Matol (Pvt.) Limited
HEAD OFFICE:
MATIARI HOUSE, C-48, K.D.A. Scheme-1, Karachi-75350 Pakistan.
Direct Phone: +92-21 34390448-9 PABX No: +92-21 34521382,
34529698, 34536614 Fax:+92-21 34541 734 E-mail: matol@cyber.net.pk
FACTORY: Deh Pannu Nasar Pur Road, Dist. Matiari Pakistan

The Registrar,
National Electric Power Regulatory Authority,
Islamic Republic of Pakistan,
NEPRA Tower, Attaturk Avenue, G-5/1,
ISLAMBAD

SUBJECT: APPLICATION OF MATOL (PRIVATE) LIMITED FOR GRANT OF GENERATION LICENCE IN RESPECT OF 6.20 MW THERMAL POWER PLANT LOCATED AT DEH PANU NASARPUR ROAD, DISTRICT MATIRI IN THE PROVINCE OF SINDH.

I, Dost Mohammad Baloch, Resident Director, being duly authorized representative of Matol (Private) Limited by virtue of Board's Resolution dated 23rd December,2015, hereby apply to the National Electric Power Regulatory Authority for grant of a Generation Licence to Matol (Private) Limited, Matiari pursuant to Section-15 of Regulation of Generation, Transmission and Distribution of Electric Power Act,1997.

2. 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 Licencing (Application 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 attached documents in support is true and correct to the best of my knowledge and belief.

3. A Pay Order # **4984317**, dated **10th June, 2020** of the sum of Rs. 147,422/= (Rupees One Hundred Forty Seven Thousand Flour Hundred Twenty Two only) being the nonrefundable license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licencing (Application and Modification Procedure) Regulation, 1999 is also attached herewith; with request to return, if same is paid in excess.

4. Documents attached as per annexed list.

Yours faithfully,
For Matol (Pvt) Limited

(Dost Mohammad Baloch)
Resident Director

Annexure – A

matol (PVT) LIMITED
HEAD OFFICE:
MATIARI HOUSE, C-48, K.D.A. Scheme-1, Karachi-75350 Pakistan.
Direct Phone: +92-21 34390448-9 PABX No: +92-21 34521382, 34529698, 34536614 Fax:+92-21 34541734 E-mail: matol@cyber.net.p
FACTORY: Deh Pannu Nasar Pur Road, Dist. Matiari Pakistan

RESOLUTION PASSED BY CIRCULATION BY THE BOARD OF DIRECTORS OF MATOL PRIVATE LIMITED ON 23RD DECEMBER 2015

RESOLVED that Syed Shafqat Ali Shah, Chief Executive of the Company is authorized to obtain Licence from NEPRA for Generator of Electricity by using Bio-Gas and to supply Grid Station and to projects of Matiari Group.

FURTHER RESOLVED that any two of the following are authorized to sign the agreement and other documents are required for this purpose.

- Syed Reza Ali Shah, Director
- Syed Taimur Ali Shah, Director
- Mr. Dost Mohammad Baloch, Resident Director

FURTHER RESOLVED that Mr. Dost Mohammad Baloch is authorized to make correspondence and to sign letters, receive notices etc for this purpose.

FURTHER RESOLVED that the Company Secretary Mr. Iqbal-ur-Rahman, is authorized to furnish a certified true copy of this resolution to NEPRA for their record.

Certified true copy

(IQBAL-UR-RAHMAN)
Company Secretary

MATOL (PVT) LTD. KARACHI

Annexure-V

DETAIL OF THE PLANT

GENERAL INFORMATION

i)	NAME OF APPLICANT	**MATOL (PRIVATE) LIMITED**
ii)	REGISTERED BUSINESS OFFICE	C-48, KDA, SCHEME # 1. KARSAZ ROAD, KARACHI
iii)	PLANT LOCATION	NASARPUR ROAD, MATIARI
iv)	Type of Generation facility:	THERMAL POWER STATION

i)	**Plant size installed capacity**	**6.2 MW**		
ii)	Type of the Technology:	Conventional Back pressure Steam Turbine Biogas based power station		
iii)	Number of Units/size (MW):	**Unit # 1** **1 No:** **1.2 MW**	**Unit # 2** **1 No:** **2 MW**	**Unit # 3** **1 No:** **3 MW**
iv)	Make & Model	Jument Schneider **N/A**	Lery Soomer-france **B 2613**	Toyo Denki-Japan **SGD2-AG21-5752**
v)	Commissioning/Commercial operation date	2006	2013	2015
vi)	Expected life of facility from commercial operation/ Commissioning	20	19	54
vii)	Expected remaining useful life of the facility	05	12	49
viii)	Supply Voltage	400 v	400 v	5,500 v
xi)	**PLANT CONFIGURATION** Installed capacity De-rated capacity at main Site conditions, Auxiliary Consumption, Net capacity	6.2 MW 5.6 MW 0.15 MW 5.45 MW		
x)	Fuel (Oil/Gas): type, imported/indigenous, supplier, logistics pipeline etc. In case of Gas fuel, a Gas Sale Agreement (GSA) signed between the applicant and gas supplier.	Biogas, Bagasse, generated at plant Biogas is blown through pipeline and Bagasse through conveyors		
xi)	Supply voltage (11 KV/132/KV), in case of 132 KV voltage distance and same of nearest gird (Single line diagram)	**Attached as annexure**		

(xii)	Plant characteristics: generation voltage, frequency, power factor, automatic generation control, ramping rate, alternative fuel time(s) required to synchronize to grid.	5.5 KV, 50 Hz, 0.85 pf. Automatic Generation control. AVR and proportional speed governor, Bagasse. 30 to 180 sec.
(xiii)	Provision of metering, instrumentation, protection and control arrangement; sketch attached	Will be provided according to WAPDA standard.

PLANT CHARACTERISTICS

1	Ramping Rate	3.1 KW per second
2	Alternative fuel	Bagasse

Annexure-VI

FUEL/RAW MATERIAL DETAILS

i)	Primary Fuel	Biogas
ii)	Alternate Fuel	Bagasse
iii)	Fuel Source (Imported/Indigenous)	Indigenous
vi)	Fuel Supplier	Self generated
v)	Supply Arrangement	Pipeline/conveyor
vi)	Sugarcane crushing capacity	5,000 TCD
vii)	Bagasse Generation Capacity	1650 Tons/Day
viii)	Bagasse Storage Capacity (if any)	50,000 Tons
ix)	No: of storage Tanks	Biogas is withdrawn from Digesters as produced. There is no storage
x)	Storage Capacity of each tank	There is no storage
xi)	Gross Storage	There is no storage of Biogas withdrawn as produced.
xii)	Logistics	Biogas Blown through pipeline. Bagasse through conveyors.

Annexure-VII

PROPOSED LAND USE AREA

#	DESCRIPTION	UNIT	VALUES
1	Cogeneration Plant Operation	Days	300
2	Total Biogas generated	M^3	50,000 m^3/day
3	Total Biogas/ Bagasse consumed	M^3 MT	50,000 m^3/day 48.0 Tons/day
4	Off-season steam generation	MT	Nil
5	Boiler Capacity	T/hr	30 Tons
6	Boiler operating parameters	Bar(g)	25 bars, 350 °C
7	Turbo-Alternator Back Pressure Turbine LP	MW	03 MW (Back-Pressure)
8	**Gross power generation:** a) Factory and grid in parallel b) Factory Off, Gird ON c) Factory ON, Grid OFF d) Off season	MW The plant is not connected to the National Grid	1.3 (At present) N/A
9	**Power generation:** a) Factory and grid in parallel b) Factory Off, Gird ON c) Factory ON, Grid OFF d) Off season	MW	(a), (b) and (d) Not applicable (c) 1.3 MW
10	**Power Export** a) Factory and grid in parallel b) Factory Off, Gird ON c) Factory ON, Grid OFF d) Off season	MW	Export Not applicable at present

(i) Building/Structures (with Roof Top)

(ii) Green Belt

(iii) Roads/Paved areas

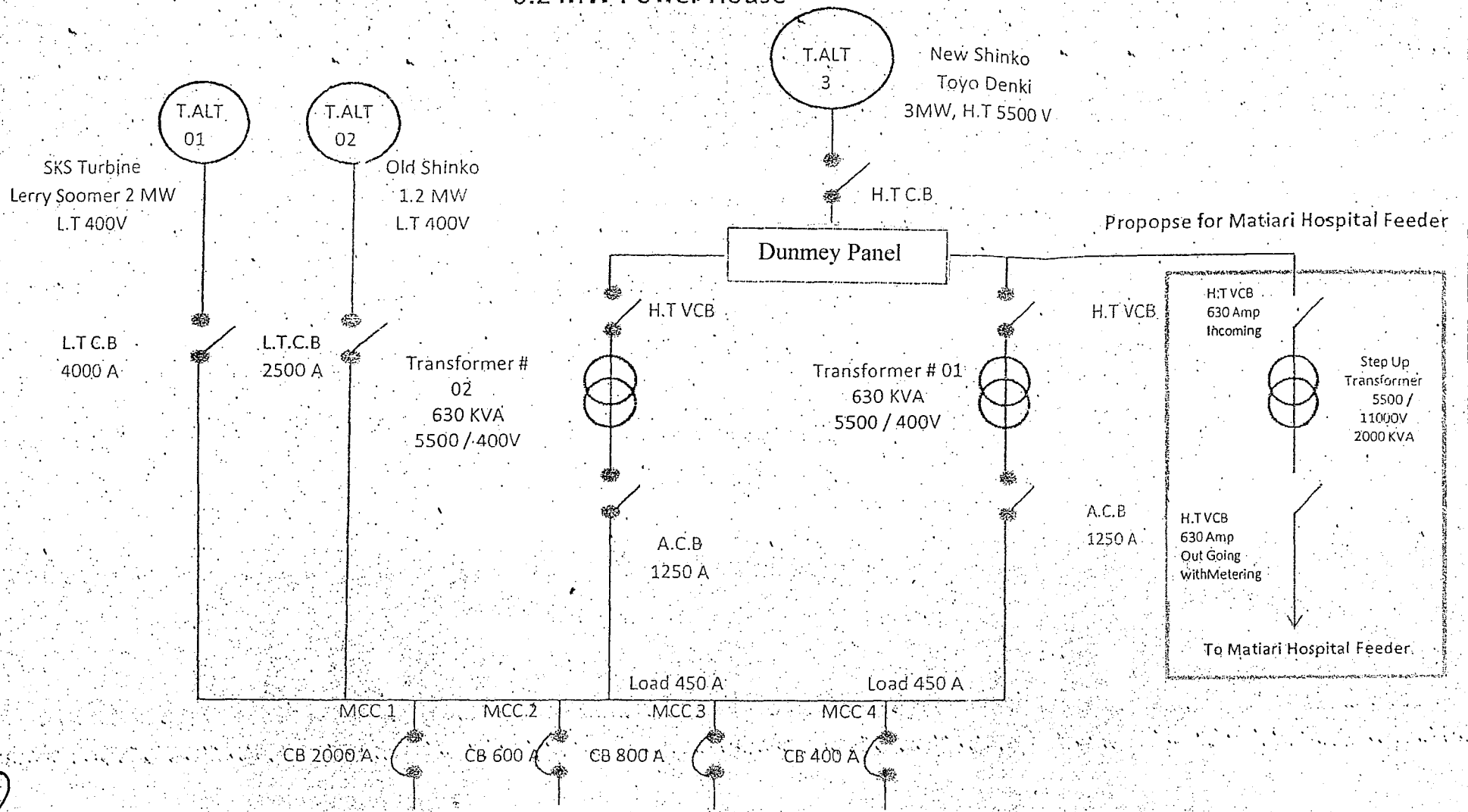
(iv) Vacant

(v) Total plant area : 10 acres

29-Jan-16

Matol (Pvt) Ltd.

Single Line Diagram
6.2 MW Power House

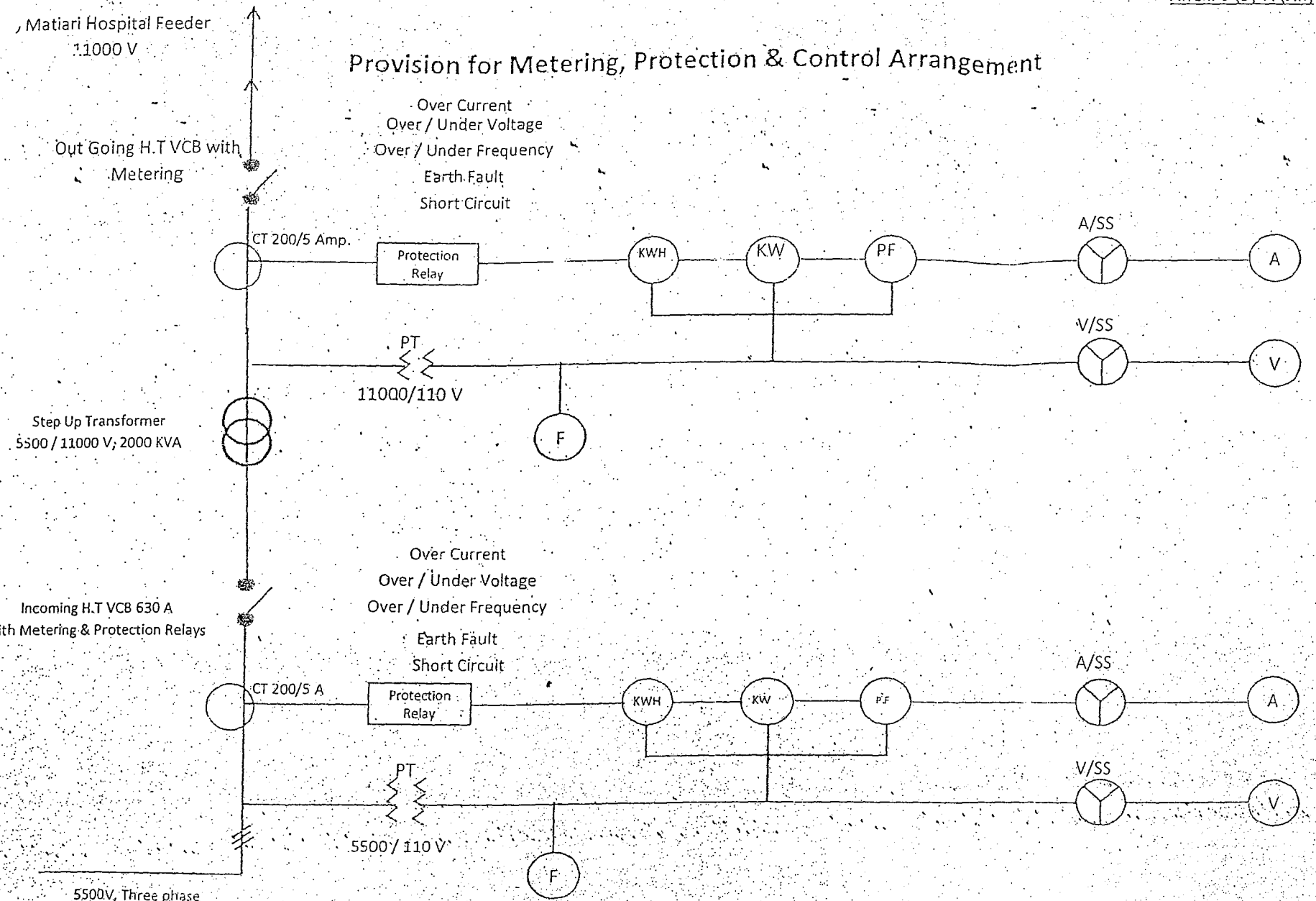


29-Jan-16

Anex: 3 (5)-A (XII)

Matol (Pvt) Ltd.

Provision for Metering, Protection & Control Arrangement



Annexure – A

Reference No: EPA/2016/10/05/IEE/86
ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF SINDH
Plot # ST – 2/1, Sector 23, Korangi Industrial area
Karachi – 74900
Ph: 021 – 35065950, 35065621, 35065946
epasindh@gmail.com
Fax No: 021 - 35065940

Dated: 24th May, 2017

SUBJECT: DECISION ON INITIAL ENVIRONMENTAL EXAMINAITON (IEE).

1.	Name and Address of Proponent:	Chief Executive Officer, M/s Matiari Sugar Mills Limited, Plot No. Matiari House, C-48, KDA Scheme No.01, Karachi.
2.	Description of Project:	6.2MW Cogeneration Bio-gas power plant.
3.	Location of Project:	Matiari Sugar Mills Limited, Nasrpur Road, District Matiari, Sindh.
4.	Date of Filing of IEE:	03-10-2016

5. After careful review of the Initial Environmental Examination (IEE) report, the Sindh Environmental Protection Agency (SEPA) has accord its approval subject to the following conditions:-

(i) Matiari Sugar Mills Limited hereinafter referred as proponent shall comply Sindh Environmental Quality Standards (SEQS) air emission from the power plant.

(ii) Mitigation measures recommended in the IEE report must be strictly adhered to in minimizing any negative environmental effect on the natural ecology.

(iii) Sindh Environmental Quality Standards for noise levels shall be implemented in order minimize noise impact of the proposed project. For dust emission/Particulate matter air pollution control equipment must be install before commissioning of the project, also an appropriate buffer shall be kept across the boundary of the project for the purpose of extensive plantation.

(iv) Monitoring of ambient air quality at the plant boundary and 500 meter radius shall be conducted on monthly basis for CO, Particulate matters and NOx parameters during operation of the plant. in order to observe incremental impact of the plant. The result shall be annexed with the quarterly monitoring reports.

(v) All emission control equipment must be install before operation of the plant. only after the verification of this office plant will operate.

(vi) A comprehensive waste management plan shall be developed for effective disposal of waste. Unusable waste shall be recycled: all remaining waste shall be disposed off at designated landfill. Proper solid waste containers of suitable size shall be provided for daily collection and disposal. Sewage waste will be treated in sewage treatment plant before disposal.

(vii) Damage to natural vegetation will be minimized. Firewood, woody plants and shrubs will not be used as fuel during construction.

Reference No: EPA/2016/10/05/IEE/86
ENVIRONMENTAL PROTECTION AGENCY,
GOVERNMENT OF SINDH
Plot # ST – 2/1, Sector 23, Korangi Industrial area
Karachi – 74900
Ph: 021 – 35065950, 35065621, 35065946.
epasindh@gmail.com
Fax No: 021 - 35065940

(viii) A complete code of Health, Safety and Environment (HSE) shall be developed, which should include efficient parameters at specific work place. For this purpose HSE setup should be established and supervised by a designated HSE officer at the senior level with sufficient administrative and technical authority to perform the designated functions. Proponent will make sure that the operating instructions and emergency actions are made available to every worker/labor/commuter at the site.

(ix) The proponent will ensure that an independent environmental monitoring consultant is engaged to monitor hazards, dust emissions, road obstructions, traffic jams, sound and noise level(s) and other environmental damages due to construction of plant.

(x) Proponent will carry out self-monitoring and reporting and will submit report to Sindh EPA for the recommended parameters with their appropriate frequencies as listed in Self-Monitoring & Reporting Rules.

6. This approval and any considerations thereof shall be treated as null and void if the conditions, mentioned in para-5 above, are not complied with.

7. The proponent shall be liable for compliance of EIA/IEE Regulations, 2014, which direct for condition for approval, confirmation of compliance, entry, inspection and monitoring.

8. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any law in force.

9. The approval is accorded only for the project activity described in the IEE Report. Proponent shall submit separate EIA or IEE as required under regulation for any enhancement or change in the design of project.

10. Implementation Report of all the mitigation measures and EMP laid down in the IEE Report shall be submitted to this office on quarterly basis. No violation of any regulations, rules, instruction and provision of SEP Act, 2014, shall be made and in case of any such violation of the rules/laws in the approval shall stand cancelled without any further notice.

11. All the environmental conditions of this approval shall be incorporated in the terms and conditions of tender document of the project for commitment and compliance.

Deputy Director(Technical-II)
***For* Director General**

Annexure-B

1. Designed Efficiency of the Plant = 16%
2. Gross Efficiency of power plant = 17%
3. Net efficiency of plant = 15%

SECURITIES & EXCHANGE COMMISSION OF PAKISTAN
GOVERNMENT OF PAKISTAN

Compulsory Registration No. 0046405

CERTIFICATE OF INCORPORATION

(Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)

Company Registration No. K-09675 OF 2003-2004

I hereby certify that MATOL (PRIVATE) LIMITED

this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that company is limited by SHARES AS A PRIVATE COMPANY.

Given under my hand at KARACHI.

24TH day of NOVEMBER

TWO THOUSAND THREE.

Rs. 390,000/-

Certified to be True Copy

Assistant Registrar of Companies

(TAHIR MAHMOOD)
ADDITIONAL
REGISTRAR
OF COMPANIES

SEAL OF THE COMPANY REGISTRATION OFFICE KARACHI PAKISTAN

TARIQ MEHMOOD
FVP/Chief Manager

S. No. 3174 dt 24/11/2003

Litho/2059/97/DCS&F—29-7-97—12,000 Leaves

THE COMPANIES ACT, 2017

MEMORANDUM OF ASSOCIATION

OF

MATOL (PRIVATE) LIMITED

COMPANY LIMITED BY SHARES

I The name of the Company is Matol (Private) Limited

II The Registered Office of the Company will be situated in the Province of Sindh

III The objects for which the Company is established are:

(1) The Principal line of business of the company shall be carry on the business

To manufacture, produce, formulate, extract, treat, blend, refine, purify, distil, ferment, reduce, dehydrate, rectify, prepare and process all kinds and all grades of ethanol, including without limitation fuel grade ethanol, and other industrial alcohols and methylated spirits and allied products, whether from sugar cane molasses or from other forms of molasses or natural substances or otherwise, and any products compounds, intermediates, derivatives and by-products which may be derived, extracted, refined, distilled, produced, prepared, developed, compounded, made or manufactured therefrom and any substances obtained by mixing any of the foregoing with other substances, and all substances compounds and products manufactured, produced, formulated, extracted, treated, refined, distilled, fermented, produced, dehydrated, rectified or prepared from any of the foregoing, including without limitation, compost, compost fertilizers, distilled water, treated water, sludge, sludge for use as fuel, acetaldehyde, acetone, acetic anhydride, acetic acid, citric acid, ethyl chloride, ethyl acetate, glycol, and to purchase or otherwise acquire, sell, supply, transport, market, distribute, pump, dispense, exchange or otherwise dispose of, import, export, store, hold, package, transport, use, develop, experiment with, handle, trade and generally deal in any or all of the chemicals, substances and products mentioned in this clause and other allied chemicals, substances and products and the raw other materials ingredients and components required therefor.

(2) To carry on business as distillers, compounders, processors and rectifiers of ethanol and other industrial alcohols and methylated spirits and allied products.

(1) To buy, sell, manufacture, make up, prepare, repair, exchange, hire, import, export and deal in all kinds of substances, articles and things which may be required for the purposes of any of the businesses aforesaid or commonly supplied or dealt in by persons engaged in any such business or which may seem beneficial to, or capable of being profitably dealt with by, the Company.

(2) To carry on research and development work and experiments in relation to any new material or substance or the application of any chemical or other process to any material or substance and to undertake, establish, provide and conduct scientific technical and industrial research or otherwise sponsor or subsidise such laboratories and experimental workshops or projects for such research on a commercial scale.

(3) To erect, build, construct, improve, maintain, develop, alter, enlarge, pull down, remove, replace, work, manage and control any buildings, offices, factories, mills, works, workshops, warehouses, showrooms, machinery, engines, roadways, tramways, railways, branches or sidings, bridges, reservoirs, watercourses, wharves, electric works and other works and conveniences which may seem calculated directly or indirectly to advance the interests of the Company, and to join with any other person or company in doing any of these things for the purposes of the business of the Company as stated in clause 1 of the objects of the Company.

(6) To set up, run, operate and manage one or more power plants and to generate, sell and supply electricity to industrial and other consumers, through distribution networks established, owned and operated by the Company itself or by any other person, body corporate, autonomous or semi-autonomous corporation or authority or local body, and for that purpose to acquire land, whether freehold or leasehold, machinery and equipment, and construct, install, operate and maintain thereon power houses, civil and mechanical works and structures, grid stations, transmission towers, power lines, buildings, workshops and other facilities as may from time to time be necessary for the attainment of the objects of the Company subject to permission from concerned authorities.

(7) To clear, manage, farm, cultivate, irrigate and otherwise work or use any lands over which the Company has any rights and to dispose of or otherwise deal with any farm or other products, whether animal or vegetable, of or any such lands, and to lay out sites for and establish temporary or permanent camps, towns and villages on any such lands and to carry on all or any of the business of farmers, dairymen, milk contractors, dairy farmers, millers, seedsmen, nurserymen, dealers in agricultural equipment, growers of and dealers in grain, hay and straw, and purveyors and vendors of dairy products, poultry, animal feeds and provisions of all kinds, and to buy, sell and trade in any goods usually traded in any of the above businesses and to carry on any other businesses which may be advantageously carried on by the Company in connection therewith.

(8) To own, acquire, construct, establish, install, lay out, improve, maintain, work, manage, operate, carry out, control, subsidise, contribute or subscribe to the construction, erection, maintenance and improvement or working of, any roads, ways, tramways, railways, aerodromes and landing fields, docks, wharves, piers, bridges, jetties, breakwaters, dredging facilities, moorings, harbour abutments, viaducts, aqueducts, canals, water courses, wells, tanks, storage installations, refineries, pipes, pipelines, conveyors, telegraphs, telephone, communication apparatus and systems,

wireless, gas works, steam works, electric lighting and power works, power houses, hydroelectric plants, laboratories, factories, mills, foundries, workshops boilers, machine shops, warehouses, shops, stores, fuel stores, hangers, garages, guard towers, machinery equipment and other appliances, hotels, clubs, restaurants, lodging houses, baths, places of workshop, hospitals, dispensaries, places of amusement, pleasure grounds, parks, gardens, reading rooms, dwelling houses, office and other buildings, works and conveniences which may be calculated, directly or indirectly, to advance the Company's interests and to contribute to, subsidise or otherwise assist or take part in, the construction, improvement, maintenance, working, management, carrying out of control thereof, and to take on lease and enter into any working agreement in respect thereof.

(9) To purchase, build, charter, affright, hire and let out for hire, or for chartering and affreightment and otherwise to obtain the possession of, and use, operate and dispose of, and employ of turn to account ships, lighters, barges, tugs, launches, boats and vessels of all kinds, automobiles, lorries, motor trucks and tractors, airplanes, helicopters, locomotives, wagons, tank cars, and other forms of transport and rolling stock, and otherwise to provide for and employ the same in the conveyance of property and merchandise of all kinds and the transportation of personnel, employees, customers and visitors and to purchase or otherwise to acquire any ship, lighter, barge, tug, launch, boat or vessel of any kind, automobile, lorry, motor truck or tractor, airplane, helicopter, locomotive, wagon, tank car, and other form of transport.

(10) To own, purchase, acquire, hire, build, erect, install, establish, operate, use, manage, repair, maintain, and dispose of factories, machinery, plants, laboratories, equipment, apparatus, and other facilities, for the manufacturing, formulating, packing, processing, refining, storage, sale and distribution of the products of all and every kind and description.

(11) To purchase, take and/or let on hire or in exchange, or otherwise acquire, any lands and to lay out, improve and prepare the same for building or commercial purposes; to sell, mortgage, or let the same; to construct, alter, pull down, decorate, maintain, furnish, fit up and improve buildings, to lay out, construct and pave roads, streets, alleys, paths and walks, to drain, improve and landscape grounds, and enter into contracts and arrangements of all kinds with builders, property owners, tenants and others and to advance money to them.

(12) To build, construct, alter, maintain, enlarge, pull down, remove or replace, and to work, manage and control any buildings, offices, factories, mills, shops, machinery, engines, roadways, tramways, railways, branches or sidings, bridges, reservoirs, watercourses, wharves, electric works and other works and conveniences which may seem calculated directly or indirectly to advance the interests of the company, and to join with any other person or company in doing any of these things.

(13) To carry on business or branch of a business, which the Company is authorised to carry on, by means, or through the agency of any subsidiary company or companies, and to enter into any arrangement with such subsidiary company for taking the profits and bearing the losses of any business or branch as carried on or for financing any such subsidiary company or guaranteeing its liabilities or to make any other arrangement which may seem desirable with reference to any business or branch so carried on, including power

at any time and either temporarily or permanently to close any such branch or business.

(14) To purchase, acquire, take on lease or tenancy, sell, dispose of, mortgage or let any estate or interest in and to take and acquire options over any property, immovable and movable, or rights of any kind, and to develop, improve, turn on account, mortgage, sell or otherwise dispose of the same in such manner as may be thought expedient.

(15) To manage, improve, develop, sell, exchange, mortgage, pledge, hypothecate, assign, transfer, or deal with all or any part of the property and assets, immovable and movable, corporeal or incorporeal, tangible or intangible, and any right, title and interest therein of the Company, including rights, licences, privileges, concessions and franchises as may seem expedient.

(16) To acquire from sovereign state, government or authority in Pakistan or elsewhere, any concessions, grants, decrees, rights, powers and privileges whatsoever, which may seem to the Company capable of being turned to account and to work, develop, carry out, exercise and turn to account the same.

(17) To obtain any legislative, judicial, administrative or other acts or authorisations of any government or authority for the purpose in that behalf for enabling the Company to carry its objects into effect and for effecting any modification of the Company's constitution, or for any other purpose which may seem expedient, to take all necessary or proper steps with the Government, supreme, national, local, municipal or otherwise, in any place in which the Company may have interests and to carry on negotiations or operations for the purpose of directly or indirectly effecting any of the objects of the Company or furthering the interests of the Member and to oppose any proceedings, applications, acts or things taken by any Governmental authority or body, or any association, firm or person, which may seem calculated, directly or indirectly, to prejudice the interests of the Company or its Members.

