delisted On/Validity : 9-Oct-2024
Amount in Words : One Hundred Rupees Only
Reason : IN FAVOUR OF NEPRA
Vendor Information : Sohail Ahad | PB-SKP-1345 | Main Bazar

نوٹ: یہ ٹرانزیکشن تاریخ اجرا سے سات دنوں تک کے لیے قابل استعمال ہے۔ای اسٹامپ کی تصدیق بذریعہ ویب سائٹ،کیوآر کوڈ یا ایس ایم ایس سے کی جا سکتی ہے۔
Type "eStamp <16 digit eStamp Number>" send to 8100

UNDERTAKING

I, Azhar Abbas S/O Ghulam Abbas undertake sworn as follows:

"That no application has previously been made for any sort of grant of License under the act".

DEPONENT

Name: Azhar Abbas

Head of Administration & IR, (ICL Power (Pvt.) Limited, 20-K.M, G.T. Road, Kala Shah Kaku

Address: Araianwali Hussain Abad Ward # 4, Jhang

C.N.I.C #: 34101-4203622-1

DEPONENT

E-STAMP

PB-SKP-1345

ID :	PB-SKP-5F8ED81A5481C3D7
Type :	Low Denomination
Amount :	Rs 100/-

Scan for online verification

1039

Description :	CERTIFICATE OR OTHER DOCUMENT - 19
Applicant :	ITTHAD CHIMCL LTD [35202-0891555-9]
Representative From :	MUBASHAR RASHEED
Agent :	Self
Address :	SKP
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Type "eStamp <16 digit eStamp Number>" send to 8100

MUHAMMAD RIAZ READER
Oath Commissioner
Notification No:18
Dated ... 2022
to 25-11-2024
DISTT. SHEIKHUPURA

UNDERTAKING

I, Azhar Abbas S/O Ghulam Abbas undertake sworn as follows:

"That as per best of my knowledge & belief, the contents mentioned in the application are correct, authentic & nothing has been concealed thereof".

DEPONENT

Name: Azhar Abbas

Head of Administration & IR, (ICL Power (Pvt.) Limited, 20-K.M, G.T. Road, Kala Shah Kaku

Address: Araianwali Hussain Abad Ward # 4, Jhang

C.N.I.C #: 34101-4203622-1

DEPONENT

MY COAL (PVT) LTD.

NTN. No. 9841418-8

Date: 03-04-2024

Memorandum of Understanding (MOU)

Parties:

1. Ittihad Chemical
2. My Coal Pvt Limited

Subject: Agreement for the Buying and Supplying of Biomass

Terms and Conditions:

My Coal Pvt Limited agrees to supply the following quantities on a monthly basis

- 2500 Metric Tons of Rice Husk
- 2500 Metric Tons of Corn Cob

Payment Terms:

1. For biomass supply with cash invoice, a different price will be applicable, and payment is to be made in cash immediately after delivery.
2. If invoices are required, payment terms for biomass will be weekly.

Special Notes:

3. Biomass prices will be settled on a weekly basis.

This Memorandum of Understanding signifies the agreement between Ittihad Chemical and My Coal Pvt Limited and will be effective upon both parties' signatures.

Signed on this day:________________

For Ittihad Chemical:________________

For My Coal Pvt Limited:______________

MY COAL PVT LIMITED ★

Address: 148-C, Mudassar Manzil. Faisal Town Lahore Pakistan.
PTCL +92 42 35177735 / Mob: +92 300 5210349
Email: info@mycoal.pk / www.mycoal.pk

Nadeem Asim Enterprises

Deals in Raw Materials & Chemicals of Cement, Chemical, Textile & Sugar Industries

Ref:__________ Dated:__________

Memorandum of Understanding (MOU)

Parties:

1- ICL Power (Pvt.) Ltd. (Party 1 - Buyer)
2- Nadeem Asim Enterprises (Party 2 - Seller)

Subject : MOU for The Buying & Supplying of Biomass Fuels.

