TWO STAR ENERGY (PRIVATE) LTD.

TSEPL/HO/PROJ/NEPRA/01 Dated: February 17, 2017

The Registrar
National Electric Power Regulatory Authority
NEPRA Tower, Attaturk Avenue (East)
Sector G-5/ I
Islamabad

Subject: Application for a new Generation License of M/s Two Star Energy (Private) Limited

Dear Sir

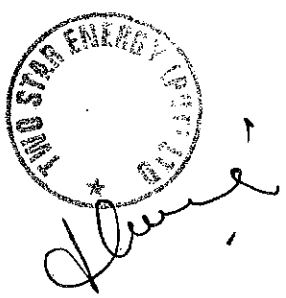
I, Mr. Muhammad Mudassir Iqbal, Head – Energy Business being the authorized representative of M/S Two Star Energy (Private) Limited by virtue of Board Resolution dated 26 December 2016, hereby apply to National Electric Power Regulatory Authority for grant of Generation license to the M/S Two Star Energy (Private) Limited pursuant to section (3) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

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

A Bank Draft No 03170652 in the sum of Rupees PKR 292,896/- (Pak Rupees Two Hundred Ninety Two Thousand Eight Hundred and Ninety Six Only), being the non-refundable license application fee calculated in accordance with the schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

We have attached below documents in this regard along with this application:

1. Schedule I
2. Specification of additional units
3. Schedule II
4. Demand draft No. 03170652 of PKR 292,896/- (Pak Rupees Pak Rupees Two Hundred Ninety Two Thousand Eight Hundred and Ninety Six Only) favoring National Electric Power Regulatory Authority being Application fee for 49.8MW of Two Star Energy (Private) Limited
5. Copy of Letter Of Intent
6. Letter for Environmental and Social Soundness Assessment ("ESSA") Report to Director General, EPA, Punjab
7. Personal Net worth's of the Directors
8. Certificate of Incorporation and Memorandum and articles of association
9. Curriculum vitae of senior management, technical and professional staff.
10. Grid Interconnectivity study report
11. Feasibility Report
12. Information of Sub-contractors
13. Prospectus
14. Infrastructure
15. Project commencement and completion schedule
16. Safety Plan
17. Emergency Plan
18. Training and Development Plan



City Towers, 9th Floor, 6-K, Main Boulevard, Gulberg-II, Lahore-54660 (Pakistan) Tel: (92-42) 35770001-3, 111-130-130
Fax: (92-42) 35770015 E-mail: lhroff@umergroup.com

TWO STAR ENERGY (PRIVATE) LTD.

We shall be pleased to provide any further information you may require.

We request an early action in this matter.

Thanking You.
For Two Star Energy (Private) Limited

Muhammad Mudassir Iqbal
Head – Energy Business

City Towers, 9th Floor, 6-K, Main Boulevard, Gulberg-II, Lahore-54660 (Pakistan) Tel: (92-42) 35770001-3, 111-130-130
Fax: (92-42) 35770015 E-mail: lhroff@umergroup.com

TWO STAR ENERGY (PRIVATE) LTD.

Ref: RES-TSE/03/BOD-RES/2017

CERTIFIED TRUE COPY OF RESOLUTION OF THE BOARD OF DIRECTORS PASSED IN THE BOARD OF DIRECTORS' MEETING HELD ON 26 DECEMBER 2016 AT 11:30 A.M. AT ITS REGISTERED OFFICE CITY TOWERS, 9th FLOOR, 6-K, MAIN BOULEVARD, GULBERG II, LAHORE

"**RESOLVED THAT** the company ("Two Star Energy (Private) Limited") intends to install an approximately 49.8 MW high pressure bagasse based cogeneration power project at Toba-Chichawatni road, Tehsil Kamalia, District Toba Tek Singh, Punjab.

FURTHER RESOLVED THAT Mr. Makhdum Omar Shehryar (Director), Mr. Mian Muhammad Shakeel Umer (Director) and Mr. Muhammad Mudassir Iqbal (Head - Energy Business) of the company, be and are hereby authorized and empowered on behalf of the company to deal with the Alternative Energy Development Board ("AEDB"), National Electric Power Regulatory Authority ("NEPRA"), Central Power Purchasing Agency (G) Limited ("CPPA-G") and Faisalabad Electric Supply Company ("FESCO") in connection with issuance of letter of intent, generation license, tariff and all related matters to sign and execute all the documents, and do and take all necessary acts, which may be required by AEDB, NEPRA, CPPA-G and FESCO from time to time and to do all other incidental and ancillary acts, things and deeds.

FURTHER RESOLVED THAT a copy of this resolution be provided to the AEDB, NEPRA, CPPA-G and FESCO with the seal/stamp duly affixed thereon for their information and record".

TWO STAR ENERGY (PVT) LTD.

Mian Muhammad Shakeel Umer
Director

A024430

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

SECP

COMPANY REGISTRATION OFFICE, LAHORE

CERTIFICATE OF INCORPORATION

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

Corporate Universal Identification No. **0104212**

I hereby certify that **TWO STAR ENERGY (PRIVATE) LIMITED** is this day incorporated under the Companies Ordinance, 2016 (VI of 2016) and that the company is **Limited by Shares.**

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

CERTIFIED TO BE TRUE COPY
14/12/2016
DEPUTY REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE.

Fee Rs.11,000/-

(SABOOHI ISRAR)
Deputy Registrar of Companies

No.ARL/12111 **DATED 14-12-2016**

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

THE COMPANIES ORDINANCE, 2016

FORM 29

[SECTION 197]

Company Registration Office * Lahore * Securities and Exchange Commission of Pakistan

Please Complete in typescript or in bold block capitals

1. Incorporation Number
2. Name of Company: TWO STAR ENERGY (PVT.) LIMITED
3. Fee Paid (Rs.): 300.0 — Name and Branch of Bank: Credit Card
4. Receipt No.: E-2016-527324 — Date (DD/MM/YYYY): 14/12/2016
5. Mode of Payment (Indicate): Credit Card
6. Particulars*:

6.1. New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)
Mr. Makhdum Omar Shehryar	4230197257327	S/O Mr. Makhdum Rukanuddin	House # 08, Shami Road, Lahore Cantt, Lahore	Director	Pakistan		Since Incorporation.	
Mr. Mian Mohammad Shakeel Umer	4230157780185	S/O Mr. Mohammad Umer	House no. B-6 II, Main Gazri Boulevard Phase -4,DHA Karachi, South Karachi	Director	Pakistan		Since Incorporation.	
Mr. Mohammad Umer	4230176255081	S/O Mr. Khurram Salim	House no. B-8, Main Gazri Boulevard Phase -4,DHA Karachi, South Karachi	Director	Pakistan		Since Incorporation.	
Mrs. Riffat Zamani	3130373490972	S/O Makhdum Rukanuddin	Mianwali Qureshian, Post Office Rahim Yar Khan, District Rahim Yar Khan	Director	Pakistan		Since Incorporation.	

6.2. Ceasing of Officer/Retirement/Resignation

Present Name in Full (a)	NIC No. or Passport No. in	Father / Husband	Usual Residential	Designation	Nationality**	Business Occupation	Date of Present	Mode of Appointement / change / any

Present Name in Full (a)	case of Foreign National (b)	Name (c)	Address (d)	(e)	(f)	*** (if any) (g)	Appointment or Change (h)	change / any other remarks (i)

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

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

Name of Signatory	Mr. Mian Mohammad Shakeel Umer	Designation	Director
Signature of Chief Executive/Secretary		Date (DD/MM/YYYY)	14/12/2016

* In the case of a firm, the full name, address and above mentioned particulars of each partner, and the date on which each became a partner.
** In case the nationality is not the nationality of origin, provide the nationality of origin as well.
*** Also provide particulars of other directorships or offices held, if any.

CERTIFIED TO BE TRUE COPY
14/12/2016
DEPUTY REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE.

THE COMPANIES ORDINANCE, 2016

(COMPANY LIMITED BY SHARES)

MEMORANDUM

OF

ASSOCIATION

OF

Two Star Energy (Private) Limited

The Companies Ordinance, 2016

(Company Limited by Shares)

Memorandum of Association of

Two Star Energy (Private) Limited

1. The name of the company is Two Star Energy (Private) Limited.

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

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

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

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

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

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

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

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

4. The liability of the members is limited.

5. The authorized capital of the company is Rs 1,000,000 (Rupees one million only) divided into 100,000 (one hundred thousand) ordinary shares of Rs. 10/- (Rupees ten only) each.

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

Name and Surname in Full	Father's/Husband Name (in Full)	Nationality with any former Nationality	Occupation	Residential Address (in Full)	Number of shares taken by each subscriber	Signatures
1. Mr. Mian Mohammad Shakeel Umer CNIC # 42301-5778018-5	Mr. Mohammad Umer	Pakistani	Business	House # B-6/II, Main Gazri Boulevard Phase -4,DHA Karachi, South Karachi	12,500 (Twelvee thousand five Hundred Only)	
2. Mr. Mohammad Umer CNIC # 42301-7625508-1	Mr. Khurram Salim	Pakistani	Business	House # B-8, Main Gazri Boulevard Phase -4,DHA Karachi, South Karachi	12,500 (Twelve thousand five Hundred only)	
3. Mr. Makhdum Omar Shehryar CNIC # 42301-9725732-7	Mr. Makhdum Rukanuddin	Pakistani	Business	House # 08, Shami Road, Lahore Cantt, Lahore	12,500 (Twelve thousand five Hundred only)	
4. Mrs. Riffat Zamani CNIC # 31303-7349097-2	Mr. Makhdum Rukanuddin	Pakistani	Business	Mianwali Qureshian, Post Office Rahim Yar Khan, District Rahim Yar Khan	12,500 (Twelve thousand five Hundred only)	
				Total Number of Shares Taken	50,000 (Fifty thousand Only)	

Company Registration Office Lahore * Securities and Exchange Commission of Pakistan *

CERTIFIED TO BE TRUE COPY
DEPUTY REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE.

Dated the 13th day of December, 2016.

Witness to above signatures:

Name: **National Institutional Facilitation Technologies (Private) Limited**
Address: **5th Floor, AWT Plaza, I. I. Chungrigar Road, Karachi**

THE COMPANIES ORDINANCE, 2016

(COMPANY LIMITED BY SHARES)

Articles of Association

of

Two Star Energy (Private) Limited

THE COMPANIES ORDINANCE, 2016

(Private Company Limited by Shares)

ARTICLES OF ASSOCIATION

OF

Two Star Energy (Private) Limited

1. The Regulations contained in Table 'A' to the First Schedule to the Companies Ordinance, 2016 (the "Ordinance") shall be the regulations of **Two Star Energy (Private) Limited** (the "Company") so far as these are applicable to a private company.

