Ghotki Power (Pvt.) Limited

GPL/NEPRA/GM/24/05/2017 May 24, 2017

The Registrar,
National Electric Power Regulatory Authority (NEPRA)
Attaturk Avenue (East),
G-5/2, Islamabad.

Subject: **Application for Generation License for a 45 MW Bagasse Based High Pressure Cogeneration Project by Ghotki Power (Private) Limited ("GPL")**

Dear Sir,

I, Munir Ahmad Daha, General Manager being the duly authorized representative of GPL by virtue of board resolution dated 24-05-2017, hereby apply to the National Electric Power Regulatory Authority for the grant of a Generation License, pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 in the name of:

GHOTKI POWER (PRIVATE) LIMITED
Incorporated under the Companies Ordinance, 1984
Corporate Universal Identification No. 0104246, dated 15-12-2016
For its Bagasse Based High Pressure Cogeneration Facility located at
Goth Islamabad, Tehsil and District Ghotki, Sindh.
(Installed Capacity: 45MW Gross ISO)

I certify that the documents-in-support attached with this application are prepared and submitted in conformity with the provisions of the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, and undertake to abide by the terms and provisions of the above-said regulations. I further undertake and confirm that the information provided in the documents-in-support is true and correct to the best of my knowledge and belief.

A bank draft no. 2747500 in sum of Rs. 300,336/-(Rupees Three lac three hundred and thirty-six only), being the nonrefundable license application fee calculated in accordance with the Schedule II to the National Electric Power Regulatory Authority (License and Modification Procedure) Regulations, 1999, is also attached herewith.

Yours truly,
for **Ghotki Power (Private) Limited**

(MUNIR AHMAD DAHA)
General Manager

Registered Office: 17-Abid Majeed Road, Lahore Cantt., Lahore. PABX # 042-36664891-95, 36602573-74, 36677020 Fax: 042-36654490
Email:info@ghotkipower.com

Ghotki Power (Pvt.) Limited

EXTRACT OF RESOLUTIONS PASSED IN BOARD OF DIRECTORS' MEETING OF GHOTKI POWER (PRIVATE) LIMITED HELD ON MAY 24, 2017 AT 11:30 A.M. AT 17-ABID MAJEED ROAD, LAHORE CANTT.

AUTHORIZATION OF MR. MUNIR AHMED DAHA TO FILE APPLICTION WITH NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ("NEPRA") FOR GENERATION LICENSE:

"RESOLVED THAT Mr. Munir Ahmad Daha, General Manager (the "**Authorized Officer**") having CNIC No. 35202-6489539-3, be and is hereby authorized and empowered on behalf of Ghotki Power (Pvt.) Limited (the **"Company"**) to deal with National Electric Power Regulatory Authority **(the "NEPRA")**, connected with obtaining approval for Generation License of 45 MW Bagasse / Biomass Based Co-Generation Power Plant at JDW Sugar Mills Limited (Unit-III), Near Goth Islamabad, District Ghotki and to sign all required Agreements/Applications and other documents for this purpose and to do and take all necessary actions, things as deemed necessary to give effect to this resolution".

Certified True Copy

GHOTKI POWER (PVT) LIMITED GPL

(Maqsood Ahmad)
Chief Executive

AO24436

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, LAHORE

CERTIFICATE OF INCORPORATION

[Under section 16(5) of the Companies Ordinance, 2016 (XLVII of 2016)]

Corporate Universal Identification No. 0104386

I hereby certify that GHOTKI POWER (PRIVATE) LIMITED is this day incorporated under the Companies Ordinance, 2016 (XLVII of 2016) and that the company is Limited by Shares.

Given under my hand at Lahore this Fifteenth day of December, Two Thousand and Sixteen.

Fee Rs.11,000/-

(SAEED ISRAR)
Deputy Registrar of Companies

No.AOL/12252 DATED 15-12-2016

Annexure - 6

THE COMPANIES ORDINANCE, 2016

(COMPANY LIMITED BY SHARES)

MEMORANDUM OF ASSOCIATION

OF

GHOTKI POWER (PRIVATE) LIMITED

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

2. The registered office of the Company will be situated in the province of 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 thermal power plants, coal fired power plants, hydal power plants, solar power plants, cogeneration 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 shall engage in all the lawful businesses and shall be authorized to take all necessary steps and actions in connection therewith and ancillary thereto.

   (iii) Notwithstanding anything contained in the foregoing sub-clauses of this clause nothing contained herein shall be construed as empowering the Company to undertake or indulge, directly or indirectly in the business of a Banking Company, Non-banking Finance Company (Mutual Fund, Leasing, Investment Company, Investment Advisor, Real Estate Investment Trust management company, Housing Finance Company, Venture Capital Company, Discounting Services, Microfinance or Microcredit business), Insurance Business, *Modaraba* management company,

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

Name and surname (present & former) in full (in Block Letters)	CNIC 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
JDW SUGAR MILLS LIMITED (THROUGH ITS COMPANY SECRETARY, MR. MUHAMMAD RAFIQUE)	0021835	-	PAKISTANI	LISTED COMPANY	17-ABID MAJEED ROAD, LAHORE CANTT. , LAHORE	98	
MAQSOOD AHMAD (NOMINEE OF JDW SUGAR MILLS LIMITED)	34501-1986185-3	REHMAT ALI	PAKISTANI	BUSINESS	68-B, PASSCO HOUSING SOCIETY, CANAL ROAD, LAHORE	01	
RAHEAL MASUD (NOMINEE OF JDW SUGAR MILLS LIMITED)	35201-1465645-1	SHEIKH MUHAMMAD MASUD	PAKISTANI	BUSINESS	135/1-L, DHA, LAHORE CANTT., LAHORE	01	
		Total number of shares taken (in figures and words)				**100 (One Hundred)**	

Company Registration Office Lahore

CERTIFIED TO BE TRUE COPY

Dated the 14th day of December, 2016.

Witness to above signatures:

Name: National Institutional Facilitation Technologies (Pvt.) Limited

Address: 5th Floor, AWT Plaza, I.I. Chundrigar Road, Karachi

THE COMPANIES ORDINANCE, 2016

(Private Company Limited by Shares)

ARTICLES OF ASSOCIATION

OF

GHOTKI POWER (PRIVATE) LIMITED

1. The Regulations contained in Table 'A' to the First Schedule to the Companies Ordinance, 2016 (the "Ordinance") shall be the regulations of **Ghotki 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, Clause (1) sub-clause (49) of the Ordinance and accordingly:

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

   II. 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

   III. 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 Section 154 of the Ordinance. 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. MAQSOOD AHMAD
   2. MR. RAHEAL MASUD

Annexure - 7

PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE, MANAGING AGENT, SECRETARY, CHIEF ACCOUNTANT, AUDITORS AND LEGAL ADVISERS, OR OF ANY CHANGE THEREIN

THE COMPANIES ORDINANCE, 2016 **FORM 29**

[SECTION 197]

1. Incorporation Number
2. Name of Company: GHOTKI POWER (PVT.) LIMITED
3. Fee Paid (Rs.): 300.0 Name and Branch of Bank: LAHORE, UBL - Lahore Cantt. [496]
4. Receipt No: E-2016-528753 14/12/2016
5. Mode of Payment (Indicate): Bank Challan
6. **Particulars*:**

6.1. New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)
MAQSOOD AHMAD (NOMINEE OF JDW SUGAR MILLS LIMITED)	3450119861853	S/O REHMAT ALI	68-B, PASSCO HOUSING SOCIETY, CANAL ROAD, LAHORE Punjab Pakistan 54000	Director	Pakistan	BUSINESS	Since Incorporation	
RAHEAL MASUD (NOMINEE OF JDW SUGAR MILLS LIMITED)	3520114656451	S/O SHEIKH MUHAMMAD MASUD	135/1-L, DHA, LAHORE CANTT., LAHORE Punjab Pakistan 54810	Director	Pakistan	BUSINESS	Since Incorporation	

6.2. Ceasing of Officer/Retirement/Resignation

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

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

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

Name of Signatory	MAQSOOD AHMAD (NOMINEE OF JDW SL	Designation	Director
Signature of Chief Executive/Secretary		Date (DD/MM/YYYY)	14/12/2016

PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE, MANAGING AGENT, SECRETARY, CHIEF ACCOUNTANT, AUDITORS AND LEGAL ADVISERS, OR OF ANY CHANGE THEREIN

THE COMPANIES ORDINANCE, 1984

[SECTION 205] **FORM 29**

1 Incorporation Number	0104246
2 Name of Company	GHOTKI POWER (PVT) LIMITED
3 Fee Paid (Rs)	300 0
4 Receipt No	E-2016-533904 27/12/2016
5 Mode of Payment (Indicate)	Bank Challan

Company Registration Office Lahore — Securities and Exchange Commission of Pakistan

6. Particulars*:

6 1 New Appointment/Election

Present Name in Full (a)	NIC No or Passport No in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation*** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)
MAQSOOD AHMAD	3450119861853	REHMAT ALI	68 B PASSCO HOUSING SOCIETY, CANAL ROAD LAHORE	Chief Executive	Pakistan	BUSINESS	22/12/2016	Appointed
RIAZ AHMAD SAQIB GOHAR AND COMPANY CHARTERED ACCOUNTANTS			BUILDING NO 35 - D / E, ALI BLOCK, NEW GARDEN TOWN, LAHORE	Auditor	Pakistan		22/12/2016	Appointed

6 2 Ceasing of Officer/Retirement/Resignation

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

6 3 Any other change in particulars relating to columns (a) to (g) above

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

DEPUTY REGISTRAR OF COMPANIES LAHORE

Name of Signatory	MAQSOOD AHMAD (NOMINEE OF JDWSA) Designation Director
Signature of Chief Executive/Secretary	Date (DD/MM/YYYY) 27/12/2016

Annexure - 8

Company Profile

Project Company

The generation facility is being developed by Ghotki Power (Pvt.) Limited ("GPL"), a private limited company incorporated under the Companies Ordinance, 1984 for the purpose of setting up, owning and operating the planned 45 MW bagasse based high pressure co-generation power project as an independent power producer (IPP).

Project Sponsors

The sponsor of GPL and the project is JDW Sugar Mills Limited ("JDW"). JDW is one of the progressive sugar groups in Pakistan. JDW owns and operates four sugar mills which account for 12%-15% of Pakistan's total sugar production and constitutes one of the largest group in the sugar sector. JDW manages one of the largest corporate farming operations in Pakistan spanning sugarcane farming of over 20,000 acres of land.

JDW has extensive and first-hand power sector experience. JDW pioneered the high-pressure cogeneration in the sugar industry by developing, constructing, commissioning and operating approximately 2 x 26.5 MW (53 MW total) bagasse-based power projects at JDW Unit-II and Unit-III. The projects were the first to materialize under NEPRA's upfront bagasse tariff regime. The first power plant at JDW Unit-II was commissioned in June 2014 whereas the second at JDW Unit-III was commissioned in October 2014. Both projects are selling electricity to the Central Power Purchasing Agency ("CPPA") under thirty-year Energy Purchase Agreements.

The management of JDW has hands-on experience in power project development (e.g. design, financing, licensing, tariff development, grid studies, and security documents) as well as project tendering, construction, installation and operation. JDW is uniquely positioned to leverage their experience towards the successful commissioning and operation of the proposed 45 MW bagasse based high pressure cogeneration project.

Financial Capacity of the Sponsor

The latest financial statements of JDW Sugar Mills Limited are attached with the application showing the financial capacity of the sponsor for setting up of the proposed 45 MW High Pressure Cogeneration Plant. Summary of financials for previous years of operations are as below:

Highlights	2013	2014	2015
Key Operating Results	PKR Million	PKR Million	PKR Million
Gross Sales	28,516	32,327	34,982
Net Sales	27,183	30,534	32,663
Profit before Taxation	1,310	978	1,211
(Taxation)	(386)	1	306
Profit after Taxation	924	979	1,517
Basic EPS-(Amount in PKR/ Share)	15.47	16.39	25.38
Balance Sheet	PKR Million	PKR Million	PKR Million
Non-Current Assets	14,721	22,289	23,440
Current Assets	9,040	11,387	11,518
Total Assets	23,761	33,677	34,959
Non-Current Liabilities	6,370	11,447	9,775
Current Liabilities	11,542	16,249	18,167
Shareholders' Equity/ Net Worth	5,488	5,981	7,016

Key Personnel

Maqsood Ahmad Malhi

Mr. Maqsood Ahmad Malhi is the Chief Executive Officer of Ghotki Power (Pvt) Limited. He is also working in the capacity of General Manager, Corporate & Legal Affairs of JDW Group for the last 9 years. By profession he is a Lawyer and also holds MBA and LLM degrees. He has started work in private sector since 1996 and previously was associated with Ernest & Young Ford Rhodes Sidat Hyder & Co., Chartered Accountants, which is a top tier professional consultancy firm.

Rana Nasim Ahmed

Mr. Rana Nasim Ahmed has served as the Chief Operating Officer / Resident Director of JDW Sugar Mills Limited since 2001. He is responsible for operations spanning corporate farming, sugarcane milling and power generation. He has helped transform JDW over the period into one of the largest and most efficient sugar sector enterprises in Pakistan.

Mr. Ahmed has directly overseen JDW's diversification into the power sector over the last several years by successfully developing first of their kind 2 x 26.5 MW (53 MW total) high-pressure cogeneration IPPs at JDW Unit-II and Unit-III. Set up at a total cost of approximately US$ 60 million, these pioneering projects are the only ones in recent times to have been set up through direct procurement and supervision without an EPC contractor. Both plants are fully operational since 2014. Besides managing various aspects related to the projects' conceptualization, development, regulatory affairs, tendering, construction and commissioning, Mr. Ahmed now also supervises their operations & maintenance.

Mr. Ahmed holds an MBA from Saint Louis University, USA and MA and BA degrees in Economics from the University of Punjab, Pakistan.

Muhammad Rafique

Mr. Muhammad Rafique is a Chartered Accountant by profession. He is the Group Finance Director for JDW. He completed his graduation in Commerce from Hailey College of Commerce, Punjab University, Lahore in 1982. He completed his articles from A.F. Ferguson and Company, Chartered Accountants, Lahore and remained associated with this firm till his qualification as CA in 1988. He worked in Audit, Tax and Management & Consultancy departments of A.F. Ferguson & Co. He has worked in private sector since his qualification in 1988 out of which most of his association is with JDW Group. He established expertise in arranging financing / funding for establishment of new projects.

Muhammad Abid

Designated as the Plant Manager, Mr. Muhammad Abid has 20 years of energy sector experience in Plant Operations, Maintenance, Performance Monitoring and security contracts like PPA, IA, PSA and PWPA Management. He has been worked in AES Corporation USA for Lalpir Power Project, Marubani Power Asset Management for TAPCO Abu Dhabi a 2000MW Power and 160MIGD Water project on different key positions. He has Graduation in Mechanical and Masters in Coal Technology along with Master in Business Administration.

Shafqat Mustafa

He is working in the capacity of Manage Operations & Performance. Mr. Mustafa is a Marine Engineer with 20 years of experience in different power generation projects and looking after the operations of the plant. He has 5 shift engineers having a rich experience of plant operations and troubleshooting and a team of 30 trained operators under his supervision.

Ghulam Rasool

He is looking after all the matters related to Mechanical Maintenance. Mr. Rasool has 20 years of experience in the field of Power Generation. He is a Mechanical Engineer. He has a team of 6 experienced energy sector professionals under his supervision

Bilal Yaqoob

Designated as Manager Electrical and Instrumentation Mr. Yaqoob is looking after the Electrical and Instrumentation maintenance of plant. He Graduated in Electrical Power Technology and has 15 years of experience in Power Generation field. He has worked for IPPs in Pakistan and UAE. He leads a team of 10 experienced and professional E&I engineers.

Saqib Bashir

He is designated as the Chief Chemist. Mr. Bashir Graduated in Chemical Technology and has 15 years experience in industrial water treatment. He is responsible of Water testing and quality assurance as per standards. A Team of 8 experienced Water Chemistry Professionals are working under his supervision.

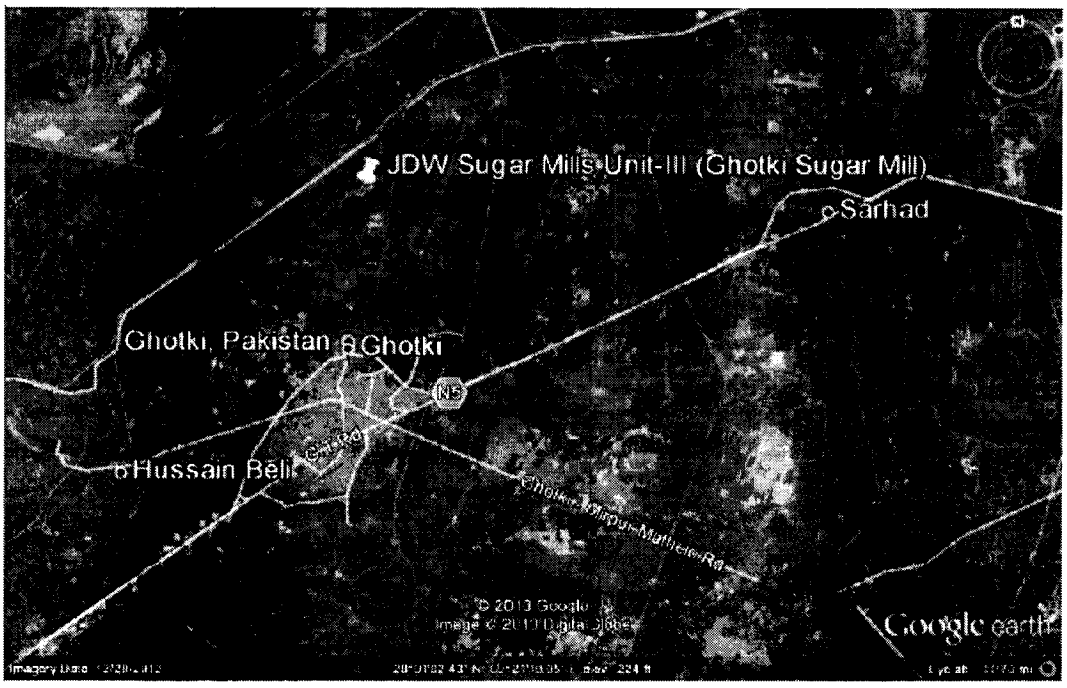
PROJECT TECHNICAL, FINANCIAL & OTHER INFORMATION

1) Location and Land Details

Ghotki Power (Private) Limited ("GPL") is setting up a 45 MW bagasse based high pressure co-generation project. The project shall be located on an area of approximately 16 acres. The project site is located adjacent to JDW Sugar Mills Unit-III near Goth Islamabad, Tehsil and District Ghotki, Sindh. The indicative coordinates of the project site are given below.

North	East
28°2'50.67"	69°19'17.21"

The selected project site has various advantages. It is located adjacent to JDW Unit-III which is the main source of bagasse supply to the power plant. The existing power plant at JDW Unit-III is looped in-out in one of the existing 132kV triple circuit between Ghotki to Liberty at JDW Unit-III. The distance of the plant from the looping point is about 3.6km. The conductor used is 132 kV Lynx. Same interconnection scheme will be used for the new 45 MW power plant. The land comprises level soil with no water table or salinity issues, which shall facilitate construction. Google image of the project location is given below.



2) Technology & Plant Details

a) Proposed Scheme

It is proposed to install a 45.0 MW capacity bagasse based high pressure co-generation power plant. The Cogeneration scheme for GPL proposes 1x220 TPH capacity boiler of 110 bar and 540 degrees centigrade parameters and 1x45 MW extraction cum condensing turbo generators. The plant will use Bagasse as fuel made available from the adjacent JDW Unit-III.

b) Bagasse Fired Boiler

The Boiler shall be single drum, natural circulation, radiant furnace with water cooled membrane wall, three stage super-heater with two stage attemperator, balanced draft and travelling grate bagasse fired boiler. The boiler is capable of a peak generation of 110% of the MCR for a period of half an hour in eight-hour shift. The boiler shall be top supported, outdoor type, with adequate provisions for the thermal expansion of the boilers in all directions.

Design Parameters:

- Bagasse Fired Boiler: 220 TPH
- Steam pressure at the Main Steam stop valve outlet: 110 bar(a)
- Steam temperature at the Main steam stop valve outlet at MCR: 540 ± 5 0C
- Boiler feed water temperature at the inlet to the Deaerator: 110 0C.
- Maximum noise level at 1.0 m distance for the boiler: 85 dB(A)

The Bagasse through drum feeders, screw feeders and pneumatic spreaders will be fed into the furnace. The travelling grate is selected for efficient combustion system and to avoid heating of grates. The Ash is collected by the continuous movement of travelling grate.

The control philosophy, boilers interlock and protection logic shall be implemented in Distributed Control System (DCS) for safe operation of boiler.

c) Steam Turbine

The turbine of the cogeneration power plant will be multistage nozzle governed, horizontal spindle, two bearings, and extraction cum condensing type with 02 number of uncontrolled extractions and 01 number of control extractions. The exhaust from the turbine will be condensed in the surface condenser at 0.101 bar (a) pressure during off-season operation.

The Medium pressure steam at 4 Bar(a) and low pressure steam at 2.5 bar (a), will be supplied to the sugar plant. 98% condensate of the supplied Low Pressure steam will be returned from the sugar mill.

d) AC Generator

AC Generator shall comprise of the following:

- Brush-less exciter with PMG
- Air coolers
- Twin bearings
- AVR cum Excitation panel
- Anti-condensation heaters
- Water leakage detector- 1 per cooler
- Lube oil flow regulator - 1 per bearing

Generator electrical output rating shall be as follow:

- [56.25] MVA rated capacity at [50]◦ C ambient.
- [11] ± [10]% KV
- [50] ± [5]% Hz
- 3 Phase
- Power factor ([0.8] lag to [0.95] lead)
- ± [0.5]% Accuracy Control for Excitation system

e) Bagasse Handling System

The bagasse handling system comprising of chain conveyors & belt conveyors to transport the required quantity of bagasse from sugar mill to cogeneration shall be provided. Bagasse from the sugar mill shall be fed to the boiler from a front mounted chain conveyor. Excess bagasse shall be returned to the bagasse storage yard. During off-season/non availability of bagasse from mill, the cogeneration boiler shall use saved bagasse from the storage yard.

f) Ash Handling system

The ash handling system envisaged for the cogeneration boiler shall consist of Submerged Ash Belt Conveyor System and Dense Phase Ash Handling System.

Submerged Ash Belt Handling System:

Submerged Ash Belt Handling System consists of conveyor belts, drive assembly, all type of pulleys, all type of idlers, bearing assembly, inlet / outlet chutes, take-up assembly, trough assembly, support frames, cross over, walkway, structural safety switches, water inlet / outlet / drain nozzles etc. The bottom ash at the discharge of travelling grate shall be conveyed by submerged ash conveyor system.

Dense Phase Ash Handling System:

This system will handle fly ash from boiler ash hopper (other than traveling grate & plenum ash hopper) and ESP hoppers. Surge hopper (water cooled for boiler ash hopper and non-water cooled for ESP hopper) arrangement shall be provided below the boiler and ESP hopper. Two air compressors with built in PLC control system and 1x100% air receiver shall be provided near the dense phase equipment. The required conveying air for dense phase ash system will be supplied by these compressors through air receivers. The ash silo storage capacity shall be enough to store 12 hours' ash generation from both the boiler and ESP system

g) Electrical Network:

The Plant shall consist of one generator and associated auxiliaries for smooth plant operation. A synchronous alternator for the proposed co-generation power plant with generation at 11 kV will be connected to 132kV system through 11kV switchboard and step-up Power Transformers.

The connection between generator and 11kV switchboard shall be through 11kV phase segregated Bus Duct and between 11kV switchboard and 11/132kV power transformer shall be through 11kV HT XLPE cables.

The surplus power, after meeting the power requirement of cogeneration plant auxiliaries and sugar plant auxiliaries, shall be exported to the grid through 11/132kV power transformer. There shall be total of 2 numbers of step-up power transformers (one working + one standby) to meet N-1 condition of NTDC.

Entire power evacuation system and associated equipment shall be designed so as to export the entire power from cogeneration plant (total generation less auxiliary power consumption), when the sugar plant is not in operation.

h) Basic Electrical Design Parameters:

Basic electrical design parameters for the Plant are given in the table below:

Basic Electrical Design Parameters

Power Factor (lagging)	0.8
Generation Voltage (kV)	11kV, 3 phase
Parallel operation with Grid	Required with 132kV grid
Grid Voltage	132 kV, 3 phase
System Frequency	50 ± 5%
System Voltage Variation	±10% Variation of Rated Voltage
System Fault Level	
132 kV	40kA
11 kV	50kA
400 V	50kA

Fault Level & Withstand Duration	
132kV Switchgear	40kA for 1 sec
For 11 kV Switchgear	50 kA for 3 sec
For 400 V Switchgear	50kA for 1 sec
400V Lighting System	10kA for 1 sec
11kV Isolated Phase Bus Ducts	50 kA for 3 sec
110VDC	25kA for 1 sec
48VDC	10kA for 1 sec
230VAC	10kA for 1 sec
Transformer and all accessories	All transformers and its accessories shall be capable of withstanding for 3 seconds short circuit at the terminal
Earthing System	
132 kV	Effectively earthed
11 kV	Neutral grounded (limited to < 50 A) / Unearthed (Whenever the generator is not in service)
400 V	Effectively earthed
110 V DC	Unearthed

i) Control Philosophy & SCADA

Critical and important electrical loads shall be interfaced with SCADA system [built in plant DCS] for local and remote operation in-line with plant operational & safety requirements.

j) Digital Control System (DCS)

The controlling and monitoring of operation of main power unit, loading and synchronizing, balance of the plant will be provided from the common control room through the operator panels of the process, electrical part including power outlet equipment, frequency control and switchyard etc. The working place of the system operator will be placed at the control room. The working place of shift engineer will be located in separate room with the window to control room. The DCS will be based on fully redundant process and network bus. The power plant will be fully automated with a target of high operation reliability as well as high operation safety. Control system will fulfill required standard functions for securing optimal, economical, safe and ecological operation for installed equipment in nominal and transient operation conditions. System will cover control function from basic level control up to fully automated control of function groups and units, control of system output and optimization of block operation. Specific autonomous functions of the plant safety system and selected regulation and

control functions will be realized by special subsystems in a hierarchical model. From a viewpoint of control, these items will create an integrated part of the DCS control system.

Hardware and software will enable realization of loop control, binary control, data functions, monitoring, remote control and emergency manual control. Communication within the system will be handled by bus routing connected to the standard bus system RS 485, Ethernet etc.

3) Interconnection with National Grid

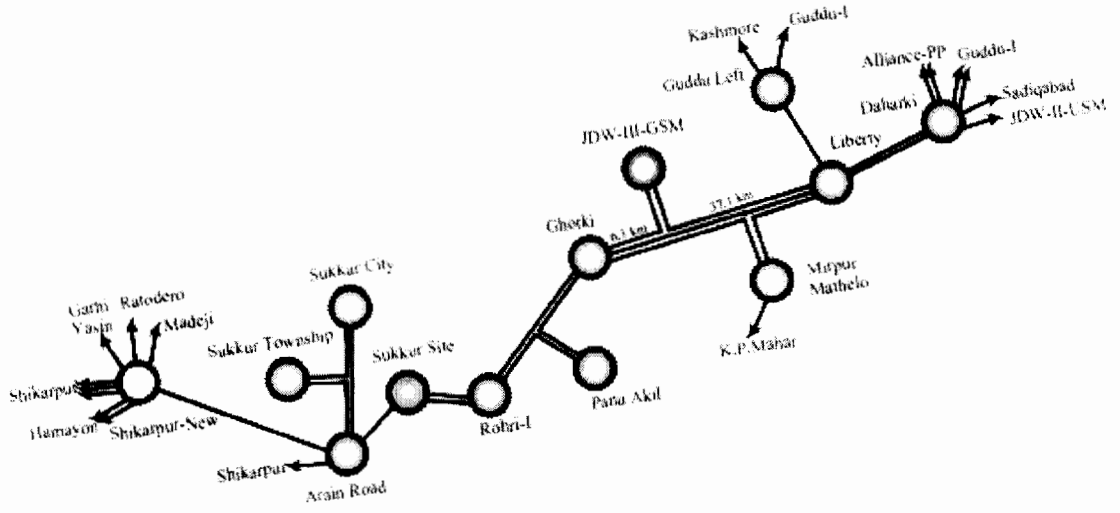
Ghotki Power (Private) Limited intends to sell electricity generated by the project to the Central Power Purchasing Agency (CPPA) pursuant to the NEPRA (Sale of Electric Power by Renewable Energy Companies) Guidelines, 2015.

The power generated from the Generation Facility / Power Plant of Ghotki Power (Private) Limited shall be dispersed to the load center of SEPCO.

The 45 MW power plant is located adjacent to JDW Sugar Mills Unit-III, Goth Islamabad, District Ghotki, Sindh. The existing power plant at JDW Unit-III is looped in-out in one of the existing 132kV triple circuit between Ghotki to Liberty at JDW Unit-III. The distance of the plant from the looping point is about 3.6km. The conductor used is 132 kV Lynx. Same interconnection scheme will be used for the new 45 MW power plant.

Any change in the above interconnection arrangement shall be communicated to the Authority in due course. The sketch of the proposed scheme is provided below.

STUDY OF INTERCONNECTION OF 45 MW JDW-III-GSM POWER PLANT
WITH 45 MW JDW-III-GSM PP, YEAR SEPTEMBER 2019



Legend

Proposed 11 kV
132 kV
66 kV
11 kV

SKETCH - II

4) Project Cost, Sources and amounts of Equity and Debt

a) Project Cost

The total project cost is expected to be in the range of USD 48.96 million with Engineering, Procurement & Construction Cost of USD 40.15 million. The cost if budgetary at this stage and shall be firmed up in due course after conclusion of EPC contract negotiations and finalization financing arrangements. The breakup of project cost is summarized as follows:

PROJECT COST	USD million
EPC Cost	40.15
Non-EPC / Development Costs	3.13
Interest during Construction	4.81
Financing fees	0.86
Total Project Cost	**48.96**

b) Financial Plan

The total project cost of approximately USD 48.96 million is to be financed with a combination of debt and equity. Based on initial discussions with the financial institutions, the Company is likely to finance the project on the basis of Debt: Equity ratio of 80:20. The debt amount is expected to be funded by local debt with interest payable quarterly on the basis of Kibor plus 300 basis points. The term of the loan is expected to be 10 years plus grace period for construction. A summary of the financial plan is provided below:

	USD million
Total Equity (20%)	9.79
Total Debt (80%)	39.17
Total Project Cost	**48.96**

5) Project Schedule

Assumed construction period of 20-month following financial close has been assumed for the Project. Financial Close is targeted in mid-October 2017 with a target Project commercial operations date ("COD") of early June 2019. This would enable the Project to smooth any teething issues that may arise during the crushing period. A schedule of activities and key milestones is provided in Table below.

Indicative Project Schedule

Activity	Duration	Start Date	End Date
Issuance of LOI			10-Feb-17
Grid Study submission and Approvals & CPPA-G Consent	120	10-Feb-17	10-May-17
Generation License Application and Approval from NEPRA	60	10-May-17	10-Jul-17
Tariff Application and Approval from NEPRA	30	10-Jun-17	10-Jul-17
Issuance of LOS	15	10-Jul-17	25-Jul-17
Signing of IA and EPA, EPC negotiations	60	25-Jul-17	25-Sep-17
Financial Close Activities, EPC finalization	120	10-Jul-17	10-Oct-17
Construction Activities	600	10-Oct-17	2-Jun-19
Commercial Operations Date			2-Jun-19

6) Project Life

As per the standard energy purchase agreement ("EPA") the Project life and EPA term has been assumed as 30 years from COD and all equipment is being procured corresponding to the same.

7) ESSA (Environmental and Social Soundness Assessment)

GPL has commissioned an Initial Environmental Examination ("IEE") to identify and assess any adverse impacts of the Project, so that necessary mitigation measures, if required, to prevent or minimize any adverse impacts can be planned in a timely and cost-effective manner. The specific objectives of the report were:

1. To have an in-depth know-how of the Project and to identify the probable sources of pollution that may arise from each stage of the process.
2. To review the current environmental status of the area within specified radius of the proposed Project site - collection of baseline data on the environmental attributes including air, noise, water, land, ecological, hydro-geological climate and socioeconomic environments.
3. To assess likely or potential environmental impacts of the proposed activity (like air, water and soil pollution, noise, waste generation) and the alternatives.
4. To estimate the impacts of the proposed Project on the surrounding environment.
5. To prepare a comprehensive Environmental Management Plan to ensure that the environmental quality of the area is preserved.
6. To formulate a strategy for effective monitoring and identify any deviations in the environmental quality after the project is operational, which would help in evolving measures to counter these.
7. The IEE is to be undertaken pursuant to the Pakistan Environmental Protection Act 1997, the Sindh Environmental Protection Act 2014.

8) Social Impact

The project will generate direct and indirect employment opportunities for the local population. The project will improve the basic infrastructure, which can be used by people of nearby villages. GPL will give priority to skilled, un-skilled labor of the nearby villages. Overall it is anticipated that there will be marginal impact on the socio-economic conditions of the locality and the impact will be positive.

9) Safety Plans, Emergency Plans

a) Health, Safety and Environment (HSE) Protection

The Company will be committed to ensuring the highest standard when it comes to the health and safety of people and protection of the environment. This shall apply to all locations of the office space as well as the construction site. Commitment will remain in place to continuously improve HSE at the workplace, and contractors will be required to follow such an example by adopting the Company's policy or developing their own equivalent.

b) Safety Plans

A comprehensive safety plan would be implemented to provide a safe and protected working environment to the staff working at the facility. All staff working at the facilities would be briefed regarding different types of safety measures which include the following:

- Moral obligations
- Hazard recognition
- Importance of Personal Protective Equipment (PPE)
- Accident prevention
- Fire prevention and protection etc.