Nadeem Asim Enterprises agrees to supply following Biomass Fuels as per following details:

Sr.#	Fuel	Monthly Projected Quantity (MT)
1	Bagasse	4,000
2	Rice Husk	3,000
3	Mustard / Sesame Straw	2,000
4	Corn Cob	1,500
5	Parali	5,000

Terms & Conditions

1- Prices will be set on Quarterly basis.
2- Payment against delivery.
3- The dates for payment will be determined and agreed upon by both parties.
4- Payment credit will be 05 days.

This Memorandum of Understanding signifies the said agreement between both above parties and will be effective once both parties authorized representatives affixed signatures.

Signed on this day -----------------

For ICL Power (Pvt.) Ltd. -----------------

Nadeem Asim Enterprises -----------------

Postal Address: 84-C Street 9 Block D Agrics Town Phase II Raiwind Road Lahore
Ph:04235464274, Cell: 0300-9196321 Email: Muhammad.nadeemasim@yahoo.com

Memorandum of Understanding (MOU)

Parties:

1. ICL Power (Pvt) Ltd (Party 1 Buyer)
2. Industrial Biomass Private Limited (Party 2-Seller)

Subject: <u>Agreement for the Buying and Supplying of Biomass Fuels</u>

Industrial Biomass Limited agrees to supply following Biomass Fuels as per following details:

Sr.#	Fuel	Annual Projected Quantity (MT)
1	Bagasse	107,000
2	Rice Husk	38,000
3	Mustard / Sesame Straw	10,000
4	Com Cob	11,000
5	Parali	35,000

Terms & Conditions

1. Prices will be set on quarterly basis.
2. Cash Payment against Delivery.
3. Prices of supply on credit terms will be different from cash.
4. Payment credit will be 05 days.

This Memorandum of Understanding signifies the said agreement between both above parties and will be effective once both parties authorized representative's affixed signatures.

Signed on this day <u>27-08-2024</u>

ICL Poser (PVT) Ltd ______________________________

Industrial Biomass Private Limited ______________________________

Memorandum of Understanding (MOU)

Parties:

1. ICL Power (Pvt) Ltd (Party 1 Buyer)
2. Grow More (SMC-PVT) Ltd (Party 2-Seller)

Subject: MOU for the Buying and Supplying of Biomass Fuels

Grow More (SMC-PVT) Ltd agrees to supply following Biomass Fuels as per following details:

Sr.#	Fuel	Monthly Projected Quantity (MT)
1	Rice Husk	5,000
2	Com Cob	5,000

Terms & Conditions

1. Prices will be set on quarterly basis.
2. Payment after delivery.
3. The dates for payments will be determined and agreed upon by both parties.

This Memorandum of Understanding signifies the said agreement between both above parties and will be effective once both parties authorized representatives affixed signatures.

Signed on this day ____________________

ICL Power (Pvt) Ltd ____________________

Grow More (SMC-PVT)Ltd ____________________

GROW MORE (SMC-PRIVATE) LIMITED

Memorandum of Understanding (MOU)

Parties:

1 ICL Power (Pvt) Ltd (Party 1 Buyer)
2 Global Trading (Party 2-Seller)

Subject: MOU for the Buying and Supplying of Biomass Fuels

Global Trading agrees to supply following Biomass Fuels as per following details

Sr.#	Fuel	Monthly Projected Quantity (MT)
1	Rice Husk	5,500
2	Com Cob	4,500

Terms & Conditions

1. Prices will be set on quarterly basis.
2. Payment after delivery.
3. The dates for payments will be determined and agreed upon by both parties.

This Memorandum of Understanding signifies the said agreement between both above parties and will be effective once both parties authorized representatives affixed signatures.

Signed on this day ______________________

ICL Power (Pvt) Ltd ______________________

Global Trading ______________________

GLOBAL TRADING * PROPRIETOR *

The Type, Technology, Model, Technical Details and Design of Facilities

Principle on Unit Selection:

- The main equipment shall be of high pressure/temperature and proven design.
- The main and auxiliary equipment has advanced technology, good quality, high reliability and availability
- The unit has high efficiency. The project is a newly built project. At this stage, one unit of 37.2 MW shall be installed, however, the present operational capacity shall be 34.5 MW.