(18) To enter into any arrangements and contracts with any government or authority, supreme, municipal, local or otherwise, that may seem conducive to the Company's objects or any of them and to obtain from such government or authority any rights, privileges, options, concessions and licences and their exercise or comply with any such arrangements, rights, privileges, concessions and licences and to promote any company to be registered or recognised in any part of the world.

(19) To apply for, purchase or otherwise acquire and hold in any part of the world any patents, patent rights, trade marks, designs, formulae, licences, protections and the like conferring any exclusive or non-exclusive or limited right to their use, or any secret or other information as to any invention, process, matter or thing which may seem capable of use for any of the purposes of the Company or the possession of which may seem calculated directly or indirectly to benefit the Company and to use, exercise, develop or grant licences in respect of or otherwise turn to account the property, rights or information so acquired, and to expend money in experimenting upon, testing and improving any such patents, inventions or rights.

(20) To enter into partnership or any arrangement for sharing profits, union of interests, co-operation, joint adventure, reciprocal concessions, or otherwise with any company, association, firm or person carrying on or engaged in, or about to carry on or engage in any business or transaction which this Company is authorised to carry on or engage in, or any business or transaction capable of being conducted so as directly or indirectly to benefit the Company, and to guarantee the contracts of, or otherwise assist any such company, association firm or person, and to purchase, take, or otherwise acquire, shares and securities of any such company or association, firm or person, and to sell, hold, reissue, with guarantee, or otherwise deal with the same.

(21) To amalgamate with any other company having objects altogether or in part similar to those of the Company.

(22) To acquire and undertake the whole or any part of the business, property and liabilities of any person or company carrying on or proposing to carry on any business which the Company is authorised to carry on, or possessed of property suitable for the purposes of the Company, or which can be carried on in conjunction therewith or which is capable of being conducted so as directly or indirectly to benefit the Company.

(23) To establish or promote or concur in establishing or promoting any company or companies for the purpose of acquiring all or any of the property, rights and liabilities of the Company or for any other purpose which may seem directly or indirectly calculated to benefit the Company, to amalgamate or consolidate or merge with a view to effecting union of interest either in whole or in part, with or into any other companies, association, firms or persons, and to place or guarantee the placing of, subscribe for or otherwise acquire all or any part of the shares, debentures or other securities of any such other companies, associations, firms or persons.

(24) To sell, mortgage or otherwise dispose of the property, assets or undertaking of the Company or any part thereof for shares, stock, debentures or other securities or obligations of any institution, corporate or governmental body, person or company, whether or not having objects altogether or in part similar to those of the Company, or for any other consideration.

(25) To invest and deal with the money of the Company not immediately required in such manner as may from time to time be thought fit.

(26) To give credit to such persons or companies and on such terms as may seem expedient.

(27) To receive money on loan and to borrow money in such manner as the Company shall think fit, and in particular by the issue of debentures or debenture stock (perpetual or otherwise) and to secure the repayment of any money borrowed or owing, by mortgage, charge or lien upon all or any of the property or assets of the Company (both present and future), and also by a similar mortgage charge to secure and guarantee the performance by the Company or any other person or company of any obligation undertaken by the Company or any other person or company as the case may be for the purpose of or in connection with the business of the Company.

(28) To draw, make, accept, indorse, negotiate, buy, sell, deal in, discount, execute and issue promissory notes, bills of exchange bills of lading, warrants, debentures and other negotiable or transferable instruments in connection with the businesses and affairs of the Company.

(29) To pay, satisfy, or compromise any claims made against the Company which it may seem expedient to pay, satisfy or compromise, notwithstanding that the same may not be valid in law.

(30) To remunerate Directors, officials, agents, employees and servants of the Company and others and to establish and support or aid in the establishment and support of associations, institutions, funds, trusts and conveniences, calculated to benefit employees or ex-employees of the Company, or the dependants or connections of such persons, and to grant pensions, gratuities and allowances, and to provide houses, amenities and conveniences of all kinds and to make payments towards issuance and to subscribe or guarantee money for charitable or benevolent objects or for any exhibition or for any public, general or useful purpose and for the purpose of this paragraph the words "employees" and "ex-employees" shall include respectively, present and former directors and other officers, agents employees, trainees and servants.

(31) To pay out of the funds of the Company all expenses which the Company may lawfully pay with respect to the formation, promotion and registration of the Company or the issue of its capital, including brokerage and commissions for obtaining applications for or taking placing or underwriting or procuring the underwriting of shares, debentures or other securities of the Company.

(32) To pay for any rights or property acquired by the Company and to remunerate any person or company whether by cash payment or by the allotment of shares, debentures or other securities of the Company credited as paid up in full.

(33) To adopt such means of making known the [illegible] and products of the Company as may seem expedient and in particular by undertaking educational, training and [illegible] programmes and by advertising in the press, by circulars, by exhibition of works of art or interest, by publication of books and periodicals and by granting prizes, rewards and donations.

(34) To get insured against loss or damage [illegible] at sea or otherwise and insurable property of the Company and to insure against or in respect of any liability on account of the Company, to pay compensation to any workers imposed by any act of legislature and to insure any servants of the company against or in respect of fidelity or otherwise in the course of their employment by the Company and to effect insurance for the purpose of indemnifying the Company in respect of claims by reason of any such risks or fidelity insurances and to pay premiums on any insurance.

(35) To join or become members of any association, company or society formed or to be formed for the protection or advancement of the interests of the Company or its employees or otherwise engaged in any trade or business and to promote [illegible] or subsidies any association, company or society.

(36) To make gift of any movable or immovable property belonging to the Company of whatsoever kind or where so ever situated to any person, persons, corporation or corporations to achieve the objects of the Company but so that no gift involving reduction of capital shall be made except with the sanction (if any) for the time being required by law.

(37) To accept gifts of cash or of any movable or immovable property of whatsoever nature from any person, persons, corporation or corporations for the purposes of the Company.

(38) To act as agents except managing agents, brokers, commission agents representatives or consultants of and to provide services to any business or concern that the Company may find convenient or advantageous.

(39) To undertake, assist and participate in commercial and industrial operations and undertakings in any part of the world, and both singly and in connection with other persons, firms, associations and companies and corporations.

(40) to carry out all or any of the objects of the Company and do all or any of the above things in any part of the world and either as principals, agents, contractors, or otherwise, and either alone or in conjunction with others, and either by or through agents, sub-contractors or otherwise.

(41) To distribute among the Members in specie any property of the Company in the event of winding up , or any proceeds of sale or disposal of any property of the Company, but so that no distribution amounting to a reduction of capital be made except with the sanction (if any) for the time being required by law.

(42) To do all such other things as may be deemed incidental or conducive to the attainment of the above objects or any of them.

AND IT IS HEREBY DECLARED THAT

(i) the word "Company" save when used in reference to this Company in this clause shall be deemed to include any syndicate, partnership or other body of persons, whether incorporated or not incorporated, and whether domiciled in the country of the Company's incorporation or otherwise.

(ii) the Company shall not engage in any other business including the business of banking as defined in the Banking Companies Ordinance 1962 or the business of insurance as defined in the Insurance Act 1938 or the business of an investment finance company or the business of leasing or the business of managing agent or commercial builder and developer and in any event the Company shall not engage in any unlawful business.

(iii) notwithstanding anything stated in any object clause, the Company shall obtain such other approval or licence from the competent authority, as may be required under any law for the time being in force, to undertake a particular business.

Syed Shafqat Ali Shah
Chief Executive

IV. The liability of the Members is limited.

The authorized capital of the company is Rs. 950,000,000/- (Rupees nine hundred fifty million only) divided into 95,000,000 (Ninety five [illegible]) ordinary shares of Rs. 10/- (Rupees Ten only) each with powers to increase and reduce the capital of the company and to divide the shares in the capital for the time being into several classes in accordance with the provisions of the Companies Act, 2017.

We, the several persons whose names and addresses are hereto subscribed, are desirous of being formed into a Company in pursuance of this Memorandum of Association, and we respectively agree to take the number of Ordinary Shares in the capital of the Company set opposite our respective names.

Name and Surname (present and former) in full (in Block) letters	Father's/ Husband's Name in full	Nationality with any former Nationality	Occupation	Residential address in full	Number of shares taken by each subscriber	Signature
SYED SHAFQAT ALI SHAH	Syed Muhammad Ali Shah Jamote	Pakistani	Agriculturist/ Industrialist	[illegible] Circular Street, Phase II, D.H.A., Karachi	[illegible]	
SYED ZULFIQAR ALI SHAH JAMOTE	Syed Muhammad Ali Shah Jamote	Pakistani	Agriculturist/ Industrialist	[illegible] Civil Lines, Hyderabad	[illegible]	
MR. HAMEEDULLAH KHAN PARACHA	K.B. Habibullah Paracha	Pakistani	Industrialist	[illegible] Defence Colony, Hyderabad	[illegible]	
MR. MASOOD AHMED	K.B. Chaudhri Ghulam Hussain	Pakistani	Technocrat	[illegible] A, South Central Avenue, D.H.A., Phase-II, Karachi	[illegible]	
MR. FEROZ F. GOLAWALLA	Fakhruddin F. Golwalla	Pakistani	Businessman	[illegible], Parsi Colony, Karachi	[illegible]	

Dated this 30th day of October 2003.

Witness to the above Signatures:

Full Name (in Block Letters)	Father's Name	Occupation	Full Address	Nationality	Signature
MARGHOOB [illegible] SIDDIQUI	[illegible] Noor Ahmed	Operations Director	[illegible] A, D.H.A. Scheme No. [illegible] Karachi	Pakistan	

Certified [illegible]

Assistant Registrar of Companies

Assistant/Deputy Registrar of Companies

THE COMPANIES ACT, 2017
(Private Company Limited by Shares)
ARTICLES OF ASSOCIATION

OF
MATOL (PRIVATE) LIMITED
PRELIMINARY

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

PRIVATE COMPANY

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

i. No invitation shall be made to the public to subscribe for the shares or debentures of theCompany.

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 hereinappearing.

INTERPRETATION

3. Unless the context otherwise requires, words or expressions contained in these regulations shall have the same meaning as in the Act; and words importing the singular shall include the plural and vice versa, and words importing the masculine gender shall include feminine, and words importing persons shall include bodiescorporate.

(a) "section" means section of theAct;

(b) "the Act" means the Companies Act, 2017;and

(c) "The Company" means **MATOL (PRIVATE)LIMITED**

(d) "the seal" means the common seal or official seal of thecompany.

(e) "Commission" means Securities and Exchange Commission of Pakistan(SECP).

(f) "Board" means the Board of Directors for the timebeing.

(g) "Board Meeting" means a meeting of the Directors duly called and constituted or as the case may be the Directors assembled at aBoard.

(h) "Member" means a person whose name is for the time being entered in the Register of Members by virtue of his being a subscriber to the Memorandum of Association of the Company or of his holding by allotment or otherwise any share, scrip or other security which gives him a voting right in theCompany.

(i) "Special Resolution" shall have the meaning assigned thereto by the Act. "The Office" means the Registered Office for the time being of theCompany.

(j) "Chief Executive" in relation to a company means an individual who, subject to control and directions of the board, is entrusted with whole, or substantially whole, of the powers of management of affairs of the company and includes a director or any other person occupying the position of a chief executive, by whatever name called, and whether under a contract of service or otherwise;

(k) "Company Law" means the repealed Companies Act, 1913 (VII of 1913), Companies Ordinance, 1984(XLVII of 1984), Companies Ordinance, 2016 (XL of 2016) **and also includes this Act unless the context provides otherwise**;

(l) "Company Secretary" means any individual appointed to perform secretarial and other duties customarily performed by a company secretary and declared as such, having such qualifications and experience, as may be specified;

(m) "The Directors" shall mean the Directors for the time being and shall include alternatedirectors.

(n) "Memorandum" means the memorandum of association of a company as originally framed or as altered from time to time in pursuance of company law or of this Act;

BUSINESS

4. The directors shall have regard to the restrictions on the commencement of business imposed by section 19 if, and so far as, those restrictions are binding upon thecompany.

SHARES

5. In case of shares in the physical form, every person whose name is entered as a member in the register of member shall, without payment, be entitled to receive, within thirty days after allotment or within fifteen days of the application for registration of transfer, a certificate under the seal specifying the share or shares held by him and the amount paid upthereon:

   Provided that if the shares are in book entry form or in case of conversion of physical shares and other transferable securities into book-entry form, the company shall, within ten days after an application is made for the registration of the transfer of any shares or other security to a central depository, register such transfer in the name of central depository.

6. The company shall not be bound to issue more than one certificate in respect of a share or shares in the physical form, held jointly by several persons and delivery of a certificate for a share to one of several joint holders shall be sufficient delivery toall.

7. If the share certificate [illegible] in physical form is defaced, lost or destroyed, it may be renewed on payment of such fee, if any, not exceeding one hundred rupees, and on such terms, if any, as to evidence and indemnity [illegible] payment of expenses incurred by the company in investigating title as the directors think fit.

8. Except to the extent and [illegible] the manner allowed by the section 86, no part of the funds of the company shall be employed [illegible] in the purchase of, or in loans upon the security of, the company's shares.

The authorized capital of the company is Rs. 950,000,000/- (Rupees nine hundred fifty million only) divided into 95,000,000 (Ninety five million) ordinary shares of Rs. 10/- (Rupees Ten only) each, with powers to increase and reduce the capital of the company and to divide the shares in the capital for the time being into several classes in accordance with the provisions of the Companies Act, '07.

[illegible]
Syed Shafiqat Ali Shah
Chief Executive

TRANSFER AND TRANSMISSION OF SHARES

10. RESTRICTION ON TRANSFER OF SHARES BY THE MEMBERS

(1) A member desirous of selling any shares held by him, shall intimate to the board of his intention through a notice.

(2) On receipt of such notice, the board shall, within a period of ten days, offer those shares for sale to the members in proportion to their existing shareholding:

(3) The letter of offer for sale specifying the number of shares to which the member is entitled, price per share and specifying the time limit, within which the offer, if not accepted, be deemed as declined, shall be dispatched to the members through registered post or courier or through electronic mode.

(4) If the whole or any part of the shares offered is declined or is not taken, the board may offer such shares to the other members in proportion to their shareholding.

(5) If all the members decline to accept the offer or if any shares are left over, the shares may be sold to any other person as determined by the member, who initiated the offer.

(6) For the purpose of this section, the mechanism to determine the price of shares shall be such, as may be specified.

11. The instrument of transfer of any share in physical form in the company shall be executed both by the transferor and transferee, and the transferor shall be deemed to remain holder of the share until the name of the transferee is entered in the register of members in respectthereof.

12. Shares in physical form in the company shall be transferred in the following form , or in any usual or common form which the directors shallapprove:-

FORM AND TRANSMISSION OF SHARES

(1st schedule to the Companies Act, 2017)

I.....S/o.....r/o.....(hereinafter called "the transferor") in consideration of the sum of rupees .....paid to me by.....

I.....S/o.....r/o.....
(hereinafter called "the transferee"), do hereby transfer to said transferee ..... the share (or share) with distinctive numbers from ..... to ..... inclusive, in the **MATOL (PRIVATE) LIMITED** to hold upto the said transferee, his executors, administrator and assigns, subject to the several conditions on which I held the same at the time of the execution hereof, and I, the said transferee, do hereby agree to take the said share (or shares) subject to the condition aforesaid.

As witness our hands this .....day of .....20.....

Signature	Signature .....
Transferor	**Transferee**
Full Name, Father's /Husband's Name	Full Name, Father's /Husband's Name
CNIC number (in case of foreigner, Passport Number.)	CNIC number (in case of foreigner, Passport Number.)
Nationality	Nationality
Occupation and Usual Residential Address	Occupation and Usual Residential Address
	Cell number
	Landline number, if any
	Email address
Witness 1:	**Witness 2:**
Signature.....	Signature.....
Date	Date.....
Name, CNIC Number and full address	Name, CNIC Number and full address

13.

(1) Subject to the restrictions contained in regulation 14 and 15, the directors shall not refuse to transfer any share unless the transfer deed is defective or invalid. The director may also suspend the registration of transfers during the ten days immediately preceding a general meeting or prior to the determination of entitlement or rights of the shareholders by giving seven days' previous notice in the manner provided in the Act. The directors may, in case of shares in physical form, decline to recognise any instrument of transferunless---------

(a) a fee not exceeding fifty rupees as may be determined by the directors is paid to the company in respect thereof;and

(b) the duly stamped instrument of transfer is accompanied by the certificate of the shares to which it relates, and such other evidence as the directors may reasonably require to show the right of the transferor to make thetransfer.

(2) If the directors refuse to register a transfer of shares, they shall within fifteen days after the date on which the transfer deed was lodged with the company send to the transferee and the transferor notice of the refusal indicating the defect or invalidity to the transferee, who shall, after removal of such defect or invalidity be entitled to re-lodged the transfer deed with thecompany:

Provided that the company shall, where the transferee is a central depository the refusal shall be conveyed within five days from the date on which the instrument oftransfer was lodged with it notify the defect or invalidity to the transferee who shall, after the removal of such defect or invalidity, be entitled to re-lodge the transfer deed with the company.

TRANSMISSION OF SHARES

14. The executor, administrators, heir, or nominees, as the case may be, of a deceased sole holder of a share shall be the only person recognize by the company to deal with the share in accordance with the law. In the case of a share registered in the names of two or more holders, the survivors or survivor, or the executor or administrators of the deceased survivor, shall be the only persons recognised by the company to deal with the share in accordance withlaw.

15. The shares or other securities of a deceased member shall be transferred on application duly supported by succession certificate or by lawful award, as the case may be, in favour of the successors to the extent of their interests and their names shall be entered to the register of members.

16. A person may on acquiring interest in a company as member, represented by shares, at any time after acquisition of such interest deposit with the company a nomination conferring on a person, being the relatives of the member, namely, a spouse, father, mother, brother, sister and son or daughter, the right to protect the interest of the legal heirs in the shares of the deceased in the event of his death, as a trustee and to facilitate the transfer of shares to the legal heirs of the deceased subject to succession to be determined under the Islamic law of inheritance and in case of non-Muslims members, as per their respective law.

17. The person nominated under regulation 16 shall, after death of the member, be deemed as a member of company till the shares are transferred to the legal heirs and if the deceased was a director of the company, not being a listed company, the nominee shall also act as director of the company to protect the interest of the legal heirs.

18. A person to be deemed as a member under regulation 14, 15 and 16 to share by reason of the death or insolvency of the holder shall be entitled to the same dividendsand other advantages to which he would be entitled if he were the registered holder of the share and exercise any right conferred by membership in relation to meetings of thecompany.

ALTERATION OF CAPITAL

19. The company may, by specialresolution:

(a) increase its authorized capital by such amount as it thinksexpedient;

(b) consolidate and divide the whole or any part of its share capital into shares of larger amount than its existingshares:

(c) sub- divide its shares, or any of them, into shares of smaller amount than is fixed by the memorandum:

(d) cancel shares which, at the date of the passing of the resolution in that behalf, have not been taken or agreed to be taken by any person, and diminish the amount of its share capital by the amount of the share socancelled.

20. Subject to the provisions of the Act, all new shares shall at the first instance be offered to such persons as at the date of the offer are entitled to such issue in proportion, as nearly as the circumstances admit, to the amount to the existing shares to which they are entitled. The offer shall be made by letter of offer specifying the number of shares offered, and limiting a time within which the offer, if not accepted, will deem to be declined, and after the expiration of the time, or on the receipt of an intimation from the person to whom the offer is made that he declines to accept the shares offered, the directors may dispose of the same in such manner as they think most beneficial to the company. The directors may likewise so dispose of any new shares which (by reason of the ratio which the new shares bear to shares held by persons entitled to an offer of new shares) cannot, in the opinion of the directors, be conveniently offered under thisregulation.

21. The new shares shall be subject to the same provisions with reference to transfer, transmission and otherwise as the shares in the original sharecapital.

22. The company may, by specialresolution-----

(a) consolidate and divide its share capital into shares of larger amount than its existingshares;

(b) sub-divide its existing shares or any of them into shares of smaller amount than is fixed by the memorandum of association, subject, nevertheless, to the provisions of section85;

(c) cancel any shares which, at the date of the passing of the resolution, have not been taken or agreed to be taken by anyperson.

23. The company may, by special resolution, reduce its share capital in any manner and with, and subject to confirmation by the Court and any incident authorised and consent required, bylaw.

GENERAL MEETINGS

24. The statutory general meeting of the company shall be held within the period required by section 131.

25. A general meeting, to be called annual general meeting, shall be held, in accordance with the provision of section 132,within sixteen months from the date of incorporation of the company and thereafter once at least in every year within a period of one hundred and twenty days following the close of its financialyear.

26. All general meeting of a company other than statutory meeting or an annual general meeting mentioned in section 131 and 132 respectively shall be called extra ordinary generalmeetings.

27. The directors may, whenever they think fit, call an extra-ordinary general meeting, and extra-ordinary general meetings shall also be called on such requisition, or in default, may be called by such requisitioinists, as provided by section 133. If at any time there are not within Pakistan sufficient directors capable of acting to form a quorum, any director of the company may call an extra- ordinary general meeting in the same manner as nearly as possible as that in which meeting may be called by thedirectors.

28. The company may provide video-link facility to its members for attending general meeting at places other than the town in which general meeting is taking place after considering the geographical dispersal of itsmembers:

NOTICE AND PROCEEDINGS OF ANNUAL GENERAL MEETINGS

29. Twenty-one days' notice at the least (exclusive of the day on which the notice is served or deemed to be served, but inclusive of the day for which notice is given) specifying the place, the day and the hour of meeting and, in case of special business, the general nature of that business, shall be given in manner provided by the Act for the general meeting, to such person as are, under the Act or the regulations of the company, entitled to receive such notice from the company; but the accidental omission to give notice to, or the no-receipt of notice by, any member shall not invalidate the proceedings at any generalmeeting.

30. All the business transacted at a general meeting shall be deemed special other than the business stated in sub-section (2) of section 134 namely; the consideration of financial statement and the reports of board and auditors, the declaration of any dividend, the election and appointment of directors in place of those retiring, and the appointment of the auditors and fixing of their remuneration.

31. No business shall be transacted at any general meeting unless a quorum of members is present at that time when the meeting proceeds to business. The quorum of the general meeting shallbe two members present personally, or through video-link who represent not less than twenty-five percent of the total voting power, either of their own account or asproxies.

32. If within half an hour from the time appointed for the meeting a quorum is not present, the meeting, if called upon the requisition of members, shall be dissolved; in any other case, it shall stand adjourned to the same day in the next week at the same time and place, and if at the adjourned meeting a quorum is not present within half an hour from the time appointed for the meeting, the members present, being not less than two, shall be aquorum.

33. The chairman of the board of directors, if any, shall preside as chairman at ever general meeting of the company , but if there is no such chairman, or if at any meeting he is not present within fifteen minutes after the time appointed for the meeting, or is unwilling to act as chairman, any one of director present may be elected to be chairman, and if none of directors is present, or willing to act as chairman, the members present shall choose one of their number to be chairman.
34. The chairman may, with the consent of any meeting at which a quorum is present (and shall if so directed by the meeting), adjourn the meeting from time to time but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which the adjournment took place. When a meeting is adjourned for fifteen days or more, notice of the adjourned meeting shall be given as in the case of an original meeting. Save as aforesaid, it shall not be necessary to give any notice of an adjournment or of the business to be transected at an adjournedmeeting.

35. (1) At any general meeting a resolution put to vote of the meeting shall be decided on a show of hands unless a poll is (before or on the declaration of the result of the show of hands) demanded. Unless a poll is so demanded, a declaration by the chairman that a resolution has, on a show of hands, been carried, or carried unanimously, or by a particular majority, or lost, and an entry to that effect in the book of the proceedings of the company shall be conclusive evidence of the fact, without proof of the number or proportion of the votes recorded in favour of, or against, thatresolution.

    (2) At any general meeting the company shall transact such businesses as may be notified by the commission, only through a postal ballot.

36. A pool may be demanded only in accordance with the provision of section143.

37. If a poll is duly demanded, it shall be taken in accordance with the manner laid down in sections 144 and 145 and the result of the poll shall be deemed to be the resolution of the meeting at which the poll wasdemanded.

38. A poll demanded on the election of chairman or on a question of adjournment shall be taken at once.

39. In the case of any equality of votes, whether on a show of hands or on a poll,the chairman of the meeting at which the show of hands takes place, or at which the poll is demanded, shall have exercise a second or castingvote.
40. Except for the businesses specified under sub-section (2) of section 134 to be conducted in the annual general meeting, the member of a private company or a public unlisted company (having not more than fifty members), may pass a resolution (ordinary or special) by circulation signed by all the members for the time being entitled to receive notice of a meeting. The resolution by circulation shall be deemed to be passed on the date of signing by the last of the signatory member to such resolution.

VOTES OF MEMBERS

41. Subject to any rights or restrictions for the time being attached to any class or classes of shares, on a show of hands every member present in person shall have one vote except for election of directors in which case the provision of section 159 shall apply. On a poll every member shall have voting rights as laid down in section134.

42. In case of Joint-holders, the vote of the senior who tenders a vote, whether in person or by proxy or through video-link shall be accepted to the exclusion of votes of the other Joint holders; and for this purpose seniority shall be determined by the order in which the names stand in the register of members.

43. A member of sound mind, or in respect of whom an order has been made by any court having jurisdiction in lunacy, may vote, whether on show of hands or on a poll or through video link, by his committee or other legal guardian, and any such committee or guardian may, on a poll, vote byproxy.

44. On a poll votes may be given either personally or through video link, by proxy or through postal ballot:

Provided that nobody corporate shall vote by proxy as long as a resolution of its directors in accordance with the provisions of section 138 is in force.

45.

(1) The instrument appointing a proxy shall be in writing under the hands of the appointer or of his attorney duly authorised inwriting.

(2) The instrument appointing a proxy and the power-of-attorney or other authority (if any) under which it is signed, or a notarially certified copy of the power or authority, shall be deposited at the registered office of the company not less than forty-eight hours before the time for holding the meeting at which the person named in the instrument proposes to vote and in default the instrument of proxy shall not be treated asvalid.

46. An instrument appointing a proxy may be in the following form, or a form as near thereto as may be:

INSTRUMENT OF PROXY
MATOL (PRIVATE) LIMITED

" I ..... s/o ..... r/o..... being a member of the Matol (Private) Limited, hereby appoint ..... s/o ..... r/o ..... as my proxy to attend and vote on my behalf at the (statutory, annual, extraordinary, as the case may be) general meeting of the company to be held on the ..... day of ..... 20.....and at any adjournment thereof".

47. A vote given in accordance with the terms of an instrument of proxy shall be valid

notwithstanding the previous death or insanity of the principal or revocation of the proxy or of the authority under which the proxy was executed, or transfer of the share in respect of which the proxy is given, provided that no intimation in writing of such death, insanity, revocation or transfer as aforesaid shall have been received by the company at the office before the commencement of the meeting or adjourned meeting at which the proxy isused.

DIRECTORS

48. The following subscribers of the memorandum of association, shall be first directors of the company, so, however, that the number of directors shall not in any case be less than that specified in section 154 and they shall hold office until the election of directors in the first annual general meeting:

    1. **Syed Shafqat Ali Shah**
    2. **Syed Zulfiqar Ali ShahJamote**
    3. **Mr. Hameedullah KhanParacha**
    4. **Mr. MasoodAhmed**
    5. **Mr. Feroz F.Golwalla**

49. The remuneration of the directors shall from time to time be determined by the company in general meeting subject to the provisions of theAct.Every director shall be entitled to a fee of Rs.5,000/- for attending every meeting .

50. Save as provided in section 153, no person shall be appointed as a director unless he is a member of the company.

POWERS AND DUTIES OF DIRECTORS

51. The business of the company shall be managed by the directors, who may pay all expenses incurred in promoting and registering the company, and may exercise all such powers of the company as are not by the Act or any statutory modification thereof for the time being in force, or by these regulations, required to be exercised by the company in general meeting, subject nevertheless to the provisions of the Act or to any of these regulations, and such regulations being not inconsistent with the aforesaid provisions, as may be prescribed by the company in general meeting shall invalidate any prior act of the directors which would have been valid if that regulation had not beenmade.

52. The directors shall appoint a chief executive in accordance with the provisions of sections 186 and 187.

53. The amount for the time being remaining undischarged of moneys borrowed or raised by the directors for the purposes of the company (otherwise than by the issue of share capital) shall not at any time , without the sanction of the company in general meeting, exceed the issued share capital of thecompany.

54. The directors shall duly company with the provisions of the Act, or any statutory modification thereof for the time being in force, and in particular with the provisions in regard to the registration of the particulars of the mortgages, charges and pledge affecting the property of the company or created by it, to the keeping of a register of the directors, and to the sending to the registrar of an annual list of members, and a summary of particulars relating thereto and notice of any consolidation or increase of share capital, or sub-division of shares, and copies of special

resolutions and a copy of the register of directors ad notifications of any changestherein.

MINUTE BOOKS

55. The directors shall cause records to be kept and minutes to be made in book or books with regard to---

(a) All resolutions and proceedings of general meeting(s) and the meeting(s) of directors and Committee(s) of directors, and every member present at any general meeting and every director present at any meeting of the directors or Committee of directors shall put his signature in a book to be kept for thepurpose;

(b) Recording the names of the persons present at each meeting of the directors and of any committee of the directors, and the general meeting;and

(c) All orders made by the directors and Committee(s) ofdirectors:

Provided that all records related to proceedings through video-link shall be maintained in accordance with the relevant regulations specified by the Commission which shall be appropriately rendered into writing as part of the minute books according to the said regulations.