All working staff shall be provided with the necessary safety gear and protective equipment and trainings shall be conducted regarding the use of safety equipment and PPE. Safety procedures and policies regarding all operational and maintenance jobs would be developed to prevent unforeseen accidents.

Furthermore, automatic fire alarm systems shall be installed along with fire suppression equipment at all fire hazardous locations of the plant site (details of the firefighting systems can be found in the attached feasibility study).

Emergency help call numbers for different emergency services e.g. fire brigade, medical center, ambulance service and administrations shall be displayed in bold throughout the facility. First Aid facilities shall also be provided at the facility. The staff working would be trained in detail through mock drills and would be made aware of the emergency escape routes and procedures for quick and safe escape. Pictorials and diagrams of the same shall be pasted at different locations through the facility.

An emergency control team shall be in place to oversee all the Safety and Emergency plans and would be responsible for taking all the necessary actions and decisions to tackle and control any type of emergency. The team would also be responsible for shutting down the facilities if required during the emergency situation.

c) **Environment**

An Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMtP), will be implemented as legal requirement under the Punjab Environmental Protection (amendment 2012) Act. This will ensure the power plant operation in environmentally sustainable fashion.

Concrete measures are to be adopted to ensure the quality of environment through the running of project in complete accordance with the 5RS Principles- Reducing, Recycling, Reusing, Refurbishing and Retrofitting. Good housekeeping will be the order of the day. Tree plantation on the project site and its vicinity will be carried out.

10) System studies: Load Flow, Short circuit, Stability, Reliability

An interconnection study for the project has been conducted by Power Planners International and approval from SEPCO has already been received. The interconnection study has also been submitted to NTDC for its vetting.

Detail of Load Flow, Short Circuit, Stability and Reliability can be found in the interconnection connection study, which has been attached with this application.

11) Plant Characteristics

Please refer to the Technical Feasibility attached with the application.

12) Control, Metering, Instrumentation and Protection

Please refer to the Technical Feasibility attached with the application.

13) Training and Development

Training is part of the scope of works to be conducted under Engineering, Procurement and Construction ("EPC") Contractor. The EPC contractor shall also carry out the training of the Employer's Personnel in the operation and maintenance of the complex.

Annexure - 14

PROSPECTUS

1. Introduction:

Ghotki Power (Private) Limited is a special purpose company incorporated under the Companies Ordinance of 1984 for the purpose of setting up a green field 45 MW (Gross) high-pressure bagasse based co-generation power plant under the provisions of the Framework for Power Cogeneration 2013 and Policy for Development of Renewable Energy for Power Generation 2006. The Project shall be located adjacent to JDW Sugar Mills Limited (JDW Unit-III) located near Goth Islamabad Tehsil and District Ghotki, Sindh, Pakistan.

Ghotki Power (Private) Limited was issued an LOI by AEDB dated February 10, 2017.

The Project will sell power to the national grid through sale of energy to the Central Power Purchasing Agency Guarantee Limited under a 30-year Energy Purchase Agreement as well partially meet the steam and power requirements of JDW Unit-III during the crushing season.

2. Salient Features of the Proposed Facility

The broad parameters of the proposed plant are as following:

Project Capacity	45 MW (Gross)
Project Location	Adjacent to JDW-Unit III, near Goth Islamabad, District Ghotki, Sindh
Land Area	16 Acres
Construction Period	24 Months
Power Purchaser	CPPA/NTDC and JDW Unit-III
Steam Turbine	1 x 45 MW condensing and extraction
Boiler	1 x 220 TPH , 110bar 540 °C high pressure boiler
Plant Factor	45%
Upfront Levelized Tariff	PKR 10.408 / kWh

3. Proposed Investment

The total project cost of approximately USD 48.96 million is to be financed with a combination of debt and equity. Based on initial discussions with the financial institutions, the Company is likely to finance the project on the basis of Debt: Equity ratio of 80:20.

4. Social and Environmental Impact of the Proposed Facility

Ghotki Power (Pvt) Limited has commissioned an Initial Environmental Examination ("IEE") to identify and assess any adverse impacts of the Project, so that necessary mitigation measures, if required, to prevent or minimize any adverse impacts can be planned in a timely and cost-effective manner. The specific objectives of the report were:

1. To have an in-depth know-how of the Project and to identify the probable sources of pollution that may arise from each stage of the process.
2. To review the current environmental status of the area within specified radius of the proposed Project site - collection of baseline data on the environmental attributes

including air, noise, water, land, ecological, hydro-geological climate and socioeconomic environments.

3. To assess likely or potential environmental impacts of the proposed activity (like air, water and soil pollution, noise, waste generation) and the alternatives.
4. To estimate the impacts of the proposed Project on the surrounding environment.
5. To prepare a comprehensive Environmental Management Plan to ensure that the environmental quality of the area is preserved.
6. To formulate a strategy for effective monitoring and identify any deviations in the environmental quality after the project is operational, which would help in evolving measures to counter these.
7. The IEE is to be undertaken pursuant to the Pakistan Environmental Protection Act 1997, the Sindh Environmental Protection Act 2014.

Further details are also provided in Annex-13 of the application.

Annexure - 15

45 MW Bagasse-based Cogeneration Power Project
Ghotki, Sindh

Table of Contents

1 Project Background

Ghotki Power (Private) Limited ("**GPL**") is a special purpose company incorporated under the Companies Ordinance of 1984 for the purpose of setting up a green field 45 MW (Gross) high-pressure bagasse based co-generation power plant ("**the Project**") under the provisions of the Framework for Power Cogeneration 2013 ("**Framework**") and Policy for Development of Renewable Energy for Power Generation 2006 ("**RE Policy**" or "**Policy**"). The Project shall be located adjacent to JDW Sugar Mills Limited (JDW Unit-III") located near Goth Islamabad Tehsil and District Ghotki, Sindh, Pakistan. JDW Unit-III is engaged in the manufacturing/sale of sugar and it operates as one of the modern sugar mills in the country with adequate crushing capacity to generate approximately 71.35 MW power by development of Power Plants based on High Pressure boiler technology. JDW Unit-III has already been operating and maintaining a 26.35 MW power plant with 67 bar boiler and is smoothly supplying electricity to the national grid since 2014.

The Project will sell power to the national grid through sale of energy to the Central Power Purchasing Agency Guarantee Limited ("**CPPA-G**") under a 30-year Energy Purchase Agreement ("**EPA**") as well partially meet the steam and power requirements of JDW Unit-III during the crushing season. The Project will enable GPL to play its role in the provision of much-need indigenous and renewable energy to the national grid and shall continue the process of diversification of its sponsor into the power sector through incentives offered by the Government of Pakistan ("GoP") under the Framework and RE Policy.

The objective of this feasibility study ("Feasibility") is to assist GPL in assessing the technical and financial viability of the Project.

2 Power Market

2.1 Structure of Power Sector in Pakistan

Historically, the power sector in Pakistan has been owned and operated by government entities, primarily the Water and Power Development Authority ("WAPDA") until the drive to unbundle started in the early 1990s. Since then the sector has evolved much with private sector involvement primarily in generation and more recently on the model of a fully vertically integrated utility company. The generation, transmission, distribution and retail supply of electricity in Pakistan is presently undertaken by a number of public and private sector entities comprising of one (1) national transmission company; nine (9) regional public sector-owned distribution companies; four (4) public sector thermal generation companies; one (1) public sector hydropower generation company and several Independent Power Producers ("IPPs"). These entities enable the supply of power to the entire country except for Karachi. The metropolitan city of Karachi and some of its surrounding areas are supplied power K-Electric, which is a vertically integrated utility owned by the private sector responsible for the generation, transmission and distribution of electricity in its region. The total installed capacity of the entire country in 2015 was 24,823 MW of which 16,814 MW (67.74%) was thermal, 7,116 (28.67%) was hydroelectric, 787 MW (3.17%) was nuclear and 106 MW (0.43%) was wind.

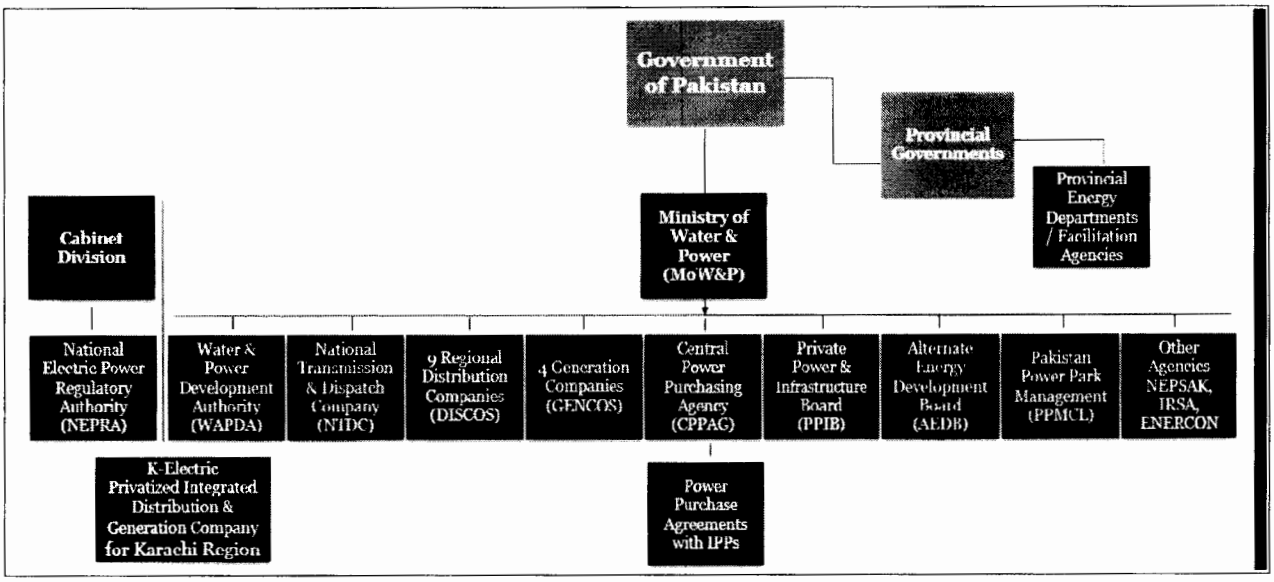
Table 1: Pakistan Power Generation Capacity

As on 30th June	2011	2012	2013	2014	2015
Thermal	15,910	15,969	15,941	15,719	16,814
Hydropower	6,645	6,730	6,947	7,116	7,116
Nuclear	787	787	787	787	787
Wind	0	1	50	106	106
Total	23,342	23,487	23,725	23,728	24,823

All figures in MW; Source: NEPRA State of Industry Report, 2015

More recently CPPA, previously residing within NTDC, has been converted into a legal, independent body acting as a central counterparty to power purchase transactions. The present form of the power structure in Pakistan is presented below:

Table 1: Pakistan Power Sector Structure



2.2 Electricity Generation

Historically, Pakistan has relied on hydropower generation to meet its electricity demands, as the ratio of hydel to thermal installed generation capacity in the country in 1985 was about 67% to 33%. However, with the passage of time, the energy mix has shifted towards thermal power generation, which now generates approximately 65% of total power produced in the country. Electrical energy generated in recent years by fuel type is presented in the table below:

Table 2: Pakistan Energy Generation by Source

As on 30th June	2010-11	2011-12	2012-13	2013-14	2013-14
Thermal	65,169	64,478	64,034	68,082	69,988
% Share	*64.79*	*65.94*	*64.91*	*64.41*	*64.17*
Hydel	31,990	28,643	30,033	32,239	32,979
% Share	*31.80*	*28.85*	*30.44*	*30.50*	*30.24*
Nuclear	3,220	4,872	4,181	4,695	5,349
% Share	*3.11*	*4.91*	*4.24*	*4.44*	*4.90*
Import	295	296	375	419	443
% Share	*0.29*	*0.30*	*0.38*	*0.40*	*0.41*
Wind	0	6	32	453	300
% Share	*0.00*	*0.01*	*0.03*	*0.25*	*0.27*
Total	100,584	99,295	98,655	105,698	109,059

All figures in GWh; Source: NEPRA State of Industry Report, 2015

Given the acute gas shortage in the country, thermal generation has relied mostly on expensive fuels such as Furnace Oil and High Speed Diesel. Increased dependence on expensive thermal fuel sources has not only led to high cost of generation but has also resulted in large amounts of foreign reserves to be spent on the import of fuel. Thermal generation breakdown in the country in recent years is given in the table below:

Table 3: Pakistan Energy Generation by Source (Thermal Fuel Mix)

	2010-11	2011-12	2012-13	2013-14	2014-15
Gas	37,076	30,162	28,190	30,769	31,196
% share of thermal generation	*56.89*	*46.06*	*44.02*	*45.19*	*44.57*
FO + HSD	27,984	35,250	35,804	37,201	38,690
% share of thermal generation	*42.94*	*53.83*	*55.91*	*54.64*	*55.28*
Coal	109	66	40	112	102
% share of thermal generation	*0.17*	*0.10*	*0.06*	*0.16*	*0.15*
Total	65,169	65,478	64,034	68,082	69,988

All figures in GWh; Source: PSS/NTDC/KEL

Due to this skewed energy mix, it has now become imperative upon the power sector in Pakistan to move towards generation technologies that are sustainable and rely on indigenous resources.

2.3 Demand and Supply of Electricity

For the past decade or so, Pakistan has been suffering from an acute energy crisis due to rising demand exacerbated by structural flaws within the sector. Some of the major reasons contributing to this crisis include:

1. Inefficient transmission and distribution
2. Increasing demand
3. Inefficient use of energy
4. Expensive energy mix and
5. Improper pricing.

Installed capacity in the country grew at an average rate of 5.51% during the period 1990-2015. However, this increase in capacity has been unable to meet the demand of electricity leading to a demand-supply gap, which can go as high as 6,600 MW during peak hours. In 2015, the maximum generation capability remained at 19,132 MW, while the maximum peak demand reached 24,757 MW, resulting in a 5,625 MW gap between supply and demand. Projections by government agencies depict that this shortfall is not going to end till 2018. The tables below show the actual and projected surplus/deficit in demand during system peak hours:

Table 4: Pakistan Historical Supply and Demand of Power

Year	Generation Capacity	Peak Demand	Surplus/(Deficit)
2011	15,430	21,086	-5,656
2012	14,483	21,536	-7,053
2013	16,846	21,605	-4,759
2014	18,771	23,505	-4,734
2015	19,132	24,757	-5,625

All figures in MW; Source: NTDC

Table 5: Pakistan Projected Supply and Demand of Power

Year	Planned Generation	Projected Peak Demand	Surplus/(Deficit)
2016	20,303	25,666	-5,363
2017	23,445	27,185	-3,740
2018	28,751	28,678	73
2019	33,545	30,154	3,391
2020	35,590	31,625	3,965

Source: NTDC

Shortage of electricity has become the most critical challenge by not only causing social disruption, but also affecting the economic growth of the country. According to estimates,

energy shortages in the country have resulted in approximately 2% reduction in the annual GDP of the country. Therefore, resolving the energy crisis is amongst the top priorities of the government and steps are being taken to attract new investment in the power sector. Moreover, steps are being taken to optimize the generation mix by adding renewable and indigenous energy sources.

2.4 Key Organizations

2.4.1 National Electric Power Regulatory Authority ("NEPRA")

In order to promote fair competition in the industry and to protect the rights of consumers as well as producers/sellers of electricity, the GOP enacted the Regulation of Generation, Transmission and Distribution of Electric Power Regulation Act, 1997 ("NEPRA Act"). Under this Act, the NEPRA Policy for Power Generation Projects was established for regulating electric power generation, transmission and distribution in Pakistan. In performing its functions under this Act, NEPRA is required to, as far as reasonably possible, protect the interests of consumers and companies providing electric power services in accordance with the guidelines laid down by the government. One of NEPRA's most prominent roles is tariff approval for the Project.

NEPRA's role in the power business, inter alia, is to issue licenses for companies and to regulate their operations according to NEPRA rules and regulations. The prospective applicants will be required to comply with all NEPRA rules/procedures, inter alia, for grant of license before security agreements are concluded for any project.

2.4.2 Private Power and Infrastructure Board ("PPIB")

PPIB provides a one-window facility to IPPs for implementation of projects above 50 MW capacity and issues the Letter of Interest ("**LOI**") and Letter of Support ("**LOS**"), prepares pre-qualification and bid documents, pre-qualifies the sponsors, evaluates the bids of pre-qualified sponsors, assists the sponsors/project companies in seeking necessary consents / permissions from various governmental agencies, carries out negotiations on the Implementation Agreement ("**IA**"), assists the power purchaser, fuel supplier, government authorities in the negotiations, execution and administration of the EPA, fuel supply agreement and water use license respectively, issues and administers the GOP guarantee backing up the power purchaser, fuel supplier and follows up on implementation and monitoring of projects.

2.4.3 Alternate Energy Development Board ("AEDB")

AEDB has been designated as one-window facility for processing all alternative and renewable energy projects in the private sector projects such as wind, biodiesel, bagasse/biomass/waste to energy, small/mini/micro hydro and solar power projects. AEDB also issues bankable IA, EPA, LOI and LOS to alternative energy producers. AEDB shall be the relevant GoP facilitation agency for the issuance of the LOI and LOS as well negotiation of the IA and provision of the GoP guarantee as applicable for the Project.

2.4.4 Central Power Purchasing Authority Guarantee Limited ("CPPA-G")

CPPA-G, a company created by Government of Pakistan, is a non-profit independent company established under the Companies Ordinance, 1984 and solely responsible for implementing and administering the "Single Buyer Plus" market mechanism (ultimately leading to competitive market operations). CPPA-G purchases power on behalf of Distribution Companies ("**DISCOS**") from IPPs. The Project shall be entering into negotiations with CPPA-G for the sale of energy to the national grid and shall enter into an EPA in this regard.

2.4.5 Sukkur Electric Supply Company ("SEPCO")

The distribution company SEPCO (Sukkur Electric Power Company) has been formed by bifurcating Hyderabad electric supply company (HESCO) so that the areas of operation that were entirely under the jurisdiction of SEPCO have now been divided between the two DISCOs. SEPCO is a newly created company and started functioning with effect from 16-08-2010. SEPCO has surrendered its historical limits which now fall under the jurisdiction of SEPCO. The areas that are now under the distribution system of the SEPCO consist of three operation circles namely, Sukkur, Larkana and Dadu.

3 Applicable Framework & Policy

The Project is being set up under the Framework for Power Cogeneration 2013 pursuant to the Policy for Development of Renewable Energy for Power Generation 2006 being administered by the AEDB. Under the terms of the Framework and Policy, electricity purchase by the CPPA-G from bagasse-based projects has been made mandatory.

The conditions of the Framework/Policy envisage JDW Unit-III/GPL seeking an LOI from AEDB for the Project which has already been issued to the company on 10th Feb 2017. In May 2013, NEPRA announced an upfront tariff (**"Upfront Tariff"**) for high-pressure boiler based bagasse projects being set up under the Framework. The Upfront Tariff has subsequently been extended up to May 2017 - proceedings are underway by NEPRA for a new upfront Bagasse Tariff. The Company shall apply for applicable tariff in vogue upon completion of pre-requisites.

Upon receipt of the Upfront Tariff approval from NEPRA the Project Company shall seek an LOS from AEDB; following which the Company shall enter into negotiations of the EPA and IA with CPPA-G and AEDB respectively, which shall be followed by the financial close of the Project. Under the terms of the Upfront Tariff (and LOS) the Company is required to achieve the commercial operations date of the Project within 24 months from date of approval of the Upfront Tariff for the Company.

In parallel, the Company shall also apply to NEPRA for the issuance of the Generation License for the Project. The application for the Generation License shall be made following the issuance of the LOI and will be issued, amongst others, after submission of an approved grid interconnection study from SEPCO and an environmental study from the relevant authority.

4 Cogeneration

4.1 Bagasse Based Cogeneration

Cogeneration refers to generation of electricity and useful heat from use of a single fuel at high efficiency. Cogeneration is a well-known process in sugar industry as every sugar mill requires steam for sugar manufacturing while supply of electricity is also necessary to operate machinery. The steam provides thermal energy which is used in heating and concentrating the juice into syrup. This process of juice concentration to syrup involves the evaporation of water in the juice by using low pressure steam as the heating medium. With the large quantum of low pressure steam usage, the sugar industry stands as an ideal candidate for cogeneration. Historically, most sugar mill boilers and the power houses were designed primarily to meet the process steam and electricity requirements of the sugar mill. Therefore, the boilers and turbo-generators employed are mostly of low pressure and low temperature style.

There has been, of late, increasing awareness of the advantages of installation of high pressure, high efficiency bagasse based systems. With installation of high pressure boilers and separate investment in steam economy of the sugar mill, electricity over and above internal use can also be produced and sold to national grid. Exports of electricity can make cogeneration an attractive and cost-efficient means of cutting production costs, reducing pollution and generating additional revenues depending on the ratio between the price of electricity secured and production cost of electricity generated in the sugar industry.

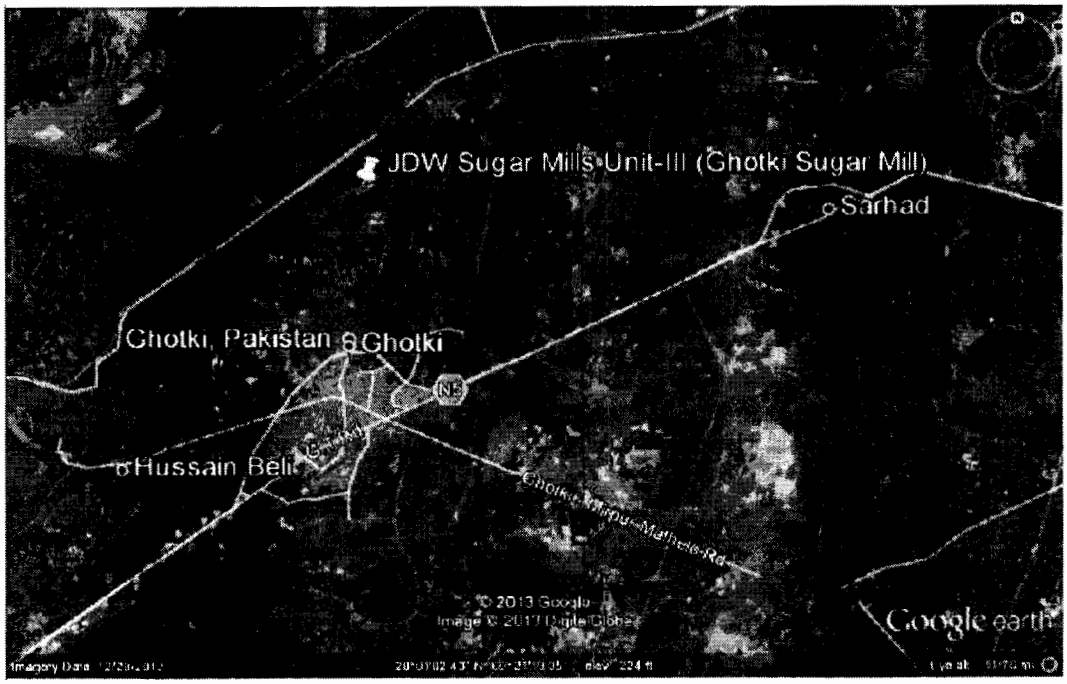
5 The Project

The Project comprises the installation of a high pressure cogeneration power plant comprising of one high pressure (110 bar) traveling grate boiler, having a steam generation capacity of 220 tons per hour, with other electro-mechanical equipment along with civil works as balance of the plant (**"Plant"**) and one condensing/extraction steam turbine generator having a capacity of 45 MW. It is planned that, during the crushing period steam and power for JDW Unit-III operations will be partially provided from the existing 67 bar high pressure system and the balance steam/power requirement of JDW Unit-III will be met through the 110 bar high pressure system of the Plant. During the crushing period, bagasse from JDW Unit-III will be utilized both in the 67 and 110 bar systems to generate steam and power. During the off-season either only 110 bar plant or both the 67 and 110 bar plant shall operate, using the saved bagasse available with JDW Unit-III as well as procured bagasse from other sugar mills as and when available.

5.1 Project Site and Location

The Project Site is adjacent to JDW Sugar Mills Limited Unit-III located near Goth Islamabad Tehsil and District Ghotki, Sindh.

The location map of the Project site map is given below and Project Layout has been attached as Annexure 1:



6 Plant Type and Technology

6.1 General Design

The design of the Facility is typical for a biomass-fired cogeneration facility which also is specific to the use of bagasse and to the cogeneration requirements.

The boilers will consist of tall water wall furnace with platen generators located at the top of the furnace. The super heater will have three stages. The first stage is a horizontal tube convective super heater located in the boiler second pass. The second stage consists of platens located at the top of the furnace adjacent to the generator section. The third stage consists of pendants located above the furnace arch between the second and first stages. Following the super heater will be three horizontal tube economizer sections and four tubular air heater sections.

The steam cycle consists of two high pressure feed water heaters and a Deaerator for each unit. The high pressure feed water heaters take steam from the two uncontrolled extractions of the steam turbine. Steam for the Deaerator is to be supplied from the controlled extraction of the steam turbine.

The Facility has two modes of operation defined by steam needs of JDW Unit-III. During the crushing season, JDW Unit-III needs steam and electricity to crush the sugar cane and produce sugar. Steam for JDW Unit-III will be supplied from the controlled extraction of the steam turbine which is at approximately 2.5 bar (ab) pressure. The expected steam demand

for JDW Unit-III is 155 TPH from Cogeneration High Pressure Power Plant. Total electricity demand of sugar mill during the crushing season is 15 MW which will be supplied from Cogeneration High Pressure Power Plants. During the off-season, the electricity demand is 0.5 MW.

6.2 Technology

Combustion technology based on the Rankine Cycle will be utilized in this project which is proven latest technology. The bagasse will be combusted in a high pressure boiler and the steam generated will be fed to the steam turbine to generate power. The turbine will be different from the conventional thermal power plants as the turbine will be provided with a controlled extraction for extracting the process steam required for the sugar mill. To enhance the efficiency of operation, regenerative heaters are used in the feed water circuit. For the cogeneration power plant proposed for GPL, the cogeneration cycle is based on the parameters of 110 bar(a) and 540 degrees centigrade at the boiler outlet, currently being used in many countries for the cogeneration projects. The cycle chosen with the above parameters is the latest used in many of the bagasse fired installations around the world. These above selected parameters make the cycle more efficient and help in the generation of more units for the same quantum of the fuel.

There are already many Cogeneration plants operating in Pakistan & India with these parameters and the operating experience of those plants, in synchronization with the sugar mill operation, has been smooth and without any hitch. The Cogeneration scheme for GPL proposes 1x220 TPH capacity boiler and 1x45 MW extraction condensing turbo generators. Considering the offseason operation of the plant, the Cogeneration power plant boilers will be designed to fire a few other compatible bio-mass fuels.

7 Design and Specifications of the Plant

7.1 Bagasse Fired Boiler

The Boiler shall be single drum, natural circulation, radiant furnace with water cooled membrane wall, three stage super-heater with two stage attemperator, balanced draft and travelling grate bagasse fired boiler. The boiler is capable of a peak generation of 110% of the MCR for a period of half an hour in eight hour shift. The boiler shall be top supported, outdoor type, with adequate provisions for the thermal expansion of the boilers in all directions.

Design Parameters:

- Bagasse Fired Boiler; 220 TPH
- Steam pressure at the Main Steam stop valve outlet: 110 bar(a)
- Steam temperature at the Main steam stop valve outlet at MCR: 540 ± 5 ^{0}C
- Boiler feed water temperature at the inlet to the Deaerator: 110 ^{0}C.
- Maximum noise level at 1.0 m distance for the boiler: 85 dB(A)

The Bagasse through drum feeders, screw feeders and pneumatic spreaders will be fed into the furnace. The travelling grate is selected for efficient combustion system and to avoid heating of grates. The Ash is collected by the continuous movement of travelling grate.

The air will be supplied by primary Forced Draft (FD) fans & secondary air fans. The air towards Bagasse will be controlled by the fuel air control system in order to guarantee safe and optimum combustion. The air supplied from FD fan will be heated up in air pre-heater. The pressure in the furnace will be controlled by the Induced Draft (ID) fans installed at outlet of boiler. These fans will be provided with Variable Frequency Drive (VFD) in order to optimize the power consumption. ID fans will discharge flue gases.

After complete combustion in furnace the flue gases shall enter the super heater section installed in the upper portion of the furnace. From the super heaters the flue gases will flow downwards into modular bank. The evaporator section of the boiler will be designed for a large circulation ratio. Even during quick plant load changes the water circulation will be stable and thus prevent steam blockage in the evaporator sections.

From evaporator section, the flue gas shall enter the bare tube economizer from the top and leave at the bottom to Air Flue Gas Pre-heater. The economizer tubes will be supported in the structure of the economizer casing and will be bottom supported. The economizer will be fully drainable.

Thereafter, the Fly Ash Arrestor installed at the outlet of the Air Pre-heater. From Fly Ash Arrestor most of the fly ash will be separated from the flue gases.

The condensate from the sugar mill shall be directly fed into the condensate tank from where it will be pumped to the Deaerator via sugar plant exhaust condensate pumps through a level control system.

Demineralized (DM) water will be supplied to the boiler for makeup. The makeup water will be pumped to the overhead surge tank via DM water distribution pumps. The makeup water will be added in the condenser hot well from the overhead surge tank by gravity through a level control system. The condensate from the condenser and makeup water added to the condenser hot well will be pumped to the Deaerator by condensate extraction pumps.

4 x 42% Boiler Feed Water (BFW) pumps shall be provided. BFW pumps are multistage, centrifugal type with low voltage 400V drive motors with Variable Frequency Drives (VFDs). The condensate and make-up water lines will have level control valve to control Deaerator level.

The control philosophy, boilers interlock and protection logic shall be implemented in Distributed Control System (DCS) for safe operation of boiler.

7.2 Steam Turbine and Auxiliaries

7.2.1 Steam Turbine

The turbine of the cogeneration power plant will be multistage nozzle governed, horizontal spindle, two bearings, and extraction cum condensing type with 02 number of uncontrolled extractions and 01 number of control extractions. The exhaust from the turbine will be condensed in the surface condenser at 0.101 bar (a) pressure during off-season operation.
The Medium pressure steam at 4 Bar(a) and low pressure steam at 2.5 bar (a), will be supplied to the sugar plant. 98% condensate of the supplied Low Pressure steam will be returned from the sugar mill.

7.2.2 Gear Box

Heavy duty reduction gear box of Double helical type with hardened & ground gears will be installed, capable of transmitting maximum power generated by turbine and able to withstand 20% over speed over a period of minimum 5 minutes.

The gear box will be designed with a service factor of 1.3 as per AGMA requirements.

7.2.3 Couplings

High speed coupling between the turbine & the gear box will be non-lubricating, steel laminated, flexible type. The coupling between the gear box and the alternator will be low speed. Both the couplings will have coupling guards and acoustic covers. Power rating of the couplings shall be in accordance with AGMA 514

7.2.4 Condensing System

Condensing system shall comprise of the following:

- Shell & Tube horizontal type surface condenser with integral hot well, thermal relief valve and atmospheric relief valve.
- Steam Ejector system consisting of:
- Twin stage main ejectors (1 working + 1 standby) with two surface type inter and after condensers.
- Startup hogging type ejector with silencer.
- Vertical canister type Condensate extraction pumps (CEP's), with a 3 x 50% capacity with LT motors and suction valves.
- Rupture disc for condenser protection.
- Expansion bellow with spool piece between turbine exhaust and condenser inlet
- Dry air/vapor line within specified battery limit

7.3 AC Generator

AC Generator shall comprise of the following:

- Brush-less exciter with PMG
- Air coolers
- Twin bearings
- AVR cum Excitation panel
- Anti-condensation heaters
- Water leakage detector- 1 per cooler
- Lube oil flow regulator - 1 per bearing

Generator electrical output rating shall be as follow:

- [56.25] MVA rated capacity at [50]° C ambient.
- [11] ± [10]% KV
- [50] ± [5]% Hz

- 3 Phase
- Power factor ([0.8] lag to [0.95] lead)
- ± [0.5]% Accuracy Control for Excitation system

7.3.1 Generator Protection and Control System:

Generation protection and control system will consist of the following equipment:

- Generator protection (Relay) Panel
- Metering & Synchronizing Panel
- MCC Panel
- Lightning arrestor, Surge capacitor and Potential transformer (LA, SC & PT) Panel
- Neutral grounding resistor (NGR) Panel
- DC Distribution

7.4 Governing System

The governor system provided will control the acceleration of the turbo generator and prevent over speed without tripping the unit under any operating condition or in the event of maximum load rejection.

The governor system will have the following important functions:

- Speed control
- Over speed control
- Load control
- Inlet steam pressure control
- Extraction pressure control

7.5 Lubrication and Control System

A single forced feed lubrication system will be installed for Turbine, Gearbox & Alternator comprising of the following major components:

- Lube oil tank
- Oil Vapor extractor
- AC Electric Main Oil Pump (MOP) driven by gearbox low speed shaft
- AC electric Motor driven Auxiliary Oil Pump (AOP)
- DC Motor driven Emergency lube Oil Pump (EOP) with auto cut-in & cut-out facility
- Lube oil coolers (1working + 1 standby)
- Lube oil filters (1working + 1 standby)
- AC motor driven oil mist separator mounted on oil tank

7.6 Control Oil System

Control oil system will comprise of the following:

- AC electric Motor driven Auxiliary Control Oil Pump (ACOP) (1 working + 1 standby) to supply oil to Control system.
- Control Oil filter (COF) (1 working + 1 standby)

7.7 Main Cooling Water Pumps

The cooling water system shall be designed to provide cooling water to the following area of the plant:

- Surface Condenser
- Auxiliary cooling water coolers

The cooling water system includes the following major components:

7.7.1 Main Cooling Water Pumps

Three (3) Main Cooling Water Pumps (two working and one standby) each of capacity approximately 3200 m^3/hr shall be provided. Pumps will be horizontal centrifugal type, driven by electric motors.