Main Equipment and Parameters

Specifications of Extraction Condensing Steam Turbine are as follows:

Power Output	:	37.2MW
Type	:	Extraction Condensing
Stage	:	Multistage, Nozzle Governed
Nom Steam Inlet Pressure	:	104 Bar(g)
Nom Steam Inlet Temper.	:	535 °C

Specifications of Generator are as follows:

Voltage Level	:	11000 V
Frequency	:	50 Hz
Power Factor	:	0.8
Insulation Class	:	F

Specifications of Boiler are as follows:

Type	:	Single Drum Membrane Type
Evaporation Capacity	:	190 TPH
Steam Pressure	:	110 Bar (g)
Steam Temperature	:	543 °C ± 3 °C
Grate	:	Travelling/Step/Vibratory
Fuel	:	Biomass (Agriculture Waste)
Feed Water Temperature	:	196°C
Boiler Efficiency on LCV	:	88%
Flue Gas Temperature	:	145°C

Proposed Plant Projected Specifications

The broad parameters of the project are:

Installed Capacity	:	37,200 kW
Turbine Capacity	:	37.2 MW Extraction/Condensing
Boiler Type	:	Single Drum Membrane Type Travelling/Step/Vibratory Grate Biomass Fired (to be decided yet) Boiler
Boiler Installed Capacity	:	190 TPH, 110 Bar(g), 543 °C
Fuel	:	Biomass (Locally Available)
Construction Period	:	18 Months
Project Operational Capacity	:	34,500 kW
Total Net Power Generation	:	30,000 kW
Boiler Operational Capacity	:	152 TPH (132 TPH + 20TPH)
For 34,500 kW Generation	:	132 TPH
For Process Steam (via PRDS)	:	20 TPH
Total Process Steam (after PRDS)	:	24~26 TPH

Major Systems of The Proposed Plant

The major systems of the proposed plant include biomass handling and processing system;

- Fuel preparation system
- Fuel handling and conveying system

Fuel feeding system

- Single Drum Membrane Type Steam Generator
- Extraction-Condensing Steam Turbine
- Electrical Power Generator
- Flue Gas Treatment System
- Cooling Water System
- Ash Handling System
- Utilities and Waste Management System
- Boiler Feed Water Treatment System
- Fire Fighting System

2.7.3 Technology Description of the Proposed Power Plant

ICL Power (Pvt.) Ltd. (IPL) is interested in technology that is the latest and proven. The 11.0

MPa, 543 °C system is identified with assumptions of **37.2MW** gross output, **30tph** net extraction, as offering a significantly superior return on investment. This configuration strikes a balance between substantial fuel savings and a modest increase in capital investment.

Specifications of Extraction Condensing Steam Turbine are as follows:

Gross Power Output	:	37.2MW
Type	:	Extraction Condensing
Stage	:	Multistage, Nozzle Governed
Nominal Steam Inlet Pressure	:	104 Bar(g)
Nominal Steam Inlet Temperature	:	535 °C

Specifications of Generator are as follows:

Voltage Level	:	11000 V
Frequency	:	50 Hz
Power Factor	:	0.8
Insulation Class	:	F

Specifications of Boiler are as follows:

The biomass-fired boiler is a top-supported natural circulating boiler with a single drum and consisting of a rigid water-cooled frame for supporting the heating surfaces and steam drum. The boiler is provided with a membrane wall construction which is water-cooled and fully gastight. Due to the welded construction, its water-cooled frame, and low wall thickness of the steam drum the boiler can react very fast to load changes and can be started relatively fast compared to other types of boilers.

The boiler has following key parameters

Type	:	Single Drum Membrane Type
Evaporation Capacity	:	190 TPH
Steam Pressure	:	110 Bar(g)
Steam Temperature	:	543 °C ± 3 °C
Grate	:	Travelling/Step/Vibratory Grate
Draft	:	Balanced
Furnace Type	:	Membrane type water-cooled
Fuel	:	Biomass (Agriculture Waste)
Feed Water Temperature	:	196°C
Boiler Efficiency on LCV	:	88%
Flue Gas Temperature	:	145°C

PRELIMINARY PROJECT SCHEDULE

DWG:

rev.