THE SEAL

56. The directors shall provide for the safe custody of the seal and the seal shall not be affixed to any instrument except by the authority of a resolution of the board of directors or by a committee of directors authorized in that behalf by the directors and in the presence of at least two directors and of the secretary or such other person as the directors may appoint for the purpose; and those two directors and secretary or other person as aforesaid shall sign every instrument to which the seal of the company is so affixed in theirpresence.

DISQUALIFICATION OF DIRECTORS

57. No person shall become the director of a company if he suffers from any of the disabilities or disqualifications mentioned in section 153 or disqualified or debarred from holding such office under any of the provisions of the Act as the case may be and, if already a director, shall cease to hold such office from the date he so becomes disqualified ordisabled:

Provided, however, that no director shall vacate his office by reason only of his being a member of any company which has entered into contracts with, or done any work for, the company of which he is director, but such director shall not vote in respect of any such contract or work, and if he does so vote, his vote shall not becounted.

PROCEEDINGS OF DIRECTORS

58. The directors may meet together for the dispatch of business, adjourn and otherwise regulate their meetings, as they think fit. A director may, and the secretary on the requisition of a director shall, at any time, summon a meeting of directors. Notice sent to a director through email whether such director is in Pakistan or outside Pakistan shall be a validnotice.

59. The directors may elect a chairman of their meetings and determine the period for which he is to hold office; but, if no such chairman is elected, or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to actas chairman, the directors present may choose one of their member to be chairman of themeeting.

60. At least one-third (1/3rd) of the total number of directors or two (2) directors whichever is higher, for the time being of the company, present personally or through video-link, shall constitute a quorum.

61. Save as otherwise expressly provided in the Act, every question at meetings of the board shall be determined by a majority of votes of the directors present in person or through video-link, each director having one vote. In case of an equality of votes or tie, the chairman shall have a casting vote in addition to his original vote as adirector.

62. The directors may delegate any of their powers not required to be exercised in their meeting to committees consisting of such member or members of their body as they think fit; any committee so formed shall, in the exercise of the powers so delegated, conform to any restrictions that may be imposed on them by thedirectors.

63. (1) A committee may elect a chairman of its meetings; but, if no such chairman is elected, or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the members present may choose one of their number to be chairman of themeeting.

(2) A committee may meet and adjourn as it thinks proper. Questions arising at any meeting shallbe determined by a majority of votes of the members present. In case of an equality of votes, the chairman shall have and exercise a second or casting vote.

64. All acts done by any meeting of the directors or of a committee of directors, or by any person acting as a director, shall, notwithstanding that it be afterwards discovered that there was some defect in the appointment of any such directors or persons acting as aforesaid, or that they or any of them were disqualified, be as valid as if every such person had been duly appointed and was qualified to be adirector.

65. A copy of the draft minutes of meeting of the board of directors shall be furnished to every director within seven working days of the date ofmeeting.

66. A resolution in writing signed by all the directors for the time being entitled to receive notice of a meeting of the directors shall be as valid and effectual as if it had been passed at a meeting of the directors duly convened andheld.

FILLING OF VACANCIES

67. At the first annual general meeting of the company, all the directors shall stand retired from office, and directors shall be elected in their place in accordance with section 159 for a term of threeyears.

68. A retiring director shall be eligible forre-election.

69. The directors shall comply with the provisions of sections 154 to 159 and sections 161, 162 and 167 relating to the election of directors and matters ancillarythereto.

70. Any casual vacancy occurring on the board of directors may be filled up by the directors, but the person so chosen shall be subject to retirement at the same time as if he had become a director on the day on which the director in whose place he is chosen was last elected asdirector.

71. The company may remove a director but only in accordance with the provisions of theAct.

DIVIDEND AND RESERVE

72. The company in general meeting may declare dividends but no dividend shall exceed the amount recommended by thedirectors.

73. The directors may from time to time pay to the members such interim dividends as appear to the directors to be justified by the profits of thecompany.

74. Any dividend may be paid by a company either in cash or in kind only out of its profits. The payment of dividend in kind shall only be in the shape of shares of listed company held by the distributingcompany.

75. Dividend shall not be paid out of unrealized gain on investment property credited to profit and lossaccount.

76. Subject to the rights of persons (if any) entitled to shares with special rights as to dividends, all dividends shall be declared and paid according to the amounts paid on theshares.

77. (1) The directors may, before recommending any dividend, set aside out of the profits of the company such sums as they think proper as a reserve or reserves which shall, at the discretion of the directors, be applicable for meeting contingencies, or for equalizing dividends, or for any other purpose to which the profits of the company may be properly applied, and pending such application may, at the like discretion, either be employed in the business of company or be invested in such investments (other than shares of the company) as the directors may, subject to the provisions of the Act, from time to time thinkfit.

2) The directors may carry forward any profits which they may think prudent not to distribute, without setting them aside as areserve.

78. If several persons are registered as joint-holders of any shares, any one of them may give effectual receipt for any dividend payable on theshares.

79. (1) Notice of any dividend that may have been declared shall be given in manner hereinafter mentioned to the persons entitled to share therein but, in the case of a public company, the company may give such notice by advertisement in a newspaper circulating in the Province in which the registered office of the company issituate.

(2) Any dividend declared by the company shall be paid to its registered shareholders or to their order. The dividend payable in cash may be paid by cheque or warrant or in any electronic mode to the shareholders entitled to the payment of the dividend, as per theirdirection.

80. The dividend shall be paid within the period laid down under theAct.

ACCOUNTS

81. The directors shall cause to be kept proper books of account as required under section220.

82. The books of account shall be kept at the registered office of the company or at such other place as the directors shall think fit and shall be open to inspection by the directors during business hours.

83. The directors shall from time to time determine whether and to what extent and at what time and places and under what conditions or regulations the accounts and books or papers of the company or any of them shall be open to the inspection of members not being directors, and no member (not being a director) shall have any right of inspecting any account and book or papers of the company except as conferred by law or authorized by the directors or by the company in general meeting.

84. The directors shall as required by section223 and 226 cause to be prepared and to be laid before the company in general meeting the financial statements duly audited and reports as are referred to in thosesections.

85. The financial statements and other reports referred to in regulation 80 shall be made out in every year and laid before the company in the annual general meeting in accordance with sections 132 and 223.

86. A copy of the financial statements and reports of directors and auditors shall, at least twenty-one days preceding the meeting, be sent to the persons entitled to receive notices of general meetings in the manner in which notices are to givenhereunder.

87. The directors shall in all respect comply with the provisions of sections 220 to227.

88. Auditors shall be appointed and their duties regulated in accordance with sections 246 to249.

NOTICES

89. (1) A notice may be given by the company to any member to his registered address or if he has no registered address in Pakistan to the address, if any, supplied by him to the company for the giving of notices to him against an acknowledgement or by post or courier service or through electronic means or in any other manner as may be specified by theCommission.

(2) Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, prepaying and posting a letter containing the notice and, unless the contrary is proved, to have been effected at the time at which the letter will be delivered in the ordinary course of post.

90. A notice may be given by the company to the joint-holders of a share by giving the notice to the joint-holder named first in the register in respect of theshare.

91. A notice may be given by the company to the person entitled to a share in consequence of the death or insolvency of a member in the manner provided under regulation 85 addressed to them by name, or by the title or representatives of the deceased, or assignees of the insolvent, or by any like description, at the address, supplied for the purpose by the person claiming to be soentitled.

92. Notice of every general meeting shall be given in the manner hereinafter authorized to (a) every member of the company and also to (b) every person entitled to a share in consequence of the death or insolvency of a member, who but for his death or insolvency would be entitled to receive notice of the meeting, and (c) to the auditors of the company for the time being and every person who is entitled to receive notice of generalmeetings.

DISPUTE

93. In the event that a dispute, claim or controversy arises between the Company, its management of its shareholders, or between the shareholders inter-se, or the directors inter-se, all steps may be taken to settle the dispute and resolve the issue through mediation by an accredited mediator before taking recourse to formal to formal dispute resolution such as arbitration orlitigation.

WINDING UP

94. (1) In the case of members' voluntary winding up, with the sanction of a special resolution of the company, and , in the case of creditors' voluntary winding up, of a meeting of the creditors, the liquidator shall exercise any of the powers given by sub-section (1) of section 337 of the Act to a liquidator in a winding up by the Court including inter-alia divide amongst the members, in specie or kind, the whole or any part of the assets of the company, whether they consist of property of the same kind ornot.

(2) For the purpose aforesaid, the liquidator may set such value as he deems fair upon any property to be divided as aforesaid and may determine how such division shall be carried out as between the members or different classes ofmembers.

(3) The liquidator may, with the like sanction, vest the whole or any part of such assets in trustees upon such trusts for the benefit of the contributories as the liquidator, with the like sanction, thinks fit, but so that no member shall be compelled to accept any shares or other securities whereon there is anyliability.

INDEMNITY

95. Every office or agent for the time being of the company may be indemnified out of the assets of the company against any liability incurred by him in defending any proceedings, whether civil or criminal, arising out of his dealings in relation to the affairs of the company, except those brought by the company again him, in which judgment is given in his favour or in which he is acquitted, or in connection with any application under section 492 in which relief is granted to him by the Court.

We, the several persons whose names and addresses are hereto subscribed, are desirous of being formed into a Company in pursuance of this Articles of Association, and we respectively agree to take the number of Ordinary Shares in the capital of the Company set opposite our respective names.

Name and Surname (present and former) in full (in Block) letters	Father's/ Husband's Name in full	Nationality with any former Nationality	Occupation	Residential address in full	Number of shares taken by each subscriber	Signature
SYED SHAFQAT ALI SHAH	Syed Muhammad Ali Shah Jamote	Pakistani	Agriculturist/ Industrialist	33-B, Circular Street, Phase II, D.H.A., Karachi	1 (One)	
SYED [illegible] ALI SHAH [illegible]	Syed Muhammad Ali Shah Jamote	Pakistani	Agriculturist/ Industrialist	17, Civil Lines, Hyderabad	1 (One)	
MR. [illegible]EEDULLAH [illegible] PARACHA	K.B. Habibullah Paracha	Pakistani	Industrialist	5, Defence Colony, Hyderabad	1 [illegible]	
MR. [illegible] AHMED	K.B. Chaudhri, Ghulam Hussain	Pakistani	Technocrat	20-A, South Central Avenue, D.H.A., Phase-II, Karachi	1 (One)	
MR. F[illegible] [illegible]	Fakirjee P. Golwalla	Pakistani	Businessman	24, Parsi Colony, Karachi	[illegible] (One)	
				Total		

Dated this 30th day of October 2003.

Witness to the above Signatures:-

Full Name (in Block Letters)	Father's Name	Occupation	Full Address	Nationality	Signature
[illegible] AHMED [illegible]	(Late) Noor Ahmed	Operations Director	[illegible], Scheme No. 1, Karachi	Pakistani	

Certified to be True Copy

Assistant Registrar of Companies

TARIQ MEHMOOD
FVP/Chief Manager
IBS # 5697
Market Chowk Br. (0077) Hyd.

matol (Pvt.) Limited
HEAD OFFICE:
MATIARI HOUSE, C-48, K.D.A. Scheme-1, Karachi-75350 Pakistan.
Direct Phone: +92-21 34390448-9 PABX No: +92-21 34521382,
34529698, 34536614 Fax:+92-21 34541 734 E-mail: matol@cybe
FACTORY: Deh Pannu Nasar Pur Road, Dist. Matiari Pakistan

August 12, 2020

The Registrar
National Electric Power Regulatory Authority,
Islamic Republic of Pakistan
NEPRA Tower, Attaturk Avenue, G-5/1
ISLAMABAD

Subject: Application of Matol (Private) Limited for Grant of Generation License in Respect of 6.20 MW Thermal Power Plant Located at Deh Panu Nasarpur Road District Matiari in the Province of Sindth.

In continuation to our application for the above-sited purpose dated June 12, 2020.

Please be informed that our present need is to supply electricity to our sister concernsviz 'Matiari Flour Mills' and Matiari Sugar. The later will receive power during the off-season which spams between 7~8 months per year. Both the projects are located alongside the proposed source of supply and no additional networking requiring external support will be required. As the system consolidates we intend to supply electricity to other sister concerns viz Matiari Health Services. Attached at Annexure 'A' is Initial Environmental Examination Report (IEE) for your record

Regards,

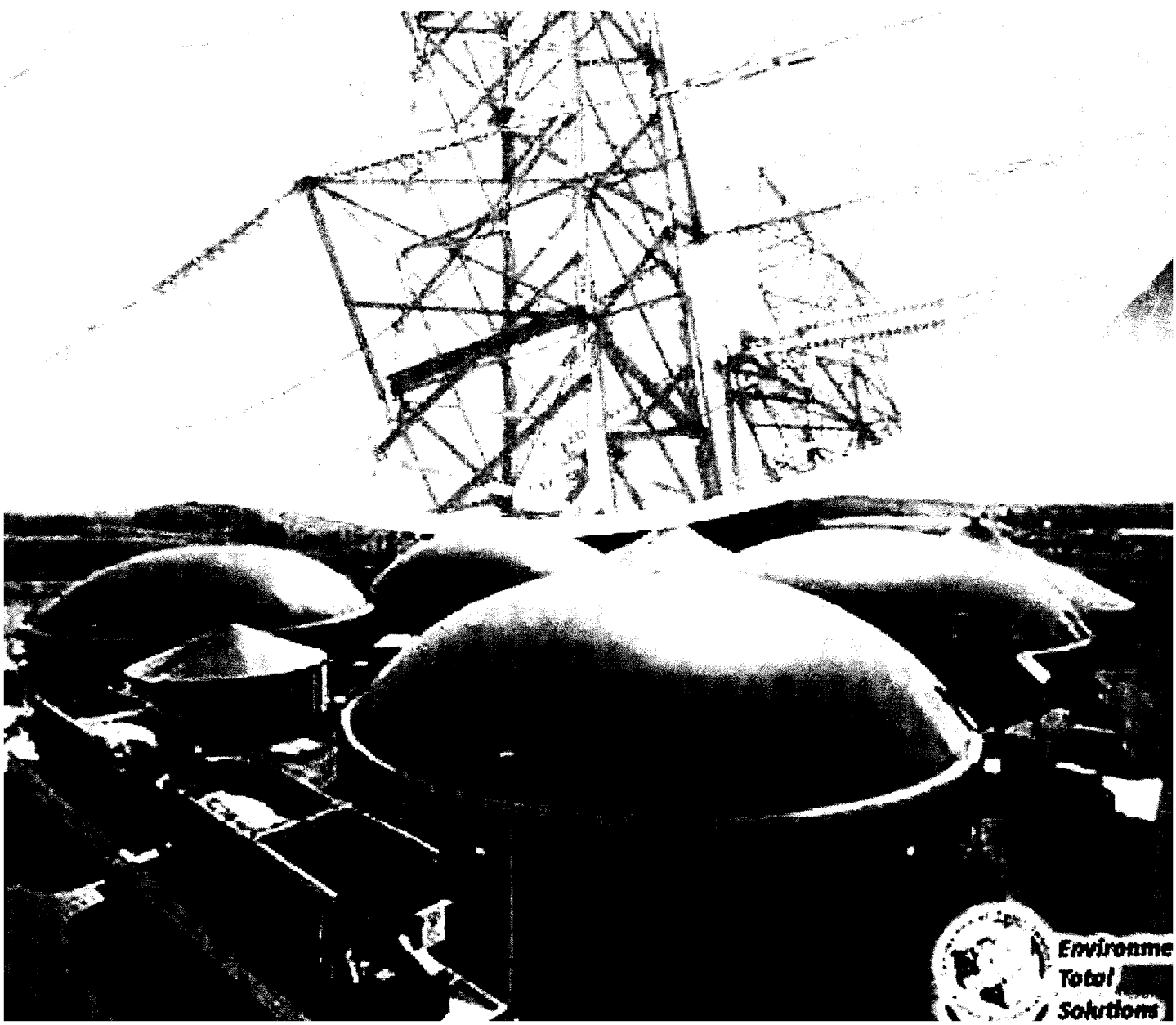
Muhemmed Yousuf Khan
General Manager (E&E)
Matiari Group

11286

Initial Environmental Examination - 2016

Matol Pvt. Ltd.

Cogeneration Power Plant



Initial Environmental Examination-2016

Matol Pvt. Ltd.

Cogeneration Power Plant

Developed by:

Environmental Total Solutions

Office No. 1, Aqsa Tower, Main Rashid Minhas Rd.,
Gulshan-e-Iqbal, Karachi
Contact: 0333-2277350, Email: etspak1@gmail.com

EXECUTIVE SUMMARY

INTRODUCTION

This report presents the findings of Initial Environmental Examination (IEE) study carried out by Environmental Total Solutions (ETS) for the proposed 6.2MW cogeneration bio-gas power plant being undertaken at Matol (Private) Limited, located at Deh Pannu, Nasar Pur Road, District Matiari, in the Province of Sindh.

The IEE has been prepared in compliance with the provision of Sindh Environmental Protection Act (SEPA) 2014 (Initial environmental examination and environmental impact assessment). The proposed facility has been designated as a Category B project under Sindh Environmental Protection Act, and listed project under EIA/IEE regulations and therefore requires a full Initial Environmental Examination (IEE).

Project Mission

To undertake integrated Agriculture + Bio-Energy Projects through optimal utilization of locally available resources.

Project Objectives

Would include the following:

a. *Energy Component*
   - Supply of Electricity from Biogas Engine + Thermal Energy through recovery of Biogas engine waste heat

b. *Agricultural Component*
   - Bio-energy production from distillery stillage and environmental fitting of liquid and solid waste generated

Project Overview

Metol private limited proposes to build, and operate the power plant within an existing fenced area of their facility. The overall proposed site area is ------- sq ft The plant comprising a system of hydrolysers and a digester to produce biogas, an engine driven electricity generating set (genset) and other associated equipment to operate and manage the process. The whole project is designed to be sited on a pre-leveled area on the facility. This project will establish an environmentally friendly and sustainable form of electricity (and heat) production from stillage. The AD process uses naturally occurring bacteria and other microbes to convert organic matter in the feedstock into:

- Biogas, which is an energy rich mixture of methane and carbon dioxide which is suitable for use as a fuel to generate electricity and heat.
- Nutrient rich solid and liquid fertilizers to be used on the farm in place of purchased chemical fertilizers

The resulting biogas is burned in an engine driven generating set (genset) to produce electricity, mostly for use on the farm with the balance available for export to the grid. The genset also produces heat in the form of engine cooling water and some of this will be used to heat the hydrolysers to 50-55^{0}C and to maintain the digester at a temperature of ~ 40-45^{0}C. The pre-hydrolysis of the feedstock material in the two hydrolysers ensures significantly higher biogas production and shorter residence times than conventional AD plants, maximizing biological degradation and stabilization, minimizing capital costs and plant footprint and increasing electricity (and heat) production.

ENVIRONMENTAL IMPACT ASSESSMENT

Contributors to the IEE Report

The Initial Environmental Examination (IEE) report is prepared by (ETS), Environmental Total Solutions based on information provided by M/S Metol Private Limited. The IEE report draws heavily on the variety of sources, including published literature, reports of other studies conducted in the area, and surveys conducted specifically for this study.

Scope of the IEE Report

The IEE has been prepared in compliance with the provision of Sindh Environmental Protection Act (SEPA) 2014 (Initial environmental examination and environmental impact assessment). The Provisions of SEPA 2014, Part VI, section 17, to assess the impacts of the construction and operation of the Matol (Private) Limited cogeneration power plant and has also considered the cumulative impacts of the plant and other existing sources, particularly the existing Matol (Private) Limited power plant, in the project area.

The IEE report presents the full assessment of the environmental, health and safety impacts of the Matol (Private) Limited power plant. This Summary presents a short resume of the findings of the IEE report. For further details, reference should be made to the full IEE report.

Alternative Technologies and Fuels

Use of Biogas is the only available option because of the high cost of other fossil fuels that include diesel oil, gasoline and furnace oil. Moreover; availability of Biogas and Captive Power Producer (CPPs) prompted the adoption of Biogas as the preferred alternative renewable source of energy.

The use of biogas as a fuel happens because it reacts with oxygen and releases energy, which is clean in nature. The resulting reaction uses up the gases and prevents them from rising into the atmosphere as it recycles most forms of biodegradable waste and works on simple forms of technology.

KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

Introduction

A thorough assessment of the impacts of the proposed plant has been carried out based on information provided by proponent. A combination of information's including published literature, visual evaluation, reports of other studies conducted in the area, and surveys conducted specifically for this study have been undertaken. The results of the assessment work have been compared with the environmental standards set by the SEPA.

The conclusions of the assessment are that (with suitable mitigation measures described in chapter 5 & 6) the project is in compliance with the environmental requirements of province of Sindh. Pakistan respect to stack emissions. ambient air quality, discharge quality and noise.

Flora and Fauna

No areas protected for their conservation value are located on, or in the vicinity of. the project area. The proposed site itself and the majority of surrounding land is poorly vegetated (desert) with no much of the area having been disturbed by urban developments. Given that the potential impacts of construction and operation on power plant area likely to be localized, and good site management practices will be implemented, no significant effects are predicted.

Land Use, Landscape and Visual Impacts

Vegetation, all existing views will be in significantly influenced by the power plant and given. The land use at the project site is un-used. infertile land. The loss of this land to the power plant development is therefore not significant.

The surrounding land use is industrial. As the land is not urbanized with limited he surrounding industrial context, due to the existence of the present distillery plant and enormous number of scattered lime quarries, the visual intrusion of the power plant will be minimal.

The potential landscape and visual impacts of the project are therefore expected to be minor and not significant.

Soils, Geology and Hydrology

Due to the characteristics of the soils and geology of the site, in particular the lack of any sensitive features, and the mitigation measures proposed as part of the construction and operation of the power plant, no significant impacts are predicted to occur. In addition,, geotechnical investigations confined the site as being uncontaminated.

Archaeology, Historical and Cultural Heritage

No available information was found which identified any archaeological, historic or cultural remains on the site or in the surrounding area. Consequently, no impact is predicted to occur on any known archaeological, historic or cultural resources.

Solid Waste Management

The management of wastes during construction and operation of the power plant will include mitigation measures to collect and store waste on-site, record all consignment of hazardous or contaminated waste for disposal and periodically audit waste contractors and disposal sites to ensure that disposal is undertaken in a safe and environmentally acceptable manner

During both construction and operation, all wastes including general waste, packaging waste, commercial wastes, raw-water pre- treatment sludge, tank sludge and interceptor sludge will be disposed of by licensed waste contractors. Solid waste management is not predicted to cause any significant impacts.

Occupational Health and Safety

With the provision of a high standard of health and safety management on site, construction and operation of the power plant in accordance with good industry practice, the occupational health and safety risks associated with construction and operation of the power plant will be minimized and are not significant.

MONITORING STRUCTURE

A management program to ensure a clean and healthy environmental would be pursued during operation stage of the plant. This would involve establishment of an environmental monitoring cell, manned by qualified and trained personnel. The cell would be responsible for developing operational guidelines and ensuring compliance with prescribed standards. The Environmental Monitoring Cell to be constituted by the power plant management from amongst the plant personnel shall be responsible for implementation of all the monitoring and mitigation programs. They shall be fully conversant with the national and the international regulatory standards for

environmental protection. The power plant laboratory will be manned by chemical engineer / laboratory technicians.

The maintenance personnel also would be responsible for the proper functioning of emission and ground level concentration monitoring system. The chemist and laboratory technicians of the plant would take care of all the laboratory and field sample tests. The test result / data prepared by this team would be presented by the environmental monitoring cell to the plant management. Supervisory control, monitoring, and data acquisition shall comply with requirements of Sindh Environmental Protection Act 2014, Rules and Regulations made there under and World Bank Guidelines relevant to thermal power plants

List of Abbreviations

AAQM	Ambient Air Quality Monitoring
ACW	Auxiliary Cooling Water
ADP	Asian Development Bank
ARE	Alternative/Renewable Energy
BFB	Boiler Feed Pump
BA	Bottom Ash
BOD	Biological Oxygen Demand
CCPP	Captive Co-generation Power Plant
CCS	Carbon Capture & Storage
CDM	Clean Development Mechanism
CFBC	Circulating Fluidized Bed Combustion
CHP	Combined Heat & Power
CO	Carbon monoxide
CO_2	Carbon dioxide
COC	Cycle of Concentration
COD	Chemical Oxygen Demand
CMI	Census of Manufacturing Industries
CPCB	Central Pollution Control Board
CRE	Combustible Renewable Energy
CSO	Clarified Slurry Oil
CSR	Corporate Social Responsibility
CW	Cooling Water
DO	Dissolved Oxygen
DM	De-mineralized
DMC	Developing Member Countries
EBM	Environmental Best Management
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
EPA	Environmental Protection Act

ESP	Electro-Static Precipitator
ETS	Environmental Total Solution
FA	Fly ash
GBEP	Global Bio-energy Partnership
GDP	Gross Domestic Product
GHG	Green House Gasses
GLC	Ground Level Concentration
HESCO	Hyderabad Electric Supply Company
HSE	Health, Safety and Environmental
HWMHTM	Hazardous Waste (Management, Handling and Tran's boundary Movement) Rules
HP	High Pressure
IEA	International Energy Agency
IEE	Initial Environmental Examination
IPCC	International Panel on Climate Change
IMD	Indian Meteorological Department
LBOD	Left Bank out Fall Drainage
N	North
NE	North East
NEQS	National Environmental Quality Standards
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
OECD	Organization for Economic Co-operation &Development
PEPA	Pakistan Environmental Protection Agency
PEPC	Pakistan Environmental Protection Council
PM	Particulate Matter
$PM_{2.5}$	Particles less than 2.5Micrometer
PM_{10}	Particles less than 10 Micrometer
PPE	Personnel Protective Equipment
RCC	Reinforced Cement Concrete
RBOD	Right Bank out Fall Drainage

SEPA	Sindh Environmental Protection Agency
SITE	Sindh Industrial Trading Estate
SG	Steam Generator
SPL	Sound Pressure Level
SPM	Suspended Particulate Matter
SO_2	Sulfur dioxide
STG	Steam Turbine Generator
SW	South West
TDS	Total Dissolved Solid
TOR	Terms of Reference
WHRB	Waste Heat Recovery Boilers
UNDP	United Nations Development Program
UNFCCC	United Nations Frame Work Convention on Climate Change
UNESCO	United Nations Educational, Scientific & Cultural Organization
UNESCAP	United Nations Economic & Social Commission for Asia & Pacific

Units

^0C	Degree Celsius
Exajoule	One Billion joule
^0F	Degree Fahrenheit
ha	Hectare
dB(A)	Decibel (A-rated)
GW	Giga Watt
ha	Hectare
Kw	Kilowatt
KWh	Kilowatt-hour
Nm^3/h	Normal cubic meter per hour
mg/Nm^3	Micro gram per normal cubic meter
mg/l	Mille gram per liter
mm	Mille meter
MW	Megawatt
mW	Milliwatt
Wh	Watt-hour
µm	micrometer

Technical Terms Used in Power Generation

Action:

To meet a specific purpose and need, this may have effects on the environment and may potentially be subject to governmental control or responsibility. For this document, the term applies to a specific project.

Aesthetic quality

A perception of beauty of natural or cultural landscape

Affected environment

The existing conditions of the human and natural environments in the areas that could potentially have impacts

Air quality:

A measure of health-related and visual characteristics of the air often derived from quantitative measurements of concentrations of specific substances.

Air shed

A geographic area where air pollutants from upwind sources or within a discrete atmospheric area of flow, are present in the air. While watersheds are actual physical features of the landscape, air sheds are determined using mathematical models of atmospheric deposition.

Alternative energy

Renewable energy sources such as wind, water, solar, biomass as an alternative to nonrenewable resources such as oil, gas, and coal

Ambient environment

The current or existing condition of the environment in a particular location, For example, ambient air quality is the current quality of the air surrounding the site

Aquatic

Growing or living in the water.

Aquifer:

A geological formation that stores water in its pores, and that is capable of providing water to be used. A free or unconfined aquifer is one with a water table at an atmospheric pressure, i.e., one not limited in its upper level by an impermeable layer. A confined aquifer one under pressure greater than the atmosphere, caused by a confining layer above the atmosphere which prohibits it from being in direct contact with atmospheric pressure. A perched aquifer is an unconfined aquifer with limited spatial distribution.

Archeological site

A discrete location that provides physical evidence of prehistoric human use.

Area of influence

Space or surface that is affected by direct and indirect impacts caused by a project, works or an activity. For a given project, works, or activity, the area of influence may vary for different environmental resources.

Baseline

Conditions against which impacts of a proposed action and its alternatives can be compared considering what would exist in the future in the absence of the proposed project or action.

Bag house

A chamber containing fabric filter bags that remove particles from furnace stack exhaust gases. A bag house is used to eliminate particles greater than 20 microns in diameter

Base load capacity

The power output that generating equipment can continuously produce.

Base load demand

The minimum demand experienced by an electric utility, usually 30-40% of the utility's peak demand

Best available control measures

The most effective measure for controlling small or dispersed particulates such as soot and ash from woodstoves and open burning of brush, timber, grasslands, or trash is at sources.

Best available control technology (BACT)

That combination of production processes, methods, systems, and techniques that will result in the lowest achievable level of emissions of air pollutants from a given facility. BACT is an emission limitation that the permitting authority determines on a case-by-case basis, taking into account energy, environmental, economic and other costs of control. BACT may include fuel cleaning or treatment or innovative fuel combustion techniques

Best Management Practices

A suite of techniques that guide or may be applied to management actions to aid in achieving desired outcomes and help to protect the environmental resources by avoiding or minimizing impacts of an action.