7.7.2 Auxiliary Cooling Water Pumps

Two (2) Auxiliary Cooling Water Pump (One working and one standby) will be provided. Pumps will be horizontal centrifugal type driven by electric motors.

7.7.3 Cooling Tower System

The Cooling Tower System shall have the following specifications:

- One (1) R.C.C structure mechanically induced draft, counter flow type cooling tower
- Capacity of cooling tower will be approximately 10,500 m^3/hr and is combined and common for the whole cogeneration power plant.
- There shall be 3 cells each having a capacity of approximately 3500 m^3/hr.
- The cooling tower will be designed for cooling of water from 41°C to 33°C, and an approach of 5-6°C while operating under the atmospheric wet bulb temperature of about 30°C.
- Each cell of cooling tower gear box will be equipped with vibration switches, oil temperature and oil level controls.
- The source of cooling water will be Bore Well Water.
- Cooling water supply and return temperature is 33°C and 41°C respectively.

7.8 Raw Water System

Raw water system consists off the following components:

7.8.1 Cooling Water Makeup Pump

Two (2) Cooling Tower make up Water Pumps for season and off-season operation will be provided.

7.8.2 Raw Water Transfer Pumps

Two (2) Raw Water Transfer Pumps (one working and one standby) each of capacity 200 m^3/hr will be provided to ensure raw water supply to Water Treatment Plant.

7.9 Compressed Air System

The function of this system is to provide service and instrument air for cogeneration plant operations. Compressed air system provides air to following users:

- **Instrument Air Users**: Instrument air will be required for the operation of pneumatic instruments like I/P converters, purge instruments, pneumatic actuation of control valves, dampers etc.
- **Service Air Users**: Service air will be required for cleaning of filters, strainers and general purpose.

7.10 Bagasse Handling System

The bagasse handling system comprising of chain conveyors & belt conveyors to transport the required quantity of bagasse from sugar mill to cogeneration shall be provided. Bagasse from the sugar mill shall be fed to the boiler from a front mounted chain conveyor. Excess bagasse shall be returned to the bagasse storage yard. During off-season/non availability of bagasse from mill, the cogeneration boiler shall use saved bagasse from the storage yard.

7.11 Ash Handling System

The ash handling system envisaged for the cogeneration boiler shall consist of Submerged Ash Belt Conveyor System and Dense Phase Ash Handling System.

7.11.1 Submerged Ash Belt Handling System

Submerged Ash Belt Handling System consists of conveyor belts, drive assembly, all type of pulleys, all type of idlers, bearing assembly, inlet / outlet chutes, take-up assembly, trough assembly, support frames, cross over, walkway, structural safety switches, water inlet / outlet / drain nozzles etc. The bottom ash at the discharge of travelling grate shall be conveyed by submerged ash conveyor system.

The ash shall be quenched in the water trough of submerged ash conveyor before conveying. The submerged ash conveyor shall discharge the ash directly to a trolley mounted tractor for further disposal.

7.11.2 Dense Phase Ash Handling System

This system will handle fly ash from boiler ash hopper (other than traveling grate & plenum ash hopper) and ESP hoppers. Surge hopper (water cooled for boiler ash hopper and non-water cooled for ESP hopper) arrangement shall be provided below the boiler and ESP hopper. Two air compressors with built in PLC control system and 1x100% air receiver shall be provided near the dense phase equipment. The required conveying air for dense phase ash system will be supplied by these compressors through air receivers. The ash silo storage capacity shall be enough to store 12 hours ash generation from both the boiler and ESP system.

7.12 Water Treatment System

The existing water treatment system at the existing 67 bar High Pressure Cogen Plant shall be expanded as required to meet the requirements of the new 110 bar High Pressure Cogeneration plant.

7.13 Firefighting System

The function of fire-fighting system is to supply water to the main risk areas of the cogeneration power plant.

The fire protection system is required for early detection, containment and suppression of fires. A comprehensive fire protection system shall be provided to meet the above objective and all statutory and insurance requirements of National Fire Protection Association (NFPA).

The fire-fighting system shall consist of the following:

7.13.1 Stand Pipe and Hose System:

Stand pipe and hose system shall be provided to cover the building and structures of the cogeneration plant. The system shall be designed as per the NFPA 14.

Standpipe shall have a hose of 65mm diameter with connection to a large supply of water. The hose connection shall be not less than 0.9m or more than 1.5m above the floor.

7.13.2 Fire Hydrant and Water Monitoring System

The hydrant system shall be provided to cover all areas. The system shall be designed as per NFPA 24. The system shall consist of over ground hydrant mains laid in rings, isolation valves, and stand pipes with hydrant valves (outdoor). A Hydrant shall be placed after every 40m.

7.13.3 Portable Fire Extinguishers:

Dry Chemical Powder, CO^2 and foam type extinguisher system shall be provided. The equipment shall be designed as per NFPA 10.

7.13.4 Automatic High Velocity Water Spray Nozzle System:

Automatic High Velocity Water Spray Nozzle System shall be provided along with deluge valve assembly for outdoor transformers in switchyard, generator & Turbine lube oil system area. The system shall be designed as per NFPA 15. The deluge valve assembly shall be UL/FM listed.

7.13.5 Fire Alarm & Detection System

Fire detection system for the power plant will provide early detection of fire and raise alarm. A comprehensive fire protection system shall be planned to meet the above objective and meet all statutory and insurance requirements of National Fire Protection Association (NFPA). A multitude of systems will be provided to combat various types of fires in different areas of the plant and all such systems for various areas shall form a part of a centralized protection system for the entire plant. Fire alarm system detection system shall be provided in following areas:

- Firm alarm and signaling in all electrical/instrumentation panel rooms in TG building
- Manual call points and Electric Horns in outdoor areas.

7.14 Effluent Handling System

Effluent handling system consists of the following main components:

7.14.1 Neutralizing Pit

Acid/caustic produced (if any) from Water Treatment Plant will be collected in neutralization pit. This effluent will be transferred to effluent pit after neutralization.

7.14.2 Neutralized Effluent Re-circulation cum Transfer Pumps

Two (2) Neutralized Effluent Re-circulation cum Transfer Pumps (One working & one standby) shall be installed at Neutralization pit to transfer effluents from Neutralization pit to Effluent pit in water treatment plant area.

7.14.3 Effluent Pit

Effluents like Boiler blow down, cooling tower blow down, RO reject, MGF backwash, side stream filter flushing, RO flushing, neutralized effluent from neutralization pit, etc. shall be collected in the separate effluent pit near Water Treatment Plant area.

7.14.4 Effluent Transfer Pump

Two (2) Effluent Transfer Pumps (One working and one standby) will be installed on Effluent pit to transfer effluents. The pumps will also be used to re-circulate the effluent with in Neutralization pit for effective neutralization. The pump capacity shall be minimum 100 m^3/hr.

7.15 Service Water System

Two (2) service water pumps (One working and one standby) will be installed to provide service water to plant users. One (1) expansion vessel will be installed to keep service water header pressurized.

7.16 Electric Overhead Travelling (EOT) Cranes

EOT cranes shall be provided in the following buildings:

TG Hall

An Electrically operated EOT crane shall be provided for the erection and maintenance requirements of turbo generator and its auxiliaries.

The main hook capacity shall be 90 Tons and suitable for lifting single heaviest component in Turbo Generator. The auxiliary hook lifting capacity shall be of 5 Tons. The crane travel will cover the entire length of the TG building. The crane shall be electrically operated, bridge type and shall be designed and equipped for indoor operations complete with all accessories. The crane bridge shall consist of bridge girders each carrying a rail on which a wheeled trolley is to run. Operation of crane shall be by pendant type push button station from ground level.

Workshop and Store

An Electrically operated EOT crane shall also be provided for routine maintenance activities and store material handling to be carried out in the building.

The single hook crane capacity shall be 90 Tons. The crane travel will cover the entire length of maintenance bay of workshop. Operation of crane shall be by pendant type push button station from ground level.

8 Electrical Design

8.1 Electrical Network

The Plant shall consist of one generator and associated auxiliaries for smooth plant operation. A synchronous alternator for the proposed co-generation power plant with generation at 11 kV will be connected to 132kV system through 11kV switchboard and step-up Power Transformers.

The connection between generator and 11kV switchboard shall be through 11kV phase segregated Bus Duct and between 11kV switchboard and 11/132kV power transformer shall be through 11kV HT XLPE cables.

The generator will operate in parallel with NTDC / DISCO National grid. A portion of the power generated in the turbo-generator will meet the power requirements of the Cogeneration plant auxiliary loads and the sugar plant loads through step down transformers.

The surplus power, after meeting the power requirement of cogeneration plant auxiliaries and sugar plant auxiliaries, shall be exported to the grid through 11/132kV power transformer. There shall be total of 2 numbers of step-up power transformers (one working + one standby) to meet N-1 condition of NTDC.

Entire power evacuation system and associated equipment shall be designed so as to export the entire power from cogeneration plant (total generation less auxiliary power consumption), when the sugar plant is not in operation.

All the existing sugar plant loads shall be fed through existing 11kV cogen switchboard. Proposed 11kV cogen switchboard shall be interconnected with the existing 11kV cogen switchboard.

Proposed 11kV cogen switchboard and existing 11kV cogen switchboard shall be interconnected through HT cables via reactor.

8.1.1 Ambient Conditions for Electrical Equipment

Ambient conditions and design temperatures for electrical equipment are given in Table 7 below:

Table 7: Ambient Conditions for Electrical Equipment

	Deg C
Maximum Temperature	50
Minimum Temperature	8
Plant Design Temperature	44
Indoor Equipment Design	50
Outdoor Equipment Design	50

8.2 Plant Operating Voltage

The plant shall be designed suitable for operating at a frequency of 50Hz, with voltage levels of various systems of the plant as given in Table 8 below:

Table 8: Plant Operating Voltage

Generation (TG) system	11 kV
Power evacuation system	132 kV
n-AC VSD / auxiliaries of cogeneration plant	400 V
AC VSD / auxiliaries of co-generation plant	400 V
DC system of co-generation plant	110 V
UPS system of co-generation plant	220 V

8.3 Basic Electrical Design Parameters

Basic electrical design parameters for the Plant are given in the table below:

Table 9: Basic Electrical Design Parameters

Power Factor (lagging)	0.8
Generation Voltage (kV)	11kV, 3 phase
Parallel operation with Grid	Required with 132kV grid
Grid Voltage	132 kV, 3 phase
System Frequency	50 ± 5%
System Voltage Variation	±10% Variation of Rated Voltage
System Fault Level	
132 kV	40kA
11 kV	50kA
400 V	50kA
Fault Level & Withstand Duration	
132kV Switchgear	40kA for 1 sec
For 11 kV Switchgear	50 kA for 3 sec
For 400 V Switchgear	50kA for 1 sec
400V Lighting System	10kA for 1 sec
11kV Isolated Phase Bus Ducts	50 kA for 3 sec
110VDC	25kA for 1 sec
48VDC	10kA for 1 sec

230VAC	10kA for 1 sec
Transformer and all accessories	All transformers and its accessories shall be capable of withstanding for 3 seconds short circuit at the terminal
Earthing System	
132 kV	Effectively earthed
11 kV	Neutral grounded (limited to < 50 A) / Unearthed (Whenever the generator is not in service)
400 V	Effectively earthed
110 V DC	Unearthed

8.4 132kV Switchyard

Switchyard shall be supplied for interface with NTDC/DISCO Grid in line with following specifications and NTDC/DISCO requirements. Detailed specifications of the switchyard are given in the table below:

Table 10: 132kV Switchyard Specifications

Voltage Level	132kV
Service	Outdoor AIS with SF6 circuit breakers
Number of Bays	2 Transformer Bays
Bus Bar	AAC conductor of "Hawthorn"
Short Circuit SF6, gang operated	3150Amp 40kA 1sec
Isolator (Centre break, motor operated with copper alloy blades)	2000 Amp
Protection & Metering	As per NTDC/DISCO Requirements
Highest System Voltage(kV rms)	145 kV
Power frequency withstand capability (kV rms)	275kV
Basic insulation level (kV peak)	650 kV
Creepage distance for insulators (mm/kV)	25
Instrument Transformers	Hermetically sealed, dead tank design. Rating as per SLD
Insulator	Brown glazed with min 6kN cantilever Strength
Towers & Support Structures	MS galvanized lattice type
Tariff Metering equipment	Three elements four-wire configuration, electronic, digital, with accuracy class of 0.2S, 30 minutes intervals for a period of 70 days with intervals programmable from 5 minutes to 30 minutes

8.5 Steam Generator

Generator shall be supplied in line with the following specifications:

Table 11: Generator Specifications

Description		Parameters
Rating & Count	:	1 x 45 MW
Type	:	Synchronous type
Number of pole & Excitation System	:	Four pole, with brushless excitation system.
Power Factor	:	0.8PF (lagging) to 0.95(leading) under entire band of ±10% voltage variation and ±5% frequency variation
Insulation Class	:	Class 'F' insulation and shall be suitable for operation within class 'B' limits
Overload Requirements	:	Over loading of 110% for one hour in every 12 hours and 150% for 30 seconds
Short Circuit and Overload Endurance	:	Generator shall withstand short-circuit of any kind at its terminal, while operating at rated load and 105% rated voltage for at least 3 seconds.

8.6 Segregated Phase Bus Duct

Generator shall be connected to 11kV panel through 11kV Segregated Phase Bus Duct with copper conductors. All other electrical distribution connections shall be through MV or LV rated cables as per application and voltage grade. Technical details of the Segregated Phase Bus Duct are given in the table below:

Table 11: Segregated Phase Bus Duct Specifications

Application	Steam Generator Connection to 11kV Panel
Power Frequency Withstand Voltage	28kV
BIL	75kVp
Enclosure	Minimum thick of 3mm
Sizing Basis	Maximum through fault current either from 132kV grid or from the generator including contribution from total plant loads through Auxiliary Transformers with 20% margin on higher side or 50kA, whichever is higher

8.7 11kV Switchboard

11 kV switchgear shall be of indoor, metal clad, fully draw out truck type with vacuum circuit breaker. The switchgear shall be suitable for maximum system voltage of 12 kV. The power frequency voltage of the board shall be 28kV and BIL of the panel shall be 75kV (peak). The circuit breakers and switchgear assembly shall withstand the rated short circuit current for not less than three seconds. The breakers shall also be rated for peak asymmetrical current with a rating of 2.5 times symmetrical rated current. The switchboard shall have incomer, Tie, Bus coupler and outgoing feeders of rating (3150A/4000A)/3150A / 2000A / 1250A for distribution of power to cogen and sugar plant and power export.

8.8 400 V Switchboard

All the cogeneration plant auxiliary loads of proposed plant shall be segregated into AC Variable Speed Drive (AC VSD) driven loads and non-AC VSD driven loads.

All AC VSD loads pertaining to cogeneration plant shall be connected to two (2) numbers of 11/0.415/0.415kV AC VSD transformer and non-VSD loads shall be connected to one (1) number of 11/0.415/0.415 kV AC VSD transformer. Both the VSD and non-VSD switchboards shall be interconnected through tie ACB feeders. DG incomer shall be provided in the non - VSD switchboard to meet the plant emergency loads. These switchboards shall be designed for 50 kA for 1 sec. The bus bar material of the panel shall be of copper.

8.9 Transformers

Technical specifications of the different transformers to be installed in the Project are given in the table below:

Table 12: Specifications of Transformers

Description	Parameters
Generator transformer (GT) / Power Transformer	45/57.5MVA, 11kV/132kV, YNd1
VSD transformers [Three winding transformer] for co-generation plant	3 x 3.15 MVA, 11kV/0.415/0.415 kV, Dyn11Dzn0
Lighting Transformer	150kVA, 415V/400V, 50Hz, Dyn11, dry type, Three Phase, Two Windings
Neutral Grounding Transformer	Zn0 windings, 50A for 10Sec & 500A for 3Sec, 11KV, ONAN

8.10 AC & DC UPS System

AC and DC UPS system will be supplied for loads that require un-interrupted power. Following UPS shall be supplied for this purpose:

Table 13: AC & DC UPS Specifications

Description	Parameters
110VDC for TG system	1x100% Dual FCBC with Battery Bank [VRLA Type]
110VDC for Switchyard	2 sets of Battery banks SMF type 2V Cell batteries, suitable for 110V DC system along with FCBC.
220VAC UPS	2x100% Dual Redundant UPS with Dedicated Battery Bank [SMF type: Sealed Maintenance Free]
230VAC Emergency Lighting inverter	Minimum 16kVA inverter with battery backup

8.11 Control Philosophy & Interfacing

Critical and important electrical loads shall be interfaced with SCADA system [built in plant DCS] for local and remote operation in-line with plant operational & safety requirements.

8.12 Energy Management System

The incoming and outgoing feeders of 132kV Switchyard Bays, Main MV [PCC] Panel and AC-VSD panel outgoing feeders shall be provided with PQM/TVM with communication port suitable for MODBUS-RTU protocol. One daisy chained link shall be provided for each switchboard which will communicate soft data to Plant DCS. All these meters shall be hooked up to a dedicated Energy Management System for data logging built in plant DCS.

Communication ports of MODBUS - RTU shall be planned in all TVMs and PQMs provided in the PCCs, AC VSD panels and control panels of the TG, power Transformer and switchyard control and relay panels. All the ports shall be hooked up to Energy Management System (Part of DCS) for data logging as well as monitoring purposes. The mimic representation of the complete electrical distribution shall be provided in Energy Management System (part of DCS) from 132 kV level to major/main LT panels.

8.13 RTDs & Thermistors

Thermistors shall be installed on motors rated between 3.7 to 75 kW. RTD shall be made available for motors rated from 90 kW. All RTDs shall be hooked up with relays in Motor Relays in respective MCC.

8.14 System Earthing

The grounding installation work shall be as per recommendation of IEEE-80. All panels, transformer, LAVT, NGR and motors shall be provided with double earthing. Lightning protection for tall structure shall be in line with IEC standards.

132kV system shall be solidly grounded through 132 kV side of power transformer neutrals at NTDC side as well as neutral of generator transformer on 132 kV side at co-generation plant.

TG system shall be grounded through Neutral Grounding Resistor (NGR) panel to limit the earth fault current to 50A to suit the system requirement, through the 11 kV neutral point of TG. The 11kV system shall be provided with 11 kV Earthing Transformer and Neutral

Grounding Resistor (NGR) panel to limit the earth fault current to 50A. This NGR of earthing transformer shall be switched ON whenever the power is imported from the grid with TG circuit breaker in open condition. LV system 400V system shall be solidly grounded through transformer neutral. Neutral bus bars shall be made available in 400V PCCs, and all MCCs.

415V VSD transformer grounding system shall be Solidly grounded.

400V system used for illumination system and small power distribution system shall be solidly grounded.

UPS System shall be of insulated neutral type (ungrounded). DC System shall be of ungrounded type.

8.15 Cable Installation

Cables shall be installed in concrete cable trenches [installed on trays], on cable racks and direct buried as required. All outdoor cables shall be laid on overhead cable trays. No cables shall be buried, except for outdoor lighting cables. Outdoor cable racks shall have clearance of minimum 6 M from the ground level to the lowest point of the cable racks.

8.16 Cable Trench

Concrete cable trenches shall be fitted with ventilation fans, air inlets, normal lighting, emergency lighting, utility sockets, fire alarm detectors, manual call points, and annunciation sirens. All wiring shall be in GI conduits.

Trench shall have access inlets provided with ladders, slopped on two sides having water excavation pits and two pumps.

8.17 Lighting & Small Power

Plant lighting loads shall be fed through one No of 415/400V, Dyn11 connected dry type lighting transformer of minimum rating of 150kVA.

Emergency Lighting Distribution Board (ELDB) shall be fed through inverter of minimum 16kVA rating.

The number of sockets [where maintenance & operation is required] shall be provided in the indoor area in such a way that approachable distance of any socket is not more than 10M distance. Minimum four (4) nos. of 24V lighting kit shall be provided for the plant.

63A power and welding socket shall be provided in all indoor as well as outdoor area wherever maintenance of mechanical equipment is required. Each socket shall comprise of MCB with ELCB and power / welding socket.

8.18 Plant Communication System

Plant communication shall be provided with following facility:

- Telephone system
- Public Address System
- Walkie-talkies.

8.19 Enclosure Ratings

Enclosure IP ratings for different applications shall be as below:

Table 14: Enclosure Ratings

HV Switchgear	IP4X
LV Switchgears	IP4X
Switchgears located outdoors	IP55
Control Panels	IP42
Motors	IP55
Push Button Stations	IP54 (indoor) IP55 (outdoor)
Segregated Phase Bus ducts	IP54 (indoor) IP55 (outdoor)

8.20 Plant Startup

The co-generation plant shall be with one (1) number of 400V Emergency DG set(EDG). This DG set shall be connected to DG panel with AMF facility, which shall be planned with incoming and outgoing feeders.

Plant startup can also be managed either from Grid supply or existing Cogeneration plant. In either case power shall be available at the main 11kV MV Panel. Through respective step down VSD transformers, power shall be fed to desired STG auxiliaries and common co-generation plant loads.

The DG set shall be with radiator cooled type. Proposed rating of EDG set shall be minimum 500kVA at Prime duty.

8.21 Instrumentation and Control (I&C) Systems

I&C System will ensure control and monitoring of operations of both the technological and electrical part of Cogen Power Plant including balance of plant (auxiliary operations) and 132 kV switchyard. Control room and its auxiliary equipment will be located in an outbuilding (CCR) adjacent to the Turbine Hall. I&C System will be designed as a complex system capable to control the whole Cogen unit both in standard conditions and transient operating conditions (start-up, shutdown, etc.). Specific autonomous functions of protections and control for steam turbines will be performed by their dedicated control system, nevertheless this dedicated control system will be an integral part of the whole I&C System from the viewpoint of operation, monitoring and control. I&C System, as a whole, will ensure control and monitoring of the following equipment:

- Boiler and its Auxiliaries
- Fuel Handling System
- Ash Handling System
- Steam turbine with accessories
- Balance of plant
- Electric equipment of Switchyard

8.22 Digital Control System (DCS)

The controlling and monitoring of operation of main power unit, loading and synchronizing, balance of the plant will be provided from the common control room through the operator panels of the process, electrical part including power outlet equipment, frequency control and switchyard etc. The working place of the system operator will be placed at the control room. The working place of shift engineer will be located in separate room with the window to control room. The DCS will be based on fully redundant process and network bus. The power plant will be fully automated with a target of high operation reliability as well as high operation safety. Control system will fulfill required standard functions for securing optimal, economical, safe and ecological operation for installed equipment in nominal and transient operation conditions. System will cover control function from basic level control up to fully automated control of function groups and units, control of system output and optimization of block operation. Specific autonomous functions of the plant safety system and selected regulation and control functions will be realized by special subsystems in a hierarchical model. From a viewpoint of control, these items will create an integrated part of the DCS control system.

Hardware and software will enable realization of loop control, binary control, data functions, monitoring, remote control and emergency manual control. Communication within the system will be handled by bus routing connected to the standard bus system RS 485, Ethernet etc.

8.23 Field Instrumentation

Instrument power circuits will employ an isolation transformer and will be individually protected from fault with the help of MCB's and fuses. Power supply to the individual instrument will be disconnect-able with the help of switch and will be protected with the help of fuse.

All instruments and equipment will be suitable for use in a hot, humid and tropical industrial climate. All instruments and enclosures in field will be dust proof, weather proof of type NEMA 4 and secured against the ingress of fumes, dampness, insects and vermin. All external surfaces will be suitably treated to provide anti-corrosion protection.

The complete instrument system will be designed for safe operation, by using normally closed contacts which open on fault conditions.

The operating value of field instrument will fall between 40% and 60% span for linear and 60% to 80% span for square root.

Transmitter valve manifold block assemblies will be type 316 stainless steel unless process conditions require higher-grade material. Internal wetted parts will be type 316 stainless steel unless process conditions require use of other material.

Process switches e.g. pressure switch and level switch will be of micro switch type.

All field-mounted instruments will be equipped with sufficient isolation device such as a block and bleed valves assembly, and vent and drain valves so as to permit safe maintenance, removal, testing and calibration of instruments during plant operation.

9 Grid Interconnection

A detailed grid interconnection study for the Project has been carried out by Power Planners International and approved by SEPCO, the same has now be submitted to NTDC for vetting. Key findings of the report are summarized in this section.

- The network around GPL at 132kV and 11kV has been modeled as shown in Annexure-4 (Sketch I).
- The nearest grid facility available is the Ghotki 132/11 kV Substation which is located at a distance of 2-3 km from the site of GPL.
- Keeping in view the location of the Project, the most feasible interconnection scheme would be the scheme being used for the existing 26.35 MW power plant. The existing power plant is looped in-out in one of the 132 kV triple circuit between Ghotki and Liberty at JDW Unit-III.
- The looping distance, as confirmed from site visit, would be 3.6 km and the conductor used would be 132 kV Lynx. The scheme is showed in Sketch-2 attached as Annexure 5.
- GPPL would generate power at 11 kV voltage level from where it will be stepped up to 132 kV using two 132/11 kV transformers with rating of 45/57.5 MVA.
- Two breaker bays of 132 kV will be required for the interconnection of the 45 MW power plant with the existing 132 kV circuits lying between Ghotki and Liberty Power Plant.
- In view of the planned COD of the 45 MW power plant, the above proposed interconnection scheme has been tested for steady state conditions through detailed load flow studies for the peak conditions of:
    - January 2020 for maximum thermal power dispatches in the grid during the Crushing Season for JDW Unit III
    - September 2019 for maximum hydropower dispatches in the grid during the off-season for JDW Unit III
    - The system conditions of normal and N-1 contingency have been studied to meet the reliability criteria of NEPRA Grid Code
- The proposed scheme of interconnection has also been tested for the extended term scenario of peak load conditions of the year 2022 for steady state conditions.
- Steady state analysis by load flow for all the scenarios described above reveals that the proposed scheme is adequate to evacuate the spillover of up to 41.175 MW power of the Plant under normal as well as contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at GPPL and the substations of 132kV in its vicinity.
- The maximum short circuit level of GPPL 132 kV is 9.18 kA and 9.93 kA for 3-phase and 1-phase faults respectively for the year 2019-20 while the same for the year 2022 are 9.35 kA and 10.07 kA. Similarly, the 3-phase and 1-phase short circuit level of the 11 kV bus bar of 45 MW GPPL is 32.55 kA and 40.50 kA for year 2019-20 and 32.66 kA and 40.55 kA for year 2022 respectively.
- It would be advisable to go for standard size switchgear of short circuit rating of 40 kA at 132 kV and 50 kA at 11 kV buses of GPPL. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out.

- The stability checks for the worst case of three phase fault right on the 132 kV bus bar of GPPL substation followed by the final trip of 132 kV circuits emanating from this substation, has been performed for fault clearing of 5 cycles (100 ms) as understood to be the normal fault clearing time of 132 kV protection system. Also the worst case of stuck breaker (breaker failure) has been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms. In all events, the system is found strong enough to stay stable and recovered with fast damping.
- The proposed scheme of interconnection has no technical constraints or problems, it fulfills all the criteria of reliability and stability under steady state load flow, contingency load flows, short circuit currents and dynamic/transient conditions; and is therefore recommended to be adopted.

10 Environmental Impact Assessment

GPL has commissioned an Initial Environmental Examination ("IEE") to identify and assess any adverse impacts of the Project, so that necessary mitigation measures, if required, to prevent or minimize any adverse impacts can be planned in a timely and cost-effective manner. The specific objectives of the report were:

1. To have an in-depth know-how of the Project and to identify the probable sources of pollution that may arise from each stage of the process.
2. To review the current environmental status of the area within specified radius of the proposed Project site - collection of baseline data on the environmental attributes including air, noise, water, land, ecological, hydro-geological climate and socioeconomic environments.
3. To assess likely or potential environmental impacts of the proposed activity (like air, water and soil pollution, noise, waste generation) and the alternatives.
4. To estimate the impacts of the proposed Project on the surrounding environment.
5. To prepare a comprehensive Environmental Management Plan to ensure that the environmental quality of the area is preserved.
6. To formulate a strategy for effective monitoring and identify any deviations in the environmental quality after the project is operational, which would help in evolving measures to counter these.
7. The IEE is to be undertaken pursuant to the Pakistan Environmental Protection Act 1997, the Sindh Environmental Protection Act 2014.

Summarily the IEE report has identified the following impact on the environment, suggested activities to cushion the impact and consequences thereof:

Impact on the environment	Suggested cushion activities	Residual impacts	Level of residual impacts
Impact on the landscape and the exterior view	None of activities are suggested, as the surrounding landscape is the industrial one. The time of construction is limited.	No	Insignificant positive impacts
Impact on the atmospheric air	Development of procedures on irrigation of road surface before the construction work begins; material storage in piles to minimize dusting. As far as necessary use closed trucks to transport discrete materials from the site in order to prevent dispersion by transportation.	Dusting in the course of construction work The impact is significantly reduced	Insignificant negative impacts
Water pollution as a result of possible leakage of fuels and lubricants and chemical substances in the course of the construction work.	To allot a special ground with a protection from leakages for the purpose of storing potentially polluting substances. Development of working instructions to guarantee the right treatment of these materials.	Impact risk is significantly reduced	Insignificant negative impacts
Waste generation by the construction work	Development of procedures of waste control and storage to guarantee the right identification of waste, rules of storage safety, reuse or recycling, where the transportation to the special site is possible.	Generation of construction Waste Reducing waste volumes which are to be buried in the course of the assumed activities.	Insignificant negative impacts
Noise	Development of the plan to control noise. It may include: Switch off plants and facilities when they do not work. Determine the site	Reducing the level of noise impact.	Insignificant negative impacts

	working hours. Develop a work program to minimize the work during the non-working hours (not daytime). A brief instruction of all workers about the noise control measures. Use temporary screens or partial enclosure of the territory, where the activity takes place.		
Impact on the atmospheric air	Development of normative standards of maximum permissible emissions for the sources of all pollutants, providing the correspondence of near the ground concentrations at the bounds of sanitary protective zone to the maximum permissible concentrations. Development of activity on the emission regulation during the period of unfavorable meteorological conditions. Organization of permanent control after pollutant emissions into the atmosphere with the application of the results of planned observations.	After putting the plant into the operation the concentration of most pollutants in the atmospheric air remain the same or decrease. The emission of green greenhouse gases decrease.	positive impact
Possibility of emergency Developing	Surface air monitoring at the bound of the sanitary protective zone and the zone of facility influence. Possibility of emergency developing Investigation of the whole range of possible measures and means, which may be opposed to the dangerous factors with the purpose of their parrying within the advantages of the environmental safety.	Operation of the proposed plant may increase danger. However, the creation of environmental safety management system, representing the aggregate of juridical, organizational and economic mechanisms, intended to decrease the environmental risk to the acceptable level, and in case of	Insignificant positive impacts

	Quantitative analysis of the possibilities for one or another situation to appear, of effectiveness of different measures and means of their parrying. Creating the system of a complex monitoring and management of environmental safety. Taking a complex of decisions, that excludes depressurization of facilities and preventing emergency emissions of dangerous substances as well as reducing corrosive attacks of pipelines and shut-off-and-regulating fixtures. Proving disclosure means to control emergencies. Development of fire prevention activities. Having a plan of work on liquidation emergency spill of fuel, lubricants and mazut. Development of procedures on preventing emergencies (including fire, spills, etc.) Provide the respective training for personnel and give out the necessary equipment.	emergency with an impact on the environment to provide security to people and to the environment, will help to achieve the maximum reduction of possible damage and compensation of the caused loss.	
Impact on surface-waters	Application of separate system of sewage disposal Application of modern systems of water treatment, grounded on the analysis of sewage quality. Monitoring the condition of water from the surface sources. Quality control of	The impact on surface-water is minimized	Insignificant positive impacts

	entering and exporting of sewage. Liquidation plan correction of oil product overflows and its approval.		
Impact on soils	Mechanical removal, storage into piles and clamps as well as soil replacement with a qualitative one. Organization of specialized places to exclude the soil contact with the substances of higher danger. Development of the complex of activities which exclude the possibility for oil products to leak on the soil surface.	Soil quality improvement at the expense of the replacement of degraded soil with a qualitatively new one. The possibility of potential soil pollution being a result of oil spill is insignificant due to the application of preventive measures complex.	Insignificant positive impacts
Waste generation	Permanent monitoring of the waste disposal places. Approval (renewal) licenses and permissions on waste treatment. Having approved instructions on collecting, storing and transporting the production waste. Making records of all data about the delivered and recycled waste and providing the respective reports. Waste sorting out and storage with account of the direction of its finale usage. Marking of containers, used for waste collection and storage, as well as registration in respective documents of such data as a source of waste products, their quantity, a danger class, a collection date and a date of disposal at the production facility with the purpose of storage.	Insignificant change of qualitative and qualitative composition of waste Waste impact on the environment is assessed as insignificant under the condition of realizing the developed projected decisions concerning the rules of temporary storage and established frequency of their removal to recycling and disposal.	Minimum positive impact

	Maximum possible replacement of toxic materials with less dangerous. Sorting out according to the classes of danger with the subsequent waste separation depending on the type. Activities on reducing the amount of generated waste.		
Impact on ground waters	Development of measures against leakage from reservoirs and from the underground water-bearing communications. Development of the system of hydrogeological monitoring.	The possibility of the impact on the ground waters is small.	Minimum positive impact
Impact on flora and Fauna	Accomplishment of the works on landscaping.	Landscaping work will allow to extend the area of greenery.	Minimum positive impact
Impact on the geological Environment	Speeding up the construction terms and observing the recommendations of the IEE (EMP) section, which exclude pollutants entering into the open trenches and pits. Monitoring of the impact on the geological environment.	The subsidence of buildings in the course of use of buildings and constructions is expected to be minimum and short-term. The impact of vibrations and impoundment of areas is extremely insignificant.	Extremely insignificant negative Impact
Social impacts		Creating additional jobs. Increase of employee incomes and population purchasing activity due to procurement of materials and supply of services for construction necessities.	Positive impact

11 Operations and Maintenance (O&M)

The Facility will be a standalone operation under the management of the Plant Manager who shall be in charge of both technical and administrative functions of the co-generation facility's operation and maintenance. Most operation and maintenance functions will be performed by permanent staff; however, certain functions, such as performance monitoring of equipment, environmental monitoring, fuel yard operation, ash handling and major maintenance, will be performed under various contracts with specialized vendors. The contracts will be equipment specific performance monitoring and maintenance contracts and will also include contracts for supply of manpower for major maintenance activities. To the extent practical, the operation of the Facility will be automated through a distributed control system.