PRIVATE COMPANY

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

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

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

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

TRANSFER OF SHARES

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

DIRECTORS

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

   1. Mr. Mian Mohammad Shakeel Umer
   2. Mr. Mohammad Umer
   3. Mr. Makhdum Omer Shehryar
   4. Mrs. Riffat Zamani

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

Name and Surname in Full	Father's/Husb and Name (in Full)	Nationality with any former Nationality	Occupation	Residential Address (in Full)	Number of shares taken by each sub-scriber	Signatures
1. Mr. Mian Mohammad Shakeel Umer CNIC # 42301-5778018-5	Mr. Mohammad Umer	Pakistani	Business	House # B-6/II, Main Gazri Boulevard Phase -4,DHA Karachi, South Karachi	12,500 (Twelve thousand five Hundred only)	
2. Mr. Mohammad Umer CNIC # 42301-7625508-1	Mr. Khurram Salim	Pakistani	Business	House # B-8, Main Gazri Boulevard Phase -4,DHA Karachi, South Karachi	12,500 (Twelve thousand five Hundred only)	
3. Mr. Makhdum Omar Shehryar CNIC # 42301-9725732-7	Mr. Makhdum Rukanuddin	Pakistani	Business	House # 08, Shami Road, Lahore Cantt, Lahore	12,500 (Twelve thousand five Hundred only)	
4. Mrs. Riffat Zamani CNIC # 31303-7349097-2	Mr. Makhdum Rukanuddin	Pakistani	Business	Mianwali Qureshian, Post Office Rahim Yar Khan, District Rahim Yar Khan	12,500 (Twelve thousand five Hundred only)	
				Total Number of Shares Taken	50,000 (Fifty thousand Only)	

Company Registration Office * Lahore * Securities and Exchange Commission of Pakistan

CERTIFIED TO BE TRUE COPY
14/12/2016
DEPUTY REGISTRAR OF COMPANIES
COMPANY REGISTRATION OFFICE
LAHORE.

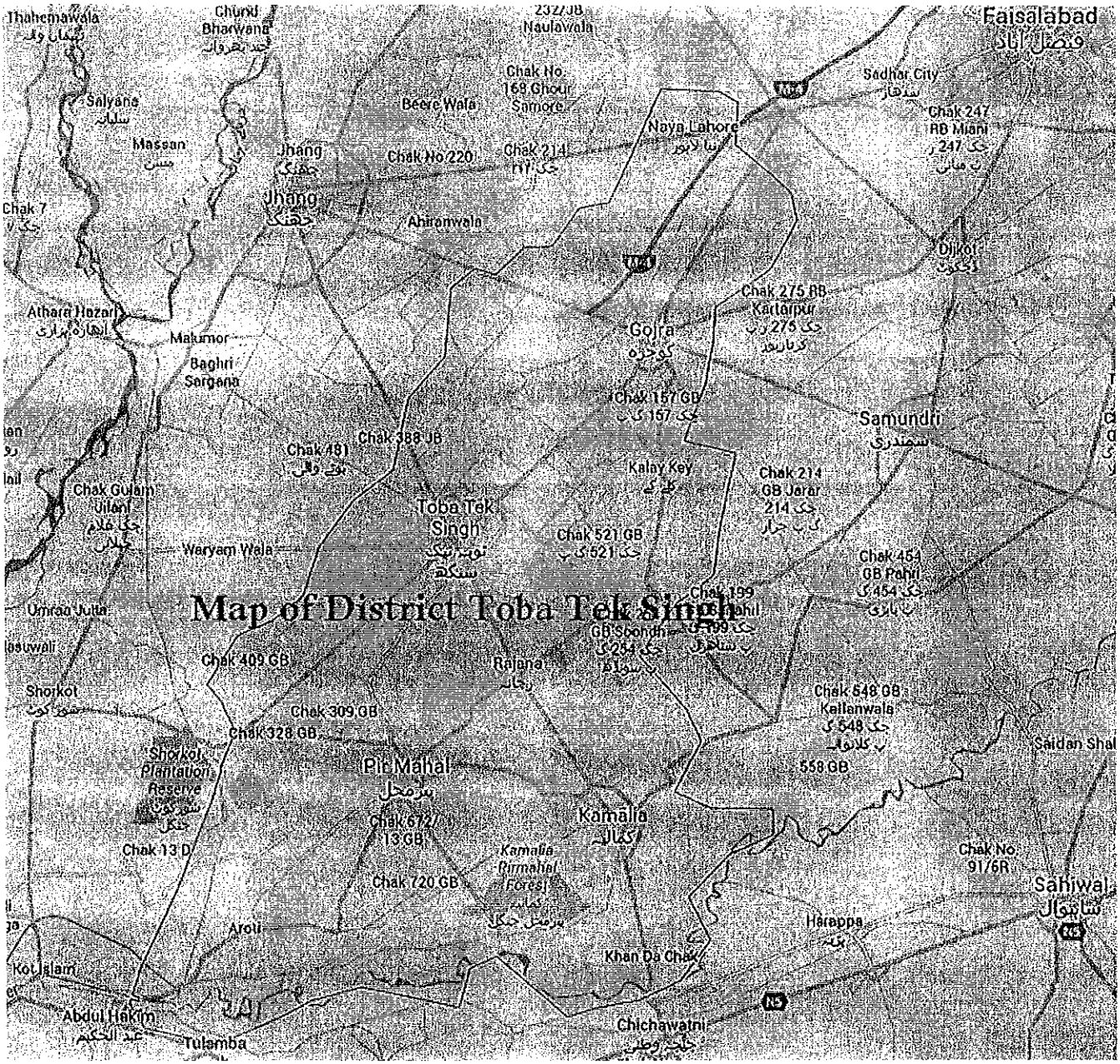
Dated the 13th day of December, 2016

Witness to above signatures:

Name: National Institutional Facilitation Technologies (Private) Limited
Address: 5th Floor, AWT Plaza, I. I. Chungrigar Road, Karachi

Schedule-1

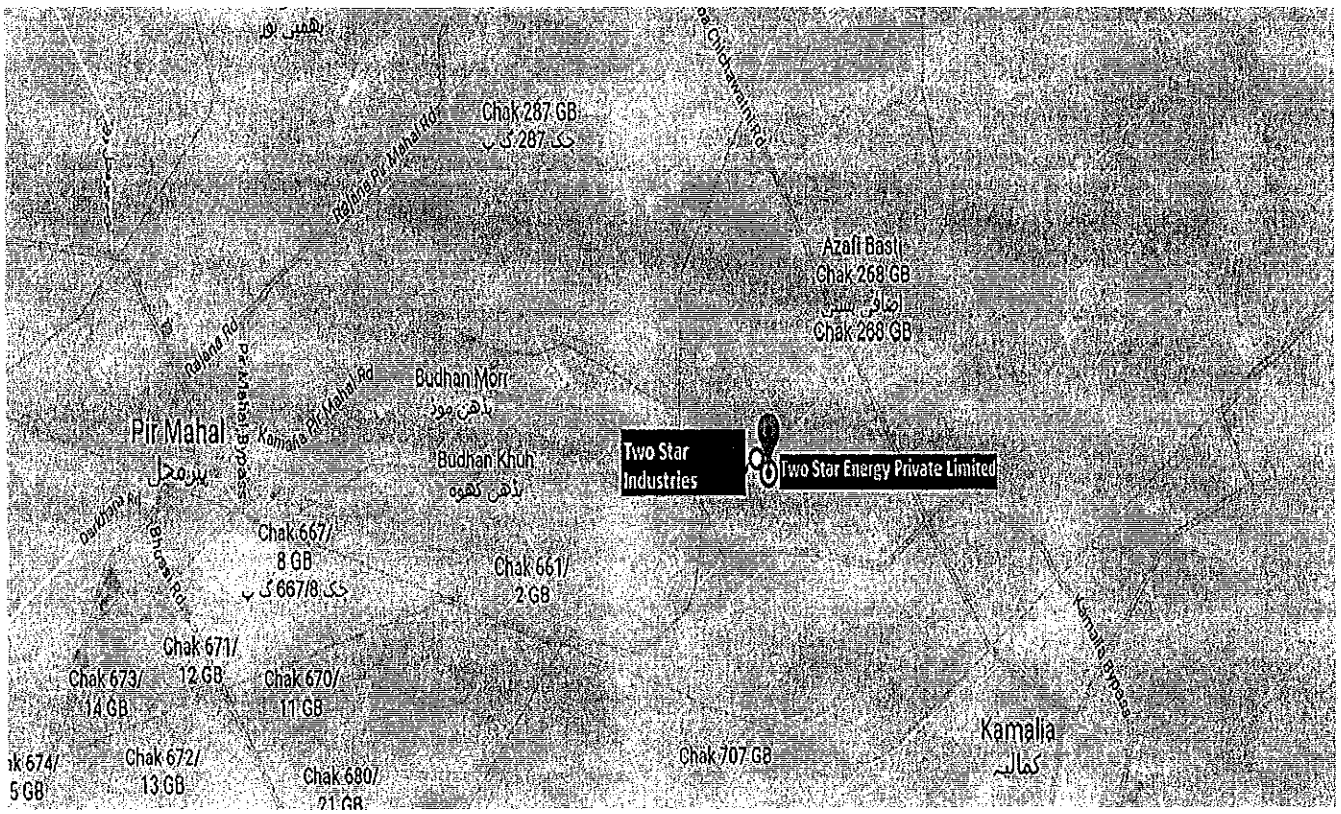
The Location, Size (capacity in MW), Type of Technology, Interconnection Arrangements, Technical Limits, Technical/Functional Specifications and other details specific to the Generation Facilities of the Licensee are described in this Schedule.