Compiled: Date:

	MILESTONES / MONTHS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	**CONTRACT COMING INTO FORCE**																				
2	**DESIGN MEETING (2-3 DAYS - LAYOUT APPROVAL BASIC**																				
3	**ENGINEERING**																				
4	**DETAIL ENGINEERING**																				
	EQUIPMENT DESIGN (Datasheets and construction drawings)																				
	PRELIMINARY FOUNDATION DRAWINGS AND STRUCTURES ONE-LINE DIAGRAMS																				
	FINAL FOUNDATION DRAWINGS																				
	PIPING ENGINEERING AND RELEVANT MATERIAL TAKE-OFF																				
	INSTRUMENTS ENGINEERING AND RELEVANT MATERIAL TAKE-OFF																				
	ELECTRICAL ENGINEERING AND RELEVANT MATERIAL TAKE-OFF																				
5	**PROCUREMENT / CONSTRUCTION OF:**																				
	EQUIPMENT																				
	MACHINERY																				
	FIELD INSTRUMENTATION																				
	POWER DISTRIBUTION PANEL																				
	PIPING AND VALVES																				
	THERMAL INSULATION MATERIALS																				
	ELECTRIC AND INSTRUMENTS CABLES WITH ACCESSORIES																				
6	**MATERIALS DELIVERY**																				
	INSPECTIONS / DELIVERIES																				
	TRANSPORT TO SITE																				
7	**CIVIL ENGINEERING AND WORKS**																				
8	**ERECTION WORKS**																				
9	**MECHANICAL COMPLETION**																				
10	**PRE-COMMISSIONING**																				
11	**COMMISSIONING**																				
12	**PLANT START-UP**																				

Capacity of the Plant at Reference Conditions

The Project has the following design ratings at reference site conditions based on the LHV of the biomass:

Parameter	Units	Value
Plant Efficiency (Based on Net Capacity)	%	23.13
Plant Efficiency (Based on Gross Capacity)	%	26.60
Power Capacity Factor (Based on Used Capacity)	%	80.65
Power Capacity Factor (Based on Installed Capacity)	%	92.74

Description of the Plant

Proposed Plant Projected Specifications

The broad parameters of the project are:

Installed Capacity	:	37,200 kW
Turbine Capacity	:	37.2 MW Extraction/Condensing
Boiler Type	:	Single Drum Membrane Type Travelling/Step/Vibratory Grate Biomass Fired (to be decided yet) Boiler
Boiler Installed Capacity	:	190 TPH, 110 Bar(g), 543 °C
Fuel	:	Biomass (Locally Available)
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For 34,500 kW Generation	:	132 TPH
For Process Steam (via PRDS)	:	20 TPH
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Fuel feeding system

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- Extraction-Condensing Steam Turbine
- Electrical Power Generator
- Flue Gas Treatment System
- Cooling Water System
- Ash Handling System
- Utilities and Waste Management System
- Boiler Feed Water Treatment System
- Fire Fighting System

Specifications of Extraction Condensing Steam Turbine are as follows:

Gross Power Output	:	37.2MW
Type	:	Extraction Condensing
Stage	:	Multistage, Nozzle Governed
Nominal Steam Inlet Pressure	:	104 Bar(g)
Nominal Steam Inlet Temperature	:	535 °C

Specifications of Generator are as follows:

Voltage Level	:	11000 V
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Power Factor	:	0.8
Insulation Class	:	F

Specifications of Boiler are as follows:

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The boiler has following key parameters

Type	:	Single Drum Membrane Type
Evaporation Capacity	:	190 TPH
Steam Pressure	:	110 Bar(g)
Steam Temperature	:	543 °C ± 3 °C
Grate	:	Travelling/Step/Vibratory Grate
Draft	:	Balanced
Furnace Type	:	Membrane type water-cooled
Fuel	:	Biomass (Agriculture Waste)
Feed Water Temperature	:	196°C
Boiler Efficiency on LCV	:	88%
Flue Gas Temperature	:	145°C

Plant Operational Hours

The plant operates 24 hours a day, ensuring continuous production throughout the year. With round-the-clock operations, the plant functions for approximately 8,000 hours annually. This consistent schedule allows for efficient resource utilization, maximizes productivity, and supports the plant's commitment to meeting high production demands. The operation's reliability and extended hours are essential in maintaining the plant's output and ensuring that it can meet its yearly goals effectively.