Bioaccumulation

Refers to the accumulation of substances, such as pesticides, or other organic chemicals in an organism. Bioaccumulation occurs when an organism absorbs a substance at a rate greater than that at which the substance is lost.

Biodiversity

Refers to the variation of life forms within a given ecosystem. Biodiversity is often used as a measure of the health of the biological system.

Biogas: Gas

Typically rich in methane that is produced by the fermentation of organic matter such as stillage under anaerobic conditions

Corrective action

An action undertaken to correct the causes or effects of a noncompliance, flaw or other similar or undesirable situations that exists

Cumulative impact

The impact on the environment and a particular resource that results from the incremental impact of the action when added to other past, present and reasonably foreseeable actions

Deforestation

Clearance of trees and other vegetation from a forest

Decibel (dB)

The unit of measurement of sound level calculated by taking ten times the common logarithm of the ratio of the magnitude of the particular sound pressure to the standard reference sound pressure of 20 micropascals and its derivatives.

Direct area of influence

Area affected by direct impacts from the actions of a project, works, or an activity

Direct impact (or effect)

An impact caused by an action that occurs at the same time and same place as the activity.

Discharge

Outflow of fluid into the environment. For hydroelectric plants, this can be the release of water back into the environment after it has turned water turbines. For wastewater, this it is the release of wastewater (treated or untreated) into the environment.

Ecology

The relationship between the environment and living organisms

Ecosystem

A complex system of a community of plants, animals and the system's chemical and physical environment

Effect (or impact)

A modification of the existing environment caused by an action of the project. The effect, or impact, may be direct, indirect or cumulative, negative or positive.

Emission

Pollution discharged into the atmosphere from smoke stacks, other vent, and surface areas of commercial or industrial facilities; residential chimneys; and vehicle exhausts. This term is used to refer to the discharge itself, or the concentration or rate of discharge.

Energy Efficiency

Energy efficiency refers to products or systems using less energy to the same or better job than conventional products or systems. Energy efficiency saves energy, saves money on utility bills, and helps protect the environment by reducing the amount of electricity that needs to be generated. When

buying or replacing products or appliances for your home, look for the ENERGY STAR® label — the national symbol for energy efficiency.

Endangered species

A plant or animal that is in danger of extinction throughout all or a significant portion of its range

Environment

All the elements that surround human beings, including: geologic features (rocks and minerals); atmospheric system (air), water (surface and groundwater), soil, biotic (living organisms), natural resources, landscapes, cultural resources, and socioeconomic resources and conditions.

Generation (Electricity)

The process of producing electric energy from other forms of ; also, the amount of electric energy produced, expressed in watt-hours (Wh)

Generation (Gross)

The total amount of electric energy produced by the generating at a generating station or stations, measured at the generator terminals

Generation (Net)

Gross generation less the electric energy consumed at the generating station for station's use

Grid

The layout of an electrical distribution system

Environmental Management System

Part of the overall management system that includes organizational structures, planning activities, responsibilities, practices. procedures, processes and resources for developing, implementing, achieving, reviewing

and maintaining the environmental policy of an organization.

Environmental Monitoring

Monitoring and surveillance of the quality of environmental variables identified in the Environmental Impact Assessment, during the installation, development and closure phases of a project

Generating capacity

The total amount of electrical power that a utility can produce at any one time. usually measured in megawatts. Generally expressed in three types of generating capacity: base load, intermediate load, and peaking capacity

Greenhouse gas

A component of the atmosphere that contributes to the warming of the planet. Greenhouses gases include, but are not limited to, carbon dioxide, ozone. methane, nitrous oxide, sulfur hexafluoride and chlorofluorocarbons.

Groundwater

Water found under the terrestrial surface, occupying the empty spaces in the soil, aggregates or geologic formations. The sole source of water for springs and wells

Habitat

A set of physical conditions in a geographical area that surrounds a species or group of species or a large community. With respect to wildlife management. major components of habitat are food, water, cover and living space.

Hazardous substances:

Material with one or more of the following attributes: , explosive. corrosive. reactive or toxic.

Hazardous waste

Wastes that share the properties of a hazardous substance (e.g. flammable, explosive, corrosive. reactive or toxic)

Impact (or effect)

A modification of the existing environment caused by an action of the project, This effect, or impact, may be direct, indirect or cumulative, negative or beneficial

Infrastructure

The services, equipment and facilities needed for a community or project to function such as roads, sewers, water and electrical lines.

Kilovolt (kV) 1,000 volts

The amount of electric force carried through a high-voltage transmission line is measured in kilovolts.

Kilowatt (kW)

The electrical unit of power that equals one thousand watts

Kilowatt hour (kWh)

One thousand watts delivered for one hour.

Leachate

The liquid produced by leaching. If it is produced by waste dumps. it will usually contain contaminants.

Leaching

The process of removing soluble compounds from rock, sediment, soil, waste dumps, etc., through the seepage water

Megawatt (MW)

The electrical unit of power that equals one million watts

Megawatt hour (MWh)

One million watts delivered for one hour.

Migratory species

Species that has a regular migration pattern that crosses the area of influence for the activity, work or project, so that the species resides in the area for only part of the year

Non-compliance

Failure to comply with a specific requirement

pH

A measure of the relative acidity or alkalinity of a solution, expressed on scale from 0 to 14, with the neutral point at 7.0

PM10

Particulate matter with an aerodynamic diameter smaller than 10 micrometers

Preliminary treatment

Removal of debris and large particles of waste water by passing through a sieve and a settling chamber

Primary treatment

A wastewater treatment process that physically removes contaminants by skimming or settling

Protected Area

An officially designated area of land with a restricted or controlled use, to protect a given natural resource

Recycling

A method by which waste generated by industry or individuals, is recovered to be used again. Recovery and processing of waste materials for reuse as raw material.

Runoff

The portion of the rainfall that is not absorbed and flows over the surface of the land towards bodies of water

Scoping

A part of the EIA process that is open to the public early in the preparation of an EIA for determining the range of issues

related to the proposed action and identifying significant issues to be addressed in the EIA.

Secondary treatment

A wastewater treatment process that follows primary treatment and further treats the wastewater using biological processes

Sludge

Semisolid material precipitated by wastewater treatment and collected from the bottom of treatment structures.

Solid waste

Any waste that comes from animal and human activities, which is normally solid and is discarded as useless or superfluous, Includes domestic garbage, inert construction/demolition materials, and residual waste from industrial operations, such as boiler slag and fly ash

Species

All organisms of a given kind; a group of plants or animals that breed together but are not bred successfully with organisms outside their group

Stakeholders

Persons, groups and organizations, who affect or can be affected by the project's actions

Surface water

All bodies of water on the surface of the earth and exposed to the atmosphere such as lakes, ponds, rivers, streams, estuaries and seas

Total suspended solids

A water quality measurement. It is measured by pouring determined volume water through a filter and weighing the filter before and after to determine the amount of solids.

Trace metals:

Metals in extremely small quantities, which are needed by plants and animals for survival but which, if ingested in large quantities, may be toxic. Examples of trace metals are: selenium, arsenic, iron, molybdenum, etc.

Transformer

A piece of equipment, which is most frequently used in use in power systems to change voltage levels

Transmission line

The structures, insulators, conductors and other equipment used to transfer electrical power from one point to another.

Transmission System (Electric):

An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers, or is delivered to other electric systems

Volt

The unit of voltage or potential difference. It is the electromotive force which, if steadily applied to a circuit having a resistance of one ohm, will produce a current of one ampere

Voltage

The force which pushes electricity through a wire

Wastewater

Is water that has been used and whose quality has been modified by the incorporation of contaminating agents?

Water table

The upper surface of an unconfined aquifer. The level at which water will stand in an open well in an unconfined aquifer.

Watt (Thermal)

A unit of power in the metric system, expressed in terms of energy per second, equal to the work done at a rate of 1 joule per second.

Watershed

The land and water within the confines of a drainage divide.

Wetlands

An area of saturated soil and standing water with vegetation that is adapted for life in saturated soil and shallow water conditions. Examples of wetlands are marshes, swamps, lakeshores, bogs, wet meadows and estuaries.

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INTRODUCTION

1.1 OVERVIEW

This report presents the findings of Initial Environmental Examination (IEE) study carried out by Environmental Total Solutions (ETS) for the proposed 6.2MW cogeneration bio-gas power plant being undertaken at Matol (Private) Limited, located at Deh Pannu, Nasar Pur Road. District Matiari, in the Province of Sindh.

The IEE has been prepared in compliance with the provision of Sindh Environmental Protection Act (SEPA) 2014 (Initial environmental examination and environmental impact assessment). The Provisions of SEPA 2014, Part VI. section 17 Clause (1) required that:

"No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies. as the case may be, or. where the project is likely to cause adverse environment effects an environmental impact assessment. and has obtained from Government Agency approval in respect thereof."

1.2 THE PROPOSED PROJECT

The disposal and treatment of distillery liquid waste are major challenges for distilleries using press mud as raw material for the production of ethanol.. Anaerobic fermentation—a superior alternative to composting—provides a unique solution for the management of a wide range of organic substances. Created during anaerobic fermentation, biogas serves as a high-energy, renewable fuel that can be used as a substitute for fossil fuels. Biogas engines not only improve waste management. but also generate an economical energy supply.

The project proposal is for an on-farm anaerobic digestion (AD) plant comprising a system of hydrolyser and a digester to produce biogas, an engine driven electricity generating set (gen set) and other associated equipment to operate and manage the process. The whole project is designed on a pre-leveled area on the facility. This project will establish an environmentally friendly and sustainable form of electricity (and heat) production from the stillage, also known as spent wash once loaded into the digestion

system. The AD process uses naturally occurring bacteria and other microbes to convert organic matter in the feedstock into:

- Biogas, which is an energy rich mixture of methane and carbon
- Biogas, which is an energy rich mixture of methane and carbon dioxide which is suitable for use as a fuel to generate electricity and heat.
- Nutrient rich solid state and liquid state fertilizers to be used on agriculture land.

The resulting biogas is burned in an engine driven generating set (gen set) to produce electricity, mostly for use on the facility with the balance available for export to the grid. The gen set also produces heat in the form of engine cooling water and some of this will be used to heat the hydrolyser's to 50-55^{0}C and to maintain the digester at a temperature of ~ 40-45^{0}C.

Project Mission

To undertake integrated Agriculture + Bio-Energy Projects through optimal utilization of locally available resources.

Project Objectives

Would include the following:

a. Energy Component

- Supply of Electricity from Biogas Engine + Thermal Energy through recovery of Biogas engine waste heat

b. Agricultural Component

- Bio-energy production from distillery stillage and environmental fitting of liquid and solid waste generated

1.3 PROJECT OBJECTIVES

The project aims to produce electricity for supply to HESCO through national grid thus reducing the supply and demand imbalance. The proposed power plant is a standalone power producing unit based on cogeneration fired Boilers along with T.G. Sets.

The main objectives of the Project are to:

- Respond to the urgent need to welfare of general public (supply to the local nearby Hospital) at District Matiari, Sindh.

- Ensure stable power supply to HESCO.
- Provide employment to the local people;
- Respond to the need of improvement in quality of life through sustainable power production systems.

Project Benefits

The major benefit of this project is that it would generate many facilities in the region such as communication, employment and transport. It will also benefit the district by the development of the rural area.

The major share of the district income is from the agriculture sector. Agriculture resources can be used for conversion into value added products.

1.4 NEED OF THE PROJECT

The need to the power project is spelled out by the recent statement of the Chief Executive Officer of the HESCO who held the following as being mainly responsible for fluctuation and tripping in the power generation system:

The position with regard to availability of power has deteriorated and has compelled HESCO to go for forced load-shedding.

Plant Details

The plant details are as under:

1. **General information**
   - (i) Name of applicant: Matol Private Limited, Matiari
   - (ii) Registered Business Office: C-48, Matiari House, KDA scheme-1, Karachi
   - (iii) Plant Location: Nasarpur Road, Matiari
   - (iv) Type of Generation Facility: Ethanol

2. **Plant Configuration**

   (i) Plant Size installed Capacity (Gross ISO): 6200 KWH or 6.2 MWH

   Type of Technology: Conventional Steam Turbine Power Station

3. **Number of units/Size (MW)** **03**
   - (i) Unit# 1 — 1.2 MW Jument Schneider N/A
   - (ii) Unit#2 — 2 MW Lery soomer-france B2613
   - (iii) Unit#3 — 3 MW Toyo Denki-Japan SGD2-AG21-5752

4. **Unit Make & Model**
   (i) Unit# 1: Jument Schneider N/A
   (ii) Unit#2: Lery soomer-france B26137
   (iii) Unit#3: Toyo Denki-Japan SGD2-AG21-5752

5. **De-rated Capacity at Mean Site Conditions 5.6 MW (Based on boiler capacity)**
6. **Auxiliary Consumption 0.15 MW'**
7. **Commissioning/Commercial Operation date**
   (i) Unit# 1 2006
   (ii) Unit#2 2013
   (iii) Unit#3 2015

8. **Expected Life of the Facility from Commercial Operation/Commissioning**
   (i) Unit# 1 15
   (ii) Unit#2 15
   (iii) Unit#3 50

9. **Expected Remaining useful Life of the Facility**
   (i) Unit# 1 5
   (ii) Unit#2 12
   (iii) Unit#3 49

10. **Supply Voltage**
    (i) Unit # 1 400 V
    (ii) Unit # 2 400 V
    (iii) Unit # 3 5500 V

11. **Plant Characteristics**
    (i) Generation Voltage 400 V
    (ii) Power Factor 0.80
    (iii) Automatic Generation Control (AGC)
    (iv) Ramping Rate 3.1 KW/Sec
    (v) Alternative Fuel Natural gas
    (vi) Unit Make & Model: Maguin Interis. France
    (vii) De-rated Capacity at mean Site Conditions: 1000KW

12. **Auxiliary Consumption:**
    (i) None but Diesel Generator of 630 KVA is a standby arrangement
    (ii) Commissioning/Commercial Operation date: 2005
    (iii) Expected Life of the Facility from Commercial Operation/Commissioning:
    (iv) Expected Remaining useful Life of the facility:
    (v) Supply Voltage (11kv/1321kv) in case of 321 kv,

(vi) Distance and name of Grid station: 16 KM, Matiari Grid Station, Jindal Kot

(vii) Provision of Metering. Instrumentation, Protection and control Arrangement's Meter

13. Fuel Details

(i) Primary fuel: Bio-gas

(ii) Alternate fuel: Natural gas, Diesel

(iii) Fuel Source (Imported/Indigenous): Local/Self Generated

(iv) Fuel Supplier: SSGC, PSO, SHELL and Self generation

(v) Supply Arrangement: Through Pipelines. Tankers

(vi) Storage capacity: 02 Tanks

One of 2500 liters capacity

Second 5000 Liters capacity

(vii) Gross Storage: 7500 Liters

(viii) Logistics: Vehicle

Emission Values

Parameters	Primary Fuel	Alternative Fuel
1. SO_x (mg/Nm^3)	410	N/A
2. NO_x (mg/Nm^3)	425	100
3. CO (mg/Nm^3)	800	250
4. Cl (mg/Nm^3)	150	------
5. CO_2	40%	480
6. PM_{10}	500	20

Plant Characteristics

1. Generator Voltage	5500/400
2. Frequency	50Hz
3. Power Factor	0.9 – 0.95
4. Auto Generation Control	Full Automatic
5. Ramping Rate	
6. Alternative Fuel	Natural gas
7. Auxiliary consumption	500 KW
8. Time (s)	15 Sec.

Plant Configuration

a. Installed capacity	6.0 MW
c. Parasitic Load	0.065 MW
d. In House Consumption	1 MW
e. Load Available for HESCO	1.6 MW
f. Type of Technology	Thermal Power Generation
g. Number of Generator	03
h. Capacity of each Generator	

i. Shinko: 3.0 MW
ii. Shinko: 1.0 MW
iii. SKS: 2.0MW

j. Gross Capacity	6.0 MW

Generation Facilities

(i) Installed Capacity Gross ISO:

(ii) De-rated capacity at mean site conditions: 830 KW

(iii) Auxiliary Consumptions: 170 KW

(iv) Net Capacity of the plant at mean site condition

Description of Plant Operation

Sr. No.	Description	Unit	Values
1	Cogeneration Plant Operation	Days	300
2	Boiler Capacity	T/hr	22
3	Boiler operating parameters	Bar(a) CO	25
3	Turbo alternator Extraction cum Back pressure turbine LP	MW	03
4	Gross power generation	MW	03
5	Power consumption	MW	1

The area available for the Matol Power Plant is given below:

Total Plant Area:	02 Acres approx
Bio-Gas storage	01 Acres approx

The plant would be using Bio-Gas generated as byproduct from digesters

1.5 INITIAL ENVIRONMENTAL EXAMINATION (IEE)

The objectives of the study is preparation of Initial Environmental Examination Report based on the EIA notification of 1997 of Pakistan Environment Protection Agency and requirement of concerned regulatory agencies of the State Government, incorporating the study on existing environmental conditions and various environmental issues due to proposed project.

- Assessment of the present status of air, noise, water, land, ecology and socio-economic components of the environment in the study area of the project.
- Identification, quantification, prediction and evaluation of significant impacts of the proposed project on various environmental components during the pre-project stage, construction stage and also after commissioning of the proposed project using mathematical/simulation models.
- Evaluation of the proposed waste disposal scheme for the aforementioned project.
- Identification of forestland, agricultural land, wasteland, water bodies etc. around the area
- Evaluation of the existing Environmental Management Plan (EMP) and preparation of mitigation of anticipated adverse impacts.
- Delineation of the post project environmental quality-monitoring program to be pursued by Reliance Industries Limited, as per the requirements of the EPA.

1.6 JUSTIFICATION ON REQUIREMENT OF IEE

The Pakistan Environmental Protection Agency (Review of EIA/IEE) Regulations 2000 clearly define the categories of projects requiring an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) in Schedules I and II respectively.

According to Para 3 of EIA / IEE regulations-2000: "A proponent of a period falling in any category listed in Schedule I shall file an IEE with the Federal Agency, and the provisions of section 12 shall apply to such project".

According to Para 4 of EIA/IEE Regulations-2000: "A proponent of a project falling in submitting EIA/IEE in any category listed in Schedule II shall file an EIA/IEE with the Federal Agency, and the provisions of section 12 shall apply to such project". Schedule II of the regulations includes "all projects situated in environmentally sensitive areas" and "any project likely to cause an adverse environmental effect."

Power plants generating less than 200MW electricity are placed in Category B (Energy) of Schedule I (List of projects requiring of IEE). In consideration of:

- Low sensitivity of the microenvironment in which the no unit is being sited,
- Impact of different activities including construction. installation, commissioning and operation being confined to and localized into the microenvironment and
- Compliance with the above cited regulations,

The project would be placed in Category B, Schedule I, requiring an IEE study.
Accordingly an IEE study has been conducted and the report will be submitted to Sindh EPA for review and approval.

1.7 SCOPE OF THE IEE

This IEE investigates the impacts likely to arise from the different activities including construction, installation, commissioning and operation of the 13MW Cogeneration (Biomass & Coal) stand alone power generating unit (MATOL), located at Nasrpur Rd., District Matiari, Sindh.

The IEE has been prepared to achieve the following objectives:

- Identification and investigation of likely impacts of the proposed activities during the different phases of construction. installation, commissioning and operations on the physical, biological, and socio-economic environment of the project area;
- Proposal of mitigation measures that would help the proponent in conducting the operations in an environmentally sustainable manner;
- Develop an Environmental Management Plan (EMP of effective implementation of the recommendation of the IEE.

1.8 METHODOLOGY FOR IEE

Review of Legislation and Guidelines

National Legislation, International agreements, environmental guidelines, and best industry practices were reviewed. It included previous environmental studies and environmental basclines conducted by ETS and associated consultants in the past in the project area and / or its surroundings. All data sources were carefully reviewed to collect project area's related information with regard to physical, biological and socio-economic environment

Field Data Collection

During the site visit. primary data and information on the physical, biological and socio-economic background conditions of the microenvironment and macro environment of project area was collected area specific primary information along with their views and concerns regarding the project activities.

Anticipated Environmental Impacts and Mitigation Measures

- Environmental parameters have been identified assessed and used for identification, prediction and evaluation of significant impacts.
- For impact on land and biological components of environment, the predictions have been made based on available scientific knowledge and judgment.

Recommendations to Mitigate Impacts

Keepings impacts which may arise from project related activities were identified; mitigation measures were recommended to minimize. eliminate, or compensate for the potential environmental and social impacts on the zone of influence of the Project. Mitigation measures were recommended on the basis of past experience, best industry practices, legislative requirements and professional judgment.

1.9 ENVIRONMENTAL QUALITY MONITORING IN THE STUDY AREA

Air Quality

The air quality status in the study area is assessed through a network of ambient air quality monitoring locations. The baseline studies for air environment include identification of site and project specific air pollutants prior to implementation of the project.

- Ambient Air Quality Monitoring (AAQM) was carried out at pre-identified locations. Numbers of sampling locations were selected close to the Matol site and in the downwind direction.
- AAQM was carried out as per SEPA guidelines to determine a finer cross-sectional distribution of air pollution in an industrial developed region. The conventional air parameters viz. SO_2, NO_x, PM_{10}, $PM_{2.5}$ was monitored.
- The concentrations have been compared with stipulated standards of NEQS (as per the National Ambient Air Quality Standards Notification,
- Micro-meteorological parameters such as wind speed, wind direction, temperature and humidity were reported including wind direction in the study area. The data were used to

determine predominant meteorological conditions, characterizing baseline status and in prediction of impacts on air environment.

Noise Environment

- Noise standards have been designated for different types of land use, i.e. residential, commercial, industrial areas and silence zones, as per 'The Noise Pollution (Regulation and Control) Rules, 2000, Notified by Ministry of Environmental protection, Government of Pakistan. The ambient noise standards and safe noise exposure limits are presented as Annexure. Different standards have been stipulated during day time (6 am to 10 pm) and night time (10 pm to 6am).
- The residential, commercial, industrial areas and silence zones close to the project site and in the study area have been identified. These locations have been chosen away from the major roads and major noise sources so as to measure ambient noise levels. Noise level measurements were carried out around the proposed plant site. Spot noise levels (A - weighted) were measured using a portable noise level meter.

Water Environment

Surface and groundwater quality has been determined and compared with Drinking Water Standards.

- The parameters of prime importance under physical, chemical (inorganic and organic), and nutrient and heavy metals category were selected.
- The water requirement and water availability in the region will be determined using secondary sources. Water balance in term of water input and output has been computed. The proposed project will have water requirement in terms of DM and cooling water only.

Land Environment

Field surveys were conducted to delineate classification of land-use pattern around the plant site.

Ecology

Flora:

- A team of botanists including biologists identify the plants in the study area through visual observation and recording the plant species as a list in the region. This list will be confirmed by the review of site literature. The data available with various agencies is referred for identifying rare or endangered species in the region.

- The ground area covered by aerial portion of the flora is called its "cover" and is used as a measure of plant's importance. The diameter of tree trunk at breast height (4.5 ft or 135 cm) is used as an expression of cover or dominance. The phyto-sociological data available for the study area are included in the report.
- Qualitatively, flora is assessed by delineating the type, its habitat, unique vegetative features, interrelations or associations with other community members. Plants are also observed for morphological aberrations, if any, due to pollution or any other stress. Plant species are rated visually based on its foliar cover and abundance.

Fauna:

A total of 27 birds species were recorded during the survey through direct sighting or information from locals and Wildlife experts/ staff deployed in the area. During discussions with locals and Sindh Wildlife Department's staff, it was noted that populations of certain bird's species are declining due to human's disturbances particularly due to hunting activities which affect the population of Black partridge

Socio-economic Environment

- Data on the demographic pattern, population density per hectare, educational facilities, agriculture, income, fuel, medical facilities, health status, transport, recreational and drinking water facilities were collected from secondary sources and field visits and analyzed.
- The information on industries, infrastructure facilities such as power supply, water supply, telecommunication, sewerage etc. and transportation such as roads, harbors, railway, airports and navigation were collected from secondary sources and field visits

Environmental Management Plan

- Environmental Management Plan (EMP) is drawn after identifying, predicting and evaluating the significant impacts on each component of the environment with a view to maximizing the benefits from the project. Post-project.
- Environmental Monitoring programme is also delineated in the report.
- Thus, the report has been prepared in accordance with the guidelines of EPA, Sindh as amended from time to time and with the scope of studies given in ToR issued by EPA, Sindh.

Compliance of ToR

The EIA report is prepared based on the primary data and data collected from secondary sources. The issues given in the ToR of EPA. Sindh is fully addressed and point-wise compliances are given in the report.

Reporting

In the end, all activities / steps performed during IEE study were documented in shape of IEE report: it was compiled in the format / guideline given by Pakistan Environmental Protection Agency (PEPA) in Pakistan Environmental Assessment Procedures, 1997.

1.10 ORGANIZATION OF THIS REPORT

The report is organized in following chapters;

STRUCTURE OF THE AUDIT REPORT

Chapter 1 Introduction

Chapter 2: Pakistan's Environmental Policy & Regulations Affecting Industry

Chapter 3: Description of the Environment

Chapter 4: Overview of Biogas Technology

Chapter 5: Review of Alternatives

Chapter 6: Anticipated Environmental Impacts & Mitigation Measures

Chapter 7: Environmental Management Plan

Chapter 8: Conclusion

PROPONENT DETAILS

Contact Person	Dost Muhammad Baloch
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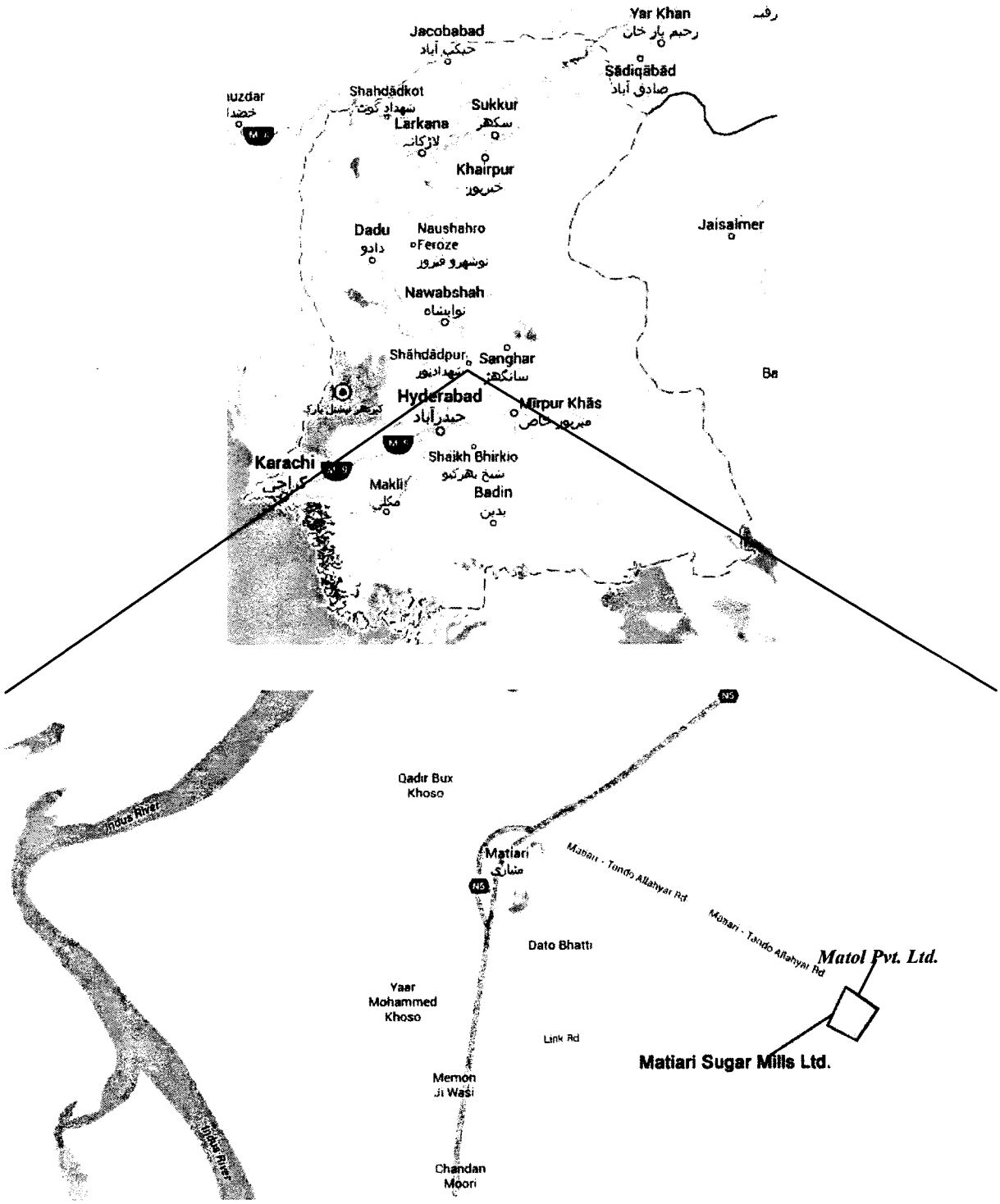
Telephone Fax	Phone #: 00-92-222-619925 / 760762 00-92-222-760507
Email	factory@matiarisugar.com
Coordinates	25° 36' 0" North. 68° 27' 0" East
Type of Industry	Manufacture and Sell of Ethanol
Production Capacity	6.0 MW
Environmental Consultant	Environmental Total Solutions (ETS) Office No. 1. Aqsa Tower, Main Rashid Minhas Rd., Karachi. Contact: 0333-2277350 Email: Etspk41@yahoo.com, iqbalh41@yahoo.com

SATELLITE MAP OF MATOL PVT. LTD.