Map of District Toba Tek Singh
Faisalabad
فیصل آباد
Thahemawala
Churid
Bharwana
232/JB
Naulawala
Chak No
169 Ghour
Samore
Sadhar City
Chak 247
RB Miani
Salyana
Beere Wala
Naya Lahore
Massan
Jhang
Chak No 220
Chak 214
Jhang
Ahiranwala
Chak 7
Dijkot
Chak 275 RB
Kartarpur
Athara Hazari
Makumor
Gojra
Baghri
Sargana
Chak 157 GB
Samundri
Chak 388 JB
Chak 481
Kalay Key
Chak 214
GB Jarar
Chak Gulam
Ullan
Toba Tek
Singh
Chak 521 GB
Waryam Wala
Chak 454
GB Pahil
Chak 199
Umraa Jutta
GB Sondh
Chak 409 GB
Rajana
Chak 548 GB
Kallanwala
Shorkot
Chak 309 GB
Chak 328 GB
Shorkot
Plantations
Reserve
Pir Mahal
559 GB
Saidan Shal
Chak 672/
13 GB
Kamalia
Chak No
91/6R
Chak 13 D
Kamalia
Pirmahal
Forest
Chak 720 GB
Sahiwal
Aroti
Harappa
Khan Da Chak
Kot Jalam
Abdul Hakim
Chichawatni
Tulamba

Plant Location

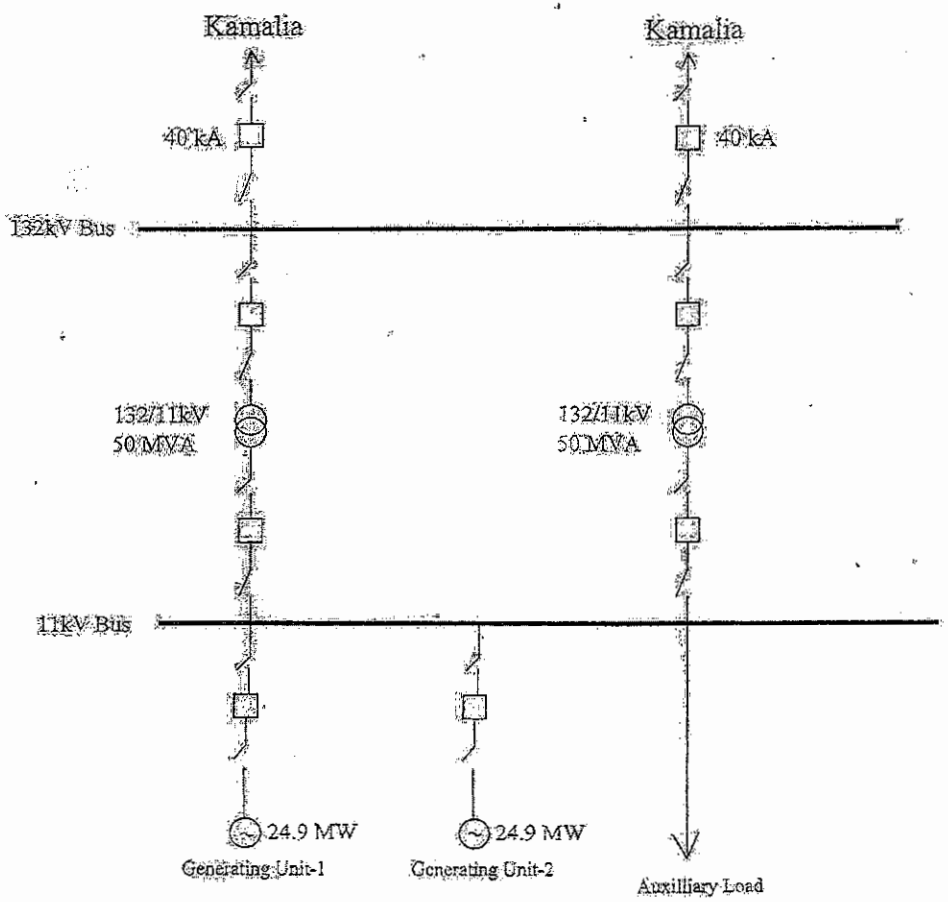
Plant Location

- The proposed project is located on Toba - Chichawatni road, Tehsil Kamalia of District Toba Tek Singh Road.
- The project is located 245 KM from Lahore and 45 KM off from Lahore-Multan road.
- Geographical/GPS Coordinates of the location are 30.758709N, 72.579567E.



Generation License
Two Star Energy (PRIVATE) LIMITED
CITY TOWERS, 9th FLOOR
6-K, MAIN BOULEVARD
GULBERG II, LAHORE

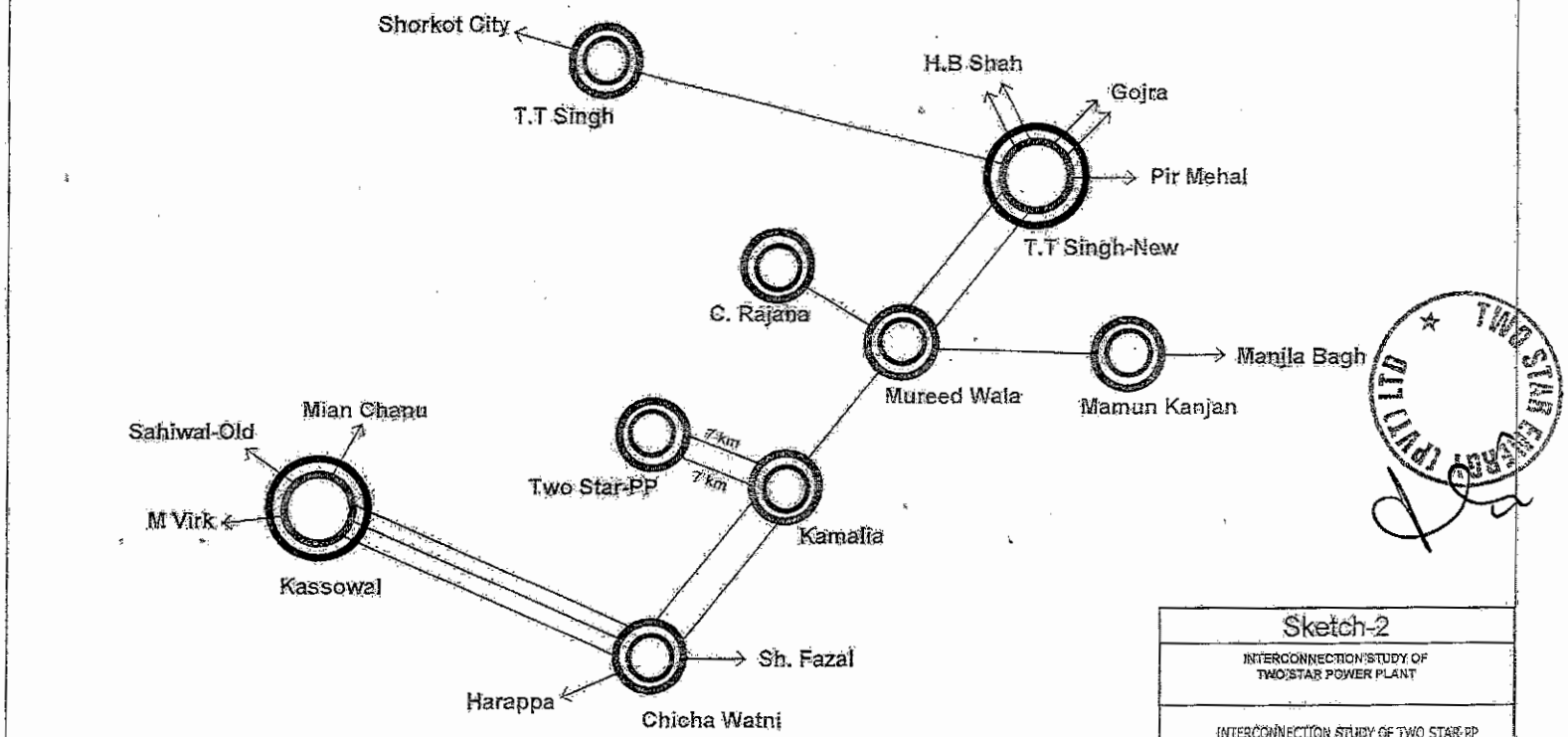
Single Line Diagram of 132/11 kV Busbar At Two Star-PP



Sketch-4	
INTERCONNECTION STUDY OF TWO STAR POWER PLANT	
INTERCONNECTION STUDY OF TWO STAR PP	
POWER PLANNERS INTERNATIONAL 64-B WAPDA TOWN LAHORE	
PREPARED BY	RECOMMENDED / VER./CHD. / APPROVED
DWN / CHD / SUPVR.	DATE / DRAWING NO. / REV.
	FIG.No. 0

Generation License
Two Star Energy (PRIVATE) LIMITED
CITY TOWERS, 9th FLOOR
6-K, MAIN BOULEVARD
GULBERG II, LAHORE

Study of Interconnection of 49.8 MW Two Star Energy (Pvt.) Limited
With Two Star PP, January 2019



TWO STAR ENERGY (PVT) LTD

Sketch-2	
INTERCONNECTION STUDY OF TWO STAR POWER PLANT	
INTERCONNECTION STUDY OF TWO STAR PP	
POWER PLANNERS INTERNATIONAL 64-E WARDA TOWN LAHORE	
PREPARED BY	RECOMMENDED / REVIEWED / APPROVED
DWN / FILE / CHD / SUPV	DATE: JAN 2019
DRAWING NO. FIG.No. 001	REV. 0

INTERCONNECTION / TRANSACTION ARRANGEMENT FOR THE DISPERSAL OF POWER FROM THE POWER PLANT

The Power generated by Two Star Energy (Pvt.) Limited (TSEPL) from its Bagasse based Thermal Power Generation facility shall be dispersed to TSEPL and Load center of Faisalabad Electric Supply Company (FESCO).

The Interconnection/Transmission Arrangement for the above mentioned facilities will be at 132 KV voltage under the Framework for Power Co-generation, 2013 (Bagasse/Biomass) approved by the ECC of the cabinet in March 2013.

The final Interconnection and Transmission Arrangement(s), for the dispersal of power, as agreed by TSEPL and FESCO shall be communicated to NEPRA in due course of time.

Plant Details

General Information

1	Name of Applicant	Two Star Energy (Private) Limited
2	Registered/Business Office	City Towers, 9th Floor 6-K, Main Boulevard, Gulberg II, Lahore
3	Plant Location	Toba - Chichawatni road, Tehsil Kamalia of District Toba Tek Singh, Punjab
4	Type of Generation Facility	Bagasse Fired Thermal Power Station

Plant Configuration

1	Plant Size Installed Capacity (Gross ISO)	49.8 MW	
2	Type of Technology	Steam Turbine	
3	Number of Units/Size (MW)	Unit 01	Unit 02
		24.9 MW	24.9 MW
4	Unit Make & Model	HTC, SKODA, SIEMENS etc.	HTC, SKODA, SIEMENS etc.
5	Commissioning/Commercial Operation Date	September, 2018	September, 2018
6	Expected Life of the Units of Facility from Commercial Operation/Commissioning Date	30 years	30 years
7	Expected Remaining useful Life of the Units of the Facility	30 years	30 years

Fuel/Raw Material Details

1	Primary Fuel	Bagasse		
2	Alternate Fuel	Furnace Oil (FO)		
3	Fuel Source (Imported/Indigenous)	Primary Fuel	Alternate Fuel	
		Indigenous	Imported/Indigenous	
4	Fuel Supplier	Primary Fuel	Alternate Fuel	
		TSEPL	Shell Pakistan Ltd/PSO	
5	Supply Arrangement	Primary Fuel	Alternate Fuel	
		Through Conveyor Belts / Loading Trucks / Tractor / Trolleys etc.	Through Oil Tankers	
6	Sugarcane Crushing Capacity	14000 Tons/Day		
7	Bagasse Generation Capacity	4550 Tons/Day		
8	Bagasse Storage Capacity	150,000 Tons Bagasse		
9	No. Of Storage Tanks	Bagasse	FO	
		Bulk Storage	2	
10	Storage Capacity of Each Tank (Tons)	Bagasse	FO	
		Bulk Storage	Tank-1	Tank-2
			500	125
11	Gross Storage (Tons)	Bagasse	FO	
		Bulk Storage	625	