The Facility operation is planned to be divided into three shifts with a fourth shift in reserve. Each operating shift will include a shift charge engineer, one control room operator, one operator, one boiler operator two field operators and a chemist. All the operations staff will report through the shift charge engineers who report to the Operations Manager reporting to Plant Manager

The maintenance of the Facility will be divided into three work areas - instrumentation, electrical, and mechanical. Each work area will be managed by a manager who reports directly to the Plant Manager. Maintenance staff reporting to the managers will be provided on each shift. The total maintenance staff is as follows:

The maintenance staff will perform the routine maintenance on the Facility. During the off-season periods when the Facility is not operating, the maintenance staff will support any major maintenance work that needs to be performed.

In addition to the operation and maintenance departments, there will be a separate performance department and a fire and safety department. The staffing for these two departments is as follows:

Table 15: O&M Staffing

Mechanical Maintenance		Electrical Maintenance		Instrumentation & Control	
Manager - Mechanical	1	Manager - Electrical	1	Manager - I&C	1
Mechanical Engineer	1	Electrical Engineer	1	I&C Engineer	1
Mechanical Supervisor	1	Electrical Supervisor	1	I&C Supervisor	1
Mechanic/Fitter	8	Electrician	5	I&C Technician	5

The performance/efficiency engineer will be responsible for monitoring the operation of the Facility and identifying any operational issues that affect the performance of the Facility. Additional responsibilities include maintaining the plant design records and drawings.

Hence the total operation and maintenance staffing, including the Plant Manager, is 64. This excludes the contract operation and maintenance staff.

11.1 Periodic Maintenance

Routine maintenance of the Project will be performed on a shift basis. Most of the routine maintenance activities are expected to be preventative maintenance work and troubleshooting during the time the Facility is operating. There will be some time during the off-season where the Facility will not be operating due to unavailability of bagasse or other appropriate biomass fuels. During these non-operating periods, which shall last up to one month during a given year, the maintenance staff can perform more extensive repairs.

The major maintenance cycle for the key components will be a function of the number of operating hours accumulated. Given the expected downtime during the off-season, it is logical to expect boiler inspections, cleaning and repairs to be performed each year. The annual boiler work would include measurement of tube thickness in certain areas of the boiler, weld repairs where there is localized tube metal loss, tube replacements where the metal loss is more extensive, refractory repairs, grate bar replacements, grate chain adjustments, ash system repairs, etc. Extensive repairs would not be required for the first ten years of operation, particularly if the fuel burned is primarily bagasse and the operating period is less than 180 days a year.

Major maintenance on the steam turbine and generator is to be performed on a five to seven year basis for a base loaded plant. A thorough inspection of the steam turbine and generator is expected prior to the expiration of the supplier warranties. After that, given the expected operating regime of approximately 180 days per year, the first major inspection of the steam turbine and generator would not be anticipated for ten years unless there are indications of some mechanical or electrical failure.

12 Key Operating Assumptions

The following sections provide a summary of the general, project cost, operating and financing assumptions related to the Project. The feasibility has been prepared following a detailed discussion of these assumptions with Project sponsors. The proceeding sections discuss the following assumptions:

- Plant Generation
- General & Timeline
- Project Cost
- Financing Assumptions
- Project Tariff & Revenue
- Financial / Economic Analysis

12.1 Plant Generation Parameters

The 110 bar system shall remain operational during off-season with its generation capacity of 45 MW Gross utilizing the bagasse saved during season. Key generation parameters during are as follows:

Table 16: Plant Generation

	Crushing Period	Non-Crushing Period
Extracting & Condensing Turbine Capacity	44.38 MW	45.00 MW
Auxiliary Consumption of Turbine	3.99 MW	3.82 MW
Net Capacity from High Pressure System	40.39 MW	41.18 MW
Sugar Mill Requirement	15.00 MW	0.50 MW
Net Exportable to Grid from High Pressure System	25.39 MW	40.68 MW

12.2 Project Timeline

Assumed construction period of 20-month following financial close has been assumed for the Project. Financial Close is targeted in mid-October 2017 with a target Project commercial operations date (**"COD"**) of early June 2019. This would enable the Project to smooth any teething issues that may arise during the crushing period. A schedule of activities and key milestones is provided in Table 17 below.

Table 17: Indicative Project Schedule

Activtity	Duration	Start Date	End Date
Issuance of LOI			10-Feb-17
Grid Study submission and Approvals & CPPA-G Consent	120	10-Feb-17	10-May-17
Generation License Application and Approval from NEPRA	60	10-May-17	10-Jul-17
Tariff Application and Approval from NEPRA	30	10-Jun-17	10-Jul-17
Issuance of LOS	15	10-Jul-17	25-Jul-17
Signing of IA and EPA, EPC negotiations	60	25-Jul-17	25-Sep-17
Financial Close Activities, EPC finalization	120	10-Jul-17	10-Oct-17
Construction Activities	600	10-Oct-17	2-Jun-19
Commercial Operations Date			2-Jun-19

12.3 Project Life

As per the standard energy purchase agreement ("EPA") the Project life and EPA term has been assumed as 30 years from COD and all equipment is being procured corresponding to the same.

12.4 Project Cost

The break-down of the estimated Project Cost is provided below in Table 18. The project cost is based on an average PKR/USD exchange rate of PKR 98/USD.

Table 18: Estimated Project Cost

Estimated Project Cost*	USD million	PKR million
EPC Cost	40.15	3,935.1
Non-EPC Cost	3.13	306.5
Financing Fee & Charges	0.86	84.77
Interest during Construction (IDC)	4.81	465.1
Total	**48.96**	**4,798.1**
EPC Cost per MW (USD million)	*0.8923*	
Project Cost per MW (USD million)	*1.0879*	

12.5 Project Financing

The Project financing will be based on a debt to equity ratio of 80:20. Under the base case financial projections debt is assumed to be repaid 10 years after COD with debt being amortized over the period through fixed annuity based installments.

Key parameters of the Project funding are provided in Table 19 below:

Table 19: Project Funding

Project Cost	PKR 4,798.1 million
Debt	PKR 3,838.5 million
Equity	PKR 959.6 million
Lending Rate	*(3-month KIBOR + 3.0%)*
Repayment Period	10 years
Repayment Frequency	Quarterly

12.6 Project Tariff

NEPRA had announced a 30-year Upfront Tariff for high pressure boiler based bagasse power projects in May 2013 which was valid for a period of 2 years. Subsequently, the Upfront Tariff was extended up to May 2017. The existing upfront tariff is being used for forecasting.

The Upfront Tariff is calculated on notional capacity of 1.00 MW with appropriate indexing of different tariff determining components. This tariff structure is generic in nature and is applicable for various sizes of new bagasse based co-generation power plants of 60 bar or higher pressure boilers. The critical assumptions upon which the tariff is based appear in the table below:

Table 20: Key Assumptions for Upfront Tariff

Description	Basis
Auxiliary Consumption	8.5%
Plant Factor	45%
EPC cost per MW	USD 0.8112
Project Cost per MW	USD 0.9966
Construction Period	20 months
Exchange rate (PKR/USD)	98.0
Benchmark Efficiency	24.5%
Bagasse Price	Rs.3128.661 per MT
Bagasse CV	6,905 BTU/kg
Total O&M Cost	3.25% of EPC
Variable O&M Local	15% of total O&M
Variable O&M Foreign	45% of total O&M
Fixed O&M Local	40% of total O&M
Insurance	1.0% of EPC
Working Capital	45 days of Fuel @ 3 month KIBOR plus 2.0%
Debt	80%
Return on Equity	17.0%
Return on Equity during Construction	17.0%
Loan Repayment Period	10 years
Repayment Frequency	Quarterly
Debt Cost	3 month KIBOR plus 3.0% (Base KIBOR: 9.5%)

Respective tariff components along with relevant indexations are provided in Table 21 below:

Table 21: Upfront Tariff

Description	Reference Tariff PKR per kWh Year 1-10	Year 11-30	Indexation
Fuel Cost	5.7702	5.7702	Yearly PKR/USD parity and annual CIF Coal Price w.e.f 1st October of each year
Variable O&M - Local	0.1074	0.1074	Quarterly CPI changes notified by FBS on start of each quarter
Variable O&M - Foreign	0.3223	0.3223	Quarterly changes in PKR/USD and US CPI changes notified by Bureau of Labor Statistics on start of each quarter
Fixed O&M	0.2865	0.2865	Quarterly CPI changes notified by Federal Bureau of Statistics ("FBS") on start of each quarter
Insurance	0.2204	0.2204	No indexation
Working Capital	0.1924	0.1924	Quarterly adjustment for changes 3 M KIBOR
Return on Equity	1.0155	1.0155	After onetime adjustment at COD, annual changes in PKR/USD parity
Debt Servicing Component	3.8249		After onetime adjustment at COD, quarterly changes in 3-M KIBOR
Total Tariff	**11.7396**	**7.1947**	
Levelized Tariff	**10.4078**		

Note: The tariff is adjusted quarterly for changes in 3-month KIBOR variations.

12.7 Project Revenue

As stated above, the Project shall be selling power to the national grid as well as partially meeting the power and steam requirements of JDW Unit-III. In such a case, the Project shall be expecting three (3) revenue streams as follows:

- Sale of energy to national grid i.e. CPPA-G
- Sale of energy to JDW Unit-III
- [1]Sale of steam to JDW Unit-III

12.8 General

The base case financial projections show that the Project is expected to generate a positive earnings before interest, taxes and depreciation (EBITDA) and net profits throughout the life of the Project.

12.9 Projected Financial Statements

Financial Statements presented below are limited to the 10-year debt period.

[1] Steam Sales are not accounted for at this stage, as negotiations for steam price are still underway with JDW Mills

12.10 Projected Income Statement

PKR Millions	1	2	3	4	5	6	7	8	9	10
Power Sale to CPPA	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,6
Power Sale to JDW Unit-III	516	516	516	516	516	516	516	516	516	51
Steam Sale to JDW Unit-III	-	-	-	-	-	-	-	-	-	-
Total Revenue	2,117	2,117	2,117	2,117	2,117	2,117	2,117	2,117	2,117	2,1
Fuel cost	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,0
Fixed O&M	52	52	52	52	52	52	52	52	52	52
Var. Foreign O&M	58	58	58	58	58	58	58	58	58	58
Var. Local O&M	19	19	19	19	19	19	19	19	19	19
Total O&M Cost	129	129	129	129	129	129	129	129	129	12
Insurance	40	40	40	40	40	40	40	40	40	40
Depreciation	160	160	160	160	160	160	160	160	160	16
EBIT	748	748	748	748	748	748	748	748	748	74
Interest on LT Debt	470	443	412	378	338	294	244	187	123	50
Working capital Cost	35	35	35	35	35	35	35	35	35	35
Net Income	243	270	301	335	375	419	469	526	590	66

12.11 Projected Balance Sheet

PKR millions	1	2	3	4	5	6	7	8	9	10
Fixed Assets	4,638	4,478	4,319	4,159	3,999	3,839	3,680	3,520	3,360	3,200
Advance	-	-	-	-	-	-	-	-	-	-
Accounts Receivable	-	-	-	-	-	-	-	-	-	-
Debt Reserves	-	-	-	-	-	-	-	-	-	-
Cash	-	-	-	-	-	-	-	-	-	-
Total Current Assets	-	-	-	-	-	-	-	-	-	-
Total Assets	**4,638**	**4,478**	**4,319**	**4,159**	**3,999**	**3,839**	**3,680**	**3,520**	**3,360**	**3,200**
Accounts Payable	-	-	-	-	-	-	-	-	-	-
Working Capital	-	-	-	-	-	-	-	-	-	-
Debt Current Portion	235	265	300	339	384	434	491	555	628	-
Current Liabilities	235	265	300	339	384	434	491	555	628	-
Long-term Debt	3,396	3,131	2,831	2,492	2,108	1,674	1,183	628	-	-
Total Liabilities	3,631	3,396	3,131	2,831	2,492	2,108	1,674	1,183	628	-
Paid-up Capital	960	960	960	960	960	960	960	960	960	960
Retained Earnings	48	122	228	368	548	772	1,046	1,377	1,773	2,241
Total Equity	1,007	1,082	1,188	1,328	1,507	1,731	2,006	2,337	2,732	3,200
Equity & Liabilities	**4,638**	**4,478**	**4,319**	**4,159**	**3,999**	**3,839**	**3,680**	**3,520**	**3,360**	**3,200**

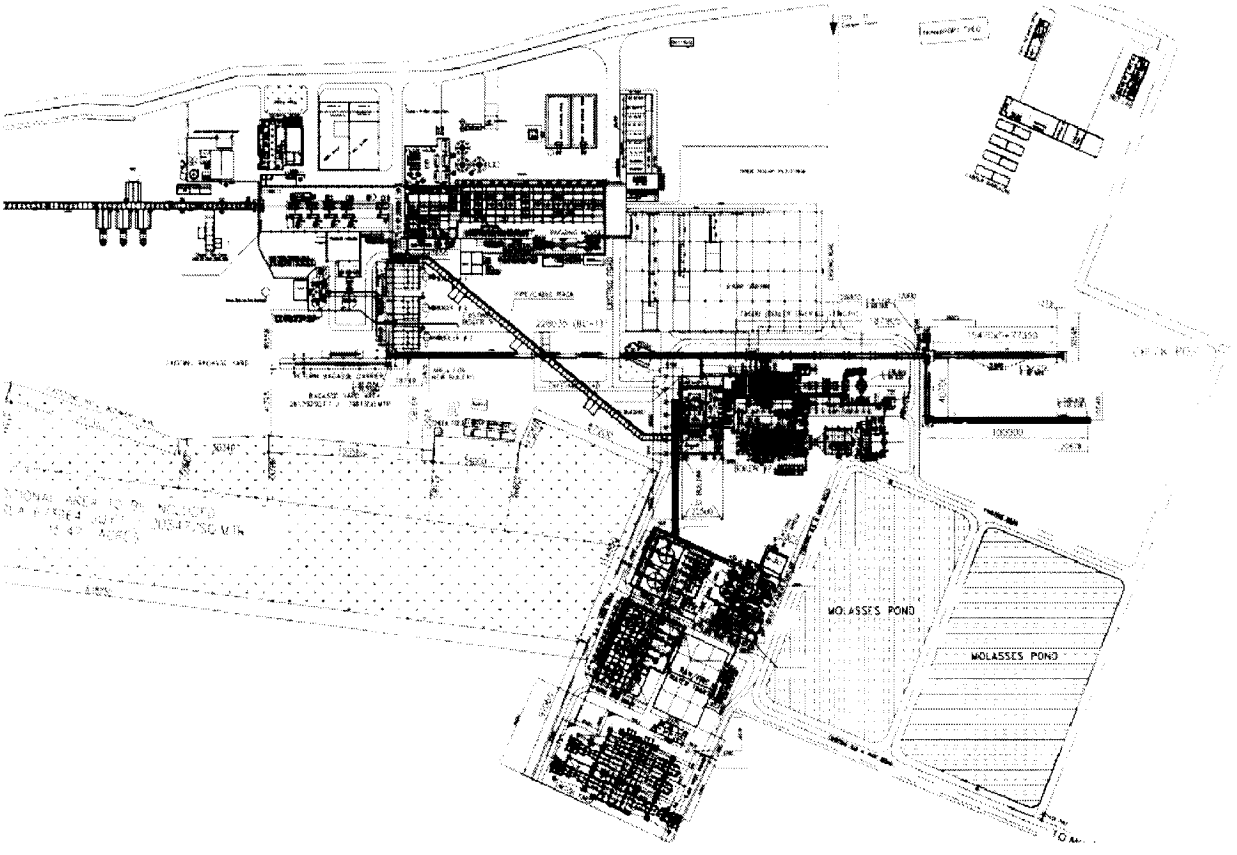
12.12 Projected Cash Flows

PKR millions	1	2	3	4	5	6	7	8	9	10
Earnings after tax	243	270	301	335	375	419	469	526	590	663
Add: Depreciation	160	160	160	160	160	160	160	160	160	160
Change in Advances	-	-	-	-	-	-	-	-	-	-
Change in A/C Receivable	-	-	-	-	-	-	-	-	-	-
Change in A/C Payable	-	-	-	-	-	-	-	-	-	-
Cash Flow from Operations	**402**	**430**	**460**	**495**	**534**	**579**	**629**	**686**	**750**	**823**
Cash Flow from Investment	-	-	-	-	-	-	-	-	-	-
Repayment of LT Debt	207	235	265	300	339	384	434	491	555	628
Repayment of WC Loan	-	-	-	-	-	-	-	-	-	-
Disbursement of Equity	-	-	-	-	-	-	-	-	-	-
Cash Flow from Financing	**207**	**235**	**265**	**300**	**339**	**384**	**434**	**491**	**555**	**628**
Net Cash Flow	**195**	**195**	**195**	**195**	**195**	**195**	**195**	**195**	**195**	**195**

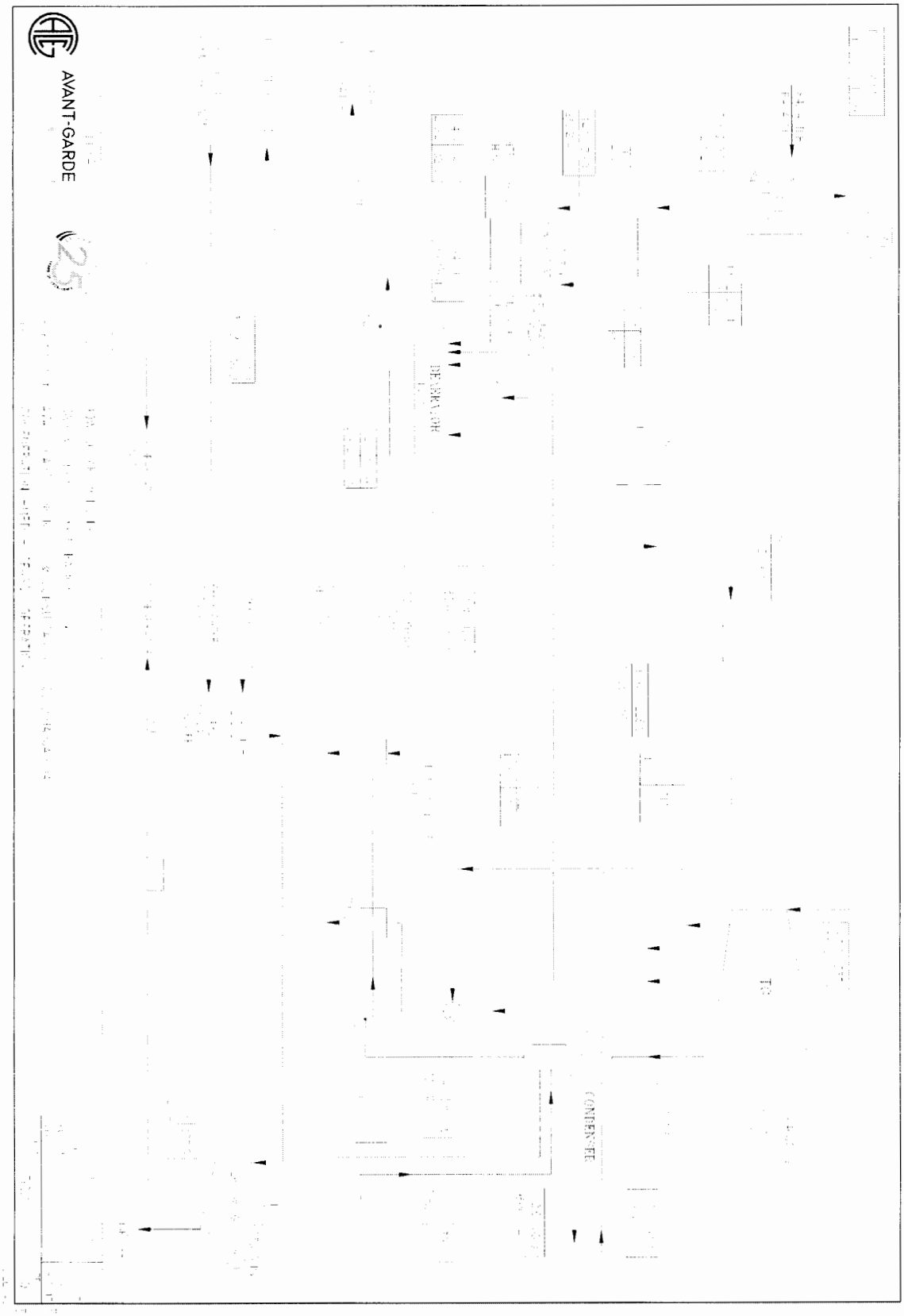
12.13 Financial / Economic Analysis

PKR Millions	Min.	1	2	3	4	5	6	7	8	9	10
Revenue	**2,117**	2,117	2,117	2,117	2,117	2,117	2,117	2,117	2,117	2,117	2,117
EBITDA	**907**	907	907	907	907	907	907	907	907	907	907
Net Income	**243**	243	270	301	335	375	419	469	526	590	663
Dividends	**195**	195	195	195	195	195	195	195	195	195	195
Annual Interest	**84**	505	478	447	412	373	329	278	222	157	84
Debt Servicing	**678**	678	678	678	678	678	678	678	678	678	678
Debt to Equity	**0**	3.78	3.54	3.26	2.95	2.60	2.20	1.74	1.23	0.65	-
Times Interest	**1.80**	1.80	1.90	2.03	2.20	2.43	2.76	3.26	4.10	5.77	10.74
DSCR	**1.34**	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34
Equity IRR	**16.6%**										
Project IRR	**12.5%**										
Project NPV @ 11%	**117.1**										

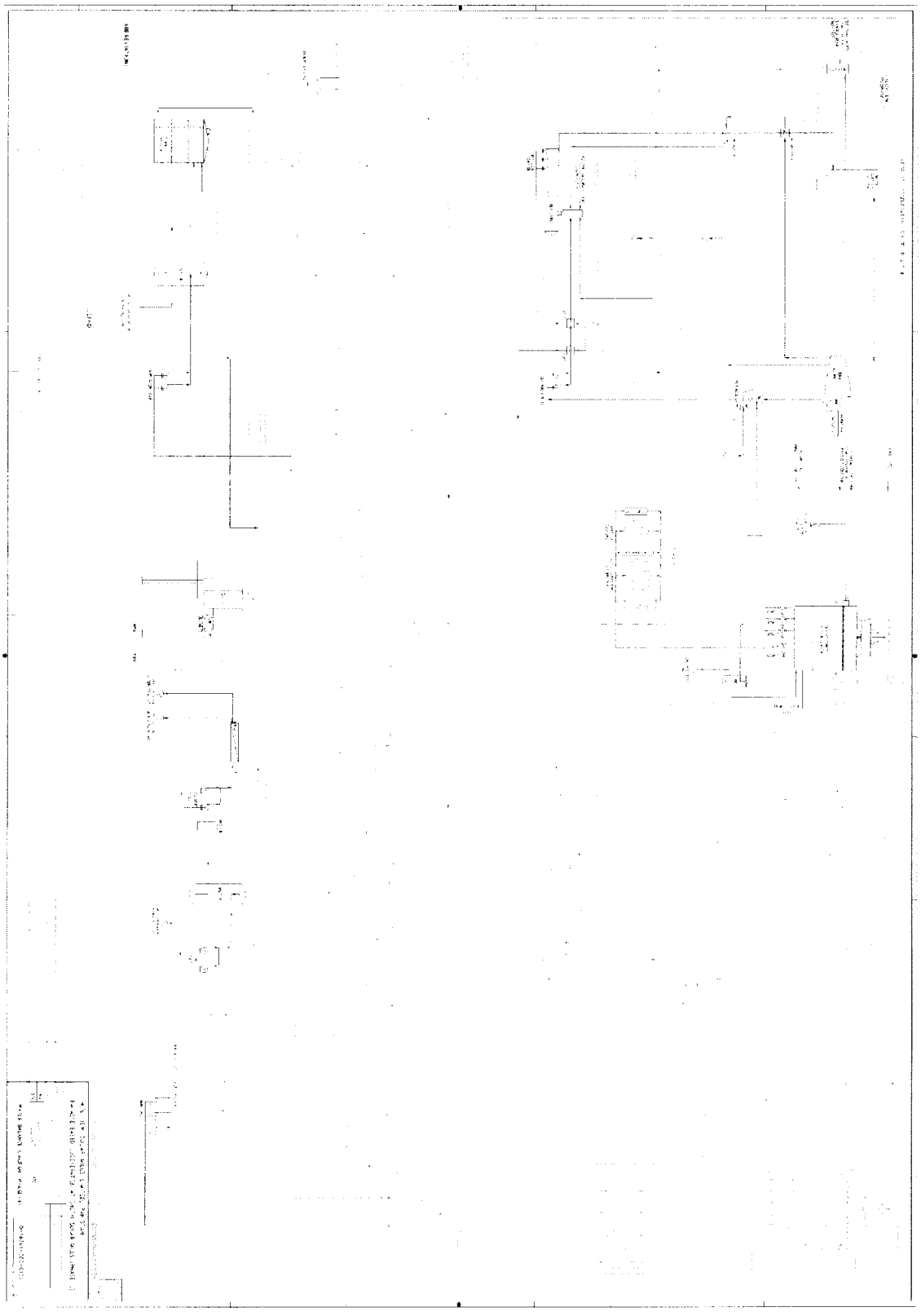
13 Annexure-1: Plant Layout



14 Annexure-2: HMBD Diagram

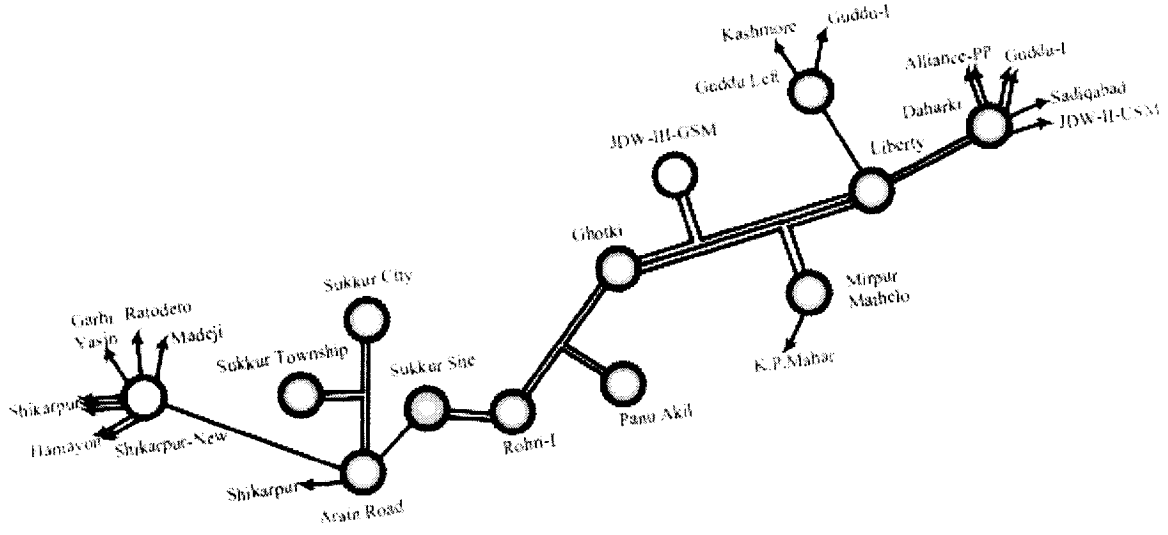


15 Annexure-3: Water Balance Diagram



16 Annexure-4: Sketch-1

STUDY OF INTERCONNECTION OF 45 MW JDW-III-GSM POWER PLANT
WITHOUT 45 MW JDW-III-GSM PP, YEAR SEPTEMBER 2019

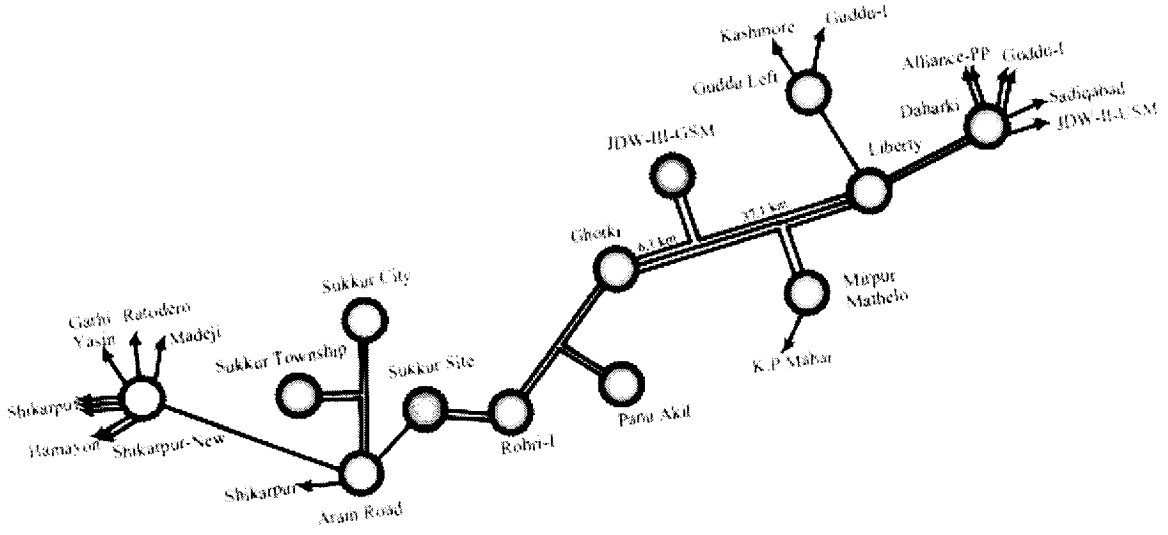


Legend
132 kV
66 kV
11 kV

SKETCH - I

17 Annexure-5: Sketch-2

STUDY OF INTERCONNECTION OF 45 MW JDW-III-GSM POWER PLANT
WITH 45 MW JDW-III-GSM PP, YEAR SEPTEMBER 2019



Legend

Proposed 11 kV
132 kV
66 kV
11 kV

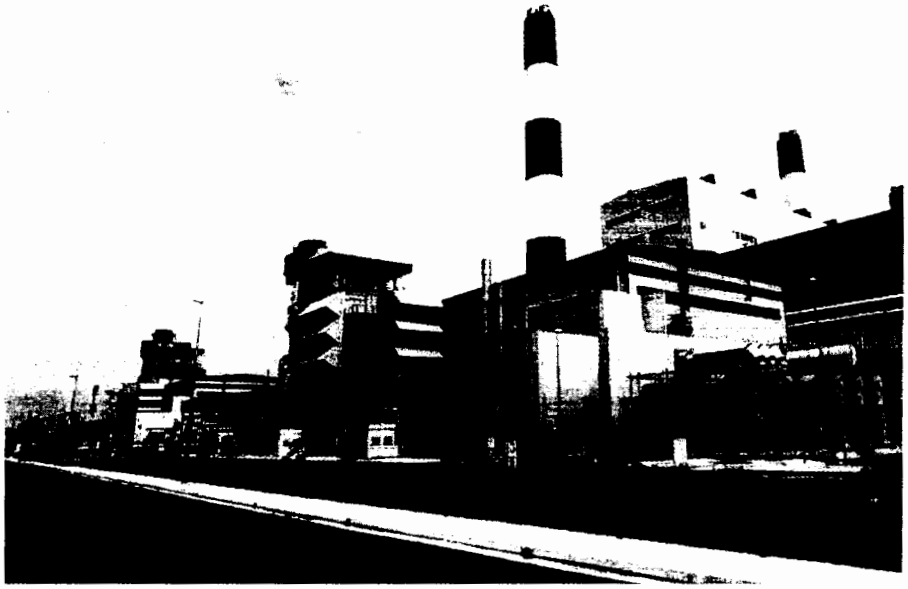
SKETCH - II

Report No. PPI-233.2-Final/17

INTERCONNECTION STUDY

For

45 MW Ghotki Power (Pvt) Limited Power Plant District Ghotki, Sindh



Final Report
(March 2017)

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Subject: **REPLY OF COMMENTS ON GRID INTERCONNECTION STUDY OF 45 MW BAGASSE BASED POWER PROJECT BY GHQTKI POWER PRIVATE LIMIIED, UNIT-III, DISTRICT GHOTKI, SINDH,**

PPI reply to all the comments received from:

SEPCO vide letter No. CTO/SEPCO/SUK/M(P&E)/JDW/675-77 dated 17-02-2017

1. In PSS/E case, Plant has been shown at a distance of approx. 5 km from looping point on Ghotki - Liberty circuit with lynx conductor whereas In Executive summary the same arrangement in shown on rail conductor which may be corrected	Incorporated in the study report.
2. A double circuit line from 132 kV Hamayon-132 kV Jacobabad has been shown in the study whereas at site there is only single circuit line between the two grids.	Incorporated in the study cases.
3. A single circuit line is from Thull to Jacobabad-II but in study it has been shown from Thull to Jacobabad grid which may be corrected.	Incorporated in the study cases.
4. A single circuit line is from Guddu-I to Guddu Left has been shown in the study. There is no such line In SEPCO Network.	Incorporated in the study cases.
5. Tangwani grid in SEPCO plan is proposed on kandhkot - Thull single circuit. An extra line has been shown from kandhkot to Thull in the study which may be switched off	Incorporated in the study cases.
6. There is no any line from Moro to Naushahro Feroze which may be switched off	Incorporated in the study cases.
7. There is no any line from New Jatoi to Naushahro Feroze which may be switched off	Incorporated in the study cases.
8. In the study Tharu Shah Grid has been shown between Bhiria Road and Naushahro Feroze whereas it is between Knndiaro and New Jatoi, which may be corrected	Incorporated in the study cases.