PAKISTAN'S ENVIRONMENTAL POLICY & REGULATIONS AFFECTING INDUSTRY

2.1 PREFACE

Effective environmental policy and regulations have a potentially greater impact on industries than industrial policy itself because they attempt to directly address the environmental problems at the source and force industries to internalize environmental costs. This chapter reviews Pakistan's environmental policy and regulations affecting industrial pollution.

Environmental Legislation

The Constitution of the Islamic Republic of Pakistan itself contains no statement of principles or policy about the rights and obligations of the state and its citizens with respect to the environment. It does however confer concurrent legislative power on the Federation and the Provinces to legislate in respect of environmental pollution and ecology.

Prior to promulgation of Pakistan Environmental Protection Ordinance (PEPO) of 1983 and the recent passage of Pakistan Environmental Protection Act (PEP-Act) 1997, Pakistan had laws that contain provisions for environmental protection. These laws dealt with land use, water quality, air quality, noise, toxic and hazardous substances, solid waste and effluents, marine & fisheries, forest conservation, mineral development, energy, public health, etc. They were not effective; punishment for violations was mild and easy to circumvent. The laws included:

- The Pakistan Penal Code, 1860
- The Canal Drainage Act, 1873
- The Motor Vehicles Ordinance, 1965; and The Motor Vehicles Rules, 1969
- The Factories Act, 1934
- The West Pakistan Fisheries Ordinance, 1961
- The Forests Act, 1927
- The Boilers Act, 1923
- The Pakistan Petroleum (Exploration and Production) Rules 1986
- The Antiquities Act, 1975
- The West Pakistan Epidemic Diseases Act, 1959, etc.

The Environmental Protection Ordinance (PEPO) No XXXVII of 1983

Before the Pakistan Environmental Protection Act of 1997 (PEP-Act, 1997), PEPO of 1983 was the only piece of Pakistani legislation dealing specifically with the environment, and it was the principal statement of Pakistan's national commitment in the field of environment. Its objective was "to provide for the control of pollution and the preservation of the living environment" in Pakistan.

The key components of this Ordinance are as follows:

- The establishment of a high level Environmental Protection Council (PEPC) at the federal level to form national environmental policy and ensure enforcement of National Environmental Quality Standards (NEQS);
- The establishment of Federal Environmental Protection Agency (FEPA), under MoELG&RD, headed by a Director General, with wide ranging functions including powers to set and enforce National Environmental Quality Standards (NEQS). These
- Include the preparation and coordination of environmental policy.

The Ordinance was designed to establish an environmental policy and management structure and to install the Environmental Impact Statement (EIS) as the central component of environmental protection in Pakistan. Under clause 8 of PEPO, Environmental Impact Assessments (EIAs) are required for all projects that may pollute the environment. Essential elements of an EIA are measures to identify, tackle and monitor adverse environmental impacts of a project during design, construction and operation.

2.2 PAKISTAN ENVIRONMENTAL PROTECTION ACT, 1997

PEP-Act of 1997 is an improvement over PEPO of 1983. The Act provides for sustainable development through the protection, conservation, rehabilitation and improvement of the environment.

After the passage of PEP-Act 1997, the following major steps have been taken:

- The Pakistan Environmental Protection Council (PEPC) was re-constituted to give more representation to provinces, trade and industry and NGOs.
- Two Environmental Tribunals have been set up, one in Lahore and the other in Karachi. The
- Karachi Tribunal has its jurisdiction in the Provinces of Sindh and Balouchistan, while the Lahore Tribunal has jurisdiction over the Provinces of Punjab, KPK and Federal Capital Territory.

- Three of the four provinces have designated Environmental Magistrates under the provision of Section 24 of the PEP-Act 1997.
- The Federal Government has delegated powers to the provincial governments for implementation of the Act.
- A system for self-monitoring and reporting for industry has been developed, which includes a
- Self Monitoring and Reporting Tool (SMART). SMART is a software and information package to streamline data reporting. This would facilitate monitoring and networking with industries and Federal and Provincial EPAs.
- A National Coordination Committee headed by the Director General, Pakistan Environmental
- Protection Agency has been constituted under Section 7(k) of the PEP-Act, 1997 to supervise implementation of environmental policies and enhance inter provincial coordination.
- Analytical methods and sampling procedures have been formulated.

2.3 NATIONAL ENVIRONMENTAL QUALITY STANDARDS

One of the functions of Pak-EPA under the provisions of PEPO of 1983 was to issue NEQS for municipal and liquid industrial effluent, industrial gaseous emissions and motor vehicle exhaust and noise. The Pak-EPA, however, did not issue a Statutory Regulatory Order (S.R.O) until 1994. It required all units coming into production after 1st July 1994 to comply immediately with the new standards. Those already in production at the time of the S.R.O. were required to comply starting 1st July, 1996.

With the PEP-Act of 1997, the Pak-EPA revised the NEQS with full consultation of the private sector: industrialists, trade and business associations and NGOs. The municipal and liquid industrial effluent standards cover 32 parameters. The standards for industrial gaseous emissions specify limits for 16 parameters, and the standards for motor vehicles prescribe maximum permissible limits for smoke, carbon monoxide and noise. Revised standards cover discharge limits of effluents into inland water, sewage treatment plants (where these are operational) and the sea.

Self Monitoring and Reporting System

The self-monitoring and reporting system (SMRS) of the Pak-EPA takes into account the resources and interests of both the EPA and industry. It classifies industries into categories A, B, and C, each corresponding to a specified reporting frequency. Category A industry will report their

effluents and emission levels every month, Category B industry quarterly and Category C industry biannually. Industries must have their effluents tested by a Pak-EPA certified/accredited laboratory and enter the results in the electronic forms included in the software package. The data must be sent to the respective provincial EPA via email or on a floppy disk. Sampling and analysis requirements and procedures and the reporting format are also prescribed.

SMRS makes the country's industry owners and operators responsible for systematic monitoring and reporting of their environmental performance, saving EPAs expense, time and effort, as well as enabling industry to make long-term provisions for environmentally friendly production. Pak-EPA started implementation of SMRS with SMART on a pilot basis on 1st January 2000.

Pollution Charge Programme

The modalities for the implementation of the pollution charges have evolved through a unique process of coordination among representatives of industry, government, environmental NGOs and academic researchers. The consensus of all stakeholders has been to adopt a market based approach, i.e. a pollution charge or tax combined with fiscal incentives to industries, rather than a command and control approach through regulations to ensure compliance with NEQS. Appreciable progress has been made towards operationalising the process. Unfortunately, the January 1999 date for commencing implementation was exceeded due to procedural and departmental hurdles.

The pollution charge payable by an industrial unit will be determined in accordance with guidelines to be prepared by the Pak-EPA. Industrial units liable to pay the pollution charge will themselves be responsible for ensuring the correct calculation, reporting and payment.

Pakistan Environmental Assessment Procedures

Pursuant to the provisions of PEP-Act of 1997, all Government ministries, departments, agencies, and establishments and private sector project sponsors are required to prepare Initial Environmental Examinations (IEEs) and Environmental Impact Assessments (EIAs) prior to the approval of their proposals for projects. The primary purpose of the environmental assessment process is to provide proponents and decision makers, as well as members of the public, with an understanding of the potential environmental effects of proposed action, so as to avoid or minimize adverse effects, bearing in mind the costs and benefits of using the environmental resource in this particular project wherever possible. Pak-EPA has developed a complete package

of Environmental Assessment Procedures. It has also developed IEE/EIA regulations (1998) for implementation of EIA process.

Environmental Policy Initiatives

Two major policy initiatives, the Pakistan National Conservation Strategy (NCS) and the World Bank funded Environmental Protection and Resource Conservation Project (EPRCP), were launched in 1992. The NCS started with the ambitious goal to transform the basic approach to development, ensuring that it does not destroy the natural resource base on which it rests. The aims of EPRCP were twofold: upgrading and strengthening of Pakistan's environmental protection institutions and the rehabilitation of several watershed and rangeland areas.

The Pakistan National Conservation Strategy and its Implementation Status

The major objectives of the NCS were improved efficiency in the use and management of resources, conservation of natural resources and sustainable development. The NCS had a clear set of priorities and 14 core program areas for implementation during the 1990s. In addition, a total of 68 specific programs were identified in these areas, each with a long-term goal and expected outputs and resource investments required within the next decade. Each program also had communication, extension, research and training components. Pakistan's 8th (1993-98) and 9th (1998-2003) Five-Year Plans have been developed keeping in view the overall development framework envisaged in the NCS.

Environmental Planning and Resource Conservation Project

This project aims to initiate the upgrading and strengthening of Pakistan's environmental protection institutions and also the rehabilitation of several watershed and rangeland areas. Again, it is difficult to make an assessment of this initiative because of poor monitoring mechanisms. However, the information that exists indicates that many of its objectives were achieved.

2.4 CONSTITUTIONAL PROVISION

Prior to the 18th Amendment to the Constitution of Pakistan in 2010, the legislative powers were distributed between the federal and provincial governments through two lists" attached to the Constitution as Schedules. The Federal list covered the subjects over which the federal government had exclusive legislative power, while the „Concurrent List" contained subjects regarding which both the federal and provincial governments could enact laws. The subject of "environmental pollution and ecology" was included in the Concurrent List and hence allowed both the federal and provincial governments to enact laws on the subject. However, as a result of

the 18th Amendment this subject is now in the exclusive domain of the provincial governments. The main consequences of this change are:

- The Ministry of Environment at the federal level has been abolished. Its functions related to the national environmental management have been transferred to the provinces. The international obligations in the context of environment will be managed by a new ministry, the Ministry of Climate Change.
- The PEPA 1997 is technically no longer applicable to the provinces. The provinces are required to enact their own legislation for environmental protection. Under the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, provide the necessary details on the preparation, submission, and review of the IEE and the EIA Regulations, 2014.

2.5 THE SINDH ENVIRONMENTAL PROTECTION ACT, 2014, SINDH ACT NO.VIII OF 2014

The legislative assembly of Sindh province of Pakistan passed the bill on 24th February 2014 to enact Sindh Environmental Protection Act 2014. The Act envisages protection, improvement, conservation and rehabilitation of environment of Sindh with the help of legal action against polluters and green awakening of communities.

The Sindh Environmental Protection Act, 2014 is the basic legislative tool empowering the Government of Sindh to frame regulations for the protection of environment.

The Act is broadly applicable to air, water, soil and noise pollution, as well as to handling of hazardous wastes. Penalties have been prescribed for those who contravene the provisions of the Act. The power of the Sindh Environmental Protection Agency (SEPA) was also considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental laws either of their own accord, or upon the registration of a complaint.

Under section 17 of Act, no project involving construction activities or any change in the physical environment can be commence unless the fulfillment of prerequisite i.e. to conduct IEE or EIA and a report submitted to the Sindh EPA.

The salient features of the law are:

- The Act covers the air, water and soil, marine and noise pollution including pollution caused by vehicles.

- The Act provides for fixing the Sindh Environmental Quality Standards (SEQS) and their strict enforcement. For default. the Government has been empowered to levy a pollution charge.
- The Government has been empowered to issue environmental protection orders so as to effectively deal with and respond to the actual or potential violation of the law leading to environmental degradation.
- Under this Act no project including construction activities or any change in the existing physical environment can commence unless the fulfillment of pre-requisite to IEE to EIA has been conducted and its approval obtained from the responsible Authority, in the present case from Sindh EPA.
- The imports of hazardous waste into the country has been banned and the transport of hazardous substances and dangerous chemicals or toxic material or explosive substances etc. has been regulated, through licenses, under prescribed rules and procedure.
- The ensure compliance with the SEQS, the law provides for an appropriate mechanism including the installation of devices so as to control the pollution caused by motor vehicles.
- A fairly high level body called, Sindh Environmental Protection Council, headed by the Chief Ministers of the province, relevant Minister of the provincial governments, representative of trade, commerce and industry and members of the academia, has been constituted to formulate policy and provide guidelines for enforcing the law.
- For the effective implementation of the provisions of the law, the Sindh Environmental Protection Agency, headed by a Director General with other staff has been constituted; this agency is responsible for enforcing the policy and implementing the provisions of the law. On the same pattern,
- There has been established Provincial Sustainable Development Fund, regulated and managed by a Board.
- The Environmental Tribunals with exclusive jurisdiction to try serious offences have been provided. The law also provides for the appointment of Magistrates to try minor offences. Appeal against an order / judgment of a Magistrate lies before the Court of Session, whose decision is final. Appeal against the Tribunals lies to the High Court. Stringent punishment through heavy fine and imprisonment has been prescribed.
- The Act also empowers the Provincial Government to make rules for the implementation of international environmental agreements and conventions to which Sindh is Party.

A number of rules and regulations have been promulgated under the SEP Act 2014. These are:

- Environmental Samples Rules, 2014
- Pollution Charge for Industry (Calculation and Collection) Rules, 2014
- Provincial Sustainable Development Fund Board (Procedure) Rules, 2014
- Sindh Environmental Quality Standards (Certification of Environmental Laboratories) Regulations, 2014
- The Sindh Environmental Quality Standards (Self monitoring and Reporting by Industry) Rule, 2014
- Sindh Environmental Quality Standards (SEQS)

2.6 SINDH ENVIRONMENTAL QUALITY STANDARDS (SEQS)

In exercise of the powers conferred by section 36 of the Sindh Environmental Protection Act, 2014, Sindh Environmental Protection Agency with the approval of the Government of Sindh, promulgated Sindh Environmental Quality Standards (Self-Monitoring and Reporting by Industry) Rules, 2014. The following standards are specified therein:

- Maximum allowable concentrations of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers)
- Maximum allowable concentrations of pollutants (16 parameters) in gaseous emissions from industrial sources

Sectoral Guidelines for Environmental Reports

These guidelines identify the key environmental issues that need to be assessed as well as mitigation measures and project alternatives to be considered in the actual EIA. These guidelines include:

- Sector overview of the industry and the processes
- Potential impacts on the environment
- Mitigation measures
- Monitoring and reporting
- Management and training
- Checklist of likely environmental impacts and mitigation measures

Guidelines for Sensitive and Critical Areas

These guidelines identify sensitive and critical areas in Pakistan in relation to both the natural environment and the cultural aspects.

2.7 INTERNATIONAL REQUIREMENTS

The Asian Development Bank (ADB) Environmental Assessment Process

The Asian Development Bank (ADB) introduced EIA requirements in 1992. The ADB "Environmental Assessment Guidelines" were published in 2003. Since 1994, the ADB has approved a number of policies to guide its project and policy cycles as well as to ensure accountability of borrowing countries, project proponents, and the Bank itself. The policies can be categorized into three: safeguards, sector and others.

The Safeguard Policies include the Environment (2002). Indigenous Peoples (1998) and Involuntary Resettlement (1995) policies. All three Safeguard Policies are due for revision and ADB intends to address emerging environmental and social challenges of development in its Developing Member Countries (DMC). Sector Policies include Energy (2000), Fisheries (1997), Forestry (1995), Water (2001), etc. Among the other important policies are the Public Communications Policy (2005) and ADB Accountability Mechanism (2004). According to Asian Development Bank, "Safeguard Policy Statement 2009":

ADB Environmental Policy: The ADB Environmental; Policy addresses five main challenges. According to the ADB, the Environmental Policy is based on its Poverty Reduction Strategy and Long-Term Strategic Framework. The area around the proposed project site has a sensitive environment comprising prime agricultural soils, human settlements, Cholistan desert biodiversity, mango orchards and cultural sites. Because of strict compliance with the environmental management system during the operational phase of the plant, all environmental aspects including stack gaseous emissions as well as particulate matter will remain well within the prescribed limits of the World Bank Standards. All effluents will be treated to meet the requirements of the World Bank Standards. Noise levels will also conform to the World Bank limiting values. Solid waste will also be disposed off in environmentally sustainable manner and necessary documentation will be maintained. Most likely, it will be done through a contractor, who will be provided due information about the wastes to be disposed by him. A record of the wastes will be maintained to tackle any eventuality likely to occur. The overall environmental aspects of the proposed project will be managed according to Environmental Management Plan and Environmental Management Monitoring Plan.

The EIA provides an assessment of the potential impacts of the project and compares them to feasible alternatives. Mitigation measures are provided to be incorporated during construction and operational stages of the project in order to make the project environmentally friendly.

2.8 THE WORLD BANK ENVIRONMENTAL ASSESSMENT PROCESS

The principal international guidance utilized in assessing the significance of impacts from the proposed development, and for determining content and form of reporting from the World Bank was also utilized.

World Bank Operational Policies OP4.01 Environmental Assessment (January 1999):

This sets out the World Bank's policy on projects requiring an EIA and defines what the assessment is designed to achieve and what issues must be considered. It also sets out guidance for screening projects and identifies other World Bank guidance and policies that may be relevant.

World Bank – Pollution Prevention and Abatement Handbook (1998):

This handbook sets out the basic principles that are considered appropriate to evaluating and controlling pollution from any defined project. The handbook provides guidance on pollution management and sets out generic environmental standards for air. water and soil pollution. This handbook also provides sector guidance. Of most significance to this project is the guidance for Thermal Power: Guidelines for new plant (July the environmental assessment undertaken in this report also utilizes The World Bank guidelines presented in the "Pollution Prevention and Abatement Handbook" effective July 1998.

International Finance Corporation (IFC) Policy and Performance Standards on Social and Environmental Sustainability

The IFC applies the Performance Standards 1 to 8 to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. Environmental Assessment is the primary administrative tool to integrate environmental considerations into decision making of all types of development initiatives such as formulating policies, programs and project funding.

2.9 INSTITUTIONAL FRAMEWORK

The capability of regulatory institutions for environmental management largely, ensures the success of environmental assessment for ensuring that development projects are environmentally sound and sustainable. For decision-making and policy formulation relating to environmental and conservation issues, the institutional framework, as it exists in Pakistan, is described below:

Federal Government Institutions

The Ministry of Environment, Government of Pakistan, deals with the environment and wildlife issues at the federal level. Within the Ministry, the National Conservation Strategy (NCS) Unit, established in 1992, is responsible for overseeing the implementation of the Strategy.

Two organizations, the Pakistan Environmental Protection Council (PEPC) and the Pak-EPA, are primarily responsible for administering the provisions of PEPA, 1997. The PEPC oversees the functioning of the Pak-EPA. Its members include representatives of the government, industry, non-governmental organizations, and the private sector. The Pak-EPA is required to ensure compliance with the SEQS, establish monitoring and evaluation systems, and both identify the need to, as well as initiate legislation whenever necessary. It is thus the primary implementing agency in the hierarchy. The provincial EPAs are the provincial arms of the federal EPA, which is authorized to delegate powers to its provincial counterparts. One of the functions delegated by the Pak-EPA to the provincial EPAs is the review and approval of environmental assessment reports.

Provincial Government Institutions

Each province has its own Environmental Protection Ministry, with a Secretary Incharge. Under the Ministry, the Environmental Protection Agency (EPA) functions with the Director General as In charge to carry out all functions related to environmental issues. Environmental Protection Agency (EPA) is under the Minister. The provincial EPAs control planning and developments of the new development projects, and are responsible for the approval of the EIA and IEE. The Sindh Environmental Protection Agency (SEPA) is the provincial agency responsible for the environmental protection and pollution control in the province of Sindh. Accordingly, the proposed project falls in the jurisdiction of SEPA. The IEE report for this project was prepared according to the Guidelines as approved by the Federal Ministry/Pak EPA and being followed by all the four provincial EPAs, is submitted to the Sindh EPA for Environmental Approval (EA)/ No Objection Certificate (NOC) for the project.

International and National Non-Governmental Organizations

International and national Non-Government Organizations (NGOs), such as the International Union for Conservation of Nature and Natural Resources (IUCN) and the World Wide Fund for Nature (WWF), have been active in Pakistan for some time. Both of these NGOs have worked closely with the governments at the federal as well as provincial levels and have positively contributed to the cause of environment. They have played significant roles with regard to the formulation of environmental and conservation policies. Another prominent NGO is the "Sustainable Development Policy Institute (SDPI)" which has also played a very significant role in upholding the cause of environmental protection in Pakistan. Environmental NGOs have been particularly active in the advocacy for promoting sustainable development approaches. Most of the government's environmental and conservation policies, even at the provincial and federal

levels have been formulated in consultation with these leading NGOs, who have also been involved in drafting new legislation on conservation.

International Framework

For the assessment of the environmental impacts of the proposed project on air, water and noise according to the international legal framework, this report has also incorporated the "Pollution Prevention and Abatement Handbook" by the World Bank Group that became effective in July 1998. Within this handbook, different guidelines are mentioned for the purpose of assessing industrial facilities with respect to their environmental compliance. The guidelines for new thermal power plants are applicable for the preparation of this environmental impact assessment.

DESCRIPTION OF THE ENVIRONMENT

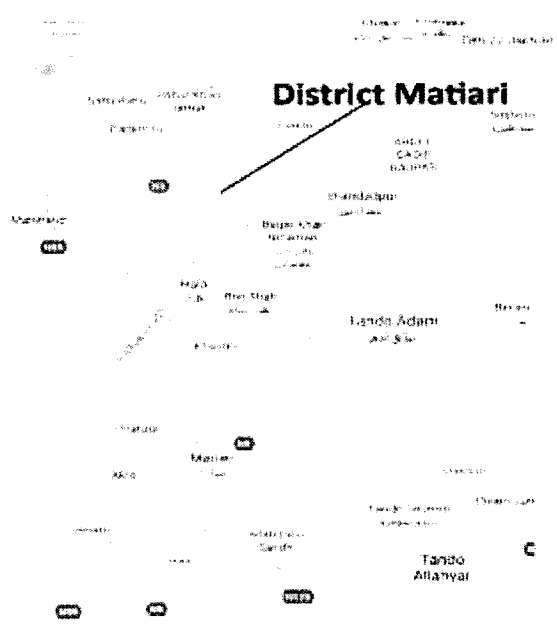
3.1 INTRODUCTION

The existing physical, biological, and socioeconomic environmental conditions of the project area are described in this section. Information for this section was collected from a variety of sources, including published literature, reports of other studies conducted in the area, and surveys conducted specifically for this study.

The purpose of reviewing published literature was to gather information on the environmental setting and the work already carried out in the area. The relevant literature was of the previous studies conducted in the project area or in areas with a similar geographical and ecological setting. A complete list of references is provided at the end of this report.

3.2 DISTRICT MATIARI

Matiari was previously a taluka of district Hyderabad. On the 4th of May 2005, this taluka was separated from Hyderabad and was awarded the status of a district. The district lies in 68° 14" 8' to 68° 14" 40' east longitudes to 25° 26" 20' to 26° 5" 43' north latitudes. The district is bounded by district Sanghar on the east, district Jamshoro on the west, district Shaheed Benazirabad on the north and district Hyderabad and Tando Allahyar on the south with River Indus in-between, spread over an area 1417 Sq. Kilometer.



3.3 DEMOGRAPHY

Population Characteristics

Pakistan is among those four countries where life expectancy for female, at birth, is less than that of males, and as such the male population outnumbers the female population. Sex ratio in Matiari is 108 male per 100 females, which is more than the ratio at the National level, which is 106:100. Matiari has 52 percent male and 48 percent female population. Though 85 percent of the total population resides in rural areas and remaining 15 percent resides in urban areas. There could be some other socio economic reasons for such a difference in male to female ratio, research has shown that there are three major contributing factors for this higher male/female ratio

Table 3.1: Estimated Population of District Matiari for 2014

Age group (in years	*TOTAL*			*RURAL*			*URBAN*		
	BOTH SEXES	*MALE*	*FEMALE*	*BOTH SEXES*	*MALE*	*FEMALE*	*BOTH SEXES*	*MALE*	*FEMALE*
All ages	834,660	433,507	401,153	708,021	367,783	340,238	126,639	65,724	60,915
00-04	131,036	67,089	63,947	113,226	58,083	55,142	17,810	9,004	8,805
04 -09	134,589	70,887	63,700	115,682	61,016	54,666	18,905	9,871	9,034
10-14	95,994	53,531	43,464	81,196	45,137	36,059	15,797	8,394	7,405
15-19	85,467	42,475	42,993	71,376	35,357	36,019	14,093	7,118	6,973
19-24	82,401	39,379	43,023	69,544	32,840	36,705	12,858	6,539	6,318
25-29	66,841	34,769	32,072	56,523	29,276	27,247	10,319	5,495	4,825
30-34	50,846	27,975	22,871	42,735	23,562	19,173	8,111	4,413	3,697
35-39	35,925	18,770	17,155	30,066	15,679	14,388	5,860	3,092	2,767
40-44	38,280	18,905	19,374	32,230	15,951	16,281	6,049	2,956	3,094
45-49	29,548	15,899	13,649	24,850	13,419	11,431	4,698	2,479	2,218
50-54	24,916	13,243	11,672	20,978	11,215	9,762	3,939	2,027	1,910
55-59	15,951	8,882	7,069	13,395	7,474	5,921	2,555	1,408	1,146
60-64	15,309	8,071	7,238	13,000	6,866	6,134	2,309	1,205	1,104
65-69	8,569	4,749	3,820	7,192	3,969	3,223	1,377	780	597
70-74	7,931	3,848	4,083	6,893	3,354	3,540	1,037	496	543
75 & above	10058	5,034	5,024	9,136	4,589	4,547	922	445	478

3.4 PHYSICAL RESOURCES

Topography, Geography, Geology, and Soils

Topography

Sindh can be divided into four distinct parts topographically i.e. Kirthar range on the west; a central alluvial plain bisected by the Indus river in the middle, a desert belt in the east and the Indus delta in the south.

Geomorphologically the 9.538 km^2 land area is part of Lower Indus Plain. more specifically flood plain of the Indus River system which is a vast alluvial plain that runs along the Indus River. As such the Project area consists of flat land that slopes towards the river. Protective bunds or dykes had to be provided in view of the devastating floods of the past which used to submerge at least 20 to 40 km land on either side of the bank. The western boundary of the Project area and also of the Hala Reserved Forest area has accordingly been dyked. The average elevation of the area is 50 m above mean sea level.

Geography

The district lies in 68°14"8'to 68°14"40'east longitudes to 25°26"20'to 26°5"43'north latitudes. The district is bounded by district Saangharon the east, district Jamshoro on the west. district Shaheed Benazirabad on the north and district Hyderabad and Tando Allahyar on the south.The whole district is irrigated through canals and the river. The plane lands of Matiari are very fertile and productive. Indus River flows alongside the western border of the district. The lands along the river are formed of silt and sandy loam. Being in the Indus basin, this district has hardly any barren lands. Only a few lands (as seen in the irrigation map below) are barren while the rest are quite fertile croplands. The climate of the district is moderate as a whole. The months of May and June are very hot during the day with maximum and minimum temperatures being 41°C and 26°C respectively. However, due to pleasant breeze, the temperature falls abruptly as the night falls. December and January are the coldest months with maximum and minimum temperature of 25°C and 11°C.

Geology

The geology of Sindh is divisible in three main regions, the mountain ranges of Kirthar. Pab containing a chain of minor hills in the west and in east it is covered by the Thar Desert and part of Indian Platform where the main exposure is of Karonjhar Mountains, which is famous for Nagar Parkar Granite. In the north Sindh is enquired by rocks of Laki range extending to Suleiman range and its southern most part is encircled by the Arabian Sea. The rocks exposed in

this area belong to upper Cretaceous which is recent in age. The sub-surface rocks are about 20,000 feet thick and belong to Cretaceous and Pre-Cretaceous periods. Mostly the rocks are of sedimentary origin of clastic and non-clastic nature and belong to marine, partly marine and fluviatile depositional environments.

Basin wise Sindh lies in the lower Indus Basin and its main tectonic features are the platform and fore deep areas. Thick sequences of Pab sandstone of Upper Cretaceous, Ranikot Group (Khadro, Bara, Lakhra) of Paleocene, Laki, Tiyon, and Khirthar of Eocene age, Nari Formation of Oligocene, Gaj Formation of Lower to Middle Miocene, Manchar of Upper Miocene to Pliocene, Dada Conglomerate of Pleistocene are present in various areas of Sindh. Limestone and sandstones are the most dominant sedimentary rocks in the area. Structurally Sindh generally contains gently folded anticlinal features trending in north-south direction. The major active faults in province are as under:

Surjani Fault: N-S Trending. Located west of Larkana. It cuts Quaternary deposits. The maximum magnitude of the earthquake associated with the fault is of the order M=6.1 on Ritcher Scale.

Jhimpir Fault: N-W Trending. A number of epicenters are located on the fault. The fault has produced an earthquake of M=5.6 on Ritcher Scale.

Pab Fault: NN-W Trending. Located in the eastern part of Pab range. The maximum magnitude of the earthquake associated with fault is of the order M=7.0 on Ritcher Scale.

Rann Of Kutch: E-W Trending The fault has produced an earthquake of the order M=7.6 on Ritcher Scale. Recent studies have revealed that this fault traverses the Karachi Metropolitan Area.

Geologically, the section of the district Matiari, where the project operating, forms part of the Southern Indus Basin that is located south of the Sukkur Rift and west of the Indus and the meandering of the plain slows down.

Soil

The soil of the area is generally loamy and clayey and has been formed from Indus River alluvial deposits. Agricultural soils in the Project area are associated with irrigation and dry land agriculture and hence are fine in texture, rich in organic matter and nutrients as a result of their history of cropping, ploughing and fertilizer additions.