Emission Values

1	SO_X	Bagasse	FO
		0 %	To be provided later
2	NO_X	Bagasse	FO
		2 ~ 5 %	To be provided later
3	CO_2	Bagasse	FO
		12 % ~ 13 %	To be provided later
4	CO	Bagasse	FO
		2 % ~ 3 %	To be provided later
5	PM_{10}	Bagasse	FO
		Nil	To be provided later

Cooling System

1	Cooling Water Source/Cycle	Condensate water of Ground Water Turbine installed at plant site / Closed Loop

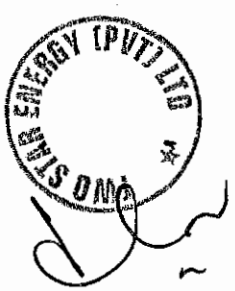
Plant Characteristics

		Unit 1
1	Generation Voltage	11 KV
2	Frequency	50 Hz
3	Power Factor	0.8 Lagging - 0.9 Leading
4	Automatic Generation Control(AGC)	Yes
5	Ramping Rate	4 KW / Sec
6	Time required to synchronizing to Grid and Loading the Complex to full load.	5 Hrs. for cold start / 30 seconds for synchronizing to Grid

		Unit 2
1	Generation Voltage	11 KV
2	Frequency	50 Hz
3	Power Factor	0.8 Lagging - 0.9 Leading
4	Automatic Generation Control(AGC)	Yes
5	Ramping Rate	4 KW / Sec
6	Time required to synchronizing to Grid and Loading the Complex to full load.	5 Hrs. for cold start / 30 seconds for synchronizing to Grid

SCHEDULE II

The Installed/ISO Capacity (MW), De-Rated Capacity at Mean Site Conditions (MW), Auxiliary Consumption (MW) and the Net Capacity at Mean Site Conditions (MW) of the Generation Facilities of Licensee is given in this Schedule.



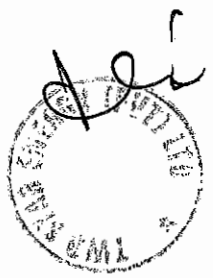
SCHEDULE-II

Proposed net installed capacity (MW) and expected annual energy output (MW)

SR. NO		Season	Off-Season
1	Installed Capacity Gross	49.80MW	49.80MW
2	Expected energy output	49.80MW	49.80MW
3	Auxiliary Consumption	4.80MW	4.0MW
4	Sale to TSIPL	12.0MW	0.5MW
5	Sale to grid	33.0MW	45.3MW

Note

All the above figures are indicative as provided by the license. The Net Capacity available to FESCO for dispatch will be determined through procedure(s) contained in the Bi-lateral Agreement(s), Grid code or any other applicable document(s).



Prospectus

BRIEF INTRODUCTION OF THE APPLICANT

Two Star Energy (Private) Limited ("TSEPL"), a limited company is setting up a new power project of 49.8 MW bagasse fired cogeneration power plant with latest high pressure technology of minimum 60 bars under the Framework for Power Cogeneration 2013 for Bagasse / Biomass to include bagasse/biomass under the ambit of the Renewable Energy Policy, 2006. The vision behind establishing TSEPL is to create a strong, well-capitalized power generation company which will design, develop and operate a power project operating at highest international standards in an economic and environmental friendly manner within shortest possible time.

TSEPL is an associated concern of Two Star Industries (Private) Limited which is a limited company located at Tehsil Kamalia of district Toba Tek which owns and operates 14,000 TCD sugar mill with 12MW low pressure bagasse based power house which it uses to meets its internal requirements.

SALIENT FEATURES OF THE FACILITY FOR WHICH LICENSE IS SOUGHT

The Facility shall employ 2 X 24.9 MW Steam Turbo Generator (STG) for power generation which shall be dispatched to the National Grid through existing 132 KV networks. Electricity from this Facility shall be connected to National Grid (Kamalia grid station) by 132kV double circuit from the proposed Two Star Power Plant through Lynx conductor.

1	Plant location	Toba - Chichawatni road, Tehsil Kamalia, District Toba Tek Singh, Punjab
2	Plant Capacity	49.8MW (Gross) – 45.8MW (Net)
2	Technology	Conventional steam power cycle
3	Installed capacity	49,800 KW
4	Plant detail i. Steam Turbo generators ii. Boiler	 2 X 24.9 MW Steam Turbo Generator (STG) 2X160 TPH, minimum 60kg/cm^2, 485+°C bagasse fired boiler

The company shall opt for the upfront tariff for New Bagasse Based Co-Generation projects determined by NEPRA in May 2013 under the Framework for Power Cogeneration 2013 for Bagasse / Biomass to include bagasse/biomass under the ambit of the Renewable Energy Policy, 2006.

TWO STAR ENERGY (PVT) LTD

PROPOSED INVESTMENT

The proposed investment is expected to be approximately PKR 7,120 Million and shall be made through a mixture of Debt (80%) and Equity (20%). Bank Al Habib Limited has shown interest for Funding for the project and the Financial Close is expected in July, 2017.

SOCIAL AND ENVIRONMENTAL IMPACT OF THE PROPOSED FACILITY

Bagasse is a by-product produced during the sugar manufacturing process and is an environmental friendly biomass fuel and helps reduce emission of Green House Gasses. Governments across the Globe including Pakistan and neighboring India have incentivized biomass based generation to reduce the effects of Global Warming and to promote the use of indigenous energy sources for electricity generation.

Bagasse based co-generation like TSEPL provides the following benefits:

- Import substitution by replacing costly furnace oil, saving precious foreign exchange. It is estimated that approximately 2,000MW ~ 3,000MW can be generated by sugar mills located in various parts of the country.
- Contributing towards reducing the electricity shortfall during the low generation months as sugar mills operate in the winter months i.e. non-gas and non-hydel months
- Environment friendly nature of the fuel, helps in reducing Green House Gases and Carbon Footprints
- Bagasse based cogeneration units offered by sugar mills can be set up in around two years against the normal period of approximately 5 years for an IPP. The fast track implementation is highly beneficial at a time when the country faces severe energy shortage.
- Reducing distribution costs. Sugar Mills are located in rural areas (away from traditional load centers) and are vastly spread and, therefore, are ideal vehicles for cheap distribution of power to rural areas and non-traditional load centers.

CV's of key personnel

- **Makhdum Omar Shehryar ("MOS")**: After graduating from Stern Business School, New York University, USA, MOS started his career as a corporate / investment banker and spent over 9 years in various senior capacities in institutions like CITI Bank, UBL and Paine Webber Inc. in New York. In 2005, MOS joined the sugar Industry by joining Etihad Sugar Mills (12,000 Tons Cane per Day) as a founding sponsor and Chief Executive Officer. He was responsible for the equity arrangement, project financing, project ordering, HR management, project implementation and successful commencement of operations. MOS was credited with completing the project in the budgeted cost and in a record time frame of one year, which is an industry record. In 2008, MOS resigned as the Chief Executive Officer of Etihad Sugar Mills to develop RYK Mills Limited as the primary founding sponsor. Additionally, MOS is credited with putting together a management team of industry specialists who have lead to RYK Mills Limited becoming one to the leading players in Pakistan's sugar sector. MOS was amongst the first in the industry to recognize the potential of selling excess electricity generated from its sugar operations to the National Grid. In line with previous project undertaken by MOS, RYK Mills Limited was setup in a record time frame and its project cost was lower than comparable projects in terms of technical specifications / installed capacity. In 2016, MOS acquired shares in Two Star Industries (Pvt.) Limited and now sits on the Board of Directors of Two Star Industries (Pvt.) Limited and Two Star Energy (Private) Limited.

BRIEF PROFILE OF PROJECT TEAM:

- **Muhammad Mudassir Iqbal ("MMI")** – Head – Energy Business: MMI is a member of the Chartered Institute of Management Accountants and brings with him C-suite and board room experience; having served on the Board of Directors of ten listed companies. MMI has been associated with the power sector since 2005. MMI heads the group Energy Business and lead RYK Mills Limited's 30MW bagasse based project and is currently working on developing RYK Energy Limited 25MW bagasse based project, the Two Star Energy (Private) Limited's 49.8MW bagasse based project as well as JEL's JAN Solar (Pvt.) Limited's 10MW$_{AC}$ Solar Power Project. MMI is credited with putting up RYK Mills 30MW project at the lowest cost and the shortest time period of all bagasse based projects. Prior to joining the Group MMI served as CFO Descon Power Solutions; a company mandated to perform EPC for power plants of up to 50MW capacity; and was a senior member of the Corporate Finance team at Kot Addu Power Company Limited

- **Fazal Husain Khan ("FHK"):** General Manager, Two Star Industries (Pvt.) Limited: FHK holds a Diploma of Associate Engineer in Mechanical and attended a Boiler Competency Exam Class. FHK has been associated with Two Star Industries from the beginning. FHK has performed the duties as a manager in Sugar industries, erection and commissioning has been done under his supervision. Furthermore, he has worked on erection of 2 rollers Mills, Erection of 80 TPH Boiler and erection of process house with having an experience of 39 years in various sections related

TWO STAR ENERGY (PVT) LTD

to Sugar Industries. FHK has been involved in the installation and O&M of more than 12MW oil and gas fired captive power plants.

- **Mazhar Abbas ("MA")** – MA holds a Mechanical Engineering degree from the University of Engineering and Technology Lahore. He brings over 20 years of experience of erection and commissioning, operations and maintenance on Captive as well as Independent Power Projects. MA currently holds the title of General Manger Power for RYK Mills Limited's Cogeneration Business. MA has held tenures as Plant Manager at Nishat Chunian, Altern Energy, JDW and RYK Mills. At JDW he was responsible for the operations and maintenance of the Co-generation plant and played an integral part as a crucial member of the project team. Prior to joining the Group, his last assignment was as Plant Manager from the platform of Descon Power Solutions at RYK Mills Limited.

- **Aamir Aqil (AA):** General Manager, Bhanero Energy Limited: AA serves as the General Manager of Bhanero Energy Limited ("BEL") which owns and operates 33.7MW oil fired power plant. BEL supplies power to group entities of UGC.

- **Muhammad Shakeel Akhtar (MSA):** Deputy General Manager, Umer Group of Companies: MSA holds a BSc in Mechanical Engineering from the University of Engineering and Technology ("UET"), Lahore and a MSc in Mechanical Engineering from the University of Alberta, Canada. MSA has been associated with the Umer Group of Companies for the last two decades. MSA has been involved in the installation and O&M of more than 60MW oil and gas fired captive power plants.