9. Similarly Bhiria Road grid has wrongly been simulated in the study, actually this grid is proposed between Kandiaro and Naushahro Feroze which may be corrected.	Incorporated in the study cases.
10. A second circuit line has been proposed from New Dadu to Old Dadu in SEPCO expansion plan which has not been included in the study.	Incorporated in the study cases.
11. A single circuit line has been proposed from Daulatpur to Moro in SEPCO expansion plan which has not been included in the study	Incorporated in the study cases.
12. A capacitor bank of 20.22 MVAR has been proposed at Mehar Grid station to address the issue of low voltage. The same may be Include in the study.	Incorporated in the study cases.
13. There are two 4O MVA transformers at Khairpur Grid Station whereas in study a 26 MVA transformer is shown which may be corrected	Incorporated in the study cases.
14. There are two capacities of 40 & 26 MVA transformers at Kandhkot Grid Station whereas in study 40 & 13 MVA transformers are shown which may be corrected	Incorporated in the study cases.
15. There are three 26 MVA transformers at Gambat Grid Station whereas in study 13 26 & 40 MVA transformers are shown which may be corrected.	Incorporated in the study cases.
16. There are two 26 MVA transformers at Shahdadkot Grid Station whereas in study 13 & 26 MVA transformers are shown which may be corrected.	Incorporated in the study cases.

17. There are two 26 MVA transformers at Mehar Grid Station whereas in study 13 & 26 MVA transformers are shown which may be corrected.	Incorporated in the study cases.
18. There are 13, 5, 2.5 MVA transformers at Nara-II Grid Station whereas in study 13, 5 & 5 MVA transformers are shown which may be corrected	Incorporated in the study cases.
19. There is 26 MVA transformer at Radhan Grid Station where as in study 13 MVA transformer is shown which may be corrected	Incorporated in the study cases.
20. Above omissions show that the SEPCO expansion/future plans has not been fully included in the study which may be incorporated accordingly.	Incorporated in the study cases.
21. Besides the case of short circuit and stability may also be revised in view of above observations.	Incorporated in the study cases.
22. SEPCO Grid wise PMS load forecast (Peak and Off Peak) has not been included in the report, therefore the loads cannot be verified on the grids individually.	Attached in Appendix - A
23. A letter has been sent to Project Director (GSC) SEPCO vide this office letter No.M(P&D)/A.D(PSS)/JDW/566-70 dated 07/02/2017 for his comments on a. Construc:tion of proposed transmission line before COD. b. Availability of Line Bay/Line entry at 132 kV GS Daharki c. Availability of Right of Way (ROW) d. Practical Implementation The comments of PD (GSC) SEPCO are still awaited which will be communicated as and when received.	Not included in the scope of our work

24. The proposed protection scheme for Power Plant may please be provided	Not included in the scope of our work
25. NOC from Environmental Protection Agency (EPA), Sindh may please be provided	Not included in the scope of our work

Executive Summary

- The Final Report of 45 MW Cogeneration Power Plant for Ghotki Power (Pvt) Ltd, which is an extension of the existing 26 MW power plant, is submitted herewith.
- All the comments raised by SEPCO planning department vide letter no. CTO/SEPCO/SUK/M(P&E)/JDW-675-77 dated 17-02-2017 have been incorporated in this final report.
- Electrical Grid Studies by Ghotki Power (Pvt) Ltd for the Total 26 MW capacity has already been approved and vetted by NTDC.
- Ghotki Power (Pvt) Ltd would like to go for high pressure cogeneration in the sugar mill with the aim of exporting power nearly 41 MW to the national grid, in addition to the existing 24.5 MW export, during both the crushing season (November to March) and Off-Season (April to October).
- The study objective, approach and methodology have been described and the plant's data received from the Client is validated.
- The network around Ghotki Power (Pvt) Ltd PP (referred to as JDW-III PP in the remainder of the report) at 132 kV and 11 kV has been modeled as shown in Appendix-B (Sketch-2).
- The existing power plant is looped in-out in one of the existing 132 kV triple circuit between Ghotki to Liberty at JDW-III-PP. The distance of the plant from the looping point is about 3.6 km. The conductor used is 132 kV Lynx. Same interconnection scheme will be used for the upcoming 45 MW power plant.
- Two breaker bays of 132 kV being used for existing 26 MW power plant at JDW-III-PP will suffice for the connection of the 45 MW power plant with the existing 132 kV circuits lying between Ghotki and Liberty.
- With the gross capacity of 45 MW, the spillover from JDW-III-PP would be 40.9358 MW in Crushing Season and 41.175 MW in the Off-Season.
- In view of planned COD of the JDW-III-PP in June 2019, the above proposed interconnection scheme has been tested for steady state conditions through detailed load flow studies for the peak conditions of

o September 2019 for maximum hydropower dispatches in the grid during the Off-season of JDW-III-PP.

o January 2020 for maximum thermal dispatches in the grid during the Crushing Season for JDW-III-PP.

The system conditions of normal and N-1 contingency have been studied to meet the reliability criteria of NEPRA Grid Code

- The proposed scheme of interconnection has also been tested for the extended term scenario of peak load conditions of the year 2022 for steady state conditions.
- Steady state analysis by load flow for all the scenarios described above reveals that the proposed scheme is adequate to evacuate the spillover of up to 41.175 MW power of the Plant under normal as well as contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at JDW-III and the substations of 132kV in its vicinity. We find that the fault currents for the proposed scheme are less than the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from JDW-III-PP. A NGR of 127 ohms has already been installed at 26 MW JDW-III-PP generator. Same has been proposed by PPI for the 45 MW JDW-III-PP generator to limit the short circuit currents that exceed the nominal standard size switchgear value.
- The maximum short circuit level of JDW-III-PP 132 kV is 9.18 kA and 9.93 kA for 3-phase and 1-phase faults respectively for the year 2019-20 while the same for the year 2022 are 9.35 kA and 10.07 kA. Similarly, the 3-phase and 1-phase short circuit level of the 11 kV bus bar of JDW-III-PP is 32.55 kA and 40.50 kA for year 2019-20 and 32.66 kA and 40.55 kA for year 2022 respectively. It would be advisable to go for standard size switchgear of short circuit rating of 40 kA at 132 kV and 50 kA at 11 kV buses of JDW-III-PP. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.
- The dynamic stability analysis of proposed scheme of interconnection has

been carried out. The stability check for the worst case of three phase fault right on the 132 kV bus bar of JDW-III-PP substation followed by the final trip of 132 kV circuits emanating from this substation, has been performed for fault clearing of 5 cycles (100 ms) as understood to be the normal fault clearing time of 132 kV protection system. Also the worst case of stuck breaker (breaker failure) has been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms. In all events, the system is found strong enough to stay stable and recovered with fast damping. The stability of system for far end faults of 3-phase occurring at Ghotki 132 kV bus bar and Liberty 132kV bus bar have also been checked. The proposed scheme successfully passed the dynamic stability checks for near and far faults even for the most stringent cases.

- The proposed scheme of interconnection has no technical constraints or problems, it fulfills all the criteria of reliability and stability under steady state load flow, contingency load flows, short circuit currents and dynamic/transient conditions; and is therefore recommended to be adopted.

Report Contents

1. Introduction

1.1 Background

Ghotki Power (Pvt) Ltd would like to go for high pressure cogeneration in the sugar mill with the aim of exporting power nearly 41 MW to the national grid, in addition to the existing 24.5 MW export, during both the crushing season (November to March) and Off-Season (April to October). There exists a triple circuit of 132 kV at a distance of about 3.6 km from JDW Unit-III GSM that goes from Ghotki 132 kV to Liberty Power Plant 132 kV having one circuit looped in-out at Mir Pur Mathelo 132 kV and one circuit at JDW-III 132 kV as shown in Sketch-2 in Appendix-B. The maximum output planned to be generated from the site is about 45 MW, in addition to 26 MW already installed at the moment, of electrical power. The project is expected to start commercial operation by June 2019. The electricity generated from this project would be supplied to the grid system of SEPCO through 132 kV grid available in the vicinity of this project.

1.2 Objectives

The overall objective of the Study is to evolve an interconnection scheme between JDW-III-GSM Power Plant and SEPCO network, for stable and reliable evacuation of 45 MW of electrical power generated from this plant, fulfilling N-1 reliability criteria. The specific objectives of this report are:

1. To develop scheme of interconnections at 132 kV for which right of way (ROW) and space at the terminal substations would be available.
2. To determine the performance of interconnection scheme during steady state conditions of system, normal and N-1 contingency, through load-flow analysis.
3. To check if the contribution of fault current from this new plant increases the fault levels at the adjoining substations at 132 kV voltage levels to be within the rating of equipment of these substations, and also determine the short circuit ratings of the proposed equipment of the

substation at JDW-III-PP.

4. To check if the interconnection withstands dynamic stability criteria of post fault recovery with good damping.

1.3 Planning Criteria

The planning criteria required to be fulfilled by the proposed interconnection is as follows:

Steady State:

Voltage	± 5 %, Normal Operating Condition
	± 10 %, Contingency Conditions
Frequency	50 Hz Nominal
	49.8 Hz to 50.2 Hz variation in steady state
	49.4 - 50.5Hz, Min/Max Contingency Freq. Band
Power Factor	0.8 Lagging; 0.90 Leading

Short Circuit:

132 kV Substation Equipment Rating 40 kA

11 kV Substation Equipment Rating 50 kA

Dynamic/Transient:

The system should revert back to normal condition after dying out of transients without losing synchronism with good damping after permanent three-phase fault on any primary transmission element; including: transmission circuit, substation bus section, transformer, or circuit breaker. It is assumed that such a fault shall be cleared by the associated circuit breaker action in 5 cycles.

In case of failure of primary protection (stuck breaker case), the total fault clearing time from the instant of initiation of fault current to the complete interruption of current to isolate the faulted element, including the primary protection plus the backup protection to operate and isolate the fault, is equal to 180 ms (9 cycles) for 132 kV and higher voltage levels.

2. Assumptions of Data

The number of generating units at JDW-III-PP is one. The following data have been provided by the Client:

2.1 JDW-III-PP

Gross capacity of power plant	= 1x45 = 45 MW
Lump sum MVA capacity	= 1x56.25 = 56.25 MVA
Generating Voltage	= 11 kV
Power factor	= 0.80 lagging ; 0.95 leading
Crushing Season:	
Auxiliary Consumption	= 4.0642 MW
Spillover to the Grid	= 40.93 MW
Off-Season:	
Auxiliary Consumption	= 3.825 MW
Spillover to the Grid	= 41.175 MW
GSU Transformer	= 45/57.5 MVA (x2)
GSU Transformer reactance	= 12.50 %

2.2 Network data

The 132 kV network in the area near JDW-III-PP are as shown in Sketches in Appendix-B. The system data of SEPCO has been used as already available with PPI.

3. Study Approach and Methodology

3.1 Understanding of the Problem

Ghotki Power (Pvt) Ltd intends to increase generating capacity in the same region as that of JDW-III GSM 26 MW Power Plant, by adding a 45 MW unit of its own. The maximum spillover to the National Grid from the site will be about 41.175 MW of electrical power during the Off-season.

The location of the JDW-III-PP is in accordance with already installed JDW-III 26 MW PP. Interconnection has already been done, Transmission Lines to evacuate the power has already been laid. The distance of the plant from the looping point is about 3.6 km. The conductor used is 132 kV Lynx. JDW-III-PP added to the existing network is shown in Sketch-2 in Appendix-B.

The adequacy of SEPCO network of 132 kV in and around the proposed site of JDW-III-PP would be investigated in this study for absorbing and transmitting this power fulfilling the reliability criteria.

3.2 Approach to the problem

The consultant has applied the following approaches to the problem:

- A base case network model has been prepared for September 2019 (Off-Season) and January 2020 (Crushing Season) after the commissioning of JDW-III-PP in June 2019, comprising all 500 kV, 220 kV and 132 kV system, envisaging the load forecast, the generation additions and transmission expansions for that year particularly in SEPCO.
- Month of January 2020 and September 2019, while representing Crushing Season and Off-Season respectively, also represent low water and high water conditions respectively in the grid system. Thus both the high water and low water flow patterns can be observed allowing us to judge the maximum impact of the plant on the transmission system in its vicinity. In addition, case for extended term scenario of the year 2022 has also been studied.
- Interconnection scheme without any physical constraints, like right of way or

availability of space in the terminal substations, have been identified.

- Perform technical system studies for peak load conditions to confirm technical feasibility of the interconnections. The scheme will be subjected to standard analysis like load flow, short circuit, and transient stability study to check the strength of the machines and the proposed interconnection scheme under disturbed conditions. Interconnection scheme without any physical constraints, like right of way or availability of space in the terminal substations, have been identified.
- Perform technical system studies for peak load conditions to confirm technical feasibility of the interconnections. The scheme will be subjected to standard analysis like load flow, short circuit, and transient stability study to check the strength of the machines and the proposed interconnection scheme under disturbed conditions.
- Determine the relevant equipment for the proposed technically feasible scheme.
- Recommend the technically most feasible scheme of interconnection.

4. Development of Scheme of Interconnection

4.1 The Existing and Ongoing Network

The existing 132 kV network available around Ghotki 132 kV grid station is shown in Sketch-1 in Appendix-B.

JDW-III GSM is in District Ghotki embedded in the distribution network of SEPCO. Network is being fed from the sources substation of Guddu 500/220/132 kV, Shikarpur 220/132 kV and Sibbi 220 kV grid station.

These are multiple feeding points in the vicinity which provides reliability and voltage support to the system. All these substations provide a strong 220 kV and 500 kV network around the proposed plant. A strong system helps in stable operation of a power plant.

4.2 The Scheme of Interconnection of JDW-III GSM PP

Keeping in view of the above mentioned 132 kV network available in the vicinity of the site of the JDW-III-PP, the interconnection scheme has already been developed and the 132 kV transmission lines have also been constructed. The interconnection scheme has been developed by looping in-out the existing Ghotki-Liberty 132 kV triple Circuit at JDW-III GSM. The distance of the plant from the looping point would be about 3.6 km. The conductor used will be 132 kV Lynx. This proposed interconnection scheme is shown in Sketch-2 of Appendix-B.

5. Detailed Load Flow Studies

5.1 Peak Case Load Flow September 2019, without JDW-III-PP

A base case has been developed for the peak load of September 2019 using the network data of NTDC and SEPCO available with PPI, after updating with latest load forecast and expansion plan of NTDC and SEPCO. The peak load of the year 2019-20 for SEPCO have been modeled as per the latest PMS Demand forecast obtained from NTDC.

The results of load flow for this base case are plotted in Exhibit 0.0 of Appendix-C. The system plotted in this Exhibit comprises of 132 kV network feeding Ghotki and its surrounding substations including Mirpur Mathelo, Panu Akil and Rohri.

The load flow results show that the power flows on all the circuits are within their normal rating. The voltage profile of these surrounding substations is also within normal limits.

For N-1 contingency conditions we have performed the following cases

Exhibit – 0.1	JDW-III to Ghotki 132kV Single Circuit Out
Exhibit – 0.2	Liberty to JDW-III 132kV Single Circuit Out
Exhibit – 0.3	Liberty to Mirpur Mathelo 132kV Single Circuit Out
Exhibit – 0.4	Mirpur Mathelo to Ghotki 132kV Single Circuit Out
Exhibit – 0.5	Liberty to Ghotki 132kV Single Circuit Out
Exhibit – 0.6	Liberty to Daharki 132kV Single Circuit Out
Exhibit – 0.7	Ghotki to Rohri-I 132kV Single Circuit Out
Exhibit – 0.8	Ghotki to Pannu Akil 132kV Single Circuit Out
Exhibit – 0.9	Pannu Akil to Rohri-I 132kV Single Circuit Out
Exhibit – 0.10	Sukkur-Site to Rohri-I 132kV Single Circuit Out

We see that in all the cases the power flows on all circuits remain within their rated limits. Also the bus voltages are within the acceptable operating range.

5.2 Peak Case Load Flow September 2019, with JDW-III-PP in Off-Season

The scenario of JDW-III-PP after the COD of the plant when it starts exporting 41.175 MW to the SEPCO network has been studied. The results of load flows with JDW-III-PP under normal conditions have been plotted in Exhibit 1.0 in Appendix-C. The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit – 1.1	JDW-III 132/11 kV Single Transformer Out
Exhibit – 1.2	JDW-III to Ghotki 132kV Single Circuit Out
Exhibit – 1.3	Liberty to JDW-III 132kV Single Circuit Out
Exhibit – 1.4	Liberty to Mirpur Mathelo 132kV Single Circuit Out
Exhibit – 1.5	Mirpur Mathelo to Ghotki 132kV Single Circuit Out
Exhibit – 1.6	Liberty to Ghotki 132kV Single Circuit Out
Exhibit – 1.7	Liberty to Daharki 132kV Single Circuit Out
Exhibit – 1.8	Ghotki to Rohri-I 132kV Single Circuit Out
Exhibit – 1.9	Ghotki to Pannu Akil 132kV Single Circuit Out
Exhibit – 1.10	Pannu Akil to Rohri-I 132kV Single Circuit Out
Exhibit – 1.11	Rohri-I to Sukkur-Site 132kV Single Circuit Out

We see that in all the contingency cases, in the event of outage of any circuit, the intact circuits remain within the rated capacity.

Also the bus bar voltages are well within the permissible limits in all the contingency events.

5.3 Peak Case Load Flow January 2020, with JDW-III-PP in Crushing Season

The scenario of JDW-III-PP during the Crushing season, for the month of January with maximum thermal dispatches, has been studied. The results of load flows with JDW-III-PP under normal conditions have been plotted in Exhibit 2.0 in Appendix-C. The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit – 2.1	JDW-III 132/11 kV Single Transformer Out
Exhibit – 2.2	JDW-III to Ghotki 132kV Single Circuit Out
Exhibit – 2.3	Liberty to JDW-III 132kV Single Circuit Out
Exhibit – 2.4	Liberty to Mirpur Mathelo 132kV Single Circuit Out
Exhibit – 2.5	Mirpur Mathelo to Ghotki 132kV Single Circuit Out
Exhibit – 2.6	Liberty to Ghotki 132kV Single Circuit Out
Exhibit – 2.7	Liberty to Daharki 132kV Single Circuit Out
Exhibit – 2.8	Ghotki to Rohri-I 132kV Single Circuit Out
Exhibit – 2.9	Ghotki to Pannu Akil 132kV Single Circuit Out
Exhibit – 2.10	Pannu Akil to Rohri-I 132kV Single Circuit Out
Exhibit – 2.11	Sukkur-Site to Rohri-I 132kV Single Circuit Out

We see that in all the contingency cases, in the event of outage of any circuit, the intact circuits remain within the rated capacity.

Also the bus bar voltages are well within the permissible limits in all the contingency events.

5.4 Peak Load Case 2022: Extended Term Scenario

Load flow studies have been carried out for the future scenario of Year 2022 to assess the impact of the plant in the extended term.

The results of Normal case of Peak 2022 are plotted in Exhibit 3.0. The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal.

We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows;

Exhibit – 3.1	JDW-III 132/11 kV Single Transformer Out
Exhibit – 3.2	JDW-III to Ghotki 132kV Single Circuit Out
Exhibit – 3.3	Liberty to JDW-III 132kV Single Circuit Out
Exhibit – 3.4	Mirpur Mathelo to Ghotki 132kV Single Circuit Out
Exhibit – 3.5	Liberty to Ghotki 132kV Single Circuit Out
Exhibit – 3.6	Liberty to Daharki 132kV Single Circuit Out
Exhibit – 3.7	Ghotki to Rohri-I 132kV Single Circuit Out
Exhibit – 3.8	Ghotki to Pannu Akil 132kV Single Circuit Out
Exhibit – 3.9	Pannu Akil to Rohri-I 132kV Single Circuit Out
Exhibit – 3.10	Rohri-I to Sukkur-Site 132kV Single Circuit Out
Exhibit – 3.11.1	Liberty to Mirpur Mathelo 132kV Single Circuit Out

We see in case of outage of 132 kV circuit between Liberty and Mirpur Mathelo, the circuit between JDW-III 132 kV and Ghotki 132 kV bus bar becomes overloaded. To avoid this, an operational measure is taken and is shown in the next contingency.

Exhibit – 3.11.2 Liberty to Mirpur Mathelo 132kV Single Circuit Out

To avoid overloading of circuit between JDW-III 132 kV and Ghotki 132 kV bus bar, the circuit between Ghotki 132 kV and Rohri-I 132 kV bus bar and the circuit between panu Akil and Rohri-I is switched off.

We see that in all the contingency cases, in the event of outage of any circuit, the intact circuits remain within the rated capacity. Also the bus bar voltages are well within the permissible limits in all the contingency events.

5.5 Conclusion of Load Flow Analysis

The proposed interconnection scheme of JDW-III-PP is adequate to evacuate the spillover electrical power from JDW-III-PP under normal and contingency conditions tested for peak load conditions of September 2019, January 2020 and extended term scenario of the Year 2022. In extended term scenario case, we see in case of outage of 132 kV circuit between Liberty and Mirpur Mathelo, the circuit between JDW-III 132 kV and Ghotki 132 kV bus bar becomes overloaded. To avoid this, the circuit between Ghotki 132 kV and Rohri-I 132 kV bus bar and the circuit between panu Akil and Rohri-I is switched off.

In all the normal and contingency cases, we find that the loading on the circuits remain within the rated capacity. Also the bus bar voltages are well within the permissible limits in all the normal and contingency events. Hence the proposed interconnection scheme of JDW-III-PP has no constraints according to the Load Flow Analysis.

6. Short Circuit Analysis

6.1 Methodology and Assumptions

The methodology of IEC 909 has been applied in all short circuit analyses in this report for which provision is available in the PSS/E software used for these studies.

The maximum fault currents have been calculated with the following assumptions under IEC 909:

- Set tap ratios to unity
- Set line charging to zero
- Set shunts to zero in positive sequence
- Desired voltage magnitude at bus bars set equal to 1.10 P.U. i.e. 10 % higher than nominal, which is the maximum permissible voltage under contingency condition.

For evaluation of maximum short circuit levels we have assumed contribution in the fault currents from all the installed generation capacity of hydal, thermal and nuclear plants in the system in the year 2019-20 i.e. all the generating units have been assumed on-bar in fault calculation's simulations.

The assumptions about the generator and the transformers data are the same as mentioned in Ch.2 of this report.

6.2 Fault Current Calculations without JDW-III-PP, 2019-20

In order to assess the short circuit strength of the network of 132 kV and 11 kV without JDW-III-PP for the grid of SEPCO in the vicinity of the site of the Plant, fault currents have been calculated for balanced three-phase and unbalanced single-phase short circuit conditions. These levels will give us the idea of the fault levels without JDW-III-PP and later on how much the contribution of fault current from JDW-III-PP may add to the existing levels.

The results are attached in Appendix – D.

A NGR of value 127 ohms has already been installed at 26 MW JDW-III MW PP generator which we have included in our study. The short circuit levels have been calculated and plotted on the bus bars of 132 kV substations lying in the electrical vicinity of our area of interest i.e. Ghotki, Mirpur Mathelo, Liberty, Rohri-I and

surrounding bus bars are shown plotted in the Exhibit 4.0 attached in Appendix-D. Both 3-phase and 1-phase fault currents are indicated in the Exhibit which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabular output of the short circuit calculations is also attached in Appendix-D for the 132 kV bus bars of our interest i.e. the substations connecting in the 132 kV circuits lying close to JDW-III-PP. The total maximum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 6.1. We see that the maximum fault currents do not exceed the short circuit ratings of the equipment at these 132 kV substations which normally are 20 kA, 25 kA or 40 kA for older substations and 40 kA for new substations.

Table-6.1

Maximum Short Circuit Levels without JDW-III-PP, 2019-20

Substation	3-Phase fault current, kA	1-Phase fault current, kA
JDW-III-GSM 132kV	**9.08**	**7.84**
Liberty 132kV	**16.02**	**16.22**
Ghotki 132kV	**10.48**	**8.76**
Mirpur Mathelo 132kV	**9.62**	**7.74**
Rohri 132kV	**9.64**	**6.93**
Daharki 132kV	**16.14**	**14.40**
Sukkur Site 132kV	**10.29**	**7.44**
Arain Road 132kV	**15.85**	**13.88**
Guddu Left 132kV	**9.86**	**7.11**
Shikarpur-New 132kV	**20.59**	**17.28**
Panu Akil 132kV	**6.70**	**4.79**

6.3 Fault Current Calculations with JDW-III-PP, Year 2019-20

Fault currents have been calculated for the electrical interconnection of proposed scheme. Fault types applied are three phase and single-phase at 132 kV and 11 kV bus bar of JDW-III-PP itself and other bus bars of the 132 kV substations in the electrical vicinity of the plant. The graphic results showing maximum 3-phase and 1-

phase fault levels are indicated in Exhibit 4.1. Both 3-phase and 1-phase fault currents are indicated in the Exhibit which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar. A NGR of 127 ohms has already been installed at 26 MW JDW-III-PP generator. Same has been proposed by PPI for the 45 MW JDW-III-PP generator to limit the short circuit currents that exceed the nominal standard size switchgear value.

The tabulated results of short circuit analysis showing all the fault current contributions with short circuit impedances on 132 kV bus bars of the network in the electrical vicinity of JDW-III-PP are placed in Appendix-D. Brief summary of fault currents at significant bus bars of our interest are tabulated in Table 6.2

Table-6.2
Maximum Short Circuit Levels with JDW-III-PP, 2019-20

Substation	3-Phase fault current, kA	1-Phase fault current, kA
JDW-III-GSM 11kV	**32.55**	**40.50**
JDW-III-GSM 132kV	**9.18**	**9.93**
Liberty 132kV	**16.09**	**16.89**
Ghotki 132kV	**10.57**	**10.15**
Mirpur Mathelo 132kV	**9.68**	**8.13**
Rohri 132kV	**9.68**	**7.13**
Daharki 132kV	**16.19**	**14.72**
Sukkur Site 132kV	**10.32**	**7.61**
Arain Road 132kV	**15.87**	**13.96**
Guddu Left 132kV	**9.87**	**7.15**
Shikarpur-New 132kV	**20.60**	**17.30**
Panu Akil 132kV	**6.75**	**5.05**

Comparison of Tables 6.1 and 6.2 show slight increase in short circuit levels for three-phase and single – phase faults due to connection of JDW-III-PP on the 132 kV bus bars in its vicinity, but still even after some increase, these fault levels are below the rated short circuit values of the equipment installed on these substations. The maximum short circuit level of JDW-III-PP 132 kV is 9.18 kA and 9.93 kA for 3-

phase and 1-phase faults respectively. The same for 11 kV bus bar is 32.55 kA and 40.50 kA. It would be advisable to go for standard size switchgear of short circuit rating of 40 kA at 132 kV and 50 kA at 11 kV buses of JDW-III-PP. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.

6.4 Fault Current Calculations with JDW-III-PP, Year 2022

Fault currents have been calculated for the electrical interconnection of proposed scheme in the year 2022. Fault types applied are three phase and single-phase at 132 kV 11 kV bus bars of JDW-III-PP itself and other bus bars of the 132 kV substations in the electrical vicinity of the plant. The graphic results showing maximum 3-phase and 1-phase fault levels are indicated in Exhibit 4.2. Both 3-phase and 1-phase fault currents are indicated in the Exhibit which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar. The tabulated results of short circuit analysis showing all the fault current contributions with short circuit impedances on 132 kV bus bars of the network in the electrical vicinity of JDW-III-PP are placed in Appendix-D. Brief summary of fault currents at significant bus bars of our interest are tabulated in Table 6.3

Table-6.3

Maximum Short Circuit Levels with JDW-III-PP, Year 2022

Substation	3-Phase fault current, kA	1-Phase fault current, kA
JDW-III-GSM 11kV	**32.66**	**40.55**
JDW-III-GSM 132kV	**9.35**	**10.07**
Liberty 132kV	**16.74**	**17.82**
Ghotki 132kV	**10.79**	**10.31**
Mirpur Mathelo 132kV	**9.89**	**8.29**
Rohri 132kV	**9.83**	**7.15**
Daharki 132kV	**16.70**	**15.30**
Sukkur Site 132kV	**10.49**	**7.63**
Arain Road 132kV	**16.33**	**14.25**

Guddu Left 132kV	**10.05**	**7.26**
Shikarpur-New 132kV	**20.86**	**17.60**
Panu Akil 132kV	**6.83**	**5.08**

Comparison of Tables 6.2 and 6.3 show slight increase in short circuit levels for three-phase and single – phase faults due to connection of JDW-III-PP on the 132 kV bus bars in its vicinity; We find that even after this increase, these fault levels are below the rated short circuit values of the equipment installed on these substations. The maximum short circuit level of JDW-III-PP 132 kV in the year 2022 is 9.35 kA and 10.07 kA for 3-phase and 1-phase faults respectively. The same for 11 kV bus bar is 32.66 kA and 40.55 kA. It would be advisable to go for standard size switchgear of short circuit rating of 40 kA at 132 kV and 50 kA at 11 kV buses of JDW-III-PP. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.

6.5 Conclusion of Short Circuit Analysis

The short circuit analysis results show that for the proposed scheme of interconnection of JDW-III-PP, there is no problem of violations of short circuit ratings of the already installed equipment on the 132 kV and 11 kV equipment of substations in the vicinity of JDW-III-PP due to fault current contributions from this powerhouse under three-phase faults as well as single-phase faults. A NGR of 127 ohms has already been installed at 26 MW JDW-III-PP generator. Same has been proposed by PPI for the 45 MW JDW-III-PP generator to limit the short circuit currents that exceed the nominal standard size switchgear value.

The short circuit level of the JDW-III-PP 132 kV is 9.18 kA and 9.93 kA for 3-phase and 1-phase faults respectively for the year 2019-20 and the same for the year 2022 are 9.35 kA and 10.07 kA. Similarly, the 3-phase and 1-phase short circuit level of the 11 kV bus bar of JDW-III-PP is 32.55 kA and 40.50 kA for year 2019-20 and 32.66 kA and 40.55 kA for year 2022 respectively. Therefore to go for standard size switchgear of short circuit rating of 40 kA at 132 kV and 50 kA at 11 kV buses of JDW-III-PP would be fine. It would provide large margin for any future increase in

short circuit levels due to future generation additions and network reinforcements in this area.

7. Dynamic Stability Analysis

7.1 Assumptions & Methodology

7.1.1 Dynamic Models

The assumptions about the generator and its parameters are the same as mentioned in Ch.2 of this report.

We have employed the generic dynamic models available in the PSS/E model library for dynamic modeling of the generator, exciter and the governor as follows;

Generator	GENROU
Excitation System	EXST1
Speed Governing System	TGOV1
Inertia Constant	H = 2.622 MW-sec/MVA

7.1.2 System Conditions

The proposed scheme of looping in-out the existing Liberty to Ghotki 132 kV triple circuit at JDW-III GSM has been modeled in the dynamic simulation.

All the power plants of WAPDA/PEPCO and IPPs from Tarbela to Hub have been dynamically represented in the simulation model.

7.1.3 Presentation of Results

The plotted results of the simulation runs are placed in Appendix-E. Each simulation is run for its first one second for the steady state conditions of the system prior to fault or disturbance. This is to establish the pre fault/disturbance conditions of the network under study were smooth and steady. Post fault recovery has been monitored for nine seconds. Usually all the transients due to non-linearity die out within 4-5 seconds after disturbance is cleared in the system.

7.1.4 Worst Fault Cases

Three phase faults are considered as the worst disturbance in the system. We have considered 3-phase fault in the closest vicinity of JDW-III-PP i.e. right at the 132 kV

bus bar of JDW-III-PP substation, cleared in 5 cycles, as normal clearing time for 132 kV i.e. 100 ms, followed by a permanent trip of a 132 kV single circuit emanating from this substation. Fault at 132 kV bus bar of JDW-III-PP has also been simulated for 9 cycles.

7.2 Dynamic Stability Simulations' Results with JDW-III-PP, Year September 2019

7.2.1 Fault at 132 kV Near JDW-III-PP

We applied three-phase fault on JDW-III-PP 132 kV bus bar, cleared fault in 5 cycles (100 ms) followed by trip of a 132 kV single circuit between JDW-III and Ghotki 132 kV substation. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows;

Fig. 1.1 Bus Voltages

The bus voltages of 132 kV bus bars of JDW-III, Ghotki, Rohri, Liberty, Daharki and Mirpur Mathelo are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 1.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 1.3 MW/MVAR Output of Generators of JDW-III-PP

The pre-fault output of JDW-III-PP was 45 MW and it gets back to the same output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a new value.

Fig. 1.4 Speed and mechanical power of Generators at JDW-III-PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed as of before fault. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 1.5 MW Flow on JDW-III to Liberty 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from JDW-III-PP to Ghotki causes the entire output of JDW-III-PP to flow on the intact 132 kV circuit

between JDW-III-PP and Liberty. This causes significant loading on the JDW-III to Liberty 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 1.6 Rotor Angles

The rotor angles of the generators of JDW-III 26 MW PP, JDW-III 45 MW PP Liberty-PP, Alliance-PP and JDW-II 45 MW PP are plotted relative to machines at Mangla 220 kV. The results show that the rotor angle of JDW-III-PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machine swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.2.2 Fault at 132kV Near JDW-III-PP (Stuck Breaker)

We applied three-phase fault on JDW-III-PP 132 kV bus bar, cleared fault in 9 cycles (180 ms), to simulate a stuck breaker case, followed by trip of a 132 kV single circuit between JDW-III and Ghotki 132 kV substation. We monitored different quantities for one second pre-fault and nine seconds after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows;

Fig. 2.1 Bus Voltages

The bus voltages of 132 kV bus bars of JDW-III, Ghotki, Rohri, Liberty, Daharki and Mirpur Mathelo are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 2.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 2.3 MW/MVAR Output of Generators of JDW-III-PP

The pre-fault output of JDW-III-PP was 45 MW and it gets back to the same output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a new value.