Soils of the surface layer to a depth of 2 m on the land of the Project area is composed of dry. soft and loosely packed clay. sand and silt. with a solid layer of clay and sandstone to a depth of approximately 20 m. A typical analysis of samples from the area shows that sulphate and chloride the parameters of concern for the integrity of concrete structures and plastic service pipes. are low.

Climate and Hydrology

Climate of the Hala, District Matiari can be described as hot and arid, characterized by low rainfall (less than 250 millimeters per annum) and absence of a well-defined rainy season, and high temperatures.

The climate of Matiari District that forms the macro environment of Hala Block can be described as moderate. The months of May and June are very hot during the day with maximum and minimum temperatures of 42°C and 26°C respectively. This is followed by abrupt falls in temperature during the night with pleasant breeze which makes nights comfortable. December and January are the coldest months with maximum and minimum temperature of 25°C and 11°C. Sometimes cold winds from Baluchistan make the winter severe and the temperature falls below 8°C.

The arca is exceedingly dry with mean annual rainfall averaged over a thirty four year period being less than 88mm. The available data indicate that there are two wet seasons: the first with low rainfall in February and March (with mean monthly rainfall of 6mm and 5mm respectively) and second with higher rainfall in the monsoon period of July, August, and September (with mean monthly rainfall of 45mm, 21.3mm and 10.5mm respectively). Approximately 78% of the mean annual rainfall occurs in the two wet seasons with 72% occurring in the monsoon season. The heaviest recorded rainfall in a given day is 184.5mm in the month of July.

The wind direction is generally NE (November to April) in winter and SW in summer (May to September). Dust storms are not frequent in the area. Hot winds blow during the months of June and July.

Humidity varies, highest about the end of August which is much less in May when the air is uncomfortable dry. Fogs are common in the cold season. Climate will have little bearing on the minor environmental impacts from the installation of transformers in the extension and augmentation subprojects.

Groundwater and Water Supply

The water resources of the macro environment of Hala are limited to canal water supply and groundwater extraction with tube wells.

Groundwater is being used to supplement the shortfall in the supply of irrigation water. Every field in the Project was found during the survey to have a tube well which was being operated due to short supply being experienced during recent years. However, operation of the tube wells irrigation channels flowing through the area.

Groundwater in the project area is generally shallow, and is very significantly affected by the irrigation system, which consists of canals fed by the Indus. The groundwater depth has been found to vary during recent times when the Indus flow has reduced to its extensive use upstream.

There is an acute shortage of safe drinking water in all the villages. Ground water level is deep at about 30 ft. Water available from canal distributaries is of good quality but is not safe for drinking since it has not been upgraded to be considered safe for drinking and fit for human consumption.

Groundwater sources exist in the area and potable water is available. The local population is generally reliant on supply from the hand pumps in rural areas while in urban areas population is using drinking water from piped water supply scheme.

Surface water

Hala being on the flood plain of the Indus receives its supply of freshwater indirectly from the canal distributaries. Indus River flowing to the west of the project area are directly or indirectly providing the surface water resource of the project area. The Indus is in flood during July and August. In the past it used to overflow the banks and inundate the riverine areas. The damages done to crops and property year after year led to construction of embankments.

This action contained the floods but also to gradual clearance of land for organized agriculture in the flood plain area towards the embankment and also beyond the embankment on the west and beyond the Highway N5 on the east.

Agricultural land in Hala area is irrigated with water from the network of branch canals and watercourses that lead from these canals irrigating the agricultural land in and around the project

area. Most of the project area canals, branch canals and watercourses are unlined and require periodic maintenance.

Air Quality

Air quality in most of the project area appears good based on observation during the study period. Emissions should be controlled at source under the EMP. There will be a few items of powered mechanical equipment to be used in the construction of the GSS works that may give rise to complaints of dust and other emissions; however these should be minor and easily dissipated. Domestic sources of air pollution, such as emissions from wood and kerosene burning stoves as well as small diesel standby generators in some households, are minor.

Although there are some sugars mills/industries but there are no other industrial pollution sources in the vicinity of Hala Road. Air quality in the project area appeared very well during the study period. Air quality measurements in major urban centers revealed that CO, SO_2 and NO levels were in excess of the acceptable levels in some areas but the average levels were found below WHO standards.

The other major source of air pollution is dust arising from construction and other ground or soil disturbance, during dry weather, and from movement of vehicles on poorly surfaced or damaged access roads. It has been observed that dust levels from vehicles may even be high enough to obscure vision significantly temporarily.

Noise

Noise from vehicles and other powered mechanical equipment is intermittent. Based on professional experience background daytime noise levels are probably well below 55dB (A)

3.5 BIOLOGICAL RESOURCES

Wildlife, Fisheries and Aquatic Biology

The resident fauna of the project area belong to the oriental region but has since vanished. A variety of mammals, birds, reptiles, and amphibians are reported to have had their habitat in the project area. The entire project area was surveyed to estimate the population of the wildlife species. None of the wildlife species were sighted during the survey as none of the main reported species including the hog deer, wild boar, Bengal fox, Indian crested porcupine and Asiatic jackal were sighted or reported in the project area.

The hog deer is vulnerable ungulate species that was the key species of the Hala area and reserve forest present in the project area. Due to habitat degradation and human encroachment this key species are locally extinct from the reserve area. No direct sighting or dropping were observed in the project area during the present survey. According to wildlife department even the species of hog deer that was present in the reserve forest along the Indus River has vanished.

Wild boar (Sus scrofa) is another ungulate commonly found in forest along the Indus River. The wildlife department and local people report that the population of this species in the area has recently grown. The Indian crested porcupine is reported from some parts of the area, but they have not been seen for some time. Bengal fox and desert cat were the common species of the area. The population of Bengal fox depends highly on the availability of rodents in large numbers, because it has to eat rodents weighing almost one kg each day. The desert cat is common in the scrub areas of the desert. It is threatened because of loss of habitat, and being hunted for its fur, as well as being killed when it attacks peoples' domestic fowl. Other common large mammals that are reported from the area include palm squirrels. The common species of small mammals that are reported from the area are cairo spiny mouse, house rat, house mouse, pigmy gerbil, Indian gerbil, and desert jird.

The monitor lizard and spiny-tailed lizard is the large lizard that is found in the area. Other reptiles that are reported from the area are spotted Indian house gecko and ground agama. The reported reptiles of the project area include saw-scaled viper, Indian cobra, Indian sandy boa and sand swimmer.

Saw-scaled viper is the most prominent snake in the area. This is a highly poisonous snake and is distributed throughout Pakistan. The cobra has also been reported in the project area. The population of the Indian sandy boa (Eryx johni) is very low. The population of sand-swimmers, or raitmahi (Ophimorrus tridactylus), is very high in the desert area. This lizard species prefers a sandy habitat with xerophytic plants. Marbled toad is the only amphibian species recorded from the area.

The most commonly observed bird is the white-cheeked bulbul, which is the most numerous species in the scrublands and, although found mainly in the plains, is also common on slopes. Other common birds are the little brown dove, black crowned finch lark, Persian short-toed lark, Indian short toed lark, lesser white throat, common white throat, house bunting, gray-necked bunting, and crested lark.

Less common birds observed and recorded in the past include the Indian sparrow hawk, tawny eagle, common kestrel, gray partridge, Indian sand grouse, pintail sand grouse, Collard dove, great gray shrike, gray-backed shrike, hooded wheatear, tree pie, hoopoe, pied wagtail, black winged stilts, red-wattled lapwings, sandpiper, white backed vulture, griffon vulture, black vulture, golden eagle, rock partridge, and black-shouldered kite.

The gray partridge, sand grouse, little brown dove, spotted owlet, Sindh nightjar, Indian roller, black-crowned finch lark, ashy-headed finch lark, crested lark, white-cheeked bulbul, Indian robin, common babbler, jungle babbler, purple sunbird, Indian myna, and house sparrow are common area residents are still around but getting rare.

There are no areas of wildlife significance near the subproject area. The wild animals are very few and are almost entirely confined to the wetland area.

Terrestrial Habitats, Forests and Protected Species

The project area is irrigated agricultural land, where mostly the natural vegetation is replaced by agricultural field and does not support rare or threatened plant species. Most of the plants species present in the site are cultivated. Shisham (Dalbergia sissoo) used to be abundant but was found reduced to a few. Kikar (Acacia prosopis) is not being used as fuel wood since the project area has been supplied naturalgas. Other trees which are planted are some varieties of mulberry, such as mulberry (Morus alba) and tut (Morus Idevigata); ber (Ziziphus jujuba); dhrek (Melia azadirachta); and sharin (Albizzia lebbek), a quick-growing tree. Sufida (Eucalyptus cameldanesis) is an exotic species that is present in the project area. This plant is also sold commercially in match factory. The old arboreal vegetation of the waste places consists of jand (Prosopis spicigera), karil (Capparis aphylla), whose berries are collected for pickling. Along the canals and other moist places, there are found sar (Saccharum sara), kans (Saccharum spontaneum), pilchi (Tamarix dioca) and kundar (Typha angustata), which are used for making ropes, baskets, thatch and mats. The domestic livestock mostly grazed in this habitat of the project area. The fodder grasses found in the area are khabbal (Cynodon dactylon) and madhana (Eleusine degyptica).

There are some barren places which are mostly saline and consist of salt tolerant species. Shrubby Tamarix dioca is commonly observed in this area. The natural vegetation of Hala reserve is mostly replaced by agricultural field, where cultivation practices are commonly observed.

The range forests outside the project area are composed of a number of scattered forest trees, which are protected by the Sindh forest department. The dominant species of these include Tamarix aphylla, Acacia nilotica, Prosopis juliflora, Calatropis procera, Alhagi marorum and Saccharum spontinium.

Protected Areas / National Sanctuaries

In Pakistan there are several areas of land devoted to the preservation of biodiversity through the dedication of national parks and wildlife sanctuaries. There is no wetland, protected area or national sanctuary near the area of works and subproject area.

3.6 ECONOMIC DEVELOPMENT

Agriculture, Crops, Horticulture and Industries

Agriculture and Crops: The project is located in the agricultural land which receives adequate water supply as well as rains. Gone are the days when their land would be inundated and there would be loss of crop and property year after year. However, this change in profession has been brought about by raising the embankment, land clearance and availability of water at farm gate. The wildlife vanished with land clearance while the people had to switch over to agriculture, and raising livestock. With reduced availability of water in River Indus, the fisher-folk also switched to farming and fish farming.

Crops and Horticulture: The main crops of this district are rice, maize and fodder, wheat, tomato, Cotton and Sugarcane, but beside these a lot of other crops are cultivated. The fruits and vegetables of this region are also considerable. "Nasarpur" is the biggest market of "Onion" in Asia.

They do not have to collect fuel wood for household consumption since they have been supplied natural gas. People own land varying in size from 2 to 5 acres.

Livestock: The village folks own livestock. Every village has 35 to 60 animals including goats and cows but not many sheep. Natural vegetation does not dry up and it is not costly to buy green or dry fodder for animals.

Industry: As Matiari is very near to Hyderabad, so the people of Matiari do accomplish their industrial needs from there. But the old industrial products of Matiari are very much popular all over Pakistan and abroad.

Residents of Hala Taluka hardly get job in industries that located in Hyderabad or Kotri, or Kotri site area which are only 60 to 75 kms away mostly because they are not skilled and opportunities for unskilled labor are very few.

These industrial products are "Khadee","Kashee" and "Jundi" of Hala, "Loongee" & "Khes"of Nasarpur and "Ajrak" Of "Matiari" City.

There are a few numbers of industrial, commercial and agricultural businesses in the vicinity of the proposed sub-project.

Energy Sources

Matiari is predominantly dependent on wood and natural gas as a source of fuel for cooking with electricity being a major source of lighting. There are no indications of planning and investment in alternative sources of fuel and energy.

3.7 SOCIAL AND CULTURAL RESOURCES

Population Communities and Employment

The estimated population of Matiari District is 5, 25,082 (2005). Matiari District has socially aware population, which has taken up many social issues due to this fact many local NGO's are working here and find it up less to work SPO, Aga Khan Foundation, HANDS & SGA are working here with local NGO's & CBO's. Edhi center is also located in Taluka Hala.

The people in the project area are engaged in low level occupation, with the members of the nuclear family engaged in farming, raising livestock, collecting sand and gravel at and from the river bed. Two or three persons from each village assume the management responsibility and assign different roles to different members of the family and to the families in other villages, if necessary. The persons in the management hierarchy are responsible to the Sardar or wadera or rais of the area.

The people both males and females are engaged in the following types of labor:

- Farming, including livestock farming
- Gravel collection
- Water sale by donkey-cart

Education and Literacy

The literacy rate of the District is 40 % including 25% in male and 15% in females. It means that out of 750,000 (Latest Assumed Population) near about 300,000 people are educated and others

are uneducated. The Adult literacy rate is 40%. It means that some of 300,000 of the total population of Adults are educated in the District

There are eight primary schools for boys, one primary school for girls, one middle school. one high school. one technical institute and one large religious institution in the fourteen villages surveyed for this study. All the schools are functional.

As such the literacy rate among the youngsters is fairly high. Male literacy ratio is less than 30% and female literacy is about 15%. Quite a few persons can speak Urdu, the National language and many more can read the Holy Quran.

There is a mosque in almost every village. Things have started to change with the emergence of new leadership which has started setting up mosques and madrassas in the area of influence.

Educational Institutions in District Matiari with Enrolment & Staff

Sr. No.	Category	Institutions			Enrolment			Staff		
		Boys	Girls	Total	Boys	Girls	Total	Male	Female	Total
1	Colleges	04	01	05	16950	11444	28394	562	468	1030
2	Technical Institutions	02	00	02	340	00	340	12	00	12
3	Vocational Institutions	00	02	02	00	69	69	00	04	04
4	Govt. College of Education in Commercial Practice	01	00	01	27	00	27	03	00	03
5	Higher Secondary School	03	01	04	10383	3673	14065	784	246	1038
6	High Schools	21	09	30						
7	Middle Schools (Govt.) / Project & Community Model School	23	14	37						
8	Primary School	787	161	948	49121	25265	74386	2445	540	2985

Health Facilities

The healthcare services are not available at each village in the Project area. However, Khondo has a Basic Health Unit (BHU). The people are compelled to go to Hala. Bhit Shah or Hyderabad depending on the severity of incidence of the disease. These places are at considerable distances and not within the reach of the farming community in the Project area. Cost of treatment is unbearable to the people particularly because of travel. fee that has to be paid to the doctor and medicine that has to be purchased. The cost of treatment takes away at least Rs. 3000 to 5000 each time a person falls seriously sick. Hiring a Datsun truck for transporting the patient, costs over Rs. 1000. This being equivalent to ten days earning of the family, adds to their debt burden. The situation is worse for the females who have to be taken to Mother and Child Health Centre for delivery and child care and that takes away a few thousand for each delivery, and subsequent child care. People pay the high cost by borrowing and that adds to their debt burden.

There are also other hospitals of voluntary and missionary organizations which provide health cover to the general public. Medical facilities are also located near sub-projects.

Poverty

Impoverishment of resources leading to environmental degradation is both a cause and a consequence of rural poverty. Therefore, impoverishment of resources leads to desertification which in turn leads to poverty. and the vicious circle completes when poverty leads to further desertification.

The Project area with lush green fields did not show signs of poverty. People did seem concerned about short supply of inputs including water and power but by and large they seemed satisfied with whatever they were getting and whatever they had. Frequent droughts occurring during recent years were a cause of concern to them but they seemed to have accepted the reality that they have to be careful in excessive use of their resources. Perhaps this is the reason that the area seemed more developed than other parts of Sindh.

Family income of Rs 10 to 25 thousand, arrived at by this study, suggests that a majority of the families live at or above the poverty line. All members of the family contribute to sustain their living. Poverty, if induced, may be caused by the following factors:

- Scarcity of water
- Recurring drought
- Low return from crop and livestock farming

- Low literacy rate
- Lack of training
- High population growth
- Lack of access to employment in industrial area
- Increasing unemployment
- High cost of healthcare

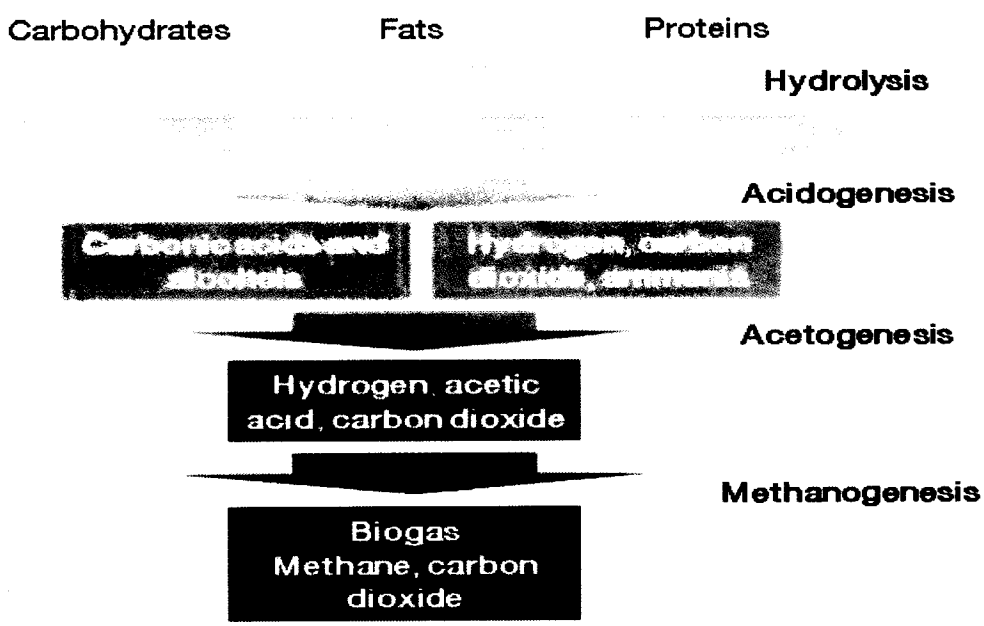
OVERVIEW OF BIOGAS TECHNOLOGY

4.1 INTRODUCTION

In recent years, biogas systems have attracted considerable attention as a promising approach to decentralized rural development. Developed and developing countries and several international organizations have shown interest in biogas systems with respect to various objectives: a renewable source of energy, bio-fertilizer, waste recycling, rural development, public health and hygiene, pollution control, environmental management, appropriate technology, and technical cooperation.

Anaerobic degradation

Anaerobic digestion technology or the methane-generating bioconversion yields both fuel (biogas) and organic fertilizer (sludge), products that are the final result of microbial action on cellulosic and other non-chemically processed organic residues. These substrates are obtained through a series of degradative steps that involve a variety of bacteria.



In the first step, complex polymeric organic substrates - proteins, carbohydrates, and fats - are transformed by non-methanogenic bacteria into essentially non-methanogenic substrates like butyrate, propionate, lactate, and alcohol. Through a second step that involves the acetogenic bacteria, the composition and identity of which still remain to be determined, these compounds are transformed into methanogenic substrates, i.e., acetate, H_2 and C1 compounds that are converted into CH_4 and CO_2 by the methane bacteria, obligate anaerobes that multiply in a neutral or slightly alkaline environment.

4.2 BIOGAS COMPOSITION

Biogas consists primarily of methane (the source of energy within the fuel) and carbon dioxide. It also may contain small amounts of nitrogen or hydrogen. Contaminants in the biogas can include sulphur or siloxanes, but this will depend upon the digester feedstock. Biogas can be recovered and can be transformed in any kind of thermal, electrical or mechanical energy

The relative percentages of methane and carbon dioxide in the biogas are influenced by a number of factors including:

- The ratio of carbohydrates, proteins and fats in the feedstock
- The dilution factor in the digester (carbon dioxide can be absorbed by water)

Raw Materials

Raw materials may be obtained from a variety of sources - livestock and poultry wastes, night soil, crop residues, food-processing and paper wastes, and materials such as aquatic weeds, water hyacinth, filamentous algae, and seaweed

Biogas technology

Biogas technology, the generation of a combustible gas from anaerobic biomass digestion, is a well-known technology. In Germany and other industrialized countries, power generation is the main purpose of biogas plants: conversion of biogas to electricity has become a standard technology.

Pakistan and most of the developing countries are in energy crisis. Pakistan depends almost 7 billion US $ on import of fossil fuels annually to fulfill its energy needs. The renewablee and sustainable energy resources are best substitute to the conventional fuels and energy resources.

Interest in biogas technology is increasing around the world due to the requirements for renewable energy production, reuse of materials and reduction of harmful emissions. Biogas technology offers versatile and case-specific options for tackling all of the above mentioned targets with simultaneous controlled treatment of various organic materials. It produces methane-rich biogas which can be utilized as renewable energy in various ways. The residual material, digestate, contains all the nutrients of the original raw materials and offers a way to recycle them. Along the process steps, also emissions directly from the raw materials (storage, use, and disposal) or from the replaced products (fossil fuels, inorganic fertilizers) can be reduced.

4.3 CONVERSION TO ELECTRICITY

Theoretically, biogas can be converted directly into electricity by using a fuel cell. However, this process requires very clean gas and expensive fuel cells. The conversion of biogas to electric power by a generator set is much more practical. In contrast to natural gas, biogas is characterized by a high knock resistance and hence can be used in combustion motors with high compression rates.

In most cases, biogas is used as fuel for combustion engines, which convert it to mechanical energy, powering an electric generator to produce electricity. The design of an electric generator is similar to the design of an electric motor. Most generators produce alternating AC electricity: they are therefore also called alternators or dynamos. Appropriate electric generators are available in virtually all countries and in all sizes. The technology is well known and maintenance is simple. In most cases, even universally available 3-phase electric motors can be converted into generators

Biogas engines

Biogas engines are specifically designed to operate on different types of biogas. These gas engines are linked to an alternator in order to produce electricity at high efficiency. High efficiency electricity production enables the end user to maximize the electrical output from the biogas and hence optimize the economic performance of the anaerobic digestion plant

4.4 APPROPRIATE COMBUSTION ENGINE

External Combustion Engines (EC Engines)

- **Stirling Motors:** In such motors, biogas is combusted externally, which in turn heats the stirling motor through a heat exchanger. The gas in the stirling motor hence expands and thereby moves the mechanism of the engine. The resulting work is used to generate

electricity. Stirling motors have the advantage of being tolerant of fuel composition and quality. They are, however, relatively expensive and characterized by low efficiency. Their use is therefore limited to a number of very specific applications.

In most commercially run biogas power plants today, internal combustion motors have become the standard technology either as gas or diesel motors

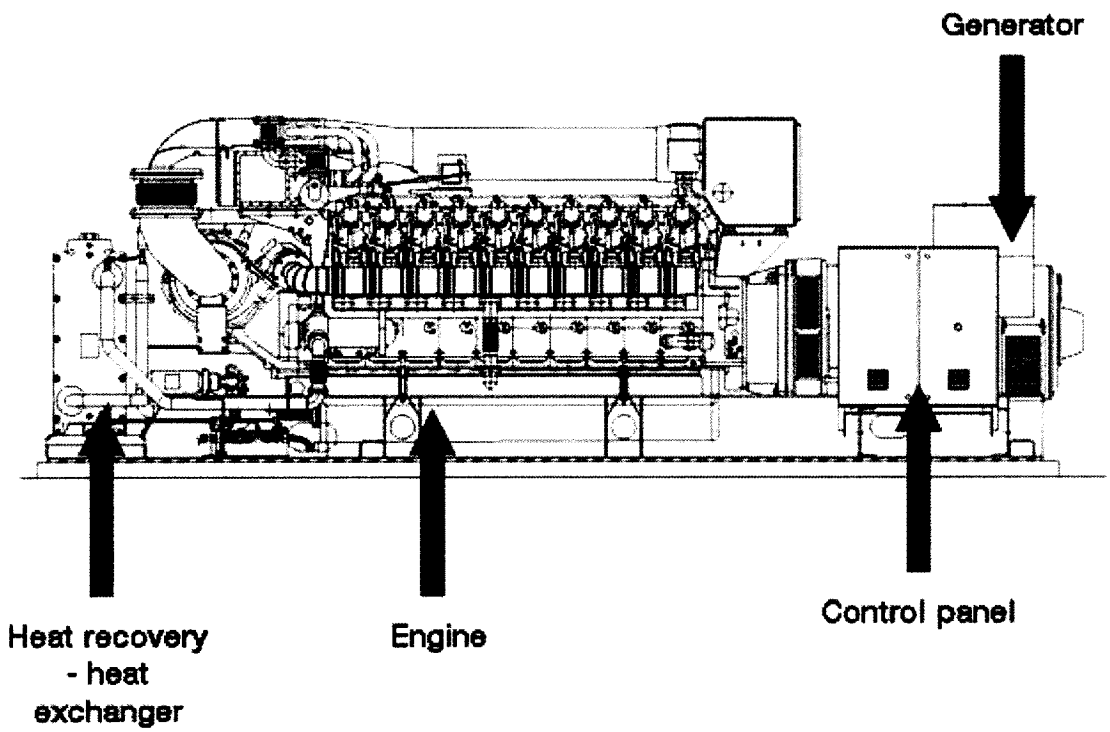


Figure 4.1: Gas Engine Basic Components

4.5 INTERNAL COMBUSTION ENGINES

Diesel Engines

Operate on biogas only in dual fuel mode. To facilitate the ignition of the biogas, a small amount of ignition gas is injected together with the biogas. Modern pilot injection gas engines ("Zündstrahlmotoren") need (about) 2% additional ignition oil. Almost every diesel engine can be converted into a pilot injection gas engine. These motors running in dual fuel mode have the advantage that they can also use gas with low heating value. But in that case, they consume a considerable amount of diesel. Up to engine sizes of about 200kW the pilot injection engines seem to have advantages against gas motors due to slightly higher efficiency (3-4% higher) and lower investment costs.

Gas Motors

With spark ignition (Otto system) can operate on biogas alone. In practice, a small amount of petrol (gasoline) is often used to start the engine. This technology is used for very small generator sets (~ 0.5-10 kW) as well as for large power plants. Especially in Germany, these engines have advantages as they do not need additional fossil fuels that would lead to lower feed-in tariffs according to the Renewable Energy Law (EEG).

Gas Turbines

Are occasionally used as biogas engines especially in the US. They are very small and can meet the strict exhaust emissions requirements of the California Air Resources Board (CARB) for operation on landfill and digester gases. Small biogas turbines with power outputs of 30-75 kW are available in the market. However, they are rarely used for small-scale applications in developing countries. They are expensive and due to their spinning at very high speeds and the high operating temperatures, the design and manufacturing of gas turbines is a challenging issue from both the engineering and material point of view. Maintenance of such a turbine is very different from well-known maintenance of a truck engine and therefore requires specific skills.

Today, experience of the use of combustion motors to produce electricity from biogas is extensive: this can be regarded as a proven standard technology. Over 4.000 biogas plants with internal combustion motors are in operation in Germany.

However, it has taken lengthy and determined effort to make this technology as durable and reliable as it is today. Internal combustion motors have high requirements in terms of fuel quality. Harmful components - especially hydrogen sulfide (H_2S) in the gas can shorten the lifetime of a motor considerably and cause serious damage.

This must be addressed in two ways:

- Production of clean biogas; and
- Use of appropriate and robust motors and components

In theory, most engines originally intended for cars, trucks, ships or stationary use can run on biogas as fuel and are available almost everywhere within a power range between 10 and 500 kW. This holds true especially in the case of dual fuel use. Robust engines with a certain sulfur resistance are mostly free of non-ferrous metal, as these materials are highly prone to damage through sulfur-rich biogas.

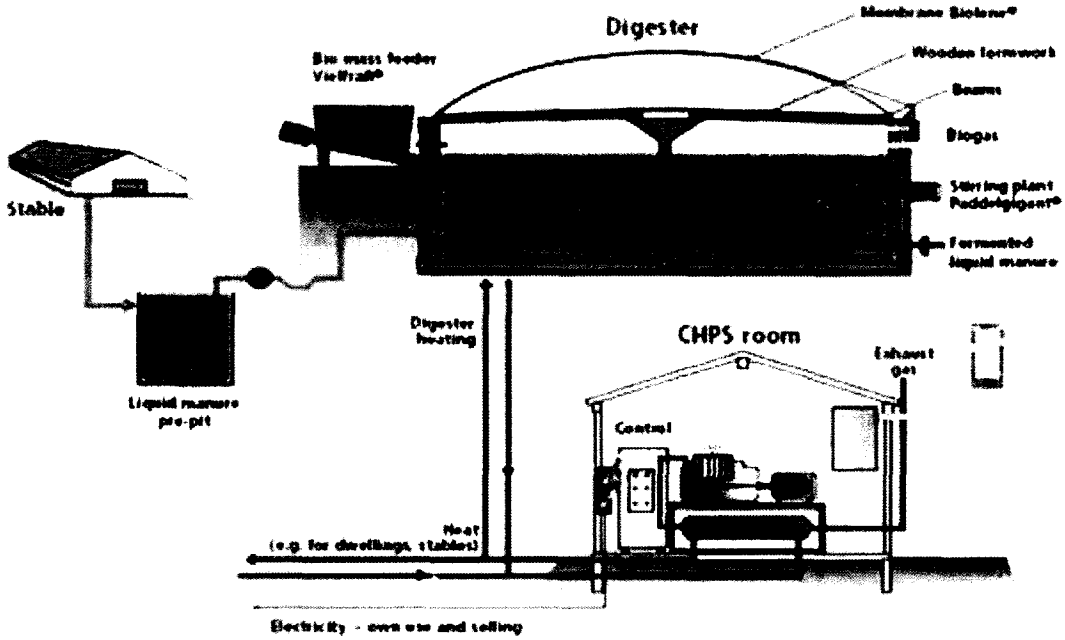


Fig: Biogas energy plant

Biogas CHP

Biologically-derived gases can be utilized in biogas engines to generate renewable power via cogeneration in the form of electricity and heat. The electricity can be used to power the surrounding equipment or exported to the national grid.