FEASIBILITY REPORT

TWO STAR ENERGY (PRIVATE) LIMITED

49.8 MW BAGASSE BASED POWER PROJECT

TEHSIL KAMALIA, DISTRICT TOBA TEK SINGH

Table of Contents

TWO STAR ENERGY (PVT) LTD

TWO STAR ENERGY

TWO STAR ENERGY (PVT) LTD

1 Project Background

Two Star Industries (Private) Limited ("TSIPL") through a Special Purpose Company titled Two Star Energy (Private) Limited ("TSEPL") intends to set up a 49.8 MW (Gross) high-pressure bagasse based co-generation power plant ("Project") under the provisions of the Framework for Power Cogeneration 2013 ("Framework") and Policy for Development of Renewable Energy for Power Generation 2006 ("RE Policy" or "Policy"). The Project will be located in the premises of TSIPL located at Kamalia, District Toba Tek Singh.

The Project will sell power to the national grid through sale of energy to the Central Power Purchasing Agency Guarantee Limited ("CPPA-G") under a 30-year Energy Purchase Agreement ("EPA") as well as partially meet the steam and power requirements of TSIPL during the crushing season. The Project will enable TSIPL to establish a sustainable market for its by-product, bagasse, and will also allow the sponsors of TSIPL to take an exposure in the power sector through incentives offered by the Government of Pakistan under the Framework and RE Policy.

The objective of this feasibility report ("Feasibility") is to assist TSEPL in assessing the viability of the Project under a given set of assumptions.

2 Power Market

2.1 Structure of Power Sector in Pakistan

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

Table 1: Pakistan Generation Capacity

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

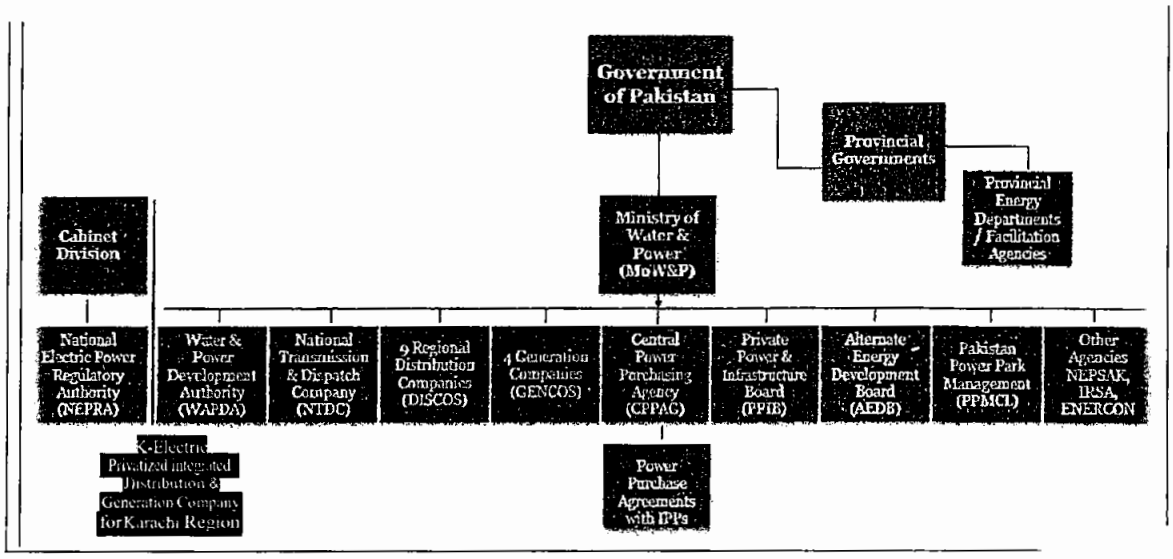
All Figures in MW

Source: NEPRA State of Industry report, 2015

TWO STAR ENERGY (PVT) LTD

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

Table 1: Pakistan Power Sector Structure



2.2 Electricity Generation

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

Table 2: Pakistan Energy Generation by Source

As on 30th June	2010-11	2011-12	2012-13	2013-14	2014-15
Thermal	65,169	64,478	64,034	68,082	69,988
% Share	64.79	65.94	64.91	64.41	64.17
Hydel	31,990	28,643	30,033	32,230	32,979
% Share	31.80	28.85	30.44	30.50	30.24
Nuclear	3,130	4,872	4,181	4,695	5,349
% Share	3.11	4.91	4.24	4.44	4.90
Import	295	296	375	419	443
% Share	0.29	0.30	0.38	0.40	0.41
Wind	0	6	32	263	300
% Share	0.00	0.01	0.03	0.25	0.27
Total	**100,584**	**99,295**	**98,655**	**I 05,698**	**109,059**

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

TWO STAR ENERGY (PVT) LTD

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

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

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

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

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

2.3 Demand and Supply of Electricity

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

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

Installed capacity in the country grew at an average rate of 5.51% during the period 1990-2015. However, this increase in capacity has been unable to meet the demand of electricity leading to a demand-supply gap, which can go as high as 6,600 MW during peak hours. In 2015, the maximum generation capability remained at 16,500 MW, while the maximum peak demand reached 21,701 MW, resulting in a 5,201 MW gap between supply and demand. Projection by government agencies depict that this shortfall is not going to end till 2019. The table below shows the actual and projected surplus/deficit in demand during system peak hours:

Table 4: Pakistan Historical Supply and Demand of Power

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

All figures in MW; Source: NTDC

TWO STAR ENERGY (PVT) LTD

Table 5: Pakistan Projected Supply and Demand of Power

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

Source: NTDC

Shortage of electricity has become the most critical challenge not only causing social disruption but also hitting the economic growth of the country. According to estimates, energy shortages in the country have resulted in approximately 2% reduction in the annual GDP of the country. Therefore, resolving the energy crisis is amongst the top priorities of the government and steps are being taken to attract new investment in the power sector. Moreover, steps are being taken to optimize the generation mix and add renewable and indigenous energy sources.

2.4 Key Organizations

2.4.1 National Electric Power Regulatory Authority ("NEPRA")

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

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

2.4.2 Private Power and Infrastructure Board ("PPIB")

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

TWO STAR ENERGY (PVT) LTD

2.4.3 Alternate Energy Development Board ("AEDB")

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

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

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

2.4.5 Faisalabad Electric Supply Company ("FESCO")

Faisalabad Electric Supply Company Limited (FESCO) is one of the nine electricity distribution companies (DISCOs) established as a result of the unbundling of the vertically integrated power wing of Pakistan Water and Power Development Authority (WAPDA). The company was established and incorporated on March 21, 1998 as a public limited company under Pakistan Companies Ordinance 1984. It was originally organized to take over the properties, assets, obligations and liabilities of former Faisalabad Area Electricity Board (FAEB) of WAPDA. FESCO purchases electricity from NTDC under an agreed rate as per NEPRA tariff that includes the Power Purchase Cost. FESCO distributes and supplies electricity to about 3.28 million customers within its territory with a population over 27.5 million and around 44,247 Sq. KM area under a Distribution License granted by National Electric Power Regulatory Authority (NEPRA) pursuant to the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (NEPRA Act). Geographical service area of FESCO comprises Faisalabad, Sargodha, Mianwali, Khushab, Jhang, Bhakker, T.T Singh and Chiniot.
FESCO is one of the best electricity distribution company in Pakistan in terms of operational performance, as it has low degree of distribution losses and a high rate of bill collection. It's main service area is Faisalabad, known as Manchester of Pakistan for its extensive textile industries.

3 Applicable Framework & Policy

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

The conditions of the Framework/Policy envisage TSIPL/TSEPL seeking a Letter of Intent ("LOI") from AEDB for the Project. In May 2013, NEPRA has announced an upfront tariff ("Upfront Tariff") for high-pressure boiler based bagasse projects being set up under the Framework. The Upfront Tariff has subsequently been extended up to May 2017; the Company shall upon completion of the applicable prerequisites apply to NEPRA for the same.

Upon receipt of the Upfront Tariff approval from NEPRA the Project Company shall seek a Letter of Support ("LOS") from AEDB; following which the Company shall enter into negotiations of the EPA and IA with CPPA-G and AEDB respectively, which shall be followed to the financial close of the Project. Under the terms of the Upfront Tariff (and LOS) the Company is required to achieve the commercial operations date of the Project within 24 months from date of approval of the Upfront Tariff for the Company. In parallel, the Company shall also apply to NEPRA for the issuance of the generation license for the Project. The application for the generation license shall be made following the issuance of the LOI and will be issued, amongst others, after submission of an approved grid interconnection study from MEPCO and environmental study from the relevant authority.

TWO STAR ENERGY (PVT) LTD

4 Cogeneration

4.1 Bagasse Based Cogeneration

Cogeneration refers to generation of electricity and useful heat from use of a single fuel at high efficiency. Co-generation is a well-known process in sugar industry as every sugar mill requires steam for sugar manufacturing while supply of electricity is also necessary to operate machinery. The steam provides thermal energy which is used in heating and concentrating the juice into syrup.

This process of juice concentration to syrup involves the evaporation of a lot of water in the juice and this removal of water is done by using low pressure steam, as the heating medium. With the large quantum of low pressure steam usage, the sugar industry stands as an ideal candidate for Cogeneration. Historically, most sugar mill boilers and the power houses were designed primarily to meet the process steam and electricity requirements of the sugar mill. Therefore, the boilers and turbo-generators employed are mostly of low pressure and low temperature style.

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

5 The Project

The 49.8 MW Co-generation Project envisages a 2+2 configuration power plant comprising of two (02) high pressure (110 bar) boilers having a steam capacity 155 tons per hour, with two (02) 24.9 MW condensing/extraction steam turbine generators and balance of plant ("**Plant**"). During the sugarcane crushing season, TSIPL shall meet part of its energy (both steam and power) requirements from its own legacy Low Pressure system. TSEPL shall supply the balance energy (both steam and power) required by TSIPL through its High Pressure system. In the off-season, leftover bagasse shall be utilized to power the High Pressure system for sale of electricity to the Grid. (Note: Only power generated from the HP system may be sold to CPPA-G).