Fig. 2.4 Speed and mechanical power of Generators at JDW-III-PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed as of before fault. The transients in mechanical power also

damp quickly and settle to a new equilibrium.

Fig. 2.5 MW Flow on JDW-III-PP to Liberty 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from JDW-III-PP to Ghotki causes the entire output of JDW-III-PP to flow on the intact 132 kV circuit between JDW-III-PP and Liberty. This causes significant loading on the JDW-III to Liberty 132 kV circuit. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 2.6 Rotor Angles

The rotor angles of the generators of JDW-III 26 MW PP, JDW-III 45 MW PP Liberty-PP, Alliance-PP and JDW-II 45 MW PP are plotted relative to machine at Mangla 220 kV. The results show that the rotor angle of JDW-III-PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.2.3 Fault at 132 kV Liberty (Far-End Fault)

We applied three-phase fault on far 132 kV bus bar of Liberty to study the impact of a disturbance in the grid on the performance of the plant. The fault is cleared in 9 cycles (100 ms) as standard clearing time for 132kV systems, followed by trip of 132 kV single circuit between Liberty and JDW-III. We monitored different quantities for one second pre-fault and nine seconds after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows;

Fig. 3.1 Bus Voltages

The bus voltages of 132 kV bus bars of JDW-III, Ghotki, Rohri, Liberty, Daharki and Mirpur Mathelo are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 3.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 3.3 MW/MVAR Output of Generators of JDW-III-PP

The pre-fault output of JDW-III-PP was 45 MW and it gets back to the same output

quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a new value.

Fig. 3.4 Speed and mechanical power of Generators at JDW-III-PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed as of before fault. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 3.5 MW Flow on Liberty to JDW-III 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Liberty to Mirpur Mathelo causes significant loading on the intact 132 kV circuit Liberty to JDW-III. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 3.6 Rotor Angles

The rotor angles of the generators of JDW-III 26 MW PP, JDW-III 45 MW PP Liberty-PP, Alliance-PP and JDW-II 45 MW PP are plotted relative to a machine at Mangla 220 kV. The results show that the rotor angle of JDW-III-PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.2.4 Fault at 132 kV Ghotki (Far-End Fault)

We applied three-phase fault on far 132 kV bus bar of Ghotki to study the impact of a disturbance in the grid on the performance of the plant. The fault is cleared in 9 cycles (180 ms) as standard clearing time for 132kV systems, followed by trip of 132 kV single circuit between Liberty and Mirpur Mathelo. We monitored different quantities for one second pre-fault and nine seconds after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows;

Fig. 4.1 Bus Voltages

The bus voltages of 132 kV bus bars of JDW-III, Ghotki, Rohri, Liberty, Panu Akil and Mirpur Mathelo are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 4.2 Frequency

We see the system frequency recovers back to normal quickly after fault clearance.

Fig. 4.3 MW/MVAR Output of Generators of JDW-III-PP

The pre-fault output of JDW-III-PP was 45 MW and it gets back to the same output quickly after fast damping of the oscillations in its output. However MVAR output acquires equilibrium at a new value.

Fig. 4.4 Speed and mechanical power of Generators at JDW-III-PP

The speed deviation of the generator, after clearing fault, damps down quickly returning to normal speed as of before fault. The transients in mechanical power also damp quickly and settle to a new equilibrium.

Fig. 4.5 MW Flow on Ghotki to Liberty 132 kV circuit

Followed by clearing of fault, the trip of a 132 kV single circuit from Ghotki to JDW-III causes significant loading on the intact 132 kV circuit between Liberty and Ghotki. We plotted the flows of MW and MVAR on this intact circuit and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 4.6 Rotor Angles

The rotor angles of the generators of JDW-III 26 MW PP, JDW-III 45 MW PP Liberty-PP, Alliance-PP and JDW-II 45 MW PP are plotted relative to machine at Mangla 220 kV. The results show that the rotor angle of JDW-III-PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.3 Conclusion of Dynamic Stability Analysis

The results of dynamic stability show that the system is very strong and stable for the proposed scheme for the severest possible faults of 132 kV systems near to and far of JDW-III-PP. Therefore there is no problem of dynamic stability for interconnection of JDW-III-PP; it fulfills all the criteria of dynamic stabilit

8. Conclusions

- The Final Report of 45 MW Cogeneration Power Plant for Ghotki Power (Pvt) Ltd, which is an extension of the existing 26 MW power plant, is submitted herewith.
- All the comments raised by SEPCO planning department vide letter no. CTO/SEPCO/SUK/M(P&E)/JDW-675-77 dated 17-02-2017 have been incorporated in this final report.
- Ghotki Power (Pvt) Ltd would like to go for high pressure cogeneration in the sugar mill with the aim of exporting power nearly 41 MW to the national grid, in addition to the existing 24.5 MW export, during both the crushing season (November to March) and Off-Season (April to October).
- The study objective, approach and methodology have been described and the plant's data received from the Client is validated.
- The existing power plant is looped in-out in one of the existing 132 kV triple circuit between Ghotki to Liberty at JDW-III-PP. The distance of the plant from the looping point is about 3.6 km. The conductor used is 132 kV Lynx. Same interconnection scheme will be used for the upcoming 45 MW power plant.
- Two breaker bays of 132 kV being used for existing 26 MW power plant at JDW-III-PP will suffice for the connection of the 45 MW power plant with the existing 132 kV circuits lying between Ghotki and Liberty.
- In view of planned COD of the JDW-III GSM PP in June 2019, the above proposed interconnection scheme has been tested for steady state conditions through detailed load flow studies for the peak conditions of
    - o September 2019 for maximum Hydropower dispatches in the grid during the Off-season of JDW-III-PP.
    - o January 2020 for maximum thermal power dispatches in the grid during the Crushing Season for JDW-III-PP.
- The system conditions of normal and N-1 contingency have been studied to

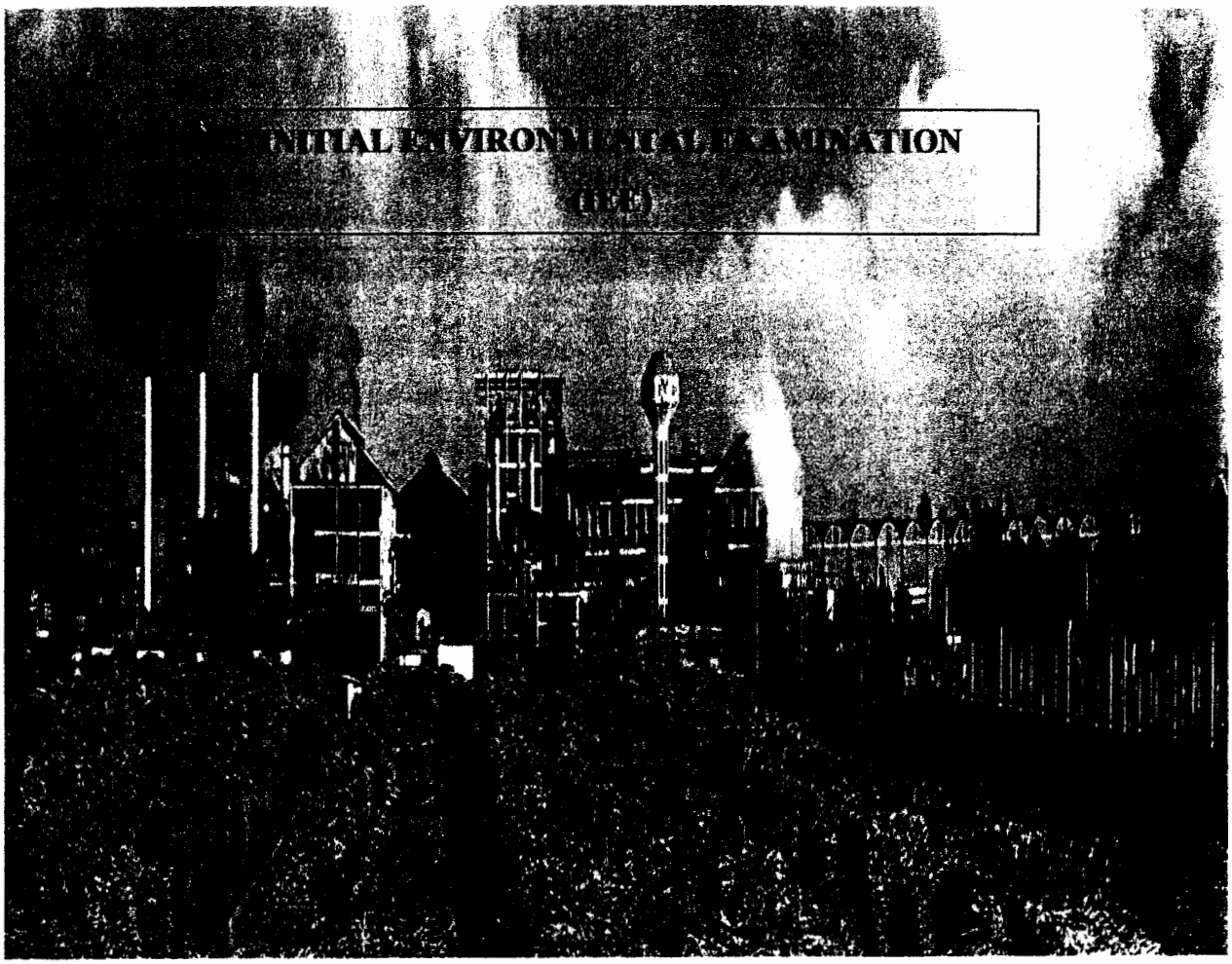
meet the reliability criteria of NEPRA Grid Code.

- The proposed scheme of interconnection has also been tested for the extended term scenario of peak load conditions of the year 2022 for steady state conditions.
- Steady state analysis by load flow for all the scenarios described above reveals that the proposed scheme is adequate to evacuate the spillover up to 41.175 MW power of the Plant under normal as well as contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at JDW-III and the substations of 132kV in its vicinity. We find that the fault currents for the proposed scheme are much less than the rated short circuit capacities of switchgear installed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from JDW-III-PP. A NGR of 127 ohms has already been installed at 26 MW JDW-III-PP generator. Same has been proposed by PPI for the 45 MW JDW-III-PP generator to limit the short circuit currents that exceed the nominal standard size switchgear value.
- The short circuit level of the JDW-III-PP 132 kV is 9.18 kA and 9.93 kA for 3-phase and 1-phase faults respectively for the year 2019-20 and the same for the year 2022 are 9.35 kA and 10.07 kA. Similarly, the 3-phase and 1-phase short circuit level of the 11 kV bus bar of JDW-III-PP is 32.55 kA and 40.50 kA for year 2019-20 and 32.66 kA and 40.55 kA for year 2022 respectively. Therefore to go for standard size switchgear of short circuit rating of 40 kA at 132 kV and 50 kA at 11 kV buses of JDW-III-PP would be fine. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out. The stability check for the worst case of three phase fault right on the 132 kV bus bar of JDW-III-PP substation followed by the final trip of 132 kV circuits emanating from this substation, has been performed for fault clearing of 5 cycles (100 ms) as understood to be the normal fault clearing time of 132 kV protection system. Also the worst case of stuck

breaker (breaker failure) has been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms. In all events, the system is found strong enough to stay stable and recovered with fast damping. The stability of system for far end faults of 3-phase occurring at Ghotki 132 kV bus bar and Liberty 132 kV bus bar have also been checked. The proposed scheme successfully passed the dynamic stability checks for near and far faults even for the most stringent cases.

- The proposed scheme of interconnection has no technical constraints or problems, it fulfills all the criteria of reliability and stability under steady state load flow, contingency load flows, short circuit currents and dynamic/transient conditions; and is therefore recommended to be adopted.

Installation of 45 MW High Pressure Co-Generation Power Plant at JDW Sugar Mills Unit-III, Ghotki.



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May-2017

Installation of 45 MW High Pressure Co-Generation Power Plant at JDW Sugar Mills Unit-III, Ghotki.

INITIAL ENVIRONMENTAL EXAMINATION

(IEE)

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May-2017

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Acronyms

AEDB	Alternative Energy Development Board
CO	Carbon Monoxide
EA	Environmental approval
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMtP	Environmental Monitoring Plan
EPA	Environmental protection agency
EPO	Environmental Protection Order
GPPL	Ghotki Power Pvt. Limited
IDA	Initial depreciation allowance
IEE	Initial environmental Examination
IUCN	International Union for Conservation of Nature
MBTu	One Million British Thermal Units
MW	Mega Watt
NEPRA	National Electric Power Regulatory Authority
NO	Nitrogen Oxide
NOC	No objection certificate
PCs	Public consultations
SEPA	Sindh environmental protection act
SEQS	Sindh Environmental quality standard
SEQSAA	Sindh Environment Quality Standards for Ambient Air
PEQSN	Punjab Quality Standards for Noise
PM	Particulate Matter
PPC	Pakistan panel code
SMART	Self-Monitoring and Reporting
TL	Transmission Line
WAPDA	Water and power development authority

1.0 EXECUTIVE SUMMARY

1.1 Project Title

Installation of 45 MW High Pressure Co-Generation Power Plant at JDW Sugar Mills Unit-III, Ghotki.

1.2 Location of the project

The Project Site is adjacent to JDW Sugar Mills Limited Unit III located near Goth Islamabad, Tehsil and District Ghotki , Sindh. The adjacent area is owned by JDW Unit-III and approximately 28.2 acres will be allocated to Ghotki Power (Pvt.) Limited.

1.3 Name of the Proponent

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1.4 Consultants who prepared the report

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1.5 Breif outline of proposal

M/S Ghotki Power (Pvt.) Limited has planned for installation of Phase-II bagasse based high pressure co-generation power plant having capacity 45 MW, adjacent to JDW Sugar Mills Unit-III, Goth Islamabad, Tehsil & District Ghotki. Project investments belong to JDW group.

JDW Sugar Mills Unit-III is already having a Cogeneration plant operating for the last three seasons. The existing Cogeneration plant is based on the cycle parameters of 67 bar and 485 Deg.C and the plant capacity is 26.5 MW. JDW Unit-III is installing a new High

Pressure Cogeneration plant, based on 110 bar and 540 Deg.C steam parameters, which would phase out the existing low pressure systems completely. With the implementation of the new High Pressure Cogeneration, JDW Unit-III will be operating with two Cogeneration Units, one based on 67 bar and 485 Deg.C cycle parameters and the other based on 110 bar and 540 Deg.C cycle parameters. The process of power production will be based on the technology of direct combustion of bagasse in the boiler to produce steam and this steam will be provided to the turbo generators to convert thermal energy in the electrical energy.

As per SEPA 2014 and the IEE/EIA Regulations, 2014 it is mandatory for the proponent of any development project to accord Environmental Approval from EPA Sindh by filing an IEE or EIA as the case may be, before the Agency. The said project is proposed to meet energy demands in era of power shortage by the proponent. This Report presents the Initial Environmental Examination (IEE) for this proposed Power Plant of 45MW capacity. For this purpose, the proponent has decided to engage environmental consultants, **M/S Ectech Environment Consultants**. The purpose of this study is to identify the environmental baseline i.e. physical, biological and socio-economic/cultural conditions and assess all possible impacts arising during the construction and operation phase of the project with the aim to find out appropriate measures for their mitigation, to either eliminate those impacts or to bring them to acceptable level and formulate Environmental Management Plan (EMP) for implementation of the project in environment-friendly manner.

1.6 The Major Impacts

Environmental problems due to project location

Environmental Management Plan (EMP) as described hereunder is to be followed covering all activities during construction phase; therefore, no environmental problems are envisaged due to the project location.

Environmental problems related to design

The plant is to be designed in a way that it complies with the required limiting values as set under the SEQS.

Under the conditions no environmental problem relating to design are envisaged.

Environmental problems resulting from construction

The most likely environmental problems to occur during construction phase could due to:

- Construction machinery,
- Compaction of soil activity,
- leveling of land,
- moving vehicles,
- Construction of building and associated civil work.

The pollution from these activities could be in the form of the following emissions from the exhaust of vehicles and from fuel burning in the operation of machines to be used for several of construction activities:

- Gaseous emission of SO_2, NO_x and CO, hydrocarbons etc.
- Particulate Matter (PM).
- Noise.
- Effluent.

In the first place, construction activity is going to be on very limited scale and for short duration, therefore, magnitude of emissions/pollutants will not be very big.

Secondly, the scheduled traffic plan of vehicles visiting plant regularly will further ensure that the environmental pollution does not adversely affect the people and environment.

The scale of erection and commissioning will also be small, thus the potential contribution of noise and dust as pollutants will also be very small and will be curtailed within the plant boundaries.

1.7 Recommendation and mitigation measures

A comprehensive details on Environment Management Plan /Mitigation / Compensation Measures is present in report

Third party quarterly monitoring will further ensure compliance with the required standards.

1.8 Conclusion

On the basis of the facts summarized as above, the project merits for issuing Environmental Approval by the Environmental Protection Agency, Government of Sindh, Karachi.

2.0 INTRODUCTION

2.0 INTRODUCTION

Considering the strong correlation between economic growth and energy demand growth, there is an imperative need for sustained increases in energy supply not only to sustain the growth momentum but also to protect the economy from disruptions caused by energy deficits reflected in demand management, popularly known as load shedding. Per capita energy consumption in Pakistan currently stands at 14 MBtu as compared to 92 MBtu in Malaysia and 34 MBtu in China.

The demand and supply of electricity was balanced in 1997 with the commissioning of private sector Independent Power Projects (IPPs) established under the Private Power Policy, 1994. Generation capacity has increased since 1997, and it was expected that demand and supply would remain in equilibrium by 2020. However, faster economic activity, rising disposable income, higher availability of consumer finance, double-digit growth of large-scale manufacturing, and higher agricultural production have all resulted in higher demand for power.

The current power installed capacity is about 17,000 MW, peak demand is 22,000 MW and the average shortfall is around 5,000 MW. Electricity demand is growing at a rate of 10% annually while the capacity addition is increasing at 7% only. This shows that by 2030, the power requirement will be greater than 45,000 MW in the country. In the year 2000–2001, the national energy consumption was 25.26 million TOE which was 0.11% less than the previous year. During the period from late 1990s to 2004–2005, the country had an extraordinary period with abundant electricity availability. The current energy shortage started in 2006–2007 with gradual widening gap between the demand and supply of electricity. Since then this gap has worsened and has reached a stage which is considered to be the worst of all such power crises in the history of the nation.

Power Development Plan

To sustain growth, Pakistan needs an integrated National Energy Plan. The Government of Pakistan is making concerted efforts to ensure development of energy resources. The government has encouraged the private sector to meet this additional demand. In order to bridge the gap between power demand and supply, Pakistan Government liberalized its

investment policies. The policy has resulted in not only investments in power production sector from local resources, but also foreign investments are pouring in large amounts. The government has encouraged the private and public sector meet this additional demand and have a plan to reform power structure and reducing delivery cost.

Pakistan has set key targets in terms of the demand-supply gap, affordability, efficiency, financial viability and governance of the system. The Government of Pakistan has initiated the following targets for electricity sector.

- Decrease supply demand gap from present 3800 MW to 0;
- Decrease transmission and distribution losses from 23-25% to 16%
- Decrease decision making processing time at the Ministry, related departments and regulators from long to short durations

With increasingly more disparity between energy supply and demand, and keener attention of the Government to environmental protection, use of non-conventional energy resources i.e. use of Bagasse as a primary fuel for power generation could win favor from the governments' policies.

Fragile economy of Pakistan cannot afford to continue importing fossil fuels spending so much hard earned foreign exchange. Under these circumstances, there is an immediate need to find a practical solution whereby, the dire need for electricity of the country could be met with minimum pressure on the national exchequer.

One among other solutions to the present state is to use locally available cheaper sources of energy production

It is with this background that M/S Ghotki Power (Pvt.) Limited has planned for installation of Phase-II bagasse based high pressure co-generation power plant having capacity 45 MW, adjacent to JDW Sugar Mills Unit-III, Goth Islamabad, Tehsil & District Ghotki. Project investments belong to JDW group.

JDW Sugar Mills Unit-III is already having a Cogeneration plant operating for the last three seasons. The existing Cogeneration plant is based on the cycle parameters of 67 bar

and 485 Deg.C and the plant capacity is 26.5 MW. JDW Unit-III is installing a new High Pressure Cogeneration plant, based on 110 bar and 540 Deg.C steam parameters, which would phase out the existing low pressure systems completely. With the implementation of the new High Pressure Cogeneration, JDW Unit-III will be operating with two Cogeneration Units, one based on 67 bar and 485 Deg.C cycle parameters and the other based on 110 bar and 540 Deg.C cycle parameters. The process of power production will be based on the technology of direct combustion of bagasse in the boiler to produce steam and this steam will be provided to the turbo generators to convert thermal energy in the electrical energy.

As per SEPA 2014 and the IEE/EIA Regulations, 2014 it is mandatory for the proponent of any development project to accord Environmental Approval from EPA Sindh by filing an IEE or EIA as the case may be, before the Agency. The said project is proposed to meet energy demands in era of power shortage by the proponent. This Report presents the Initial Environmental Examination (IEE) for this proposed Power Plant of 45MW capacity. For this purpose, the proponent has decided to engage environmental consultants, **M/S Ectech Environment Consultants**. The purpose of this study is to identify the environmental baseline i.e. physical, biological and socio-economic/cultural conditions and assess all possible impacts arising during the construction and operation phase of the project with the aim to find out appropriate measures for their mitigation, to either eliminate those impacts or to bring them to acceptable level and formulate Environmental Management Plan (EMP) for implementation of the project in environment-friendly manner.

The report provides relevant information, as required under the officially approved format, to help the decision makers i.e. EPA Sindh before issuing for the Environmental Approval.

2.1 Purpose of the report:

Main purpose of the report is;

- To determine and document the state of the environment of the project area to establish a baseline in order to assess the suitability of the Proposed Project in that area.

- To identify pre-construction, construction and operation activities and to assess their impacts on environment.
- Provide assistance to the proponent for planning, designing and implementing the project in a way that would eliminate or minimize the negative impact on the biophysical and socio-economic environment and maximizing the benefits to all parties in cost effective manner.
- To present Mitigation and Monitoring Plan to smoothly implement the suggested mitigation measures and supervise their efficiency and effectiveness.
- To provide opportunity to the public for understanding the project and its impacts on the community and their environment in the context of sustainable development.

This Initial Environmental Examination (IEE) report is being submitted to the Environmental Protection Agency (EPA)), Government of the Sindh, Karachi for getting No Objection Certificate (NOC) /EA (Environmental Approval).

The project is being run on fast track so as to make it operational within 20 months from the financial close. Major part of this electric power generated will be exported to the national grid, after fulfilling its own needs.

2.2 Identification of the project & the proponent

2.2.1 Identification of project

M/S Ghotki Power (Pvt.) Limited is in the process of installing a 45 MW Bio Mass (Bagasse) based Co-generation power plant for the generation of electricity. The project is very adjacent to the Ghotki sugar mills so that raw material i.e. Bagasse could easily available for the power plant. The cane being crushed by the sugar mill has high fiber content and cane bagasse percentage on the average is 30%. The sugar mill crushes for a period of 120 days/year, and proponent will get raw material in the form of bagasse from JDW Unit-III and other sugar mills.

The proposed Power Plant aims at installing power plant with new High Pressure Boilers and Extraction cum Condensing Turbo Generators. Approximately 26 MW during season

and 40.5 MW during off-season will be exported to the national grid, providing much-needed indigenous and renewable electricity to help reduce the acute power shortage.

Alternative Energy Development Board (AEDB), Government of Pakistan, issued letter of intent vides its No. B/3/21/2017/Bagasse-Biomass/GPL dated 10/02/2017 to M/s Ghotki Power (Pvt.) Limited for 45 MW Bagasse/Biomass Based High Pressure Cogeneration Power Plant in the province of Sindh. Annexure-I

2.2.2 Identification of the proponent

Munir Ahmed Daha
General Manager
M/S Ghotki Power (pvt.) Limited
17 Abid Majeed Road, Karachi, Cantt.
Phone:04236664891-92
Email:munirdaha@jdw-group.com

2.3 Consultants who prepared the report

ECTECH–Environment Consultants,
Suite No. 4, 2nd Floor, Link Arcade,
Model Town Link Road, Karachi-Pakistan
Phone: +92 42 35887517, 35925693, 35841688
Fax: +92 42 35855508
E-mail: ectech_ectech@yahoo.com.

Names, qualification, experience and position of the persons involved in this IEE study are given as below

Name of the EIA/IEE team	Qualification and brief experience	Position in the IEE Team and role*
Dr. Muhammad Hanif (Chief Executive) **ECTECH-Environment Consultants And APEX**	**A-Qualifications:** **1- M.Sc.** (Chem. Tech.) Sindh Uni; Karachi; 1962. **2-Ph.D.** (Chemistry) Charles University,	- Project Team Leader. -Principal author of the

Environment Laboratory	Czech Republic; 1968. **3- Post Doctorate**-Alex. Humboldt. Foundation, Senior Post Doctorate Fellow, Germany; 1974-75. **B-Experience/past Positions:** **1-Director General (R),** PCSIR Labs. Complex, Karachi. **2-Director General (Ex.)** Ministry of Environment, Local Government and Rural Development, Govt; of Pakistan. **3- (ex.) Consultant Environment, Category-A,** Asian Development Bank. **4- (ex.) Consultant Environment, UN—ESCAP** **5- Worked on World Bank Funded Project.** **6- Author** of the National Environment Quality Standards **(NEQS)** **7- Author of:** i -104 Scientific Research papers ii - Over 60 technical end project reports on environment. **8- Carried out EIA for 28 projects and reviewed** over 15 EIA reports. **9**--Among many others, EIA carried out on behalf of the Asian Development Bank regarding Katmandu Valley (Nepal) Industrial Sites. **10**-EIA-Saindak Gold/copper Project, Pakistan.	EIA report. - Coordination, supervision, guidance and co-author of the EIA report. -Over all monitoring of the project work, supervision, guidance and participation in all activities to ensure quality of work.

	11-EIA Pakistan Steel, Karachi; **12**-ESIA Report (According to OPIC Environmental Handbook Format) for D.G. Cement Company Limited, Kallar Kahar, District Chakwal, Pakistan. ESIA Report (According to OPIC Environmental Handbook Format) for Lucky Cement Limited, Pezu, District Lakki Marwat, North West Frontier Province, Pakistan. ESIA Report (According to OPIC Environmental Handbook Format) for D.G. Cement Limited, Kallar Kahar/ Khairpur Project, District Chakwal Pakistan. ESIA Report (According to OPIC Environmental Handbook Format) for Chakwal Cement Company Limited, District Chakwal Pakistan. - ESIA Report (According to OPIC Environmental Handbook Format) for Packages Limited, Karachi.	
Mr. Muhammad Saif-Ur-Rehman	**-B.Sc.** (Chemical Engineering), Sindh Uni, Karachi, Pakistan. **-M.Sc.** (Applied Environmental Sciences), Sindh Uni. Karachi, Pakistan. - Special B.Sc. Final Year thesis was completed on Environmental Management Practices and Waste Water Treatment Technologies. **-General Manager,** APEX Environment Lab. **-Chief Engineer Monitoring,** ECTECH	-Senior Team Member -Project on site monitoring & related activities. - Co-author of the EIA report.

	-Experience in Environment: For the last over 10 years working in the field of environment on the following subjects: - **Prepared 10 EIA reports,** in the field of cement, textile, oil & gas, power generation, fertilizer, power alcohol and chemical industry. **-Designing, fabrication, installation and operation of Waste Water Treatment Plants;** So far three plants have been installed. - **Carrying out environmental Audit:** Around 18 industrial units have been completed so far. - **Lab. Testing of effluents and water:** For the last 5 years lab. testing services have been provided. -Full time participation in the assignments under serial 12 – under Dr. M. Hanif's contributions.	- Collection of demographic data. - Preparation of environmental management plan.
Mr. Muhammad Anees.	**B.A; L.L.B**; Expert on Environment Law - Full time participation in the assignments under serial 12 – under Dr. M. Hanif's contributions (legal aspects).	Guidance on various aspects of Environmental Law as applicable to EIA. Environmentalist. Preparation of Environmental management

		plan,
Mr. Muhammad Mujahid	**M.Sc.** (Env. Sciences), University of the Sindh, Karachi **M.Phil** (Env. Sciences), University of the Sindh, Karachi - Senior Lab. Analyst, APEX Environment Laboratory & Senior Monitoring Engineer -Senior Environmentalist ECTECH-Environment Consultants -Environmental monitoring of over 25 projects for EIA reports plus help in writing these reports. Also participated in - EIA Report (According to OPIC Environmental Handbook Format) for 10 projects. - IEE reports of 15 projects.	On site monitoring and lab. testing of samples and data processing. - Report writing. -Preparation of environmental management plan, Environmental monitoring, Lab. Testing of pollutants
Mr. Muhammad Hassan Sharif	**M. Phil** Environmental Sciences (COMSATS Institute of Information Technology) **BS(Hons)** Environmental Sciences (University of Agriculture Faisalabad)	On site monitoring and lab. testing of samples and data processing.

		- Report writing. -Preparation of environmental management plan
Mr. Samiullah	**BS(Hons)** Environmental Sciences University of Karachi	On site monitoring and lab. testing of samples and data processing. - Report writing. -Preparation of environmental management plan Environmental monitoring Lab. Testing of pollutants
Mr. Arif Hussain	**M.Sc.** Environmental Sciences	Senior

	(University of The Sindh) Lab. Analyst, APEX Environment Laboratory Monitoring Engineer ECTECH-Environment Consultants -Environmental monitoring of over 12 projects for EIA reports plus help in writing these reports.	Environmentalist. On site monitoring and lab. testing of samples and data processing. - Report writing. -Preparation of environmental management plan
Mr. Hassan Waqas	**M.Phil** Environmental Sciences (University of Gujrat)	Senior Environmentalist, APEX Environment Laboratory Monitoring Engineer ECTECH-Environment Consultants
Ms. Tayyaba Akhtar	**M.Sc** Environmental Sciences (University of Sindh)	Lab. Analyst, APEX Environment

		Laboratory ECTECH-Environment Consultants

2.4 Brief description of nature, size and location of the project

2.4.1 Nature and size of the plant

The project is waste to energy or energy recovery in nature. By-product of sugar cane i.e. bagasse will used as fuel to produce electricity. Bagasse is a valuable resource which can be consumed more effectively. In framework for power Co-Generation 2013 (Bagasse / Biomass) opportunity is provided to sugar mill to export the electricity to grid under the scope of Renewable Energy Policy of 2006. NEPRA has prepared upfront tariff for bagasse based high pressure power plants. The power portion (high grade energy) of combined heat and power mix can be increased by adopting higher pressures.

45 MW high pressure Co-Generation power plant will be installed. The proposed power plant will cover a total area of 28.2 acres.

2.4.2 Location of the project

The Project Site is adjacent to JDW Sugar Mills Limited Unit III located near Goth Islamabad, Tehsil and District Ghotki , Sindh. The adjacent area is owned by JDW Unit-III.

The location map of the Project site map and Project Layout is provided below:

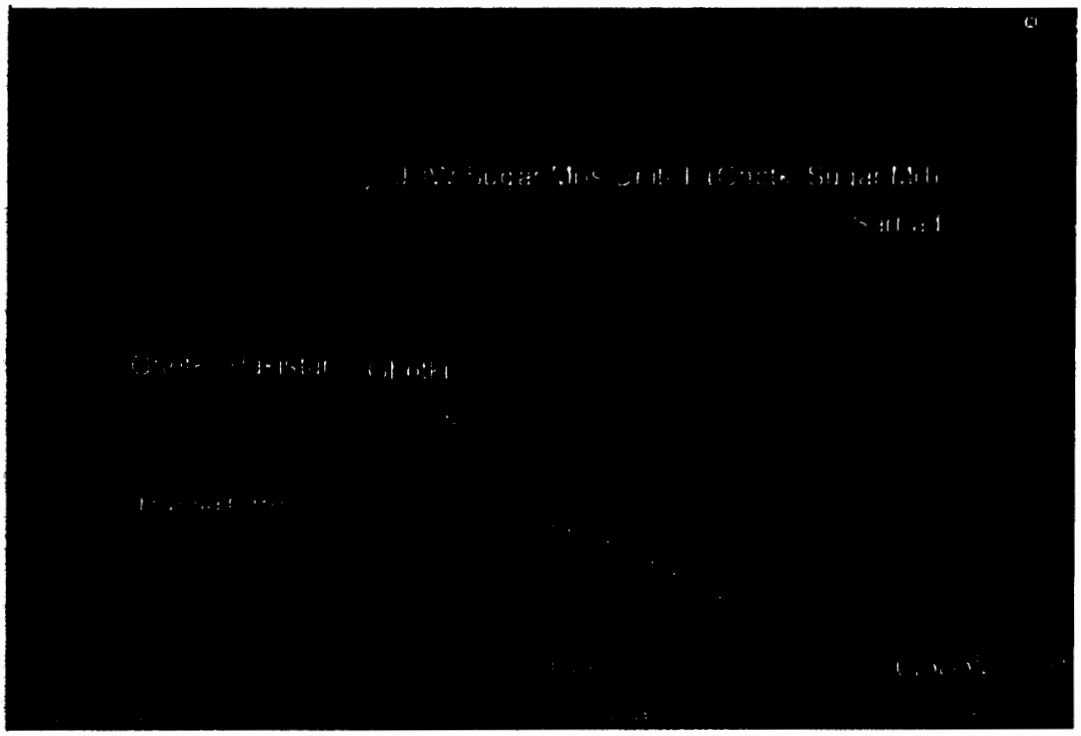

Figure 2.1: Location of the Project **Courtesy: Google**

3.0 DESCRIPTION OF THE PROJECT

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3.1 Type and category of the project

This Project is of energy generation project and falls in Schedule-I of The Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014 List of Projects Requiring an IEE, Subsection-B Article-II "Thermal power generation less than 200 MW"

The plant site is situated within the legal jurisdiction of the Environmental Protection Agency, Government of the Sindh, Karachi. Therefore, this IEE report will be submitted to this EPA for getting Environmental Approval/No Objection Certificate as required under the Sindh Environment Protection Act, 2014, Part-VI, Section-17 to fulfill the mandatory legal condition.