Fuel Supply

Biomass (Agricultural Waste) is selected as fuel for this project. Biomass emerges as a promising, cost-effective, and sustainable alternative with the potential to address both energies needs and environmental concerns. A possibility of burning local coal up to 20% in the boiler shall be studied during the detail design.

Selected Types of Biomass Fuel

The following types of biomasses are selected for power generation that are readily available in Pakistan.

1- Bagasse	2- Rice Husk	3- Rice Straw
4- Corn Cob (Red)	5- Corn Cob (White)	6- Corn Stalks
7- Brassica	8- Mustard Straw	9- Wood Chips
10- Cotton Stalks	11- Wheat Straw	12- Sugarcane Trash
13- Maize Husk		

I & C Design Scope

This design scope includes the thermal control of boiler and its auxiliary system, turbine and its auxiliary system, deaerator& feed water system, circulating water systematic.

Level of I & C

Control Mode

This term project uses a DCS monitoring system control method to control and regulate the boiler system, turbine system and auxiliary system. According to the arrangement of plant, some system shall set DCS remote I/O stations, such as Circulating water pump system, Fuel oil pump system, etc.

The balance of plant shall adopt PLC control or on-site control mode and the PLC control system shall communicate with plant DCS system.

The unit is monitored and controlled via mouse/keyboard and LCD in the central control room. For safety and reliability, emergency measures are considered against "DCS" failure, that is, some hard-manual operations are reserved (for example, MFT push button, Drum emergency water releasing valve push button, emergency stop turbine push button, AC lube oil pump start/stop push button, DC lube oil pump start/stop push button, etc.).

The DCS network of unit covers:

- Control of Boiler and Its Auxiliary System
- Control of Turbine and Its Auxiliary System
- Control of Auxiliary System (Deaerator & Feed Water System, Etc)

Electrical System

- Circulating Water System (DCS Remote I/O Station)
- Fuel Oil Pump System (DCS Remote I/O Station)

The PLC System shall cover

- Fuel Handing System
- Air Compress System
- Cooling Tower System
- Water Treatment System;

Arrangement of Central Control Room and Electronic Equipment Room

Based on the arrangement of thermal equipment and auxiliary production equipment in the main building, one Central Control Room (CCR) and one Electrical Equipment Room (EER) shall be adopted for the main building thermal system.

Arrangement of Central Control Room

DCS operator stations, Electrical station, printer console supervising screen, etc. are arranged in the central control room which is on 8.00mfloor.

The DCS station mainly houses LCD (not less than 24 inches) and, mouse/keyboard for the DCS.

Steam drum water level TV, steam drum electrical contact water level gauge, DCS graphic display screen, plant CCTV video display screen, and LED display screen are set on the supervising screen.

Arrangement of Electronic Equipment Room

The DCS cabinets, I &C power supply cabinets, turbine cabinet, Electrical system cabinets, etc. are set in the electronic equipment Room. DCS engineer station and printers are set in the engineer station room.

I & C Automation Function

A set of DCS shall be provided for Units in the project. Power supplies shall be respectively provided according to Turbine, Boiler, Electrical, and Auxiliary System (deaerator &feed water system, etc.)

The automation function of DCS mainly consists of the following systems:

- Data Acquisition System (DAS)
- Modulating Control System (MCS)
- Sequential Control System (SCS)

The DCS shall be designed to achieve high levels of reliability by dual redundancy and provide self-diagnostics. Any single component failure shall not affect the operation of other parts of the system. The system parameters, alarm, and self-diagnostic function shall be highly displayed on LCD and printed out.

Distributed Control System (DCS)

The hardware system shall be implemented using field-proven experiential, 0 advanced, reliable digital technology of the microprocessor-based distributed control type.

All control processors and I/O modules in the system shall be of standardized, modular, plug-in construction and shall clearly show the identification of all components and have applicable LCD diagnostic indications.