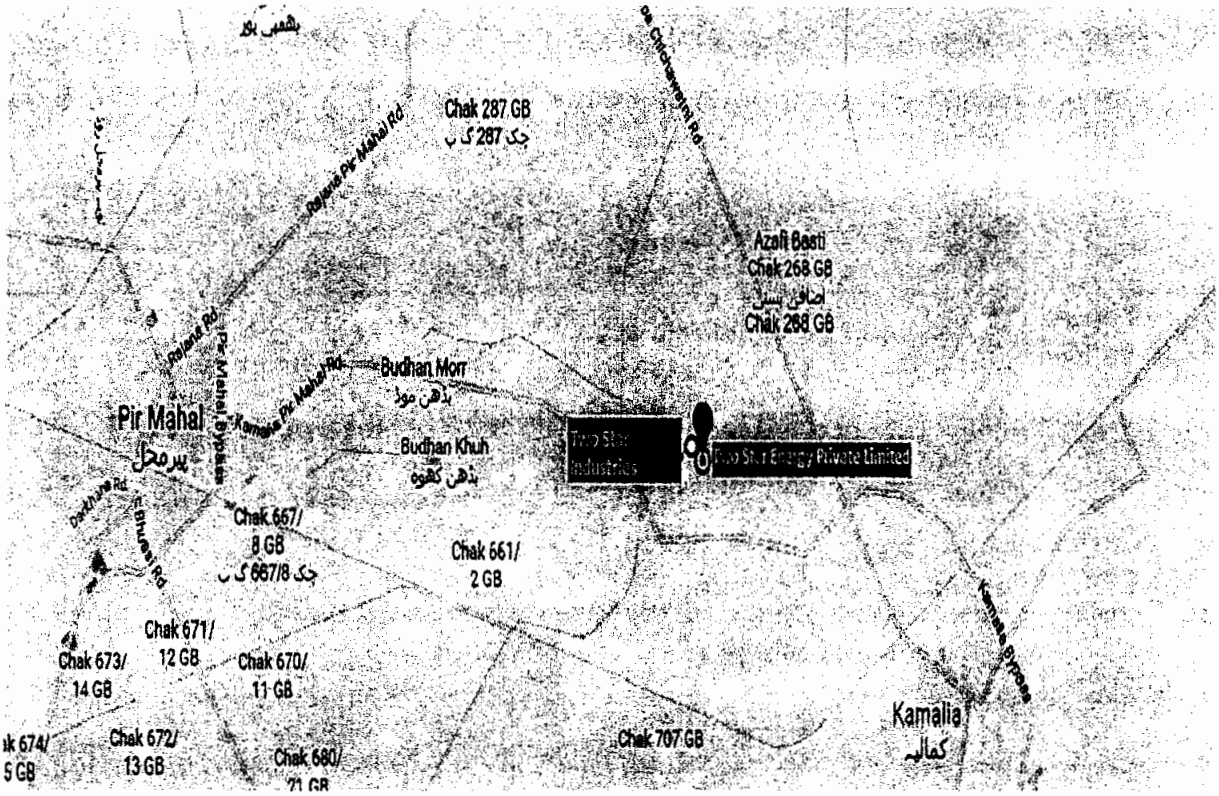
Detailed workings regarding the fuel availability and generation mix are provided in the following sections.

TWO STAR ENERGY (PVT) LTD

5.1 Project Site

The Project Site will be located on Toba-Chichawatni road, Tehsil Kamalia of District Toba Tek Singh Road (Coordinates: 30.758709°N, 72.579567°E).

A map of the Project site is given below:



5.2 Interconnection

Kamalia 132kV grid station of FESCO is at a distance of 7km from the Project site. A detailed grid interconnection study has been carried out and approved by FESCO.

6 Plant Design

6.1 General

The Project Facility shall be based on the Rankine cycle as is typical of biomass cogeneration facilities.

The boilers will consist of tall water furnace with platen generators located at the top of the furnace with multi-stage super heaters, economizers and air heaters.

TWO STAR ENERGY (PVT) LTD

The steam cycle consists of high pressure feed water heater and deaerator for each unit. The high pressure feed water heater takes steam from uncontrolled extraction of the steam turbine whereas steam for the deaerator is obtained through controlled extraction

The Facility has two modes of operation defined by steam needs of TSIPL. During the crushing season, TSIPL needs steam and electricity to crush the sugar cane and produce sugar. Steam for TSIPL will be supplied from the controlled extraction of the steam turbine which is at approximately 3 bar pressure. The expected steam demand for TSIPL is 186 tons/hr. The electricity demand during the crushing season is 12.0 MW. During the off-season, the electricity demand is 0.5 MW.

6.2 Technology

Combustion technology based on the Rankine Cycle will be utilized in this project which is proven latest technology. The bagasse will be combusted in a high pressure boiler and the steam generated will be fed to the steam turbine to generate power. The turbine will be different from the conventional thermal power plants as the turbine will be provided with a controlled extraction for extracting the process steam required for the sugar mill. To enhance the efficiency of operation, regenerative heaters are used in the feed water circuit. For the Cogeneration power plant proposed for TSEPL, the Cogeneration cycle is based on the parameters of 2×24.9MW Steam Turbo Generators. The cycle chosen with the above parameters is the latest used in any of the bagasse fired installations around the world. These above selected parameters make the cycle more efficient and help in the generation of more units for the same quantum of the fuel.

There are already many Cogeneration plants operating in Pakistan & India with these parameters and the operating experience of those plants, in synchronization with the sugar mill operation, has been smooth and without any hitch. The Cogeneration scheme for TSEPL proposes 2x155 TPH capacity boilers and 2×24.9MW extraction condensing turbo generators. Considering the off season operation of the plant, the Cogeneration power plant boilers will be designed for firing the saved bagasse and a few other compatible bio-mass fuels.

7 Project Specifications and Equipment

7.1 Bagasse Fired Boiler

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

Design Parameters:

- Bagasse Fired Boiler; 155TPH
- Steam pressure at the Main Steam stop valve outlet: 110 bar
- Steam temperature at the Main steam stop valve outlet at MCR: $540 \pm 5\ ^{0}c$
- Maximum noise level at 1.0 m distance for the boiler: 85 dB(A)
- Maximum noise level at 1.0 m for boiler drum safety valves: 110 dB(A)

TWO STAR ENERGY (PVT) LTD

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

The air towards the fuel shall be controlled by the fuel air control system to guarantee safe and optimum combustion. Primary Force Draft (FD) fans and Secondary Air frans shall be used to supply air. Air from FD fans will be heated up in air pre-heater. The pressure in the furnace will be controlled by the Induced Draft (ID) fans installed at outlet of boiler. These fans will be provided with Variable Frequency Drive (VFD) in order to optimize the power consumption. ID fans will discharge flue gases.

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

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

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

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

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

4x42% Boiler Feed Water (BFW) pumps shall be provided. BFW pumps are multistage, centrifugal type with low voltage [400V] drive motors with Variable Frequency Drives (VFDs). The condensate and make-up water lines will have level control valve to control deaerator level.

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

7.2 Steam Turbine and Auxiliaries

7.2.1 Steam Turbine

The turbine of the cogeneration power plant will be multistage nozzle governed, horizontal spindle, two bearings, and extraction cum condensing type with two (02) numbers of uncontrolled extractions and one (01) number of control extractions. The exhaust from the turbine will be condensed in the surface condenser at 0.1 bar (a) pressure during off-season operation.
The low pressure steam at 3 bar (a), 133°C will be supplied to the sugar plant for juice heating in the evaporator station. The medium pressure steam at 10 bar (a), 190°C will supplied for centrifugal washing.
c . 95% condensate of the supplied LP steam will be returned from the sugar mill. There will be no condensate return of medium pressures steam.

7.2.2 Gear Box

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

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

7.2.3 Couplings

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

7.2.4 Condensing System

Condensing system shall comprise of the following:

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

7.3 AC Generator

AC Generator shall comprise of the following:

- Brush-less exciter with PMG
- Air coolers
- AVR cum Excitation panel

Generator electrical output rating shall be as follow:

- 32MVA rated capacity at 50°C ambient.
- 11± 10%KV
- 50±5%Hz
- 3 Phase
- Power factor (0.8 lag to 0.95 lead)
- ± 0.5% Accuracy Control

7.3.1 Generator Protection and Control System:

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

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

7.4 Governing System

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

The governor system will have the following important functions:

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

TWO STAR ENERGY (PVT) LTD

7.5 Lubrication and Control System

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

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

7.6 Control Oil System

Control oil system will comprise of the following:

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

7.7 Main Cooling Water Pumps

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

- Surface Condenser
- Auxiliary cooling water coolers

The cooling water system includes the following major components:

7.7.1 Main Cooling Water Pumps

Three (3) Main Cooling Water Pumps (two working and one standby) each of capacity approximately 3000 m^3/ hr shall be provided. Pumps will be horizontal centrifugal type driven by electric motors.

7.7.2 Auxiliary Cooling Water Pumps

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

7.7.3 Cooling Tower System

The Cooling Tower System shall have the following specifications:

- One (1) R.C.C structure mechanically induced draft, counter flow type cooling tower
- Capacity of cooling tower will be approximately 10,000 m3/hr and is combined and common for the whole cogeneration power plant.
- There shall be minimum three (3) cells each having a capacity of approximately 3,300m3/hr.

TWO STAR ENERGY (PVT) LTD

- The cooling tower will be designed for a cooling range of 10°C, and an approach of 5°C while operating under the atmospheric wet bulb temperature of about 29°C.
- Each cell of cooling tower gear box will be equipped with vibration switches, oil temperature and oil level controls.
- The source of cooling water will be Bore Well Water.
- Cooling water supply and return temperature is 33°C and 41°C respectively.

7.8 Raw Water System

Raw water system consists off the following components:

7.8.1 Cooling Water Makeup Pump

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

7.8.2 Raw Water Transfer Pumps

Two (2) Raw Water Transfer Pumps (one working and one standby) each of capacity 30m3/hr will be provided to ensure raw water supply to Water Treatment Plant.

7.9 Compressed Air System

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

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

7.10 Bagasse Handling System

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

7.11 Ash Handling System

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

TWO STAR ENERGY (PVT) LTD

7.1L1 Submerged Ash Belt Handling System

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

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

7.11.2 Dense Phase Ash Handling System

This system will handle fly ash from boiler ash hopper (other than traveling grate & plenum ash hopper) and ESP hoppers. Surge hopper (water cooled for boiler ash hopper and non-water cooled for ESP hopper) arrangement shall be provided below the boiler and ESP hopper. Two air compressors with built in PLC control system and l×100% air receiver shall be provided near the dense phase equipment. The required conveying air for dense phase ash system will be supplied by these compressors through air receivers. The ash silo storage capacity shall be enough to store 12 hours ash generation from both the boiler and ESP system.

7.12 Water Treatment System

The Cogeneration power plant make up water requirements will be met from the bore wells located in the sugar plant. For the make up for the cycle, it is proposed to take the raw water through a Water Treatment Plant with the following treatment scheme.

2x Multi-grade Filter → 2 x Two Stage Reverse Osmosis system → 2 x Electro De Ionization system.(2x MGF + 2xRO +2x EDI). There shall be two independent streams. The capacity of water treatment plant is 75 m3/hr. DM water is collected in two DM water tanks each having a capacity of 400 m3. Water will be distributed from DM tanks through pumps to different users i.e., Deaerator. Condenser etc.

7.13 Firefighting System

The function of fire-fighting system is to supply water to the main risk areas of the cogeneration power plant.
The fire protection system is required for early detection, containment and suppression of fires. A comprehensive fire protection system shall be provided to meet the above objective and all statutory and insurance requirements of National Fire Protection Association (NEPA).