3.2 Objectives of the project

The main objective of the project is to contribute indigenous source of electricity to the national grid with minimal impact on the environmental conditions of the surrounding area while aiding local employment and socio-economic development.

Bagasse based Cogeneration Power production facility in sugar industry, provides a lot of advantages both to the sugar industry as well as to the country. Some of the advantages using Bagasse as fuel are highlighted as below:

i- Reduces gap between demand and supply in the national grid with Bagasse as fuel available at very low cost

ii- The Bagasse based cogeneration is environment friendly

iii- Cutting upon foreign exchange bills outflow from the country for the purchase of the fossil fuels

iv- Improving financial status of sugar sector and its downstream products, by the use of Bagasse as fuel for power production, which can also be called value addition

3.3 Alternatives considered for Site Selection

Hereunder, alternatives considered for the site selection for installation of the cogeneration power plant are highlighted.

a- Availability of Land for the Power Plant

Ghotki Power (Pvt.) Limited, would be located on land available adjacent to JDW Unit-III.

b- Availability of Bagasse as Fuel from In Sourcing

The power plant is adjacent to the JDW Sugar Mills Unit-III. Bagasse from JDW Unit-III will be available for Cogeneration plant within the premises of Ghotki Power (Pvt.) Limited as the sugar mill also belongs to the proponents of the Cogeneration Power Plant.

c- Availability of Bagasse/bio mass from Out Sourcing

Bagasse can also be purchased from external sugar mills during off-season operations, as and when available.

d- Basic infrastructure

Basic Infrastructure like roads, plentifully availability of underground water of good quality, cheap labor, telephone, Internet, transportation etc. are available and well developed.

e- Interconnection with Grid

Keeping in view the location of the Project, the most feasible interconnection scheme would be the scheme being used for the existing 67 bar power plant. The existing power plant is looped in-out in 132 kV double circuit at JDW Unit III. Ghotki Power (Pvt.) Limited would generate power at 11 kV voltage level from where it will be stepped up to 132 kV using 132/11 kV transformers.

f- Transportation cost of Bagasse as raw material

To meet the requirement of steam for the 45 MW High Pressure Cogeneration project at Ghotki Power (Pvt.) Limited, Bagasse from the adjacent JDW Unit-III would be transported through conveyer belts. Bagasse from external sources shall be transported by trucks.

g- Environment

Environmental consideration for industrial sitting is of utmost importance. The plant is to operate according to the Environment Management Plan (EMP) as provided under section 6. Under this EMP necessary safeguards have been provided to minimize all type of pollutants to the level as required under the Sindh Environment Quality Standards (SEQS)a.

The present site for installation of the power plant is not situated within or near to any sensitive environment around. Accordingly, the site selected for the power plant is quite suitable.

h- Waste water disposal facility

Effluent generated from Co-generation power plant will be neutralized and will be let into the existing sugar effluent treatment plant. The treated water will be used for the irrigation purpose inside the plant boundary walls and left over if any, will be discharged into the nearby farms.

i- Labor availability

All categories of the labor required for the project operation are available conveniently and plentifully at affordable cost at the project site. This factor too supports siting of the project at the present site.

Estimated 100-150 labour will be engaged during construction phase while 50 persons in three (03) shifts during regular operation of the power plant.

On the basis of the above facts, the selected site for the new cogeneration power plant project is the most suitable.

3.4 Location and site layout of the project (May be annexed at the end of report)

Location map is given in chapter-1

Overall plant layout, M/S Ghotki Power (Pvt.) Limited Pakistan, is attached as Annexure-II.

Cogeneration HMBD-Season operation, M/S Ghotki Power (Pvt.) Limited Pakistan, is attached as Annexure-III

Water Balance Diagram M/S Ghotki Power (Pvt.) Limited Pakistan, is attached as Annexure-IV

3.5 Land use in the project area

The project site is within the Premises of Ghotki Power (Pvt.) Limited. Most of the area around the project is in agricultural use. Sugarcane is one among the major cash crop of the project area.

3.6 Road access

Project is at 2 km off from National Highway (N5) Ghotki toward Goth Islamabad, district Ghotki , the district head quarter of the project area is connected with other parts of the country by roads, railway and even airport. These facilities provide good opportunities to the people to mix up with the public of the other parts of the country. The airport even provides good air link to other countries. The economy of the district is growing quite rapidly.

3.7 Vegetation features of the site

The area around the project site is vegetated and cultivation is mostly depends upon rain, canals and the water obtained from tube wells. Wheat, sugarcane and corn are the main crops and almost all the vegetables are grown. Fruit orchards are numerous and the main fruit are Dates, Mango, lokat, Jaman, and guava.

The fauna and flora of the area include: Kikar, Piple, Bohar, Eucalyptus, Popular and Sharin. There is very little of wild life in the area. Karil (Capparis aphylla) is commonly met with but is no-where bigger than shrub. Jand a much-prized tree for its firewood and charcoal is becoming a Varity. Shisham Kikar along canal banks has developed into fine big trees. There is no locality without a rich growth of trees mainly Piple, Bohar, Eucalyptus, Popular and Sharin.

3.8 Cost and magnitude of the operation

As above mentioned 45 MW Co-generation power plant using Bagasse as fuel is going to be installed at Ghotki Power (Pvt.) Limited, District Ghotki. The estimated cost of the project is US$ 48.96 Million. The total area required for the project is 28.2 Acres. There will not any other activity except the generation of power.

3.9 Schedule of Implementation

The complete Cogeneration plant could be implemented within a period of Twenty (20) months from the date of purchase order to the boiler/TG contractor. In the proposed cogeneration plant the boiler and the steam turbine are the long lead items and the selection and implementation of the same require adequate time frames. The turbine is likely to be imported from Japan. China or Europe, where as boiler maybe manufactured locally or imported from China.

3.10 Description of the Project (process flow charts/ steps)

JDW Sugar Mills Unit-III is already having a Cogeneration plant operating for the last three seasons under the same name. The existing Cogeneration plant is based on the cycle parameters of 67 bar and 485 Deg.C and the plant capacity is 26.5 MW

Now, M/S Ghotki power (Pvt.) Limited has planned for phase-II of the bagasse based co-generation program based on 110 bar and 540 Deg.C steam parameters, which would phase out the existing low pressure systems completely. With the implementation of Phase II Cogeneration, the proponent will be operating with two Cogeneration Units, one based on 67 bar and 485 Deg.C cycle parameters and the other based on 110 bar and 540 Deg.C cycle parameters.

The proposed project capacity is 45 MW and will install adjacent to JDW Sugar Mills Unit-III, Goth Islamabad, Tehsil & District Ghotki.

Table 3.1: Existing Power Plant Operation Energy Audit report

Plant operation (Season mode)		
DECEMBER, JANUARY, FEBRUARY, MARCH		SEASON MONTH
REFERENCE DATE		29-Jan-17
GROSS GENERATION OF STG	MW	25.600
AUXILIARY LOAD	MW	1.985
SUGAR MILL CONSUMPTION	MW	3.923
EXPORT TO WAPDA	MW	19.692
PROCESS STEAM TO SUGAR	TPH	114.0
Plant operation (Off-Season mode)		
APRIL, MAY, JUNE, JULY, AUGUST, SEPTEMBER, OCTOBER, NOV		OFF SEASON
REFERENCE DATE		5-Aug-16
GROSS GENERATION OF STG	MW	26.350
AUXILIARY LOAD	MW	1.95
SUGAR MILL CONSUMPTION	MW	0.432
EXPORT TO WAPDA	MW	24
PROCESS STEAM TO SUGAR	TPH	NIL

The power plant will be connected to the national grid through a loop in, loop out arrangement at the 132-kV double circuit between Liberty and Ghotki grid stations that is located at a distance of about 43.4km from the sugar mill.

As the fuel for power generation is Bagasse and power plant is going to be installed adjacent to JDW Sugar Mills Unit-III, therefore, sufficient of bagasse will be available

for power production, as it also belongs to proponent. Sugar mill have 120 days of crushing operation at 90% capacity utilization, the saved bagasse at the end of the season will be 222,234 MT. Further, Bagasse will also be purchased from other sugar mills to fulfill the plant requirement as and when available. The power plant maintenance shall be carried out during non-operational off-season days.

The cultivable area surrounding the purposed power plant site is approximately 70,000-acres where major crop is sugarcane hence a surplus amount of Bagasse will be available for the power plant. Ground water availability is about 25-30 ft and it is very good and quality is quite suitable for meeting all water needs of the project.

3.10.1 Raw Materials

The Major raw material for this project is Bagasse, which is a by-product of the sugar production process. The Co-generation power plant will use Bagasse produced in-house by JDW Unit-II and any additional bagasse available from external sources. The quantity of the Bagasse to be used for the co-generation plant is detailed as below.

3.10.1.1Bagasse Characteristics

Bagasse is a by-product/waste of sugarcane in JDW Unit-II. Bagasse is a fuel of varying composition and heating value. These characteristics depend on the climate, type of soil upon which the cane is grown, variety of cane, harvesting method, amount of cane washing, and the efficiency of the milling plant.

Table 3.2: Bagasse and Ash Analysis Report

Date	Time	Bagasse Calorific Value Cal/gm (HHV)	Bagasse Moisture %	Date	Time	Ash Density kg / M^3	Un burned % value
1-Jan-17	9:00	2177	51.72	1-Jan-17	9:00	228.28	17.44
2-Jan-17	9:00	2226	50.88	2-Jan-17	9:00	243.06	16.44
3-Jan-17	9:00	2215	51.16	3-Jan-17	9:00	284.2	19.60
4-Jan-17	9:00	2236	50.95	4-Jan-17	9:00	296.3	12.71
5-Jan-17	9:00	2202	51.47	5-Jan-17	9:00	249.97	16.91
6-Jan-17	9:00	2193	51.57	6-Jan-17	9:00	220.3	16.78

7-Jan-17	9:00	2210	51.62	7-Jan-17	9:00	242.43	17.17
8-Jan-17	9:00	2223	51.26	8-Jan-17	9:00	273.81	16.72
9-Jan-17	9:00	2189	51.73	9-Jan-17	9:00	192.20	21.66
10-Jan-17	9:00	2190	51.57	10-Jan-17	9:00	212.03	23.24
11-Jan-17	9:00	2190	51.9	11-Jan-17	9:00	206.58	21.83
12-Jan-17	9:00	2198	51.63	12-Jan-17	9:00	211.13	23.48
13-Jan-17	9:00	2180	52.15	13-Jan-17	9:00	198.39	22.09
14-Jan-17	9:00	2177	52.25	14-Jan-17	9:00	203.42	19.59
15-Jan-17	9:00	2152	52.7	15-Jan-17	9:00	239.17	18.93
16-Jan-17	9:00	2190	51.93	16-Jan-17	9:00	253.56	16.25
17-Jan-17	9:00	2185	50.05	17-Jan-17	9:00	254.39	19.76
18-Jan-17	9:00	2188	51.94	18-Jan-17	9:00	249.00	19.22
19-Jan-17	9:00	2180	52.13	19-Jan-17	9:00	206.22	22.35
20-Jan-17	9:00	2204	51.64	20-Jan-17	9:00	216.07	20.35
21-Jan-17	9:00	2182	52.14	21-Jan-17	9:00	215.19	23.93
22-Jan-17	9:00	2148	52.85	22-Jan-17	9:00	196.18	30.40
23-Jan-17	9:00	2200	51.72	23-Jan-17	9:00	227.13	19.73
24-Jan-17	9:00	2209	51.55	24-Jan-17	9:00	212.84	23.40
25-Jan-17	9:00	2218	50.76	25-Jan-17	9:00	168.7	27.97
26-Jan-17	9:00	2138	52.69	26-Jan-17	9:00	218.6	24.56
27-Jan-17	9:00	2158	52.16	27-Jan-17	9:00	206.65	23.19
28-Jan-17	9:00	2151	52.47	28-Jan-17	9:00	158.9	24.91
29-Jan-17	9:00	2175	52.13	29-Jan-17	9:00	156.29	26.79
Average		**2189.10**	**51.75**			**222.10**	**20.94**

3.10.2.2 Water

All requirements of water are given as:

The site will require make up and cooling water for the operation. The water requirement of the proposed power plant is to be met from tube-wells. The ground water availability is good and reliable. However, there is plenty of surface water available from nearby irrigation canal system. Water from the canal could be utilized in case of emergency.

Due to plentiful availability of water, it has been decided to go with water cooled condensing system for the cogeneration plant. The raw water supply has been planned to be provided by tube-wells installed within the proposed plant boundary.

The raw water will be used as a source for makeup water for the losses in the process steam, boiler blow down, cooling tower blow down, service water, etc. It has been proposed to provide totally independent raw water and treated water system for the proposed cogeneration project. The new system will include the storage reservoir, clarifier, reverse osmosis and de-mineralization system and storage tanks. The proposed plant will be located in the area which is being fed by an elaborate irrigation canal system; with the result that ground water aquifer is being regularly replenished. Shortage of ground water is not expected.

Cooling Tower

Induced draft counter flow RCC cooling tower of capacity 10,200 m^3/hr. Three (3) cells each of capacity 3400 m^3/hr.

Reverse Osmosis (RO) Plant

The RO plant shall be designed to have two streams of 38 m^3 each. Adequately sized neutralizing pit shall be provided near the RO plant for collecting the discharges from the RO plant and effectively neutralizing the same before pumping the waste to the sugar plant's effluent treatment system.

The water requirement for different processes during construction and operation phase are fulfill by underground water.

Demineralized (DM)

Water Plant DM water plant will be installed for complete demineralization of raw water for use as boilers makeup water. Regeneration effluents after neutralization will be sent to the wastewater treatment plant.

Wastewater Treatment Plant

Liquid effluents from all sources will be treated according to required levels of the National Environmental Quality Standards as well as those by the World Bank, before pumping the waste to the sugar plant's effluent treatment system. It is estimated that 50 to 60% of the liquid effluents will be recycled thus reducing the requirement of raw makeup water by 40 to 50%. Thus, there is no possibility of any damage to the agriculture crops in the least.

a. Boiler feed water total requirement 220 Ton/h

b. The raw water will be made available from the deep 3 Well turbine pumps. 2 turbines are reserved if there is problem in any one. Cooling water for extraction / condensing turbine total requirement is 10,200 m^3/h. All the water will be re-circulated. Drift Losses 0.005 % will be met from underground water. Evaporation loss 1.56 %. All cooling water requirement will be met through cooling tower.

- Water requirements during construction phase =100 – 150 cum/day
- Water requirements during operational phase (during season) =5400 cum/day
- Water requirements during operation phase (during off season) = 7200 cum/day
- Coolant water requirement = 10200 cum/hr Approx.(circulation)

Table 3.3: Specifications of Deep Well Turbine

Specification of Deep Well Turbine		
Description	**Detail**	**Unit**
NO OF UNITS	3	NO.
MANUFACTURER	KSB KARACHI	
DEEP WELL TURBINE TYPE	B10 D/8	
CAPACITY	155	CUM-Hr
HEAD	60	METER
SETTING DEPTH	70	FEET
NO OF STAGES	8	NOS.
STATIC WATER LEVEL	44	FEET
BORE DEPTH	270	FEET
Specification of Deep Well Turbine Motor		
MAKE	ABB	
FRAME	225 S	
SPEED	1482	RPM
CURRENT	65.5	AMP
VOLTAGE	400	VOLT
MOTOR RATING	37	KW
SOURCE TO RUN DEEP WELL TURBINE		
SOURCE NUMBER # 01	ELECTRICAL SUPPLY (WAPDA)	
SOURCE NUMBER # 02	DIESEL GENSET (OLYMPIAN)	

Fuel availability, requirement and supply

Bagasse requirement shall be met through availability from JDW Unit-III and from external sources as and when available.

3.11 Technology Review & Selection

3.11.1 Major Equipment: (Layouts and details)

The following gives the major equipment and systems involved in the proposed new Cogeneration plant. It is important that the new equipment or the system is properly optimized and integrated with the existing equipment and systems associated with the 67 bar Cogeneration plant. Brief commentary is given, wherever required, to highlight the requirement regarding the integration of the systems.

Steam generator and Auxiliaries

New standalone system, to be located on the southern side in new vicinity adjacent to the existing boiler.

Steam Turbine and Auxiliaries

New extraction condensing steam turbine, to be located in new vicinity adjacent to the existing setup.

Fuel & grate bottom ash Handling system

The bagasse handling system comprising of chain conveyors & belt conveyors to transport the required quantity of bagasse from sugar mill to cogeneration shall be provided. Bagasse from the sugar mill shall be fed to the boiler from a front mounted chain conveyor. Excess bagasse shall be returned to the bagasse storage yard. During off-season/non-availability of bagasse from mill, the cogeneration boiler shall use saved bagasse from the storage yard.

The ash handling system envisaged for the cogeneration boiler shall consist of Submerged Ash Belt Conveyor System and Dense Phase Ash Handling System

Cooling Tower

Will be new and stand alone for the new plant. The location will be by the side of the existing cooling tower of the 67-bar plant. Side stream filters to be added.

Water treatment plant and other associated systems

The existing water treatment system at the existing 67 bar High Pressure Cogen Plant shall be expanded as required to meet the requirements of the new 110 bar High Pressure Cogeneration plant.

EOT crane

An Electrically operated EOT crane shall be provided for the erection and maintenance requirements of turbo generator and its auxiliaries.

The main hook capacity shall be 90 Tons and suitable for lifting single heaviest component in Turbo Generator. The auxiliary hook lifting capacity shall be of 5 Tons. The crane travel will cover the entire length of the TG building. The crane shall be electrically operated, bridge type and shall be designed and equipped for indoor operations complete with all accessories. The crane bridge shall consist of bridge girders each carrying a rail on which a wheeled trolley is to run. Operation of crane shall be by pendant type push button station from ground level.

Compressed Air System

The function of this system is to provide service and instrument air for cogeneration plant operations. Compressed air system provides air to following users:

- **Instrument Air Users**: Instrument air will be required for the operation of pneumatic instruments like I/P converters, purge instruments, pneumatic actuation of control valves, dampers etc.
- **Service Air Users**: Service air will be required for cleaning of filters, strainers and general purpose.

Firefighting System

The function of fire-fighting system is to supply water to the main risk areas of the cogeneration power plant.

The fire protection system is required for early detection, containment and suppression of fires. A comprehensive fire protection system shall be provided to meet the above objective and all statutory and insurance requirements of National Fire Protection

Association (NFPA).

3.11.2 Plant Technology Suppliers

Tentative manufacturers of plant and equipment are provided below, which are subject to change after the detailed design process and submission of financial and technical proposal

a. Boiler – Heavy Mechanical Complex (HMC), Descon Engineering, imported from China.

b. Steam Turbine – Imported from Japan, China or Europe.

c. Switchyard and transformers – Siemens Pakistan.

d. Fuel & Ash handling system – Same as boiler manufacturers.

e. EOT Crane – Kuhnezug, Germany

f. Water Treatment plant – WEMS Pakistan

g. Cooling Towers – Truwater, Malaysia

h. Drivers / Motors / Instrumentations – ABB / Siemens / Yokogawa / Emerson.

3.11.3 Process details

This proposed Cogeneration plant is configured with a travelling grate multi fuel fired boiler, of 220 TPH capacity. The boiler outlet steam parameters will be 110 bar (a) and 540 Deg.C. The steam from the boiler will be supplied to an extraction condensing type turbogenerator with a nominal capacity of 45 MW and with the turbine inlet steam parameters of 105 bar(a) and 535 Deg.C. The turbine and generator will be coupled through a gear box. The turbine will be designed with a controlled extraction port at 2.5 bar (a), for supplying the 2.5 bar(a) process steam and two uncontrolled extraction ports, one at 10 bar (a) and the other at 22 bar (a).

There will be two stages of high pressure feed water heating to a final feed water temperature of 210 Deg.C. The total process steam and the regenerative heating steam will be drawn from the turbine extractions. The condenser of the turbine will be water

cooled and shall be sized for condensing the steam flow during the off-season operation. The Cogeneration plant will be designed with all the auxiliary plants and systems like the fuel and ash handling system, Cooling water system, feed water system, Raw water and DM water system, Instrument air system, Distributed Control System, Electrical system and EHV transmission system etc., for its successful operation.

The total steam generation from the boiler shall be 220 TPH and this will be fed to the new extraction condensing turbine. The total process steam requirements will be met by the extraction drawl from the new TG and the extraction from the existing TG in the 67 bar system. While the new 110 bar TG supplies 155 TPH of process steam the existing 67 bar TG will supply 120 TPH of process steam. None of the other low pressure systems will operate.

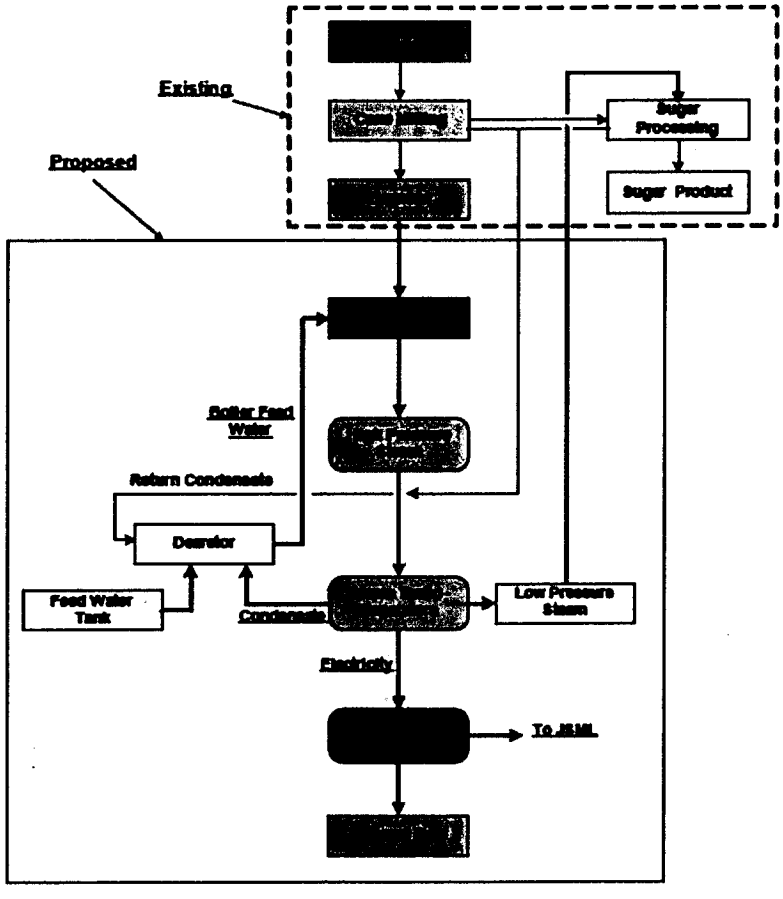

Figure 3.1: Proposed Co-Generation Scheme

3.12 Details of restoration and rehabilitation at the end of the project life

The co-generation power plant is expected to have a project life of about 30 years. Once the useful life of the new plant will be over, it will be refurbished completely. A comprehensive mechanical, electrical and civil structural overhaul will be carried out. To bring the plant to-date with the then technology available, all necessary equipment replacements will also be done. In this way, the plant will be revived for another term of its useful life. The redundant parts and equipment will be sold in the market for recycling.

In fact, the replacement / up gradation of damage / obsolete components of all the major equipment's will be carried out as and when needed. However, if the restoration/ rehabilitation of any component/ equipment will be deemed imperative and that will be carried out with the most modern technology available at that time.

This all will be done conforming to the environmental management and controls so as to avoid any damage to any segment of environment or human health. Good part of the civil works, specially the digging of the soil, has already been completed therefore for restoration and rehabilitation of the site at the end of the project shall be one month.

3.13 Government approvals and leases required by the project

No objection certificate (**NOC**)/Environmental Approval (**EA**) from the EPA, Sindh, is the major requirement to start work on the project.

4.0 DESCRIPTION OF THE ENVIRONMENT

4.0 DESCRIPTION OF THE ENVIRONMENT

(AREA AFFECTED BY THE PROJECT)

4.1 Spatial and temporal boundaries adopted for the various aspects of The study

While carrying out the present study, factors including present environmental settings and likely future trends around the project site were taken into consideration. Availability of basic infrastructure, water, raw materials, and markets for the product, labor, transport and electricity were the major among other factors considered in the project area. Socio-economic conditions were also considered during the course of the study.

a) Existing (baseline) condition of the biophysical and socio-economic environment, trends and anticipated future environmental conditions should the project not go ahead.

Canals and tube wells provides water for the irrigation in the project. There are mango orchards spread over long distances. Wheat, cotton, sugarcane and pulses are the major cash crops.

Many people rear especially cows and buffalos for producing milk even on semi commercial scale. It will not be out of place to say that the area is one among the other food baskets of the Sindh province.

The awareness about the importance of education is now developing in the area. Some people of the area are playing an important role in the politics of the country even at higher levels. Fairly reasonable proportion of the people in cities is educated. While in villages, like in other parts of the Sindh province, % of educated people is low. Modern means of communication including television, radio, telephone, fax, e-mail and newspapers are within the reach of majority of the people especially in the cities. The socio-economic values are subject to change in cities specifically under the influence of media especially television.

Goth Islamabad, which is a small town, has infrastructure and basic facilities of life available for the peoples of the area. High Schools, Hospital, Vocational training institutes, Police Station and Post Offices etc. are present in the area.

Ghotki, the district head quarter of the project area is connected with other parts of the country by roads, railway and even airport. These facilities provide good opportunities to the people to mix up with the public of the other parts of the country. The airport even provides good air link to other countries. The economy of the district is growing quite vastly.

There also exists a highly educated and well placed segment of society, this segment is quite affluent and socially and politically well off also. Their way of life is comparable with that of any developed segment of the society in Pakistan. This segment of the society is playing leadership role for the people of the area.

Mostly, villagers follow old traditions in almost every walk of their life. Elderly people command respect and play deciding role in decision making. A large cross section of the older generation is uneducated. But due to awareness about education younger generation of both sexes, is now trying to get education in almost every department including science and technology on preferential basis. There is a rising trend in the society to change their old traditional socioeconomic pattern of life. Print and electronic media are playing great role in bringing tangible change in the old pattern of life.

Environmentally speaking the carrying capacity of the environment is not utilized. The project activity, under the proposed strict operational environmental controls, is not going to leave adverse impacts on all out environment. The operational Environmental Management Plan and Environmental Monitoring Plan further provide protection to the environment around. Legal compliance of environmental monitoring with NEQS standards is to doubly ensure environmental protection of all the segments of the environment.'

b) Environmentally sensitive areas of special or unique value

(Physical resources of the project area: Topography and geology; Soils and Climate; water; **Ecological resources:** Fisheries and aquatic biology, Biodiversity, Forestry, Wildlife, scientific institutions, Socio-economic and Cultural and other heritage)

- **Physical Resources of the Project Area:**

  The physical resources of the project area are described below:

Topography and Geology:

Pakistan lying in the northwestern part of the Southern Asian Subcontinent, occupies the western end of the Indo-Genetic Plain, which is beyond bounded in the north by mountain wall of the Great Himalayas and their offshoots.

Physiology of the earth is description of the behavior of the upper crust. Accordingly, some knowledge of the geology is desirable.

Of the six Physiographic Divisions of Upper Indus Plain namely:

i- Bari Doab- 2.9 million hectares,

ii- Rechna Doab-2.8 million hectares,

iii- The Chaj Doab- 1.3 million hectares,

iv- The Sindh Sagar Doab/Thal Desert, 3.2 million hectares,

v- The Bahawalpur Plain and

vi- The Derajat/Suleman Piedmont, 2 million hectares.

The land in this area consists of the alluvial soil deposited by the waters of the river Indus, so it is naturally very fertile. Almost 60% of the land is cultivated while the rest is under forest. Major crops are wheat, cotton and sugarcane. Sunflower and a variety of vegetable are also grown. In addition to the river Indus a number of canals including Ghotki Feeder provide the necessary irrigation system. Hand pumps and tube wells are also common in this area because of a very shallow water table which may rise as high as 1.5 feet below ground in some Katcha area.

The area is classified as hot arid on overall basis; however, canals are available for irrigation purpose. December and January are the coolest months of the year while June and July are the hottest. Total annual rainfall is in the range of 125 to 250 mm.

More than 65% of the land is owned by the farmers themselves and around 35% is cultivated by the tenant farmers. Land holding range from as low as 2.5 acres to well over 1000 acres. Farmers in the area keep small cattle herds of poultry,

sheep, goats, buffalos and cows to supplement their income and to obtain milk and other dairy products.

- **Soils:**

Soils form major part of environment. Their fertility and other special characteristics have great relationship with environment. Climate has great influence on the formation of soils; therefore, study of these factors is of great importance. Soil is dynamic layer in which many complex physical, chemical and biological activities are taking place. Therefore, soil is a dynamic changing body. Soil scientists restrict the word soil or solum to the surface materials which over the ages have adopted the distinctive layers or horizon. Soils are made up of solids, liquids and gases. The solid part of the soil is made up of both inorganic and organics. While weathering of rocks make inorganic particles, the organic solids consist of living and decayed plants. In order to classify the entire soils in Pakistan, the Soil Survey of Pakistan has divided the entire country into nine ecological zones.

The fertile land of the Goth Islamabad falls in the Sub Recent River Plains and consists of areas between Old River Terraces and the recent times floodplains of the rivers. There is a great similarity in the nature of sediments, depositional pattern and their configuration to that of the "BAR" areas. As regards their age, they far too younger and have been deposited only during Sub recent times. It is this age difference which is responsible for weaker development in these soils. Because of illuviation or eluviation of clay, calcic horizon, vertices characteristic and features are absent in the soils of this area. The soils are developed to only moderate depths. Orchicepipedon and cambic horizon are found in the soils. In local language, these soils are called "Bangar Soils"

- **Climate:**

Pakistan is situated on the western margin of one of the main regions of the world—the monsoon region. Due to this, the climate of the country is more Continental than that of the other parts of Subcontinent. Annual Rain fall in the project area is 50-70 mm. Pakistan has four seasons namely:

- Cold Weather Season—December to March.
- Hot Weather Season—April to June.
- Monsoon Season -- July to September

Temperature:

Mean monthly temperature during July = 30 - 35^0 C

Mean monthly temperature during January = 10 - 15^{0}C

Mean monthly temperature (July and January):

i- Hottest Month:

- M.Min. = 29.0 ° C
- M.Max. = 41.1 ° C

ii-Coldest month:

- M.Min. = 4.7 °C
- M.Max. = 20.0^{0}C

Rainfall:

Rainfall (July to December) = 100 – 150 mm

Rainfall (December to March) = 50-80 mm

Mean annual rainfall = 100 - 160mm

Seismicity:

Zone category: III Moderate Hazard

Seismic factor ground acceleration: g/15 – g/20

Possible damage: Minor

- **Water:**

Canal water and underground sweet water are the two main sources of water for irrigation.

a) Underground Water:

This underground water available in large quantities will be used for the entire needs of the project. Extraction of water for project needs will not be at the cost of its availability for irrigation or other uses.

Ecological Resources fisheries, aquatic biology, wildlife, forests, rare or endangered species:

Fishery and Aquatic Biology:

The Indus River flowing at a distance of about 20 Km contains fish which is sold on yearly basis to private contracors for its commercial exploitation. The famous fish varieties in the IndusRiver water include Roho (Labeorohita), Thaila (catlacatla), Mallri and Singara.

There are no fish farms at least within 15 km radius of the project site or any other source of fish in the entire area.

Biodiversity:

Natural capital of a country mainly includes all of a country's wilderness areas and scenic landscapes, including the associated flora and fauna.

Pakistan has a total of nine major ecological zones. The contribution of the "Natural capital" is recognized at three distinct levels: species, genera, and communities (habitat and ecosystem). Both collectively and within each level, the range or variety of the resources is referred to as the "Biological Diversity". The term has relevance for each of Pakistan's administrative units—district, province, and particularly country. The more the number of species, genera and habitats and ecosystems present within these units, the greater is said to be the Biodiversity. The biodiversity of the area, with this background, is discussed as under:

Forestry:

There are no forests within about 30 km radius of the project site. Plantation, grasses and shrubs along road, rail, canal and river sides exist. Similarly, in general trees, grasses and shrubs exist on the cultivable land. For detailed account of important trees, grasses and shrubs of the area refer to under caption "Flora".

Wildlife:

Ghotki project area is quite rich in wildlife due to its diversity of habitat. The species of birds are especially common, a number of reptiles and amphibian species are

also found here. There is a long list of mammals, birds and reptiles which are found here.