CHP produces electrical and total (electrical + thermal) efficiencies of up to 45 percent and 95 percent. respectively. Thermal energy is released in the combustion process and can be used for preheating or generating steam, as well as a variety of process heating or cooling systems. In addition, surplus electricity can be exported to the power grid, often providing additional income. The result is a system that can provide significant efficiency, profitability and environmental advantages over individually generating heat and power for your facility

- Low grade heat from the cooling circuits of the gas engine, typically available as hot water on a 70/90°C flow/return basis. For anaerobic digestion plants that are using a CHP engine. there are two key types of heat
- High grade heat as engine exhaust gas (typically ~450°C)
- The low grade heat is typically used to heat the digester tanks to the optimum temperature for the biological system. Mesophilic anaerobic digesters typically operate at 35-40°C. Thermophilic anaerobic digesters typically operate at a higher temperature between 49-60°C and hence have a higher heating requirement.

High temperature exhaust gas heat can either be used directly into a drier, waste heat boiler or organic Rankin cycle unit. Alternatively it can be converted into hot water using a shell and tube exhaust gas heat exchanger to supplement the heat from the engine cooling systems.
Waste heat boilers produce steam typically at 8-15bar. Driers may be useful to reduce the moisture content of the digest-ate to assist in reducing transportation costs. Organic Rankin cycle turbines are able to convert surplus waste heat into additional electrical output.

The heat from the CHP engine can also be used to drive an absorption chiller to give a source of cooling. converting the system to at regeneration plant.

Minimum Flow Rate

The minimum gas flow rate to operate the smallest biogas engine at full load is 127Nm3/hour at 50% methane.

Calorific value

The calorific value of biogas is variable and is in the range from 22.500 to 25.000 kJ m^{-3}, admitting the methane with about 35,580 kJ m^{-3}. This means a recovery from 6.25 to 10 kWh m^{-3}

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 INTRODUCTION

An impact on environment is an alteration of the environmental conditions or creation of new set of environmental conditions, adverse or beneficial, caused or induced by the action or a set of actions under consideration.

Impact Assessment is the identification, prediction and evaluation of environmental impact whether adverse or beneficial due to each of the activity of proposed project

This chapter describes the possible impacts due to the proposed cogeneration biogas fired power plant on each and every component of environment like air, water, noise, soil, etc. in the study area and mitigation measures adopted to reduce the impacts on environment.

The implementation of bio-gas fired power plant has a positive impact in meeting targets, making use of renewable energy resources or fulfillment of the indicative target of a share of electricity from renewable resources in gross electricity consumption in the Islamic Republic of Pakistan in the amount of 10 – 15 % as of 2020.

A bio-gas fired power plant is a facility which makes use of renewable resources of organic waste for the production of biogas in the anaerobic way – fermentation. Biogas is entrapped and burnt in a cogeneration unit with generation of electricity and heat. Apart from biogas, the output products of the anaerobic fermentation process is also digest-ate, which solid and liquid components can be separated. Both of the components are utilizable as fertilizer in agriculture.

The most common composition of biogas from anaerobic fermentation that is combusted in a cogeneration unit is stated as:

Biogas Composition

Component	**Volume Percentage (%)**
Methane, CH_4	40 --80
Carbon-di-oxide, CO_2	14 --55
Nitrogen, N_2	0 --20

Oxygen, O_2	0 --2
Hydrogen, H_2	0 --1
Ammonia, NH_3	0 --1
Hydrogen sulfide, H_2S	0 --2

5.2 ENVIRONMENTAL IMPACT ANALYSIS OF BIOGAS FIRED POWER PLANTS

During operation, no significant waste will be generated. However, the following were taken into consideration when analyzing and assessing the significance of the impacts that may be created:

- Impacts on the atmosphere
- Noise
- Impacts on the surface and ground water
- Impacts on the soil
- Impacts on the landscape

Impacts on the atmosphere

The major point source of pollution in a biogas fired power plant is a cogeneration unit combusting biogas. The quantity of emission from biogas combustion is, is the majority of cases negligible. In order to achieve maximum reduction of negative impacts of exhaust gases on the atmosphere there is a desulphurization plant for the produced gas. To calculate emission from cogeneration unit, emission limits for combustion sources – piston combustion engine – must be applied.

Transportation of Fuel

Since the power plant is located in the premises of the distillery unit, therefore, no additional environmental impacts will arise from transporting the biogas and all operations will remain on site using normal equipment and practices.

Odor

During the bio-methanation process various bacteria present in the digestor will be reacting with the organic material to produce methane gas. During this process, the reaction with Sulphonic compounds will result in traces of H_2S which contributes to the bad smell. Generally fermentation of molasses by yeast generates CO_2 which will be acting as a carrier for the mercaptans and spreads the odor in the surrounding area With advancement of technology, this problem has resolved by sealing the fermentors and collecting the CO_2 gas through the washers and botting it. This CO_2 gas has ready market for use in aerated drives.

Technically advance biogas fired power plant that function with a biogas yield of as much as 95% mostly comprise of steel tube fermenters, concrete main fermenter's, secondary fermenter, gasholder, digestate's storage (concrete reservoir which may be covered) and cogeneration units.

The majority of technically advanced biogas fired power plants are not source of odor emitted into the surroundings. Nevertheless, it must be pointed out that the working regulations of a biogas fired power plant must include a description of places of possible emergence of odor substances emission and a description of adopted technical – organizational measures to prevent their formation and to trap odor substances emissions during ordinary operations as well as during emergencies in the facility.

Noise

As far noise from a biogas fired power plant it must be stated that its assessment is implemented by means of noise study that evaluates noise level at the nearest build up area. With regard to considerable distance from residential areas (250) meters, the noise impacts are not significant (noise level is 28 dB, noise level limit is 50 dB – day time). Moreover, a cogeneration unit is situated in a sound proof, insulated engine hall. The unit is of a compact version with an engine and generator placed on a flexible base plate. Other parts are an exhaust heat exchanger and an exhaust muffler.

There are four main items of equipment in the AD plant that could give rise to the generation of noise; Main Pump, stirrers, Feed hopper and Gen sets. The Main Pump is situated in the Central Building which is formed from the walls of the 4 AD system tank walls. These tanks are full of sound deadening liquid. The Main Pump operates intermittently and is considered to produce NO noise and NO abatement measures are necessary.

The stirrers and feed hoppers themselves are propeller like units which operate at very low speed, ~ 40 rpm, and are submerged in liquid. The stirrers themselves produce NO noise. However, the stirrers are electrically driven via gearboxes and these drive systems are mounted on the outside of the tanks. The drive systems will produce noise typical of electric motors and gears, which, due to its frequency content is easily attenuated by ~ 30dB by a typical acoustic enclosure. The proposed AD plant site is contained within land occupied by the applicant so the risk of un attenuated noise nuisance at the site boundary is LOW. If noise levels at the site boundary are measured as being unacceptable typical acoustic enclosures could be fitted to the offending stirrer(s) to achieve acceptable noise levels.

The Gen sets proposed for this project are outdoor packaged in acoustic enclosures and fitted with roof mounted cooling systems and exhaust systems which discharge > 3m above ground level. The noise output from the complete gen set system is 60 dB (A) at 1m from the enclosure wall at 1.2m above ground level. The proposed AD plant site is contained within land occupied by the applicant so the risk of gen set noise nuisance at the site boundary is LOW. If noise levels at the site boundary or any receptor are measured as being unacceptable additional noise mitigation measures would have to be introduced. These could be fences, earth banks, tree plantations, etc. Any of these could also be used to adjust the visual impact of the development. The most likely impacts are described in Table 1 below. Some are short term and a few are long term.

Use of noise generating equipment

- Use of lagging with attenuation properties on plant components / installation of sound attenuation panels around the equipment.
- Other than the regular maintenance of the various equipment, ear plugs/ear muffs are recommended for the personnel working close to the noise generating units;
- All rotating items will be well lubricated and provided with enclosures as far as possible to reduce noise transmission.
- Extensive vibration monitoring system will be provided to check and reduce vibrations.
- Vibration isolators will be provided to reduce vibration and noise wherever possible;
- The insulation provided for prevention of loss of heat and personnel safety will also act as noise reducers
- Under any circumstances the noise level from the other sources of the industry will not exceed 85 dB. Noise levels generated at the project site will be confined to the plant area
- The impact of noise from transportation and its changes in relation with operation of biogas fired power plant is shown mainly during the day time in the surroundings of the access road where transport takes place.

5.3 IMPACTS ON THE SURFACE/GROUND WATER

Stillage is the main wastewater from ethanol production, generated specifically in the step of distillation and use for the production of biogas as byproduct. Stillage contains high concentrations of organic matter, potassium and sulfates, as well as acidic and corrosive characteristics. The polluting potential of stillage characterizes its land disposal as problematic, considering probable negative impacts on the soil structure and water resources in case of excessive dosages.

Evidence from the literature indicate that the main obstacles to reuse stillage in nature include risks of soil salinization: clogging of pores, reduction in the microbial activity and the significant depletion of dissolved oxygen concentrations in water bodies: contamination per nitrates and eutrophication; soil structure destabilization due to high concentrations of potassium and sodium: and, possible acidification of soil and water resources, considering the low pH of stillage (~4,5). Toxic metals, such as cadmium, lead, copper, chromium and nickel, were also identified in concentrations above the recommended limits in stillage samples, increasing risks to human health (e.g. carcinogenic potential) and to crops (e.g. productivity loss). In short, although some studies report benefits from the land application of stillage, its treatment prior to disposal is essential to make its use an environmentally suitable practice.

A biogas fired power plant products returns back into the agriculture if applied properly. Therefore, it may be stated that operation activities of biogas fired power plant can be made useful in the fertility of agriculture land. The rock environment does not get affected by the assumed activities. The impact on mineral resources is not manifested either.

Impact on soil

Project site has been identified in the Deh Pannu, Nasar Pur Road, District Matiari, in the Province of Sindh. The forest area in the study area is in patches. There is no designated ecological park or Bio Reserve/Wild life sanctuary in the 10 km radius of the proposed plant site. The impact on terrestrial ecology will be negligible in the first instance and shall be insignificant

5.4 SOLID WASTE GENERATION

The three principal products of anaerobic digestion are:

- Biogas;
- Digestate, and
- Water

Digestate is the solid remnants of the original input material to the digesters that the microbes cannot use. It also consists of the mineralized remains of the dead bacteria from within the digesters

The byproduct (acidogenic digestate) is a stable, organic material consisting largely of lignin and cellulose, but also of a variety of mineral components in a matrix of dead bacterial cells; some plastic may be present. The material resembles domestic compost and can be used as such or to

make low-grade building products, such as fiberboard. The solid digestate can also be used as feedstock for ethanol production.

Management Plan of Solid waste

Management practices will be adopted:

- To minimize the canteen and colony solid waste generation
- The fermenter sludge containing the spent yeast will be utilized as secondary yeast along with the primary yeast culture in fermentation process rather than disposing to composting yard.

Impacts on the landscape

In most cases biogas fired power plant do not influence the face of the landscape in the negative way as they are often situated in a locality where agriculture. Industrial premises are situated.

5.5 BEST PRACTICES RELATED TO ENGINEERING AND WARNINGS

Important elements are the exhaust air extraction systems for relevant parts (where the highest concentrations are expected) system of the production. To improve the exhaust system, it makes sense to maintain extraction at optimum design rate, to partially enclose machinery when feasible and to mark areas with high chemicals emission.

General Safety Management

The effectiveness of good work practices is entirely dependent on the knowledge and the cooperation of employers and employees. Therefore the employer must take all necessary steps to ensure that

- Each employee receives adequate instruction and training in safe work procedures, the proper use of all operational equipment, the correct use of protective devices and all emergency procedures;
- Each employee periodically receives refresher sessions and drills to maintain a high level of competence in safe work practices and emergency procedures;
- Each employee is provided with proper tools equipment, and personal protective clothing or devices; and
- Each employee is given adequate, responsible supervision to assure that all safety requirements and practices are followed.

Only properly trained individuals should be permitted to access to areas in which exposures to elevated chemicals are likely. All such areas should be clearly identified by appropriate posted warnings.

For the prevention of injuries from contact by chemicals-based resins and adhesives with the eyes, skin or other sensitive tissues, good work practices include, but are not limited to, the wearing of personal protective garments and equipment as recommended.

Work practices, procedures and protective equipment and devices should be developed and utilised so that the likelihood of employees suffering injurious contact with chemicals-based resins and adhesives is minimal. The wearing of personal protective garments and equipment is necessary for additional, positive protection in those activities and accidental situations where exposures are likely in spite of other precautions.

The following work practices and procedures should be observed by all employees:

- Respiratory and clothing protection and equipment should be worn in accordance with recommendation and requirements:
- Tanks, machines, pumps, valves, and lines must be drained and flushed thoroughly with water before doing maintenance or repair work on them. Care must be exercised to avoid contact with the drained or Care must be exercised to avoid contact with the drained or flushed fluid;

Employees shall properly utilise ventilation, enclosures, remote controls, and other engineering or administrative controls provided.

Training

All employees who are assigned to workplaces where there is exposure to chemicals should participate in a training program The work area supervisor or a designated person shall provide training to employees at the time of initial assignment, Whenever a new exposure to chemicals is introduced into work area and periodically thereafter. The Training program should at least include the following

- A discussion of the contents of related regulations and the contents of the applicable Material Safety Data Sheet(MSDS)

The purpose for and a description of the medical surveillance program required including:

- A description of the potential health hazards associated with exposure to chemicals and a description of the signs and symptoms of exposure to chemicals. As a minimum, specific health hazards that the employer shall address are as follows: cancer, irritation and sensitization of the skin and respiratory system, eye and throat irritation, and acute toxicity.
- Instructions to immediately report to the work area supervisor and to Occupational Health upon the development of any adverse signs or symptoms that the employee suspects are attributable to chemicals exposure;
- A description of operations in the work area where chemicals is present and an explanation of the safe work practices appropriate for limiting exposure to chemicals in each job;
- The purpose for, proper use of, and limitations of personal protective clothing and equipment
- Instructions for handling spills, emergencies. and clean-up procedures:
- An explanation of the importance of engineering and work practice controls for employee protection and instructions in the use of these controls:

Reviews of emergency procedures including the specific duties or assignments of each employee in the event of an emergency are as follows:

Minimise working time in areas with elevated chemicals Emission.

To the extent feasible, the working time in areas with elevated chemicals emission shall be minimised. Rotation of the work can be implemented to minimise chemicals exposure.

Special requirements during repair and control of machinery

Workers who have to control and repair in areas with elevated chemicals emissions should have personal protective equipment and should be trained and instructed regularly

Medical surveillance

The purpose of a medical surveillance programme is to prevent or detect a disease at the subclinical or pre-symptomatic stage, in order to take appropriate action to reverse the effects, or to slow down the progression of the disease towards the clinical status. In addition, the objective is not only to detect adverse effects in employees, but also to relate the findings to the effectiveness of exposure control measures

Recordkeeping

Exposure Monitoring records should be kept and include:

- The date of measurement;
- The operation being monitored;
- The methods of sampling and analysis and evidence of their accuracy and precision;
- The number, durations, time, and results of samples taken;
- The types of protective devices worn:

The names, job classifications, social security numbers, and exposure estimates of the employees whose exposures are represented by the actual monitoring results

ENVIRONMENTAL MANAGEMENT PLAN

6.1 INTRODUCTION

Sustainable development is built on three basic premises i.e., economic growth, ecological balance and social progress. Economic growth achieved in a way that does not consider the environmental concerns will not be sustainable in the long run. Therefore, sustainable development needs careful integration of environmental, economic, and social needs in order to achieve both an increased standard of living in the short term, and a net gain or equilibrium among human, natural, and economic resources to support future generations in the long term

The Initial Environmental Examination (IEE) study has evaluated the proposed project of 6.2MW Bagasse based power plant located at Matol (private) limited, Deh Pannu, Nasar pur Road, District Matiari, province of Sindh. The mitigation measures for the impacts identified during the study have been highlighted which the proponent is committed to comply with. However, to ensure that the power plant is environment friendly, a systematic programme of environment management would be followed to ensure that prescribed standards are strictly followed under an appropriate monitoring programme. The factors which require management and monitoring are discussed in the following sections.

The Environmental Management Plan (EMP) for the cogeneration bio-gas power plant Matol (Private) Limited, identifies the principles, approach, procedures and methods that will be used to control and minimize the environmental and social impacts of all construction and operational activities associated with the project.

As part of their ongoing commitment to excellence in environmental and social performance for power project, Matol (Private) Limited will ensure the following:

- Fulfill all environmental and social conditions associated with project approvals;
- Develop, promote and foster a shared sense of responsibility for environmental and social performance of the project;

- Promote environmental awareness and understanding among employees through training, identification of roles and responsibilities towards environmental and social management and linking project performance to overall environmental performance;
- Encourage an understanding of social and cultural sensitivities in local communities and the importance of minimizing project impacts on local lifestyles and culture;
- Monitor environmental and social performance throughout the project and implement an adaptive management approach to continuous improvement:
- Maintain an ongoing commitment to informing, engaging and involving local stakeholders.

Potential Contaminants

Biologically derived gases may include contaminants or impurities including water, hydrogen sulfide and siloxanes. Please discuss your gas quality expectations with your local Clarke Energy office. GE provides specific guidelines on fuel gas quality in technical instruction documents.

Water

Biological gases contain water vapor due to the nature of the feedstock that produces the gas. The quantity of water is linked to the temperature of the biological gas and the method of production. Above certain limits the moisture content of the biogas becomes a combustion challenge for the gas engines.

Water can be removed from the gas by using:

- Gas dehumidification (drying) units
- Ground tube dewatering

Hydrogen Sulfide

Hydrogen sulfide (H_2S) is derived as a by-product of the anaerobic digestion process of high sulfur feed stocks such as amino-acids and proteins. When burnt in a gas engine hydrogen sulfide can condense with water to form sulfuric acid. Sulfuric acid is corrosive to elements of gas engines and so must be limited to prevent adverse effects on the CHP engine.

Processes for the removal of hydrogen sulfide include:

- Activated carbon filters
- Low level oxygen dosing into digester head space (typically <1%)
- External biological scrubber towers

- Ferric chloride dosing into the digester

Siloxanes

In some cases biogas contains siloxanes. Siloxanes are formed from the anaerobic decomposition of materials commonly found in soaps and detergents. During the combustion process of the gas that contains siloxanes, silicon is released and can combine with free oxygen or various other elements in the combustion gas. Deposits are formed containing mostly silica (SiO_2) or silicates (Si_xO_y). These white mineral deposits accumulate and must be removed by chemical or mechanical means.

Siloxanes are often problematic in landfill gas and sewage gas plants due to contamination that is often found associated with the organic wastes.

In source-segregated biodegradable waste and agricultural biogas plants, it is much less common to find problems associated with siloxanes.

6.2 ENVIRONMENTAL MONITORING

In many cases, an environmental monitoring can serve as a first step towards the development and implementation of a broader and more inclusive environmental management system that may involve over time depending new national and international requirements. An environmental monitoring program will, therefore, be implemented and will remain in force during the plant operation. Key parameters of an environmental monitoring program will include:

- A monitoring system for ambient air quality including stack emissions
- A monitoring system for waste resource, water use and plant effluent
- A monitoring system for noise

Ambient Air Quality

Impact

- Exhaust gasses
- dust
- Odor

Proposed actions

- Use of properly serviced machinery during construction. There is no added effect on environment during operation

- Pour water on the ground to avoid dust.
- Continuous regulation of gas production in the Digester to ensure constant and effective operating conditions
- Regulation of biogas production to ensure minimum flaring and venting of biogas

Environmental Monitoring

Environmental monitoring should include a continuous ambient air quality monitoring system. Such system should be ready for implementation at least 2 to 3 months prior to the start of plant operation. The monitoring stations for monitoring emissions should be located with consideration of local meteorological conditions. Meteorological data should be recorded in parallel to air quality monitoring. The monitoring plan will also include monitoring stack emissions. Equipment for continuous should be installed at the stacks and be online at the start of plant commissioning to cover the following parameters: total flue gas flow, NOx, SO_2 and PM_{10}. Monitoring locations, parameters and the monitoring program should be approved by the Sindh Environmental Protection Agency. Monitoring record should be submitted as an information memorandum to the Environmental Protection Agency. Frequency of submissions of such information memorandum is open for discussion between power plant operator and Sindh EPA.

6.3 WATER RESOURCES

Surface water quantity and quality

Impacts

- Increased water usage
- Discharge of effluent

Proposed actions

- Maintain / improve the current drainage system

Environmental monitoring

A groundwater and surface water monitoring should be implemented at least three months prior to the start of plant construction. It is recommended that for groundwater covers the parameters should be checked frequently at the point of waste water discharge. More stringent limiting values for inland surface waters must be met in this regard.

Monitoring locations, parameters and the monitoring program should be approved by the provincial EPA concerned. Monitoring records should be submitted as an information memorandum at such intervals as agreed between the plant operator and the provincial EPA.

6.4 NOISE LEVELS

Impacts

- Noise generation

Proposed actions

The preferred method for controlling noise from stationary sources is to implement noise control measures at the source.

- Noise to be controlled by use of acoustic enclosures for respective equipment or other noise mitigation measures would have to be introduced

General Remarks

- Noise prevention and environmental measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception.
- Methods for prevention and control of sources of noise emissions depend on the source and proximity of receptors. Noise reduction options that should be considered include:
    - Selecting equipment with lower sound power levels
    - Installing silencers for fans
    - Installing suitable mufflers on engine exhausts and compressor components
    - Installing acoustic enclosures for equipment casing radiating noise
    - Improving the acoustic performance of constructed buildings, apply sound insulation
    - Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m2 in order to minimize the transmission of sound through the powerhouse walls,
    - Transformer bays or other enclosures within which a noise source may be operated.

Environmental monitoring

An ambient noise measurement program should be implemented upon commissioning of the project. The monitoring program should consider the noise limits prescribed by SEPA. Noise levels should be recorded where possible impacts might occur. This is normally where settlements are located. Noise should be monitored frequently during the construction phase and, more importantly, during plant operation

If the measurement results comply with the relevant standards, the program should be terminated and the measure record achieved. In the event of any perceived noise level increase as a result of an accident or technical default. control measurements should also be made once every year. The plant operator should be prepared to implement noise reduction measures in the event that acceptable noise levels are exceeded. The noise measurement program and the measurement locations should be approved by Sindh EPA.

Soil

Impacts

- Soil Excavation

Proposed actions

- No mitigation

General Remarks

- Ensure effective disposal of excavated soils

Health and Safety

Impacts

- Occupational Hazard

Proposed actions

- Identification and elimination of potential hazards
- Provision and use of appropriate and adequate personal protective equipment. Ensuring contractor compliance
- Provision of adequate firefighting equipment and emergency procedures as is currently the case
- Use of properly serviced equipment and effective control of dust and odor will ensure that that health of the workers and individuals living in the area will not be affected.

Implementation

- Continuous

Responsibility

- Company

Socio-economic impacts

Impacts

- Increased incomes from project activities

Proposed actions

- The company should continue with diversification program so as to increase the revenue generation and economic development.

Implementation

- Continuous

Resource conservation

Impacts

- Use of clean technology

Proposed actions

- Putting measures in place to ensure that operational procedures are followed always and identification of non- conformity identified and addressed

Implementation

- Continuous

Responsibility

- Proponent

General Remarks

- A legal register will ensure compliance with laid down guidelines at all times,
- Obtain necessary permits where required, e.g. Water abstraction permit.

Compliance Aspects

Impacts

Compliance with the legal requirements, market demands and ethical obligations

Proposed actions

- Establish a legal register with a focus on the critical relevant environmental laws,
- Carry out annual environmental audits as required by law,
- Review all contractual agreements to reflect the environmental legal requirements,

- Review a corporate environmental policy guideline.

Implementation

- Continuous

Responsibility

- Proponent

General Remarks

- A legal register will ensure compliance with laid down guidelines at all times.

Table 6.1: Mitigation measures for physical and biological impacts

Activity	Affected Environment	Operational, Best Practices and Monitoring
Solid and human waste disposal	Soil & Water Quality	Degradation of Soil and Water Quality. • Apply water conservation (e.g., reduce, reuse and recycle) measures to reduce water use and wastewater generation. • Implement a solid waste reduce, reuse and recycle Program. • Prohibit use of nearby water bodies or wetlands for washing or waste disposal.
	Terrestrial Fauna	• Schedule activities to avoid disturbance of wildlife during critical periods of the day (e.g., night) or year (e.g., breeding or nesting season) • Implement a program to instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship, nesting) season • Clean vehicles before entering the project area to mitigate the introduction of invasive, exotic species. • Monitor emergence of invasive, exotic species

		and respond appropriately.
Fuel and/or chemical storage and handling	Aquatic Species and associated Ecosystems	Contamination from Spills and Fuel Leaks • Train workers on the Spill Prevention and Response Plan • Provide onsite portable spill management. control and cleanup equipment and materials. • Containerize and periodically remove wastes for disposal at appropriate off-site permitted disposal facilities, if available. • Document accidental releases as to cause. corrective actions taken, and resulting environmental or health and safety impacts.
	Water Quality	Contamination from Spills and Fuel Leaks • Train workers on the Spill Prevention and Response Plan • Provide onsite portable spill management. control and cleanup equipment and materials. • Periodically remove wastes for disposal at appropriate off-site permitted disposal facilities, if available. • Document accidental releases as to cause. corrective actions taken, and resulting environmental or health and safety impacts
	Accidental Releases of Insulating Gases	• Minimize disturbed areas. • Surface access roads and on-site roads with aggregate materials. wherever appropriate. • Post and enforce speed limits to reduce airborne fugitive dust from vehicular traffic. • Reestablish vegetation of disturbed areas as soon as possible after disturbance with timeframes set in the IEE
	Noise and Vibration	• Noise from Substations

	• Ensure that substation mounting hardware is periodically tightened. Implement noise monitoring to verifying operational phase noise levels. • Develop a mechanism to record and respond to complaint
Aesthetics	• Disruption of Views and Landscapes Maintain the site during operation of the project. • Inoperative equipment and poor housekeeping, creates a poor image of the project in the eyes of the public. Paint grouped structures the same color to reduce visual complexity and color contrast. • Maintain vegetative screens. • Prohibit the use of commercial symbols • Plant vegetative screens to block views of facilities and right-of-way

6.5 SPECIFIC MITIGATION MEASURES

Thermal/combustion projects can be significant sources of air emissions with the potential for significant impacts to ambient air quality. These projects should prevent or minimize impacts by ensuring that:

- Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national/Sindh environmental legislated standards, or in their absence, standards from other internationally recognized sources.
- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards.

Where possible, facilities and projects should avoid, minimize, and control adverse impacts to human health, safety, and the environment from air emissions through a combination of:

- Energy use efficiency
- Process modification
- Selection of fuels or other materials, the processing of which may result in less polluting emissions

- Application of emissions control techniques.

The selected prevention and control techniques may include one or more methods of treatment depending on:

- Regulatory requirements
- Significance of the source
- Location of the emitting facility relative to other sources
- Location of sensitive receptors
- Existing ambient air quality, and potential for degradation of the air shed from a proposed
- project
- Technical feasibility and cost effectiveness of the available options for prevention, control, and release of emissions.

Post-Combustion Controls

Carbon dioxide (CO_2) control

Mitigation measures for CO_2 are focused on carbon capture and sequestration technologies Carbon capture may involve either pre-combustion or post-combustion separation of CO_2 from emission sources.

Pre-combustion CO_2 capture typically involves gasification processes, such as integrated gasification combined cycle (IGCC) technology, where coal or biomass is converted into gaseous components by applying heat under pressure in the presence of steam. IGCC plants may be designed so that concentrated CO_2 at a high pressure can be captured from the synthesis gas that emerges from the gasification reactor before it is mixed with air in a combustion turbine. Because CO_2 is present at much higher concentrations in synthesis gas than in post-combustion flue gas, IGCC systems currently appear to be the economic choice for new plants.

Post-combustion CO_2 capture involves physical and chemical processes to separate CO_2 from the exhaust flue gas. These systems might be applicable to retrofits of conventional coal or biomass energy plants, and also might be applicable to other thermal/combustion energy production technologies. However, such systems are challenging and, currently, costly because the low pressure and dilute CO_2 concentrations dictate a high actual volume of gas to be treated. Further, trace impurities in the flue gas tend to reduce the effectiveness of the CO_2 adsorbing processes, and

compressing captured CO_2 from atmospheric pressure to pipeline pressure represents a large parasitic load.

After the CO_2 emissions have been collected/captured. the CO_2 should be sequestered (immobilized or removed), either geologically (e.g., saline aquifers) or via enhanced oil recovery.

Environmental monitoring

Airborne emissions should be monitored and reported. and these reports should include PM. SO_2, NO_X (as appropriate for the facility), and CO_2. Monitoring and reporting would assist in the mitigation of impacts if they occur.

Transmission Lines

One way to reduce the potential impacts of an energy transmission project during the design stage is to replace or double-circuit an existing line rather than building a new line. The environmental advantages of double-circuiting an existing line are:

- Little or no additional right-of-way clearing. if the new line can be placed in the center of the existing right-of-way
- Land use patterns may have already adapted to the existing right-of-way
- Electric and magnetic fields (EMF) may be reduced because new structure designs place line conductors closer together resulting in lower EMF
- However. upgrading an existing transmission line from single-circuit to double-circuit can increase the cost by 130 percent or more, depending on the choice of structures and the size of the line.