The fire-fighting system shall consist of the following:

7.13.1 Stand Pipe and Hose System:

Stand pipe and hose system shall be provided to cover the building and structures of the cogeneration plant. The system shall be designed as per the NPFA 14.
Standpipe shall have a hose of 65mm diameter with connection to a large supply of water. The hose connection shall be not less than 0.9m or more than 1.5 m above the floor.

7.13.2 Fire Hydrant and Water Monitoring System

The hydrant system shall be provided to cover all areas. The system shall be designed as per NFPA 24. The system shall consist of over ground hydrant mains laid in rings, isolation valves,

TWO STAR ENERGY (PVT) LTD

and stand pipes with hydrant valves (outdoor). A Hydrant shall be placed after every 40m.

7.13.3 Portable Fire Extinguishers:

Dry Chemical Powder, $C0^2$ and foam type extinguisher system shall be provided. The equipment shall be designed as per NFPA 10.

7.13.4 Automatic High Velocity Water Spray Nozzle System:

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

7.13.5 Fire Alarm & Detection System

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

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

7.14 Effluent Handling System

Effluent handling system consists of the following main components:

7.14.1 Neutralizing Pit

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

7.14.2 Neutralized Effluent Re-circulation cum Transfer Pumps

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

7.14.3 Effluent Pit

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

7.14.4 Effluent Transfer Pump

Two (2) Effluent Transfer Pumps (One working and one standby) will be installed on Effluent pit to transfer effluents. The pumps will also be used to re-circulate the effluent with in Neutralization pit for effective neutralization. The pump capacity shall be minimum 35 m3/hr.

7.15 Service Water System

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

7.16 Electric Overhead Travelling (EOT) Cranes

EOT cranes shall be provided in the following buildings:

TWO STAR ENERGY (PVT) LTD

TG Hall

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

The main hook capacity shall be 60 Tons and suitable for lifting single heaviest component in Turbo Generator. The auxiliary hook lifting capacity shall be of 5 Tons. The crane travel will cover the entire length of the TG building. The crane shall be electrically operated, bridge type and shall be designed and equipped for indoor operations complete with all accessories. The crane bridge shall consist of bridge girders each carrying a rail on which a wheeled trolley is to run. Operation of crane shall be by pendant type push button station from ground level.

Workshop and Store

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

The single hook crane capacity shall be 5 Tons. The crane travel will cover the entire length of maintenance bay of workshop. Operation of crane shall be by pendant type push button station from ground level.

8 Electrical Design

8.1 Electrical Network

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

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

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

The surplus power, after meeting the power requirement of cogeneration plant auxiliaries and sugar plant auxiliaries, shall be exported to the grid through 11/132kV power transformer. There shall be total of 2 step-up power transformer

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

All the existing sugar plant loads shall be fed through interconnecting transformers.

8.1.1 Ambient Conditions for Electrical Equipment

Ambient conditions and design temperatures for electrical equipment are given in Table 6 below:

Table 6: Ambient Conditions for Electrical Equipment

	Deg. C
Maximum Temperature	49.0
Minimum Temperature	1.0
Plant Design Temperature	30
Indoor Equipment Design	40
Outdoor Equipment Design	50

8.2 Plant Operating Voltage

The plant shall be designed suitable for operating at a frequency of 50Hz, with voltage levels of

TWO STAR ENERGY (PVT) LTD

various systems of the plant as given in Table 7 below:

Table 7: Plant Operating Voltage

Generation (TG) system	11kV
Power Evacuation system	132 kV
Non-AC VSD/auxiliaries of cogeneration plant	400 V
AC VSD/auxiliaries of cogeneration plant	400 V
DC system of cogeneration plant	110 V
UPS system of cogeneration plant	230 V

8.3 Basic Electrical Design Parameters

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

Table 8: Basic Electrical Design Parameters

Power Factor	0.8
Generation Voltage (kV)	11kV, 3 Phase
Parallel operation with Grid	Required with 132kV Grid
Grid Voltage	132kV, 3 Phase
System Frequency	50±5%
System Voltage Variation	±10% Variation of Rated Voltage

System Fault Level	
132kV	40kA
11kV	50kA
400V	50kA

Earthing System	
132kV	Effectively Earthed
11kV	Neutral Grounded (Limited to < 50A/Unearthed (Whenever generator is not in service)
400V	Effectively Earthed
110VDC	Unearthed

8.4 132kV Switchyard

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

Table 9: 132kV Switchyard Specifications

Voltage Level	132kV
Service	Outdoor AIS with SF6 circuit breakers
Number of Bays	2 OHL Bays

TWO STAR ENERGY (PVT) LTD

	2 Transformer Bays 1 Bus-Coupler Bay
Bus Bar	AAC conductor of "Hawthorn"
Short Circuit SF6,gang operated	2500Amp 40kA 3 sec
Isolator (Centre break, motor operated with copper alloy blades)	2000Amp
Protection & Metering	As per NTDC Requirements
Highest System Voltage(kV rms)	145kV
Power Frequency Withstand Capability (kV rms)	275kV
Basic Insulation Level (kV Peak)	650kV
Creepage Distance for Insulators (mm/kV)	31
Instrument Transformers	Hermetically Sealed, dead Tank Design. Range as per SLD
Insulator	Brown Glazed with min 6kN cantilever Strength

Towers & Support Structures	MS galvanized lattice type
Tariff Metering Equipment	Three elements four-wire configuration, electronic, digital, with accuracy class of 0.2S; 30 minutes intervals for a period of 70 days with intervals programmable from 5 minutes to 30 minutes

TWO STAR ENERGY (PVT) LTD

8.5 Steam Generator

Generator shall be supplied in line with the following specifications:

Table 10: Steam Generator Specifications

Description	Parameters
Rating & Count	2x24.9MW
Type	Conventional Steam Turbine Cycle
Number of Pole & Excitation System	Four Pole, with Brushless Excitation System
Power Factor	0.8 PF (lagging) to 0.9 (leading) under entire band of +10% Voltage Variation and 5% Frequency Variation
Insulation Class	Class 'F' Insulation and shall be Suitable for Operation within class 'B' Limits
Overload Requirements	Over Loading of 110% for one Hour every 12 Hours and 150% for 30 seconds
Short Circuit and Overload Endurance	Generator shall withstand short-circuit of any kind at its terminal, while Operating at rated load and 105% rated voltage for at least 3 seconds

8.6 Isolated Phase Bus Duct

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

Table 11: Insolated Phase Bus Duct Specifications

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

TWO STAR ENERGY (PVT) LTD

8.7 11kV Switchboard

Switchboard rated 11kV IP4X 3200Amp 50kA for 3 sec shall be provided for feeding transformers and connection to steam generator.

8.8 6.6kV Panel

One (1) 2500A 6.6kV VCB stand-alone panels and HT 6.6kV XLPE Aluminum cables of adequate size shall be provided for interface of co-gen plant with existing sugar mill power house.

8.9 400 V Switchboard

All the cogeneration plant auxiliary loads shall be segregated into two groups, each consisting of AC Variable Speed Drive (AC VSD) driven loads and non-AC VSD driven loads.

All AC VSD loads pertaining to cogeneration plant shall be connected to two (2) AC VSD transformers. Common systems like cooling water [main & auxiliary cooling water pumps and cooling tower fans] shall be distributed uniformly on both VSD transformers.

The co-generation plant non-AC VSD loads shall be fed at 400V with two (2) 11/0.415kV transformers.

8.10 Transformers

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

Table 12: Specifications of Transformers

Description	Parameters
Generator Transformer (G/T)/ Power Transformer	31.5/40 MVA 11/132kV YNd11
VSD transformers (Three winding transformer) for co-generation plant	4MVA 11/0.415/0.415kV, Dzn0yn11
Distribution Transformer for co-generation Plant Auxiliaries	2.0MVA, 11/0.415kV, Dyn11
Interconnection Transformer at Sugar	10/13MVA, 11/6.9kV, Dyn11
Lighting Transformer	Cast Resin Encapsulated 200kVA, 0.4kV/0.4kV, 50Hz, Dyn11, ONAN, Three Phase, Two Windings
Neutral Grounding Transformer	Yd Windings, 50A for 10 sec & 500A for 3sec, 11kV, ONAN

8.11 AC & DC UPS System

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

TWO STAR ENERGY (PVT) LTD

Table 13: AC & DC UPS Specification

Description	Parameters
110VDC	2x100% Dual Redundant UPS with Dedicated Battery Bank (SMF Type: Sealed Maintenance Free)
230VAC UPS	2x100% Dual Redundant UPS with Dedicated Battery Bank (SMF Type: Sealed Maintenance Free)
Lighting 230VAC UPS	1x100% UPS with Single Battery Bank (SMF Type: Sealed Maintenance Free)

8.12 Control Philosophy & Interfacing

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

8.13 Energy Management System

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

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

8.14 RTDs & Thermistors

Thermistors shall be installed on motors rated between 30 to 75kW. RTD shall be made available for motors more than 90kW. All RTDs shall be hooked up with relays in motor Relays in respective MCC.

8.15 System Earthing

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

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

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

TWO STAR ENERGY (PVT) LTD

circuit breaker in open condition. The 6.6kV system at the secondary side of Interconnection Transformer shall be provided with NGR grounding to limit earth fault current of 100A.

LV system 400V system shall be solidly grounded through transformer neutral. Neutral busbars shall be made available in 400V PCCs, and all MCCs.

400V VSD transformer grounding system shall be as for 6 Pulse AC VSD drives – Solidly grounded.

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

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

8.16 Cable Installation

Cables shall be installed in concrete cable trenches [installed on trays], on cable racks and direct buried as required.

8.17 Cable Trench

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

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

8.18 Lighting & Small Power

Plant lighting loads shall be fed through two (2) Nos. of 400/400V, Dyn 11 connected dry type lighting transformer of minimum rating of 200kVA.

Emergency Lighting Distribution Board (ELDB) shall be fed through inverter of minimum 20 kVA rating.

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

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

8.19 Plant Communication System

Plant communication shall be provided with following facility:

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

8.20 Enclosure Ratings

Enclosure IP ratings for different applications shall be as below:

TWO STAR ENERGY (PVT) LTD.

Table 14: Enclosure Ratings

HV Switchgear	IP4X
LV Switchgears	IP4X
Switchgears located outdoors	IP55

8.21 Plant Startup

The co-generation plant shall be started with one (01) number of 400V Black start DG sets. These DG sets shall be connected to DG panel, which shall be planned with the incoming DG set feeder and five outgoing feeders.

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

The DG set shall be with radiator cooled type. Proposed rating of DG set shall be 1250kVA at Prime duty.

8.22 Instrumentation and Control (I&C) Systems

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

I&C System, as a whole, will ensure control and monitoring of the following equipment:

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

8.23 Digital Control System (DCS)

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

TWO STAR ENERGY (PVT) LTD

equipment in nominal and transient operation conditions. System will cover control function from basic level control up to fully automated control of function groups and units, control of system output and optimization of block operation. Specific autonomous functions of the plant safety system and selected regulation and control functions will be realized by special subsystems in a hierarchical model. From a viewpoint of control, these items will create an integrated part of the DCS control system.