Mammals

- Tatera indica (Antilope rat)
- Lepus nigricollis (Black napedhare)
- Herpestes edwardsi (Grey mongoose)
- Hemiechinus auritus (Hedgehog)
- Axis procinus (Hog deer)
- Mus musculus (House mouse)
- Ratus ratus (House rat)
- Platanista indi. (Indus dolphin)
- Canis aureus (Jackal)
- Felis chaus (Jungle cat)
- Funanbulus fennanti (Northern palm squirrel)
- Lutra perspicillata (Otter)
- Hystrix indica (Procupine)
- Vulpes vulpes (Res fox)
- Nesokia indica (Short tailed mole rat)
- Sus scrofa (Wild boar)

- **Birds**
  - Acridotheres gingianus (Bank myna)

- Lanius vittatus (Bay backed shrike)
- Dicrurus adsimilis (Black drongo)
- Francolinus francolinus (Black partridge)
- Larus ridibundus (Black headed gull)
- Podiceps nigricollis (Black necked grebe)
- Elanus caeruleus (Black winged kite)
- Himantopus himantopus (Black winged stilt)
- Bueto bueto (Buzzard)
- Bubulcus ibis (Cattle egret)
- Corvus splendens (Common crow)
- Trunga hypoleucus (Common sandpiper)
- Haliaetus leucoryphus (Fish eagle)
- Anas querquedula (Gargany)
- Francolinus pondicerianus (Grey partridge)
- Saxicoloides fulicata (Indian robbin)
- Torgos calvus (King vulture)
- Vanellus indicus (Lapwing)
- Phalacrocorax niger (Little cormorant)
- Egretta garzetta (Little egret)
- Egretta intermedia (Median egret)

- ❖ Ceryle rudis (Pied kingfisher)
- ❖ Anas acuta (Pintail)
- ❖ Ardea purpurea (Purple heron)
- ❖ Neophron peromopterus (Scavenger vulture)
- ❖ Alcedo atthis (Small blue kingfisher)
- ❖ Aquila rapax (Tawny eagle)
- ❖ Halcyon smyrnensis (White breasted kingfisher)
- ❖ Amaurornis phoenicurus (Whtie breasted waterhen)

- **Amphibians and Reptiles:**
  - ❖ Hardella thurgi (Crown turtle)
  - ❖ Trionyx gangeticus (Giant soft shelled turtle)
  - ❖ Kachuga smithii (Hard shelled turtle)
  - ❖ Chitra indica (Soft shelled turtle)
  - ❖ Natrix piscator (Water snake)
- **Protected Animals:**

  Sindh Wildlife Department promulgated an ordinance in 1972 for protection of Wildlife in the province which contains a list of protected animals, some of which are found in the vicinity of project area: Indus Dolphin and Hog Deer are of special importance as they are endangered animals.

- **Protected Birds:**
  - ❖ All members of the family Ardeidae: i.e., all Herons, Night Herons, Paddy
  - ❖ Birds, Egrets or Bitterns.

- All members of the f
- amily Pelecanidae: i.e., all Pelicans.
- All members of the family Ciconidae: i.e., all Strokes.
- All members of the genus Cygnus: i.e., all Swans.
- All members of the family Phasianidae: i.e., all Pheasants, Partridges,
- Quails, Supurfowls, Jungle fowls and Peafowls.
- All members of the genus Heliopais: i.e., all Finfoots.
- All members of the family Otidiae: i.e., all Bustards.
- Pterocles alchata. – Large Pin-tailed Sandgrouse.

Protected Mammals:

- Macaca speciosa. – Stump-tailed Macaque.
- Presbytis obscurus. – Dusky Leaf Monkey.
- Vulpes cana. – Boanford's Fox.
- Felis viverrina. – Fishing Cat or Marsh Billi, Mach Bagral.
- Azis axis. – Spotted Deer or Chittal, Chitra, Jhank, Pagal, Hiran, Boro,
- Khetiya.
- Axis porcinus. – Hog Deer or Para.
- Boselaphus tragocamelus. – Blue Bull or Nilgai, Gond, Bain, Ranjh, Rojra.
- Platanista gangetica. – River Dolphin or sus, Susu, Susuk, Sishuk,
- Bhulan, Sunsar.

Protected Reptiles:

- Crocidilus palustris. – Marsh Crocodile or Muggar, Magar Mach.
- Crocodilus porosus. – Estuarine Crocodile or Maggar.
- All Snakes pf the genus Python: i.e., all Pythons, Azdha or Arar.
- All marinr turtles of the genera Dermochelys, Chelone, Caretta and
- Eretomichelys i.e., all Leather back, Green or edible, Hawks bill, Logger head and Tortoise-shell Turtles.

Flora:

The land is fertile. Major cash crops include sugar cane, cotton, wheat and pulses. Trees, grasses and shrubs found are listed as below:

Local name	Botanical name	Local name	Botanical name
Kikar	Acacia Arabia	White siris	Albizziaprocera
Phulahi	Acacia modesta	Nim	Azadirachtaindica
Siris	Albizzialebbek	|Aam	Mangiferaindca
Amaltas	Cassia fistula	Jal or Wan	Salvadoraoleodes
Lasura	Odiamixa	Frash	Tamarix articulate
Shishamtali	Dalbergiasisso	Arjan	Terminaliaarjuna
Jaman	Eugenia jambolana	**Shrubs:**	
Pipal	Ficusretusa	Babri	Acacia jacquemontii
Barh	Fecusbengalenisis	Jawanh	Alhaji-camelorum
Bakain	Meliaazdarach	Karir	Capparisaphylla
Toot	Morus alba	Phog	Calligonumpolygonodes
Poplar	Populusspp	Aak	Alotropisprocera
Date palm	Phoenixdactylifera	Khar	Haloxilonrecurvum
Jand	Prosopisspicigera	Lani	Salsolafeetida
Mesquite	Prosopisglandulosa	Lana	Suaedafroticora
Sukhcahain	Pongamiaglabra		
Grasses:		**Grasses:**	
Khabbal	Cynodondactylon	Siriala	Hetropogoncontortus
Khowi	Cymbopogonjwara ucusa	Gam mali	Panicumantidotale
Dhaman	Cenchrusciliaris	Sanwakt	Panicumcolnum
Sinn ghorkhs	Elionurushirsutus	Kana	Saccharummunja
Dabb	Eragrosticcynosurioides	Kundar	Typhaangusti-folia

Fauna:

The area where the project site is located is thickly covered with crops. Very few wild animals found in the area, like jackals, Black Cobra, lizards and porcupine etc. Rearing of buffalos and cows is done for milk both for own use and for commercial purpose. Goats and sheep are also kept in abundance for meat and milk. Camels and donkeys are also reared for transport of goods especially in villages for carriage of fodder from fields to the farm houses or "dairas", sugar cane to sugar factories and cotton to ginning factories besides other uses.

The major wild life in is listed as below:

Serial #	Name	Serial #	Name
1	Wild hare	12	Chinkara
2	Partridge	13	Lizards
3	Sand grazer	14	Goh
4	Carnisaureus (Jackal)	15	Wild rats
5	Falcon	16	Wolf
6	Hubara bustard	17	Snakes
7	Paracol cat	18	badger(haena)
8	Great Indian Bustard	19	Valpusvalpus (Fox)
9	Luggar	20	Ovisorientalis (Urial)
10	Black buck	21	Susscrofa (Wild boar)
11	Hystrixindica (Porcupine)		

- **Socio-Economic:**

The land around the project area is not arid completely as canal water is also available for irrigation. Average land holdings are very small. The people also supplement their income also by rearing of goats, sheep and cows on a limited scale. The people of the area are generally poor.

Since the area is not yet industrialized, therefore, job opportunities are very less. A large number of the people do mostly labor and other menial work especially at

Islamabad, Faisalabad, Lahore and Karachi. However, some are working in Middle East. Fairly over 10% of the younger generation is in Pakistan Army.

There is also a highly educated, affluent and well placed segment of the society in the area. Their way of life can be compared with that of any developed segment of the society of Pakistan. They provide leadership role for development of other classes of the society. They are quite helpful to the people of their areas. They serve as Beacon house for the other low placed class. Their role in the development of the area and society is quite important.

People mostly follow old traditions in almost all walks of their life. Elders are very much respected and play vital role in decision-making. Old people are mostly illiterate. Old customs are being practiced. Arranged marriage system is followed and it is quite successful. People are proud of their traditions and customs. Joint family system prevails and people reap the fruits of this system. Families are quite coherent. Guests are welcome as a tradition from the old past. Life style is simple.

Due to awareness about the importance of education most of younger generation, including both sexes, is now trying to get education. There is a rising trend in the society to change their old traditional socioeconomic pattern of life. Print and electronic media are playing great role in bringing tangible change in the old pattern of life.

- **Cultural and Other Heritage:**

There is no worth mentioning cultural or other heritage around. However, Bhong Mosque is really a wonder of the present times in the area. Religious harmony is also a major character of these communities. The industrial set up in the area may have a diversified impact on the socio-economic environment of the area.

- **Existing Socio-Economic Baseline Conditions:**

➢ **Population and Communities**

The project site is situated at Ghotki city close to the Goth Islamabad. There are many small and big villages around which are given here under:

Available school and health facilities are basic. Model School JDW Sugar Mills is present near the project site. In some of the villages there are primary or high schools. For intermediate onward education students have to go to Rahim Yar city mostly.

Medical facilities in most of the villages are lacking and those available are of very preliminary nature. Social Security Dispensary is present within Mill's premises.

Peoples belonging to the different castes and religious sects live in complete harmony with each other. People belonging to the different tribal origins are Khore, Balochi, Kanjan, Sheikh, Vadher, Bochrey, Jholan, Khumbney, ChaCher, Solangi, Larr, Mothey, and Chogley in the area.

Underground water through tube wells and hand pumps and canal water is used for drinking and other house hold purposes. Approximate population of the villages near the project site, their approximate distances from the project site, availability of health and education facilities are given here under.

Name of the Village	Number of Houses (approximate)	App. Population (Nos.) (Approximates)	Education facility	Medical care availability	Gas availability	Electricity availability	Potable water availability
1-Jagger Kacha	416	2500	Primary School	No	_	Yes	Yes
2-Pakku miran Pur	428	3000	Primary School	JDW Dispensary	_	Yes	Yes
3-Sohinyan	250	2000	Primary School	OGDCL Dispensary	Yes	Yes	Yes
4-Jageer Pakko	500	4000	_	_	_	Yes	Yes
5-Hussan Khan Sandhar	350	2000	_	_	_	Yes	Yes
6-Sundrani Kachoo	570	4,000	_	_	_	_	Yes
7-Kham	800	500	Primary	_	_	_	Yes
8-Muhammad Ibrahim Goto	16	100	_	_	_	_	Yes

5.0 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.0 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Baseline/ Zero Environmental Monitored Data:

In order to assess the existing status of the environment as baseline, on site environmental monitoring was carried out. Results of this monitored data are shown in the Annexures-V

5.2 Environmental problems during construction and mitigation measures:

i- Environmental problems due to project location

The project aims at installation of new Cogeneration Power Plant under the name "Ghotki Power (Private) Limited, 45 MW High Pressure Cogeneration Power Plant" using Bagasse as fuel. The power plant will be installed adjacent to already installed 26 MW cogeneration power plant near the Bagasse storage facility. Surplus quantity of Bagasse required to run the power plant will be available from JDW Unit-III.

Environmental Management Plan (EMP) as described hereunder is to be followed covering all activities during construction phase; therefore, no environmental problems are envisaged due to the project location.

Environmental problems related to design

The plant is to be designed in a way that it complies with the required limiting values as set under the SEQS.

Under the conditions no environmental problem relating to design are envisaged.

Third party quarterly monitoring

Third party quarterly monitoring will further ensure compliance with the required standards.

iv- Environmental problems resulting from construction:

The most likely environmental problems to occur during construction phase could due to:

- Construction machinery,
- Compaction of soil activity,
- leveling of land,
- moving vehicles,
- Construction of building and associated civil work.

The pollution from these activities could be in the form of the following emissions from the exhaust of vehicles and from fuel burning in the operation of machines to be used for several of construction activities:

- Gaseous emission of SO_2, NO_x and CO, hydrocarbons etc.
- Particulate Matter (PM).
- Noise.
- Effluent.

In the first place, construction activity is going to be on very limited scale and for short duration, therefore, magnitude of emissions/pollutants will not be very big.

Secondly, the scheduled traffic plan of vehicles visiting plant regularly will further ensure that the environmental pollution does not adversely affect the people and environment.

The scale of erection and commissioning will also be small, thus the potential contribution of noise and dust as pollutants will also be very small and will be curtailed within the plant boundaries.

And lastly, a dedicated Environmental Management Plan (EMP) to be operational during construction will further ensure that environmental problems to accrue during construction are well managed within the required limits of the SEQS Pakistan.

v- Environmental problems resulting from project operations:

The technology suppliers/designers and fabricators enjoy international reputation. The boiler will be designed in a way that all sort of emissions from them meet the required levels of the SEQS Pakistan.

- **Noise levels:**

Since most of the machinery will be placed within the built up area thus ensuring noise level compliance with the required standards. Wherever necessary, double housing to the rattling parts of the machinery, is to be provided for reduction of noise levels. This is to be incorporated at the design stage of the plant. The maximum noise levels will not increase from 75 dB (A) during day time and 65 dB (A) during night time at the plant boundary thus will remain in compliance with the limits of the SEQS

State of the art technology (if and wherever required) to reduce CO, NO_x and SO_2 and Particulate Matter (PM) emissions will be used. Hereunder, more details are given.

- **Boiler Stack Emissions**

Boiler stack emissions of concern are primarily nitrogen oxides (NO_x), carbon monoxide (CO) and particulate matter (PM) and sulphur dioxide (SO_2).

Since CO emissions are a function of plant operations such as the level of excess air and maintenance of combustion temperature and residence time, therefore, its concentrations can be easily controlled while controlling these factors.

- **Ash Handling**

The ash handling system envisaged for the cogeneration plant is of two types and shall be provided for two boilers individually:

- Sub-merged scrapper conveyor system for grate ash
- Dense phase handling system for fly ash

The fly ash from Electrostatic precipitator (EP) (Fly Ash Arrestor) will be dry and powdery in nature and occasionally with hot solids. Since the fly ash is to be collected though EP, therefore for the fly ash from the stack gas emission will be trapped in the system up to 99.9%. This ensures that the main emission of PM will be conveniently controlled to the desired levels as set by the SEQS.

The fly ash will be collected in storage yard having a suitable capacity & will be disposed-off by trucks / trailers suitably covered to avoid any spillage on the way. This ash may be disposed off according to any one of the following methods, individually of collected:

- Supply to cement factory. In case of using this method both fly ash and bottom ash can be mixed and dispose off together.
- Landfills. In case of using this method both fly ash and bottom ash can be mixed and dispose off together.
- For making bricks for face lifting,
- Used as manure in field,
- making bricks for paving
- Supply of the fly ash to agriculture use as rich source of Potassium, (K) being cheaper substitute of costly potassium fertilizer. It is to remember that since the ash comes from Bagasse an agree product therefore it will not harm to soil.

➢ **Bottom ash**

The furnace bottom ash is collected by water impounded scrapper conveyers, and as the quantity of ash discharge is less, the same is collected in trolleys parked near the scraper conveyor. This ash can be disposed of in variety of methods like:

- In cement as aggregate
- Manufacturing of tiles for face lifting of buildings, flooring of paths etc.
- Landfill

➢ **SO_2 emissions**

After the plant startup, SO_2 emissions will be low as the sulphur content in the fuel is very less.

➢ **NOx emissions**

After the plant startup, NOx emissions will be low due to the very low level of nitrogen content in Bagasse. The maximum stack emissions of SO_2 and NOx will not exceed the permissible limits of the SEQS Pakistan.

➢ **Particulate Matter (PM) emissions:**

Particulate matter emissions will be emitted and will be controlled with Electrostatic Precipitator (EP) to remain within the prescribed limits of the Sindh Environmental Quality Standards (SEQS)-Pakistan limits.

➢ **Effluents:**

The Effluent generated from Co-generation power plant lagoon treatment process will be used as effluent will be neutralized and will be let into the proposed effluent treatment plant of sugar mill. The treated water from the power plant will be used for agriculture purpose and for sprinkling inside the plant boundary wall.

5.3 Environment Management Plan /Mitigation / Compensation Measures during Construction Phase

Potential	Mitigation/ Compensation Measures Impact
Air Quality	1. Vehicles transporting loose construction material to be Covered with tarpaulins.

2. Limit on speed and movement of vehicles, where considered appropriate speed-breakers should be installed

3. Use low emissions trucks/vehicles for material transport where possible.

4. Routine service and maintenance of vehicles and machines to reduce engine emissions.

5. During periods with abnormal wind speeds, in particular during dry weather conditions, workers on the construction site should be provided with adequate inhalation and eyes protection gears. In case particulates in air hamper a clear view over the site completely, so that safety is impaired, the construction should be interrupted until weather conditions improve.

6. To reduce generation of dust in the construction process, onsite roads and parking areas, as far as possible, would be constructed with asphalt over a compacted sub base.

7. Spraying exposed soil with water to reduce PM emissions. Water to be applied at a rate to maintain a moist surface, but not create surface water runoff or erosion conditions.

8. Provide wheel washers to remove particulate matter that would otherwise be carried offsite by vehicles that would decrease deposition of particulate matter on area roads and subsequent entrainment from those roads.

9. Routing and scheduling construction trucks to reduce delays to traffic during peak travel times would reduce secondary air quality impacts caused by a reduction in traffic speeds while waiting for construction trucks.

	10. As far as possible planting vegetative cover (matching the local climate), as soon as possible after grading, would reduce windblown particulate matter in the area.
Water Supply	1. During construction, non-potable water would be supplied by trucks to provide dust control. 2. Potable drinking water for construction workers would be provided by a water service to be contracted by the site contractor.
Ground Water	1. Water and wastewater that accumulate during the construction phase should not infiltrate into the soil that have a direct contact to the ground water. Septic tanks shall be used for any waste water collection. Each tank, when filled and closed, should be brought to the closest wastewater treatment plant for further treatment. 2. Closed tanks should be removed from the site as soon as possible and should not be allowed to remain on the construction site as an interim storage until the end of the construction phase. 3. Monitoring of the characteristic of waste water collected in the septic or other tanks should be carried out on routine basis. 4. Maintenance and washing of all mobile machinery & vehicles should be carried out at adequate service stations. Good and regular maintenance of all vehicles and machines used on site is mandatory.

	5. Maintenance and re-fueling (if necessary) of any construction equipment shall be done at a decent distance from the excavation area and only be undertaken on sealed area. Any re-fuelling must be handled carefully taking particular attention to not spilling any fuel. 6. On site storage of fuel, engine oil and lubricants (if any) shall be in locked tanks, sealed and shadow-roofed area. 7. On site storage of fuel, engine oil and lubricants that might be stored shall be collected at the end of construction phase and brought to either a disposal point as hazardous waste or be brought back for re-use to the place it was rented for the purpose of this construction.
Solid Waste	1. All solid wastes shall be disposed off according to a set Procedure and record of sales will be kept to track at any time when it is required. 2. The contractors to whom any waste is to be sold shall be fully made aware of the environmental impacts and health effects of the waste to be sold to him. He shall be provided instructions for reuse / handling of such wastes in environmentally sustainable way.
Soil	1. Construction activities must be limited to the designated areas. 2. Refilling of excavated soil should be done as far as possible. Where possible reuse of excavated soil should be done.

	3. Prevention measures should be developed in the event of an accident or threat (e.g. massive, uncontrolled leakage of waste water into unsealed soil on-site).
Fauna and flora	1. Planting of indigenous grass, trees and bushes between the edge of the site and the adjacent un-utilized area should be carried out. If not earlier practical, such measures should be implemented after the completion of all construction activities 2. Develop green strips of suitable vegetation, along the access road to improve the landscape shape.
Noise	1. Power mechanical equipment like bulldozers, air compressors, Concrete pumps, excavators, concrete mixers etc. shall only be used with low sound power, whenever possible. 2. Optimize transportation management to avoid needless truck trips; avoidance of truck movements in residential areas at least during night time. 3. The building machinery equipment shall be well-maintained and serviced regularly during construction phase. 4. Silencers or mufflers on construction equipment shall be used. 5. Whenever possible, mass construction material and excavated soil shall be stored in direction of the nearest habitat as noise barrier.

6. Construction activities shall be scheduled in such a way that noise intensive operations side by side with an increased net noise level will be avoided.

7. Workers on the construction site should be equipped with ear protection in particular those directly exposed to higher noise levels.

5.4 Environment Management Plan /Mitigation / Compensation Measures During Operation Phase

Potential	Mitigation /Compensation measures Impact
Landscape	1. To the extent possible, develop a green belt along the facilities boundary area and other open spaces, to create to some extent a natural landscape. The flora to be used for such green belt should be tolerant to the local climate.
Ambient Air Quality	2. Continuous monitoring of ambient air for SO_2, NOx, and PM to be carried. Sindh Ambient Air Quality Standards (SAAQS) -2016 will also be applicable Standards.
Surface Water	3. Waste water treatment, as described in this report, to be carried out continuously and monitored.
Ground Water	4. Regular inspection of facilities for intercepting leaking and spilled liquids.

	Hazardous chemicals shall be handled only in appropriate segregated, sealed and bundled areas at site.
Solid Waste	1. All solid wastes shall be disposed offaccording to a set procedure and record of sales will be kept to track at any time when it is required. 2. The contractors to whom any waste is to be sold shall be fully made aware of the environmental impacts and health effects of the waste to be sold to him. He shall be provided instructions for reuse/handling of such wastes in environmentally sustainable way.
Noise	1. Equipment will be acoustically shielded and /or lagged as far as possible. 2. A noise measurement campaign during full operation at operation start should be implemented to verify the real noise levels are in line with SEQSN. 3. Workers should be obliged to use ear protection in areas within the plant and for specific work that exceed the tolerable maximum noise limits. 4- Double housing of the rattling parts will be incorporated at the design stage in the area

	wherever necessary to ensure noise level reduction to the SEQS.
Ash handling	1. Bottom Ash and fly ash generated by burning Bagasse in the boiler will be used as manure / Fertilizer and disposed to the farmers and also made available to other growers in the region. The ash will be stored in enclosed silos on site. Transportation of the ash from the site will be done through trucks to be completely covered with tarpaulin to avoid any ash being spread on the roads during transportation.

With all these arrangements in place Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMtP), as recommended in this report will also be operational as legal requirement under the Sindh Environmental Protection Act, 2014. This will further ensure the power plant operation in environmentally sustainable fashion.

Besides the concrete measures to be adopted as described above, the quality of environment will further be enhanced through the running of project in complete accordance with the 5RS Principles- Reducing, Recycling, Reusing, Refurbishing and Retrofitting. Good housekeeping will be the order of the day. Tree plantation on the project site and its vicinity will be carried out.

5.5 Potential Environmental enhancement measures

Besides the concrete measures to be adopted as described above, the quality of environment will further be enhanced through the running of project in complete accordance with the 5RS Principles- Reduce, Reuse, Recycle, Refurbish and Retrofit. Good housekeeping will be the order of the day. Tree plantation on the project site, the quarries and on roads in the project vicinity will be carried out.

In fact, a lot of environmental enhancement measures including also tree plantation over a vast stretch of the project area boundary wall have been adopted.

During construction and regular operation of the project activity large number of the persons will be employed. Local people will be preferred for employment as per employment policy of Ghotki Power Private Limited. It is estimated that about 100 - 150 people of all categories will get employment during construction phase of the project while 50 regular employees are required for the smooth running of the plant.

5.6 Occupational Health and Safety and Environmental Management

The HSE management system will be implemented and attach as Annexure-VI

Environmental Management Plan is attached as Annexure-VII

5.7 Disaster Management Plan

Emergency prevention through good design, operation, maintenance and inspection are essential to reduce the probability of occurrence and consequential effect of such eventualities. However, it is not possible to totally eliminate such eventualities and random failures of equipment or human errors, omissions and unsafe acts cannot be ruled out. An essential part of major hazard control has therefore, to be concerned with mitigating the effects of such Emergency and restoration of normalcy at the earliest. The overall objective of a disaster management plan is to make use of the combined resources at the site and outside services to achieve the following:

1. To localize the emergency and if possible eliminate it.
2. To minimize the effects of the accident on people and property.
3. Effect the rescue and medical treatment of casualties.
4. Safeguard other people.
5. Evacuate people to safe areas.

6. Informing and collaborating with statutory authorities.

7. Provide authoritative information to news media.

8. Initially contain and ultimately bring the incident under control.

9. Preserve relevant records and equipment for the subsequent enquiry into the Cause and circumstances of the emergency.

10. Investigating and taking steps to prevent reoccurrence.

6.0 ENVIRONMENTAL MONITORING PROGRAM AND INSTITUTIONAL REQUIREMENTS

6.0 ENVIRONMENTAL MONITORING PROGRAM AND INSTITUTIONAL REQUIREMENTS

The project aims at installation of 45 MW Bagasse based Cogeneration power plant using Bagasse as fuel adjacent to JDW Sugar Mills Unit-III, Ghotki. Environmental Management Plan (EMP) and Environmental Monitoring Programme (EMtP) as recommended for the project will ensure that all type of pollutants from the projects remain within the prescribed limiting values of the Sindh Environmental Protection Act, 2014- Pakistan.

6.1 Assigning responsibility for implementation (by name or position)

6.1.1 Institutional capacity

The project will be implemented and monitored by the Project Proponent that will be executed as Implementing Agency, which will be supported by Design and Supervision Consultant (Engineer). Ghotki Power (Pvt.) Ltd. will be the Implementing Agency.

Ghotki Power (Pvt.) Ltd. shall be responsible for ensuring compliance to environmental requirements as well as central/ state governments. An Environmental Management Plan (EMP) will be a part of contract with the civil works contractors engaged for execution of the works. The supervision and implementation of EMP shall be the responsibility of contractors and Engineers with SPPL as implementing agency (with assistance of HSE officer).

For effective environment management, responsibilities are set for each operation as follows:

Official concerned	Responsibility
1-General Manager/Plant Incharge/ RD	i- Over all in-charge of all the Environmental Management Plan (EMP) and EMtP. ii- He will be responsible to ensure smooth functioning of the EMP and EMtP/ system iii- Daily progress on the state of the environmental status will be reported to him in writing by his junior responsible staff. iv- All other Environmental Management and Monitoring matters, issues and problems will be reported to him for rectification. v- He will work as bridge between the Government concerned authorities and the inside E.M. vi- He will be answerable to the higher management in all matters relating to E.M.
2- Shift Engineer/ In Charge	i- During his shift timings, he will be responsible to look into smooth functioning of the process in environmentally sustainable fashion. ii- He will be responsible to rectify any problem regarding environmental matters. iii- He will directly report all matters regarding E.M.

	to the G.M.
3- Plant Operator	i- He will record emissions behavior on hourly basis and will report to the Shift Engineer.
4- Laboratory Chemist	i- He will be responsible to carry out all tests regarding environmental monitoring which includes Gaseous emissions monitoring, particulates monitoring, sound levels monitoring etc. according to the monitoring scheduled and will report to the Shift Engineer/In Charge.

6.2 Monitoring program to assess performance:

According to "Guidelines for Self- Monitoring and Reporting by Industry (SMART)," Final Report, March 1998, approved by Pakistan Environmental Protection Council (PEPC), in August 1999, Power Plant falls under "Category B" regarding monitoring of gaseous emissions.

All out environmental monitoring of the power plant should be carried out according to the schedule as recommended in the SMART.

After the plant start up, once a comprehensive monitoring report for all SEQS parameters for normal plant operations should be carried out. This is to establish that the plant does meet the environmental commitments made in this IEE Report. This monitoring should be carried out by a third party. Thereafter, subsequent regular monitoring will be restricted to priority parameters as suggested in the SMART. Reporting will be done according to the format as approved in the SMART.

Even though all effluent generated through the entire project activities along with sewage will be treated in the designed waste water treatment plant and all relevant data regarding generation, treatment and disposal mode of the effluent will be duly recorded.

A track record of all solid wastes and their disposal shall also be regularly maintained for its use as and when required.

All monitoring data should be reviewed and analyzed regularly in comparison with the SEQS limiting values. In case of any deviation/violation of the required standards, immediate necessary corrective actions should be taken. All the monitored data should be reported to the EPA Sindh.

6.3 Reporting and reviewing procedures

Monitoring schedule, as explained above will be adhered to and all the data to be monitored will be scrutinized at the level of Shift Engineer/ In Charge and on monthly basis at the G.M. level. The data will be documented according to appropriate format. Discrepancies will be duly addressed to. For presentation of the data to the Government Agencies, approved data recording to the SMART format.

6.4 Training Schedules

In order to effectively operate the EMP all the staff to be engaged in this activity should be trained extensively.

All the environment management staff to be engaged for operating effluents treatment plant, monitoring and testing should be duly trained. Laboratory chemist should be trained in all operations of laboratory testing of the effluents and other relevant materials/samples. He should be trained in applying analytical methods/techniques of testing, data processing, interpretation and reporting. He should know the local laws, rules and regulations as applicable to the testing of effluents.

6.5 Environmental Monitoring

Environmental monitoring will be carried out by the staff to be engaged for the purpose.

The person to monitor gaseous emissions, PM and noise levels should be extensively trained to handle his job capably. Training program should include use of monitoring instruments, data generation, processing, interpretation, recording and presentation.

6.6 Environment quality monitoring laboratory

The existing laboratory will be upgraded and furbished with required equipment to also act as environmental monitoring laboratory.

6.7 Summary of Impacts and mitigation measures

The most significant pollutant emitted by Bagasse-fired boilers is **ash**. As JDW Unit-III is already using High pressure boilers and ash is in very little quantity, the high pressure boilers will produce minor quantity of ash which will be controlled by the use of Electrostatic Precipitator separator (fly as arrestor) to meet the permitted dust concentration as required by SEQS Pakistan. Both of these technologies have the ability to remove up to 99.9% of ash (PM) in stack exhausts.

Gaseous Emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) are lower than conventional fossil fuels due to the characteristically very low levels of sulfur and nitrogen associated with Bagasse, therefore, they will remain within the prescribed limiting values of the SEQS Pakistan.

The noise levels of 75 dB (A) and 65 dB (A) indicated are at the plant boundary, as the maximum noise level shall be 85dB (A) at 3.0 m from the equipment.

Bottom ash

- Supply to cement factory. In case of using this method both fly ash and bottom ash can be mixed and dispose off together.
- Landfills. In case of using this method both fly ash and bottom ash can be mixed and dispose off together.
- For making bricks for face lifting,

- Used as manure in field,
- making bricks for paving
- Supply of the fly ash to agriculture use as rich source of Potassium, (K) being cheaper substitute of costly potassium fertilizer. It is to remember that since the ash comes from Bagasse an agree product therefore it will not harm to soil.

The furnace bottom ash is collected by water impounded scrapper conveyers, and as the quantity of ash discharge is less, the same is collected in trolleys parked near the scraper conveyor. The bottom ash of ash during transportation. This ash can be disposed of in variety of methods like:

- In cement as aggregate
- Manufacturing of tiles for face lifting of buildings, flooring of paths etc.
- Landfill

6.8 Equipment maintenance details

Predictive maintenance and preventive maintenance will be managed as per recommendation of OEM.

6.9 Environmental budget

The cost for environmental management and monitoring will be the part of contract of Contractor and Consultants respectively. However, an appropriate budget will be allocated by the project proponent towards environmental training and monitoring during construction and operation of the project.

7.0 PUBLIC CONSULTATIONS

7.0 PUBLIC CONSULTATIONS

Public consultations were held with the people from the project area. They are very much in favor of the project installation for the reasons and advantages to accrue to them directly as well as indirectly as described below.

Written comments/views of the public consultations are attached as Annexure-VIII

Community Awareness and Perception about the Project:

- By and large, a large proportion of the people of the project area are aware of the planned project implementation.
- Among the people consulted as a part of the Public Consultations, virtually all of them welcome the project.
- The people have clear perception that there will at least some addition to the shortfall of power.
- People foresee all out positive impacts like employment opportunities, business development, operating small hotels/tea stalls, tires and tubes repairing shops along with other vending services for the vehicles.
- Study findings depict that the people of the study area perceive overall positive impacts as a result of installation of the power plant. Therefore, their attitude towards the project installation is quite positive.
- As far as the Social Impact Assessment (SIA) is concerned, positive social impacts are dominant over any negative social impacts observed during the study.
- They correlate their positive attitude towards the plant with many socio-economic opportunities and benefits to restart.
- The people believe that installation of the plant in the area will not only help to restart earning opportunities but also, it will open up vast employment new opportunities which in turn follow a chain of indirect socio-economic benefits.

- They also perceive accelerated economic activity due to the business opportunities likely to emerge in the area. Directly or indirectly, some reasonable number of the local people will get employment and business from the installation of the plant e.g.: shop keepers, traders, suppliers, contractors, transporters, technicians etc.

- They feel that the plant and its related activities will provide a strong base for positive financial and social change.

- They foresee improvement in the quality of life of the people.

From the above facts one can conclude that many positive economic and social impacts will reappear in the quality of the lives of the people of the Study Area due to the plant installation.

8.0 CONCLUSIONS

8.0 CONCLUSIONS

M/S Ghotki power (Pvt.) Limited has planned for installation bagasse based high pressure cogeneration power plant having capacity 45 MW adjacent to JDW Sugar Mills Unit-III, Goth Islamabad, Tehsil & District Ghotki.

Bagasse based Cogeneration is being considered by many countries as an environment friendly way of augmenting the generation capacity. The Government of Pakistan has estimated a potential of 2800 MW of Cogeneration power from the existing sugar mills. The Government of Pakistan is treating these projects on "fast track basis".

The proposed new Cogeneration plant, on commissioning will export a substantial quantum of power to the national grid. The proposed Cogeneration cycle is already proven and implementation of this project will benefit the project in itself and the country.

It has been found that the project has inbuilt mechanism to:

- Treat the effluents, control stack gases emissions and PM, control Noise to the prescribed limits of the SEQS- Pakistan.
- Solid wastes disposal will be done according to the environmentally sustainable order.
- EMP and EMtP as recommended in this IEE Report are to be put in place during operations of the project.

On the basis of the major facts summarized as above, the project merits for issuing No Objection Certificate (**NOC**)/Environmental Approval (**EA**) by the Environmental Protection Agency, Government of Sindh, Karachi.

RECOMMENDATION:

On the basis of the facts summarized as above, the project merits for issuing Environmental Approval by the Environmental Protection Agency, Government of Sindh, Karachi.