All modules in the system shall be capable of on-line removal and replacement. Guidance and interlocks shall be provided to prevent the operated modules and other modules from damage and faults during removal or insertion of the modules. Module addresses shall not be position

Dependent, but modules shall function in any slot of a cabinet.

The number of types and sizes of modules shall be kept to a minimum to reduce the extent and cost of spare parts required. All DCS modules should be anti-corrosive coating.

Processor Modules

Processor functions in the distributed processing units shall be functionally dedicated to enhance the reliability of system. The functional processor modules shall utilize the process information gathered by the I/O processing functions to implement both modulating control and digital control.

If RAM is used it shall be backed up by batteries to support storage. Batteries shall be replaceable without interfering with equipment operation and the loosing of data.

All CPU load shall not exceed 60% load. A processor module shall be able to be removed, modified or restarted without affecting operation of other processor modules.

Upon failure of one processor module, the system shall automatically switch to the redundant processor module in a bump less fashion and alarm the fault at the Operator Station. The redundant processor module shall have parallel access to the system and shall continuously receive all changes (including those in configuration in the controlling processor module) and update itself while in the backup state.

Time required to synchronized to Grid is 30 to 180 Seconds

Main Equipment Data

Main Data of Generator

- Rated output 50 MVA
- Number of phases 3

Rated voltage 11 kV

- Rated power factor 0.8
- Rated frequency 50Hz
- Rated current 2624A
- Direct axis sub transient reactance 11.7% (saturated)
- Short circuit ratio >0.55
- Efficiency >98.2%
- Insulation class (Applied according to temperature rise of insulation: class B)
- Speed 3000r/m
- Excitation system brush-less excitation type
- Cooling system air cooling system

The excitation control equipment shall consist of an automatic voltage regulator (AVR) (with power factor controller). The AVR shall as a minimum, be of the dual auto channel type with manual control device and appropriate auto/manual changeover circuits.

Electric Connections

The generator shall be connected to the 11kV switchgear via non-segregated phase bus bar. The grounding transformer shall be set at the neutral point of the generator. The 11kV bus is single bus. The low voltage bus including bus A, common bus and standby bus is from 3 set LV PDC transformers. The outgoing lines from 11kV bus are ten feeder lines and 1 connection line.

a. Excitation Transformer

The excitation system is brush-less excitation type.

b. Current Transformer

In order to meet the requirements of measurement, protection, energy metering and voltage regulation, the outlet side of generator are 3 groups CT equipped respectively.

c. Generator Circuit Breaker

The Generator Circuit Breaker is installed at 11kV switchgear. The switchgear is metal armoring draw out cabinet.

d. Generator Neutral Point Grounding Equipment

The neutral point of generator is earthed through a distributed transformer whose secondary winding is loaded by a resistance

Electric Equipment Layouts

a. 11kV and 0.4kV Switchgear

The 11kV distribution equipment is set on 0.00m floor inside plant building. MCC is located on 0.00m floor of the plant building.

b. Generator Output System and Excitation Equipment

The 11kV bus bar is drawn out from output termination of the generator and Exciting transformer, then connect to Generator C.B switchgear through the no segregated phase bus. Exciting transformer, Neutral point equipment cubicle and excitation equipment cubicle are located in generator outlet chamber.

Cabling

Cables shall have copper conductors with extruded insulation/bedding/over sheath and be of the following or equivalent types MV single core and multicore power cables shall have XLPE insulation rated for restricted earth fault current, PVC bedding, galvanized steel or aluminum wire armor, PVC over sheath.

The over sheath of single core power cables shall have a suitable semiconducting coating applied for over sheath testing.

LV single core and multicore power cables shall be 600/1000V rating having either XLPE or PVC insulation, PVC bedding, galvanized steel or aluminum wire armor, PVC over sheath. The over sheath of single core power cables shall have a suitable semi-conducting coating applied for over sheath testing. Earthing cables shall be single core, PVC insulated colored as appropriate. Bare copper may also be used.

Fire resisting cable tested to the highest test temperature shall be used for essential circuits required to remain functional in the event of a fire. This shall include the trip circuits necessary to safely, shut down the plant and isolate it from the Transmission System, fire detection and firefighting equipment and emergency communication and audible alarm circuits.