Using an existing transmission line right-of-way may also not be the best choice when:

- The existing right-of-way is in a poor location
- New residential areas have been built around the existing line
- Electricity use has grown more in other areas, so using the existing right-of-way reduces the efficiency of the new line and increases costs
- A wider right-of-way is needed because the size of the new line is much greater than the existing line

Another common method for mitigating impacts is corridor sharing. Transmission line right-of-ways can be shared with urban or rural roads. highways, railroads, or natural gas

pipelines. Corridor sharing with existing facilities is usually encouraged because it minimizes impacts by:

- Reducing the amount of new right-of-way required
- Concentrating linear land uses and reducing the number of new corridors
- Creating an incremental, rather than a new impact

A common method to reduce EMF is to bring the lines closer together. This causes the fields created by each of the three conductors to interfere with each other and produce a reduced total magnetic field.

Magnetic fields generated by double-circuit lines are less than those generated by single-circuit lines because the magnetic fields interact and produce a lower total magnetic field. In addition, double circuit poles are often taller resulting in less of a magnetic field at ground level.

Additional Provisions in Environmental Monitoring

Monitoring of incidents and measurement the possible impact on air quality, noise levels and water pollution would be important since damages caused by a breakdown may be considerable. Development of an operational risk management (e.g. the identification risks, assessing the suitability of risk, mitigation measures to counteract these risks etc. and defining action plans) would be beneficial insofar as it would facilitate the elaboration on the environmental monitoring, in particular in the event of breakdown.

6.6 MONITORING STRUCTURE

A management program to ensure a clean and healthy environmental would be pursued during operation stage of the plant. This would involve establishment of an environmental monitoring cell, manned by qualified and trained personnel. The cell would be responsible for developing operational guidelines and ensuring compliance with prescribed standards. The Environmental Monitoring Cell to be constituted by the power plant management from amongst the plant personnel shall be responsible for implementation of all the monitoring and mitigation programs. They shall be fully conversant with the national and the international regulatory standards for environmental protection. The power plant laboratory will be manned by chemical engineer / laboratory technicians.

The maintenance personnel also would be responsible for the proper functioning of emission and ground level concentration monitoring system. The chemist and laboratory technicians of the plant would take care of all the laboratory and field sample tests. The test result / data prepared

by this team would be presented by the environmental monitoring cell to the plant management. Supervisory control, monitoring, and data acquisition shall comply with requirements of Sindh Environmental Protection Act 2014, Rules and Regulations made there under and World Bank Guidelines relevant to thermal power plants.

6.7 PROJECT PARAMETERS AFFECTING EMISSION REDUCTION

Monitoring Approach

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and reporting

As the emission reduction units from the project are determined by the number of units exported to the grid (and then multiplying with appropriate emission factor) it becomes important for the project to monitor the net export of power to the grid on a real time basis. Frequency of monitoring the project developer will install all metering and check metering facilities within the plant premises as well as in the grid substation where exported power is connected to the grid. The measurement will be recorded and monitored on a continuous basis.

CONCLUSION

7.1 FINDINGS

Anaerobic biogas digesters are airtight reactors in which organic waste is decomposed and transformed into biogas by a biological process called anaerobic digestion. Biogas is recovered and transformed into heat or any other form of energy.

Matol Private Limited is planning to establish a power within the outskirts of distillery unit plant to generate the electricity with the aim to utilize stillage (waste material from distillery unit) to produce biogas which will be used as fuel to generate electricity. The results of this study show that the proposed Matol Private Limited's Biogas Plant will not have a potential for serious negative environmental impacts rather it will reduce greenhouse gas emissions through methane recovery.

7.2 CONCLUDING REMARKS

The project will use renewable waste to produce energy in Pakistan where at least 50% of the energy is hydro based and very susceptible to weather patterns. The other option is significantly fossil fuel based thermal energy which is prone to exchange fluctuations and other political instability in certain regions of the world. Energy source diversification is therefore very beneficial to the whole country.

The Project will generate social and economic benefits from power production, employment generation, tax payments and contributions to economic development

The Project will adopt best practice mitigation measures and effective pollution control technologies to minimize emissions and impacts on the environment. It is not expected to have any significant ecological impacts.

The Project is designed to comply with the environmental standards in Sindh, specifically those related to air emissions, ambient air quality, wastewater effluent, receiving surface water quality and noise.

The potential adverse environmental impacts such as odor, noise, wastewater or any gas emissions will be adequately mitigated. Plans are also in place to adequately mitigate the health and safety impacts of the project.

An EMP, including a monitoring program, is to be developed and form an integral component of plant construction and operation. It will be implemented by the proponent during operation. The Project will be able to fully comply with relevant national laws and regulations relating to environment, health, and safety

The recommendations have been provided in the Environmental management Plan as proposed actions.

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ANNEXURE-I

WILDLIFE PROTECTED AREAS

Protected Area Name	Area (ha)	Classification	Coordinates
Bijoro Chach	121	Wildlife Sanctuary	Not Recorded
Cut Munarki Chach	405	Wildlife Sanctuary	Not Recorded
Deh Akro/Nara Canal	20,000	Wildlife Sanctuary	27/42 N. 68/52 E
Deh Jangisar	314	Game Reserve	Not Recorded
Deh Khalifa	429	Game Reserve	Not Recorded
Deh Sahib Saman	349	Wildlife Sanctuary	Not Recorded
Dhoung Block	2,098	Wildlife Sanctuary	Not Recorded
Dograyon Lake	648	Wildlife Sanctuary	Not Recorded
Dosu Forest	2312	Game Reserve	Not Recorded
Drigh Lake	164	Wildlife Sanctuary	Not Recorded
Ghamo	27283	Game Reserve	Not Recorded
Ghondak Dhoro	31	Wildlife Sanctuary	Not Recorded
Gullel Khon	40	Wildlife Sanctuary	Not Recorded
Gulsher Dhand	24	Wildlife Sanctuary	Not Recorded
Hadero Lake	1321	Wildlife Sanctuary	24/50 N. 67/53 E
Hala	954	Game Reserve	25/48 N. 68/25 E.
Haleji Lake	1704	Wildlife Sanctuary	24/49 N. 67/44 E.
Hilaya	324	Wildlife Sanctuary	Not Recorded
Indus River	44200	Game Reserve	28/24 N. 69/45 E
Keti Bunder South	8948	Wildlife Sanctuary	24/08 N. 67/27 E.
Keti Bunder North	23040	Wildlife Sanctuary	24/08 N. 67/27 E
Khadi 81	81	Wildlife Sanctuary	Not Recorded
Khairpur Game Reserve	Not Recorded	Unclassified	Not Recorded
Khanpur	Not Recorded	Unclassified	Not Recorded
Khat Dhoro	11	Wildlife Sanctuary	Not Recorded
Khipro	3885	Game Reserve	25/49 N. 69/21E
Kinjhar (Kain) Lake	13468	Wildlife Sanctuary	29/54 N. 70/57 E.
Kirthar	308733	National Park	25/44 - 27/15 N 67/10.E
Kot Dinghano	30	Wildlife Sanctuary	Not Recorded
Lakht	101	Wildlife Sanctuary	26/36 N. 67/53 E.
Langh (Lungh) Lake	19	Wildlife Sanctuary	27/30 N. 68/03 E.
Mahal Kohistan	70577	Wildlife Sanctuary	Not Recorded
Mejiran	24	Wildlife Sanctuary	Not Recorded
Mando Dero	1234	Game Reserve	Not Recorded

Marho Kohn	162	Wildlife Sanctuary	Not Recorded
Miani Dhand	57	Game Reserve	25/27 N. 68/23 E
Mirpur Sakro	777	Wildlife Sanctuary	24/32 N. 67/38 E
Mubahat Dero	16	Wildlife Sanctuary	Not Recorded
Munarki	12	Wildlife Sanctuary	Not Recorded
Nara	109966	Game Reserve	27/42 N. 68/52 E
Nara Desert	223590	Wildlife Sanctuary	Not Recorded
Norang	243	Wildlife Sanctuary	Not Recorded
Pai	1069	Game Reserve	Not Recorded
Pir Mahfooz Game Reserve	Not Recorded	Unclassified	Not Recorded
Pir Pagara Game Reserve	Not Recorded	Unclassified	Not Recorded
Sadnani	320463	Wildlife Sanctuary	Not Recorded
Samno Dhand	84	Wildlife Sanctuary	Not Recorded
Samno Dhand	23	Wildlife Sanctuary	Not Recorded
Shah Lanko	61	Wildlife Sanctuary	Not Recorded
Surjan, Sumbak, Eri and Hothiano	40632	Game Reserve	25/25 N. 67/55 E.
Surjan, Sumbak, Eri and Hothiano	43513	Wildlife Sanctuary	27/15 N. 68/49 E.
Tando Matha Khan	5343	Game Reserve	Not Recorded

ANNEXURE-II

RELEVANT HEALTH, SAFETY ENVIRONMENTAL LAWS AND THEIR APPLICABILITY

Subject	Legislative Power	Enforcing Agencies	Pertinent Laws
Environmental Pollution and Ecology	Federal and Provincial	Ministry of Environment Local Government and Rural Development	Pakistan Environmental Protection Act, 1997
		Pakistan Environmental Protection Agency	National Environmental Quality (NEQS), 2000
		Sindh Environmental Protection Agency	NEQS (Self-Monitoring and Reporting by Industry) Rules, 2001
Boilers	Federal & Provincial	The Boiler Board Chief Inspector of Boilers	NEQS (Self-Monitoring and Reporting by Industry). Rules, 2001
Regulation of Labor and Safety in factories	Federal and Provincial	Chief Inspector of Industries	Factories Act, 1934
			Hazardous Occupation Rules, 1963
Electricity	Federal and Provincial	Federal Electricity Boards	Electricity Act, 1910
Ancient and historical monuments; archaeological sites and remains	Federal and Provincial	Departments of Museum	Antiquities Act, 1975, Sindh Cultural Heritage Act, 1994

ANNEXURE-III

POTENTIAL NEGATIVE IMPACTS VS MITIGATION MEASURES SITE SELECTION

Potential Negative Impacts Site Selection	Specific Mitigation Measures Site Selection
1. Plant sure near sensitive habitats, eg: • **estuaries** • **mangroves**	• Locate facility elsewhere, eg. Within industrial estate which are equipped to deal with stress on local environment services. It should also facilitate the monitoring of emissions. This will concentrate and from sensitive air quality receptors
2. Water course degradation	• Examine alternate site location that will not affect beneficial use of water course. • Check water course capacity to assimilate treated effluent • Dilute effluent at point of discharge
3. Air pollution problems for locals	• Locate plant site based an assessment of pollution trapping and prevailing winds are towards relatively unpopulated areas.
4. Solid waste problems	• Select site with landfill disposal on-site. or • Proximity to suitable disposal site with easy system for solid waste collection for final disposal

ANNEXURE-IV

POTENTIAL NEGATIVE IMPACTS VS MITIGATION MEASURES PLANT OPERATION

Potential Negative Impacts Plant Operation	Specific Mitigation Measures Plant Operation
1. Water contamination with high temperature, BOD, COD, TDS, and pH due to • **Process cooling waster** • **Effluents, or** • **Runoff from stockpiles / waste piles**	• Recycling cooling water. If this is not feasible ensure receiving body waster temperature does not rise > 3°C • Maintain pH between 6-9 • Control effluent to specified NEQS • Minimize rain exposure to stockpiles and minimize uncontrolled runoff • Line open storage areas to collect all storm water.
2. Particulate emissions	• Use Fabric (Baghouse) Filter or Electrostatic Precipitators.
3.Gaseous emissions, eg: • **SO_{x1} NO_{X1} CO and others.**	• Scrub with water or alkaline solutions • Incinerate, or • Absorption by other catalytic process.
4. Accidental release of hazardous solvent	• Assess use of double wall tanks • Housekeeping and maintenance to prevent accident • Provide and maintain spill kits.
5. Noise	• Use low rated equipment • Control timing of noise and vibration to least disruptive periods • Install noise barriers
6. Groundwater contamination	• Cover and contain open storage areas to prevent runoff to surface and ground waters • Use lines disposal cells to prevent ground water seepage • Monitor storm water quality before discharge

ANNEXURE-V

POTENTIAL NEGATIVE IMPACTS VS MITIGATION MEASURES INDIRECT

Potential Negative Impacts Indirect	Specific Mitigation Measures Indirect

1. Occupational health effects due to dust, noise, or other process operations	• Provide dust collector equipment and dusk masks
	• Maintain noise levels below 85 Dba. OR provide ear protection
	• Implement Occupational Health and Safety Program to:
	  • Identify, assess, monitor and control health hazards
	  • Provide safety training

2. Regional solid waste problems	• Plan and design adequate on-site storage and ultimate disposal facilities
3.Heavy traffic carrying hazardous materials threat to motorists and pedestrians	• Appropriate site selection • Conduct traffic studies to select best route to reduce impacts • Regulations for transporters and develop emergency contingency plans to minimize risk of accidents

ANNEXURE-VI

ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS DISCHARGED TO INLAND WATERS (mg/l, unless otherwise defined)

Sr. No.	Parameter	Standard
1.	Temperature Increase	<3 °C
2.	pH value	6-9
3.	Biochemical oxygen demand $(BOD)_6$ at 20C[b]	80
4.	Chemical oxygen demand (COD)[b]	150
5.	Total suspended solids (TSS)	200
6.	Total dissolved solids (TDS)	3.500
7.	Grease and oil	10
8.	Phenolic compounds (as phenol)	0.1
9.	Chloride (as Cl^-)	1.000
10.	Fluoride (as F^-)	10
11.	Cyanide (as CN^-) total	1.0
12.	Anionic detergents (as MBAs)[o]	20
13.	Sulfate ($SO^{=}$)	600
14.	Sulfide ($S^{=}$)	1.0
15.	Ammonia (NH_3)	40
16.	Pesticides[d]	0.15
17.	Cadmium*	0.1
18.	Chromium (trivalent and hexavalent)[d]	1.0
19.	Copper*	1.0
20.	Lead*	0.5
21.	Mercury*	0.01
22.	Selenium*	0.5
23.	Nickel*	1.0
24.	Silver*	1.0

25.	Total toxic metals	2.0
26.	Zinc	5.0
27.	Arsenic*	1.0
28.	Barium*	1.5
29.	Iron	8.0
30.	Manganese	1.5
31.	Boron*	6.0
32.	Chlorine	1.0

Explanations

- The effluent should not result in a temperature increase of more than 3 °C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the discharge point;
- Assuming minimum dilution 1:10 on discharge; lower ratio would attract progressively stringent standards to be determined by the Federal Environmental Protection Agency (EPA);
- 1:10 dilution means that for each one cubic meter of treated effluent the recipient water body should have 10 cubic meters of water for the dilution of this effluent;
- Modified Benzene Alkyl Sulfate; assuming surfactant as biodegradable;
- Pesticides include herbicides, fungicides, and insecticides;
- Subject to total toxic metal discharge should not exceed level given at Sr. No. 25.

Notes:

1. Dilution of liquid effluents by mixing them with fresh water to bring them to the NEQS limiting values before discharging to the environment is not permissible.

2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the NEQS limits.

ANNEXURE-VII

NATIONAL ENVIRONMENTAL QUALITY STANDARDS FOR SELECTED GASEOUS POLLUTANTS FROM INDUSTRIAL SOURCES

No	Parameter	Sources of Emissions	Standards
1	Smoke	Smoke opacity not to exceed	40% or 2 on Rnglemann
2	Particulate matter	Boilers and furnaces:	
		Oil fired	300mg / Nm3
		Coal fired	500mg / Nm3
		Cement Kilns	300mg / Nm3
		Grinding, crushing, clinker, coolers and related process, converter, blast furnaces and cupolas	500mg / Nm3
3	Hydrogen Chloride	Any	400mg / Nm3
4	Chlorine	Any	150mg / Nm3
5	Hydrogen Fluoride	Any	150 mg / Nm3
6	Hydrogen Sulfide	Any	10 mg / Nm3
7	Sulfur Oxides	Sulfuric Acid / Sulfonic acid plants	5.000 mg / Nm3
8	Carbon dioxide	Any	800 mg / Nm3
9	Lead	Any	50 mg / Nm3
10	Mercury	Any	10 mg / Nm3
11	Cadmium	Any	20 mg / Nm3
12	Arsenic	Any	20 mg / Nm3
13	Copper	Any	50 mg / Nm3
14	Antimony	Any	20 mg / Nm3
15	Zinc	Any	200 mg / Nm3
16	Oxides of Nitrogen[1]	Other plants except power plants operating on oil or gas:	
		Cement kilns	1,200 mg / Nm3
		Oil fired	400 mg / Nm3
		Coal fired	600 mg / Nm3

Notes:

- All values are in mg / Nm3, unless otherwise defined
- Based on the assumption that the size of the particulate is 10 microns or more.
- Based on 1% sulfur content in fuel oil. Higher content of sulfur will cause standards to be pro-rated
- In respect of emission sulfur dioxide and nitrogen dioxide. The power plants operation on oil and coal as fuel shall comply with the National Environmental Quality Standards.

ANNEXURE-VIII

PRPOSED NATIONAL ENVIRONMENTAL QUALITY STANDARDS FOR NOISE

Proposed National Environmental Quality Standard for Noise					
S. No.	Category of Area / Zone	Effective from 1st January, 2009		Effective from 1st January, 2010	
		Limit it in dB(A) Leq*			
		Day Time	Night Time	Day Time	Night Time
1	Residential area	65	50	55	45
2	Commercial area (B)	70	60	65	55
3	Industrial area (C)	80	75	75	65
4	Silence Zone (D)	55	45	50	45
Note: 1	Day time hours: 6.00 a. m to 10.00 p. m				
2	Night time hours: 10.00 p. m to 6.00p. m				
3	Silence zone; Zone which are declared as such by competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.				
4	Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.				
*dB(A) Leq	Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.				

ANNEXURE-IX

EMERGENCY RESPONSE PLAN

SEISMIC OPERATION

Purpose and scope of the document

The objective of this Medical Emergency Evacuation Plan is to explain the line of action to be followed in case of a medical emergency on MATOL operation and to define the responsibilities of different persons. All the concerned MATOL employees will act as a team on both the ends i.e. Karachi Head office and distillery location.

Once issued, the plan will be used as a guideline to deal with all the medical emergencies and will be practiced through drills on quarterly basis. Under no condition the plan should be changed without the information of Management in Karachi, and any change should be followed, in not more than 24 hrs, by the written report of the reason of the change from documented guidelines.

To cover the medical problems on the MATOL operational site. MATOL will set a well-managed medical system, with contacts at reliable health facilities to take care of grave medical emergencies.

The brief description is as follows:

MATOL operational site doctor shell is responsible for providing the medical coverage for minor health problems on the field. He is also responsible for providing first aid in case of a medical emergency and to giving suggestion to management regarding evacuation of a diseased person in case of medical emergency.

Medical emergency location

Medical emergencies for example uncontrolled high-grade fever. severe dehydration, flaring up of gastric ulcer, burns etc. All such emergencies will be referred to the nearest hospital. Surgical emergencies for example acute abdomen, trauma, fractures etc. All such emergencies will also be referred to the nearest hospital.

Insect bites

The field clinic should have capability to treat scorpion and snakebite cases. However, all such cases will be referred to the hospital for treatment on the decision of the onsite doctor. Site

doctor will accompany the victim to the hospital and will return after ensuring that the right person has started the proper treatment.

Medical Emergencies related to Road Traffic Accidents All such cases will be referred initially to nearest facility.

FIRE CONTINGENCY PLAN

Fire is a major hazard in any situation where large number of people work and sleep in a relatively confined area. Four essential steps in the control of the fire hazards are:

Reduction of the Basic Risk by:

- Restricting cigarette smoking
- Upgrading and maintenance of electrical fittings •
- Posting warning notices
- Training -both in the use of fire-fighting equipment and in general awareness of the hazards and what to do in the event of fire.

Early Detection by:

- Means of smoke alarms•
- Personal vigilance

Prompt Reaction by:

- Shouting "Fire, Fire, Fire!"
- Sounding the fire alarm •
- Evacuating the tents and trailer
- Fighting the fire, if appropriate

Immediate Response by:

- Using the nearest suitable fire extinguishers
- Isolating the electrical supply, if appropriate
- Accounting for all personnel (Head count)
- Organizing available personnel to assist with fire-fighting, if appropriate

There shall be one Fire Chief! Fire Fighting Team Leader. He will form a Fire Team from available personnel if the fire team member not present. When the Fire Alarm is sounded, the

facility must be evacuated immediately and the occupants must proceed directly to the Muster Point. A head count and search must be carried out as soon as all occupants are out of their working locations.

On discovering fire Fire extinguishers, Dry Powder fire extinguishers are located near the door of every portion of the building, and on each vehicle. Foam fire extinguishers shall be located near fuel locations. On discovering a fire, you should immediately attempt to fight it with the nearest extinguisher UNLESS:

There is no extinguisher on hand

OR

The fire is near the exit to your room

OR

There is a noticeable quantity of smoke

OR

You are not confident of using the extinguisher

OR

The fire is visibly increasing in size.

OR

A fuel tank has caught fire (EVACUATE THE AREA) In which case,

GET OUT AT ONCE AND SOUND THE ALARM

All personnel, upon hearing the alarm, proceed to the Muster Point immediately. Anyone near a radio upon hearing the alarm will make a general call announcing:

Fire in Camp - Fire in Camp"

If a fire is extinguished, remember that it can re-ignite spontaneously. Do not leave the scene until it is assured that the fire is out and will not re-ignite. Then immediately report the incident to the Party Chief, HSE Adviser or the most senior person in camp.

On hearing the fire alarm **everyone** is to proceed directly to the Muster Point. A head count will be conducted at the Muster point. Following procedures are designed to insure the safety of Personnel.

- All the fire wardens will check the areas allotted to them. The fire team will approach to the fire scene under the direction of the fire chief.

- The Fire Chief I Fire Team is to proceed directly to the fire and carry out the crew procedure for dealing with the situation.

Fire fighting procedures

These are guidelines only to give a general outline towards getting a fire extinguished should the situation arise. Below assumes that we have a major fire in the camp area. Hopefully before it gets to this situation somebody has been able to put the fire out while it is minor.

A fire fighting team will be set up from available personnel. This team will be trained in correct fire fighting procedure. Other crew members will also be trained so they maybe co-opted onto the team as required. Eventually all crew members should be trained in the use of fire extinguishers and basic fire control.

Protection of personnel -equipment

The prime concern in case of fire is the protection of personnel -equipment is secondary; the person discovering the fire should raise the alarm, immediately evacuate everyone from the area and notify the fire chief.

The "FIRE CHIEF" will be the most experienced in camp and will take complete charge of fire fighting and directing the "FIRE TEAM". the senior member of the kitchen staff will account to the coordinator for their personnel, including the camp boss.

The head of each department will account for his men. The coordinator gets a head count at the muster point. At the same time the electrician will cut off the power to the fire location. Power should only be cut to the fire site as power is required for lighting if at night and also to run water pumps, if available. The least people involved the better. All other people are to stay at the muster point. Should they be required they will be directed where to go and what to do.

REMEMBER THAT THIS IS ONLY A GUIDE. NOTHING EVER HAPPENS AS PLANNED

WEATHER CONTINGENCY PLAN

In case of severe weather conditions the following precautions will be taken:

Fog

No one shall leave the camp until the PC has assessed the situation and is satisfied that the visibility is such that driving will not be hazardous. All vehicles will travel with headlights on until the fog has completely cleared. Vehicles will travel in convoy if necessary.

Heavy rain driving in the rain calls for extra care and driving skills. The roads will be slippery, and acceleration and braking must be made gently. Reduce your speed and be aware of olfler road users. Should the rain be heavy enough to impair your vision, you should pull off the road in a safe location and wait for the weather to pass. Call base camp to inform them of your late arrival and present location.

Sandstorm

The sandstorm will be treated as FOG. Visibility will be seriously impaired, and disorientation is a possibility. Take care exiting the vehicle as the strong wind could blow the door out of your grasp.

In all severe weather conditions the senior most staff member will decide upon the best course of action for the crew and trouble shooters. Should the situation dictate, production will be stopped and personnel ordered to take shelter? Department heads will co-ordinate with their unit's incharge to decide upon the safest course of action. All vehicles standing by on weather should call back and inform them of their status and position.

EMERGENCY SPILL PROCEDURE

Stop the flow as soon as possible Use any safe, practical means at your disposal. Remember to locate and check the operation of all valves daily. Remember that every gallon you keep from leaking is one less to clean up later: Contain the spill in the smallest possible area Sound judgment is the key to good containment. Keep in mind that other regulatory agencies have very definite ideas about what you can or cannot do with the natural resources around the fuel site. If you use the material around the spill to create a dike, be sure that it can be restored to its original condition after clean up is complete. Report the spill through the proper channels and initiate clean-up procedures:

- Prompt, accurate reporting is imperative and should be done as soon as possible after discovery of the spill.
- If the spill is minor and the cleanup is obvious you should go ahead but if a major spill occurs you should stand by for detailed instructions.

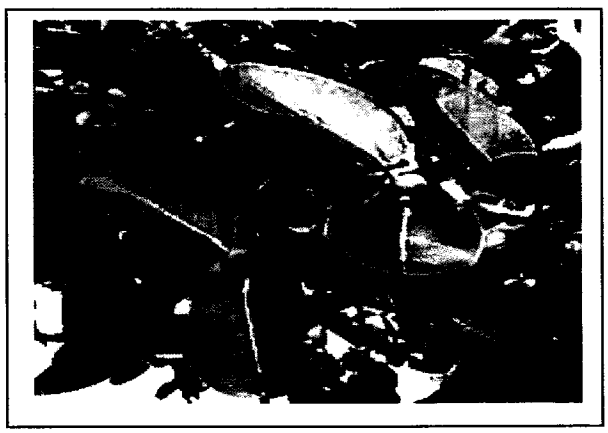
- Remember that disposal of waste created by clean up has to be taken care of properly and not left to create another problem
- In some cases, this may require evacuation of the waste to a suitable site designated by the authorities.

In conclusion, you must do everything possible to prevent a spill but if one does happen you should STOP THE FLOW, CONTAIN THE MATERIAL and REPORT THE INCIDENT through proper channels, AND CLEAN IT UP

ANNEXURE-X

FLORA AND FAUNA OF THE STUDY AREA

Citrus aurantifolia



Ficus benghalensis

Cassia fistula

Common nightingale

Bulbul

Leopard Gecko

ANNEXURE-XI

TEST REPORTS

GEL
Pvt Ltd

PNAC | LAB 074 17025

CHEMICAL ANALYSIS TEST REPORT

Report reference No.: GEL/LAB/14385-B
Date: 04.02.2015
Name of industry: Matyari Sugar Mills
Address: District Matyari
Telephone/Fax:
Nature of sample: Waste Water (Distillery)
Grab/Composite: Grab
Date of sample collection: 27.01.2015
Date of sample received: 28.01.2015
Sample collected/sent by: Collected by GEL
Date of completion of analysis: 04.02.2015

S.No.	Parameters	Unit	NEQS Limits			Concentration	Method	Remarks
			1	2	3			
1	Temperature	°C	40=<3	40=<3	40=<3	32	Thermometer	
1	pH value	---	6-9	6-9	6-9	7.14	pH meter	
2	COD	mg/l	150	400	400	~5150	Hach Method 8000	
3	BOD5	mg/l	80	250	80**	~7344	Hach BOD Trak 10099	
4	Total suspended solids	mg/l	200	400	200	556	APHA 2540 D	
5	Oil & Grease	mg/l	10	10	10	14	Solvent Extraction	

NEQS= National Environmental Quality Standards
1 = NEQS for Municipal and Liquid Industrial Effluents into Inland Waters
2 = NEQS for Municipal and Liquid Industrial Effluents into Sewage Treatment
3 = NEQS for Municipal and Liquid Industrial Effluents into Sea
** = The value for industry is 200mg/l
This report is not valid for any negotiation
Note: The above test conducted are not in the scope of Accreditation

Analyzed/tested by: Muhammad Jawwad, Analyst

Checked/Verified by: Zahid Raza, GM P & D

Muhammad Qamaruddin, GM Karachi Lab

End of the Report

Global Environmental Lab (Pvt) Ltd
2nd Floor, Aiwan-e-Sanat, ST-4/2, Sector-23, Korangi Industrial Area, Karachi.
Ph: (92-21) 35113804-5 Fax: (92-21) 35113806 Email: info@gel.com.pk

GEL

Pvt Ltd

PNAC LAB 074 17025

GEL/LAB/14385 E

Date : 29.01.2015

NOISE LEVEL ESTIMATION RESULTS

1) Name of Company : Matyari Sugar Mills
2) Address : District Matyari
3) Date of Analysis : 27.01.2015
4) Test Method : Noise Level Meter
5) No. of Samples : 3

S. No.	Source	Average dB	Remarks
1	*Boiler Area*	84.5	
2	*Power House*	87.5	
3	*Production House*	74.5	

NEQS LIMIT is 85 dB for sound level measured from a distance of 7.6 meters.
Note: The above test conducted are not in the scope of Accreditation

Sample analyzed by : Ahsan Ali

Verified by:

Signature of Incharge of the Environmental Laboratory:

Name : Muhammad Qadiruddin
Designation : GM Karachi Lab
Date : 29.01.2015

End of the Report

Global Environmental Lab (Pvt) Ltd

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