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

8.24 Field Instrumentation

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

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

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

The Operating Value of field instrument will fall between 40% and 60% span for Linear and 60% to 80% span for square root.

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

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

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

9 Operations and Maintenance (O&M)

The O&M shall led by a competent Plant Manager who shall be charged with management of the technical functions. A mixture of permanent and contractual staff augmented by specialized third party staff for functions, such as performance monitoring of equipment, environmental monitoring, fuel yard operation, ash handling and major maintenance shall be deputized at the plant. To the extent practical, the operation of the Facility will be automated through a distributed control system.

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

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

The maintenance staff will perform the routine maintenance on the Facility. During the off-season

TWO STAR ENERGY (PVT) LTD

periods when the Facility is not operating, the maintenance staff will support any major maintenance work that needs to be performed.

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

Table 15: O&M Staffing

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

The performance/efficiency Engineer will be responsible for monitoring the operation of the Facility and identifying any operational issues that affect the performance of the Facility.

Additional responsibilities include maintaining the plant design records and drawings.

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

TWO STAR ENERGY (PVT) LTD

9.1 Maintenance of the Plant

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

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

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

10 Key Operating Assumptions

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

- Sugar Mill Operations & Fuel Availability
- Plant Generation
- General & Timeline
- Project Cost
- Financing Assumptions
- Project Tariff & Revenue
- Operating Cost Assumptions (including fuel)

10.1 Sugar Mill Operations & Fuel Availability

The tariff structure of the Project is based on the availability of the project to generate power, which in turn depends on the availability of fuel i.e. bagasse to ensure such generation. In such a scenario adequate availability of bagasse for' generation is the most important factor for the feasibility of the Project.

As stated above, during the assumed 120-day crushing period, power generation will be based on bagasse provided by TSIPL. During non-crushing days, the un-utilized bagasse from the crushing period at TSIPL will be utilized for power generation. TSIPL management plans to bring efficiencies in the current sugar mill which will reduce the steam requirement of the plant by the time the project comes online to make more bagasse available for TSEPL. Based on a 120-day season and 94% capacity utilization, the mill shall be able to generate 490,000 MT of bagasse during the crushing period and as a consequence the plant shall be capable of operating at a 92% capacity factor for 195 days in a year or an effective 179 days.

TWO STAR ENERGY (PVT) LTD

10.2 Plant Generation Parameters

The two (02) 24.9MW steam turbine generators shall be provided steam by the HP boiler. During the crushing period, the' HP boiler and steam turbine shall meet the steam and power requirements of TSIPL to the extent these are not met by the LP boiler. To meet the steam requirements of the TSIPL process, the current LP boiler along with a 6 MW (net) backpressure turbo generator shall be operational during the crushing period. The steam generation through the LP system shall only be available during the season and will be dedicated to the sugar mill. Key generation parameters during are as follows:

Table 17: Plant Generation

	Crushing Period	Non-Crushing Period
Installed Capacity (Gross)	49.8MW	49.8MW
Expected energy output	49.8MW	49.8MW
Captive utilization	12.0MW	0.5MW
Auxiliary Consumption	4.8MW	4.0MW
Spillover available for sale to grid	33.0MW	45.3MW

10.3 Project Timeline

A 17-month construction time has been assumed for the Project. Financial Close is targeted in end July 2017 with a target project commercial operations date ("COD") of end-September 2018. This would enable the project to smooth any teething issues that may arise before the crushing period commences-in mid to end November 2018.

As per the standard energy purchase agreement ("EPA") the Project life and EPA term has been assumed as 30 years from COD.

10.4 Project Cost

Table 18: Estimated Project Cost

Estimated Project Cost	USD million	PKR million
EPC Cost	53.96	5,936
Non-EPC Cost	1.31	144
Project Development Cost	2.46	271
Insurance During Construction	0.55	60
Financing Fee & Charges	1.92	211
Interest During Construction (IDC)	4.53	498
Total	64.73	7,120
EPC Cost per MW (USD million)	1.08	
Project Cost per MW (USD million)	1.30	

- **EPC Cost** is estimated to be USD 1.08 per kW. The Company is in the process of finalizing the equipment for the Project.

- **Non-EPC** costs include costs related to
  - o Land, colony, workshop and non-reimbursable fuel during testing.

TWO STAR ENERGY (PVT) LTD

- **Project Development** costs include costs related to technical studies, owners' engineer, construction manager as well as legal and other advisors; fees related to NEPRA, AEDB, SECP; and Company overheads during the construction period.
- **Construction Insurance** has been budgeted at 1.0% of EPC cost, which is in line with precedent transactions.
- **Financing Fees & Charges** have been estimated in line with precedent transactions and have been budgeted in the range of 3.5% of total debt.
- **Interest during Construction** has been calculated over a 17-month construction period, a 80:20 debt to equity ratio and a lending rate of 3-month KIBOR plus 3%. The payment profile shall be firmed at the time of award of the EPC contracts(s).

10.5 Project Financing

In line with debt financing parameters with precedent transactions, a debt to equity assumption 80 to 20 has been applied to the financial projections. Under the base case financial projections debt is assumed to be repaid 10 years after COD with debt being amortized over the period through fixed annuity based installments.

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

Table 19: Project Funding

Project Cost	PKR 7,120 million
Debt	PKR 5,696 million
Equity	PKR 1,424 million
Lending Rate	3 month KIBOR + 3%
Repayment Period	10 years
Repayment Frequency	Half yearly
Annual Installment	PKR 876 million

TWO STAR ENERGY (PVT) LTD

10.5 Project Tariff

NEPRA had announced a 30-year Upfront Tariff for high pressure boiler based bagasse, power projects in May 2013 which was valid for a period of 2 years. Subsequently, the Upfront Tariff was extended up to May 2018 and in the mean while an adjusted Upfront Tariff (**"Adjusted Upfront Tariff"**) was announced based on indexations applicable at May 2015. As per discussions with NEPRA, the Adjusted Upfront Tariff shall be applicable for the Project.

The Adjusted Upfront Tariff is calculated on notional capacity of 1 MW with appropriate indexing of different tariff determining components. This tariff structure is generic in nature and is applicable for various sizes of new bagasse based co-generation power plants of 60 bar or higher pressure boilers. The critical assumptions upon which the tariff is based appear in the table below:

Table 20: Key Assumptions for Adjusted Upfront Tariff

Description	Basis
Auxiliary Consumption	8.5%
Plant Factor	45%
EPC cost per MW	USD 0.796
Project cost per MW	USD 0.9795
Construction Period	20 months
Exchange Rate(PKR/USD)	101.6
Benchmark Efficiency	24.5%
Baggase Price	Linked to CIF Karachi Coal Price Minimum USD 100.67 per MT
Bagasse CV	6,905 btu
Total O&M cost	3,25% of EPC
Variable O&M local	15% of total O&M
Variable O&M foreign	45% of total O&M
Fixed O&M local	40% of total O&M
Insurance	1% of EPC
Working Capital	45 days fuel (3 month KIBOR+2%)
Debt	80%
Return on Equity	17%
Return on Equity during Construction	17%
Loan Repayment Period	10 years
Repayment Frequency	Quarterly
Debt Cost	3 month KIBOR + 3%

TWO STAR ENERGY (PVT) LTD

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

The tariff is payable on a take or pay basis based on the declared availability of the Plant by the Company. Key features of the tariff applicability are as follows:

1. For all energy dispatched to the grid, a tariff based on the sum of indexed values of all the above mentioned components shall be payable.
2. During the crushing period, if the Plant is not dispatched following a declaration of energy a tariff based on the sum of indexed values of all the above mentioned components shall .still be payable based on the declared energy.
3. During the non-crushing period, if the Plant is not dispatched following a declaration of energy a tariff based on the sum of indexed values of all the above mentioned components (excluding the fuel and variable components) shall be payable based on the declared energy.
4. All upside and downside risk with respect to the annual generation lies with the Company. In case the Company is able to achieve a plant factor above 45% the full indexed tariff shall be payable.

Table 21: Adjusted Upfront Tariff

Description	Reference Tariff PKR per KWh		Indexation
	Year 1-10	Year 11-30	
Fuel Cost	5.9825	5.9825	Fuel Price
Variable O&M local	0.1198	0.1198	Local CPI
Variable O&M foreign	0.3393	0.3393	PKR/US$, US CPI
Fixed O&M	0.3194	0.3194	Local CPI
Insurance	0.2204	0.2204	-
Working Capital	0.1673	0.1673	Kibor
Return on Equity	1.0345	1.0345	PKR/US$
Debt Servicing Component	3.6658		Kibor
Total Tariff	11.8491	8.1833	
Levelized Tariff	10.5727		

Note: The tariff is adjusted quarterly for change in 3-month KIBOR variation. The financial Projections have been prepared on the basis of the recent 3-month KIBOR rate of 6.44% with the tariff and related cost adjusted accordingly.

10.7 Project Revenue

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

- Sale of energy to the National Grid i.e. CPPA-G
- Sale of energy to TSIPL
- Sale of steam to TSIPL

10.8 Projected Financial Statements

Projected financial statements and key financial ratios based on the base case assumptions discussed in Section 10 are provided in the following sections. Financial Statements presented below are limited to the 10-year debt period.

10.9 Projected Income Statement

Million PKR	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Total Revenue	**1,916**	**1,916**	**1,916**	**1,916**	**1,916**	**1,916**	**1,916**	**1,916**	**1,916**	**1,916**
Bagasse Cost	756	756	756	756	756	756	756	756	756	756
Total O&M cost	105	105	105	105	105	105	105	105	105	105
Insurance cost	56	56	56	56	56	56	56	56	56	56
Depreciation	237	237	237	237	237	237	237	237	237	237
EBIT	**761**	**761**	**761**	**761**	**761**	**761**	**761**	**761**	**761**	**761**
Working Capital Cost	38	38	38	38	38	38	38	38	38	38
Interest on LT Loan	504	470	433	392	348	299	246	188	125	56
Net Income	**219**	**253**	**290**	**331**	**376**	**424**	**477**	**535**	**599**	**668**

10.10 Projected Balance Sheet

Million PKR	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	10
Fixed Assets	**6,883**	**6,646**	**6,408**	**6,171**	**5,934**	**5,696**	**5,459**	**5,221**	**4,984**	**4,747**
Current portion LT debt	405	443	484	528	577	630	688	751	820	-
Current Liabilities	**405**	**443**	**484**	**528**	**577**	**630**	**688**	**751**	**820**	-
Long-term Debt	4,919	4,477	3,993	3,465	2,888	2,259	1,571	820	0	0
Total Liabilities	**5,325**	**4,919**	**4,477**	**3,993**	**3,465**	**2,888**	**2,259**	**1,571**	**820**	0
Paid-up Capital	1,424	1,424	1,424	1,424	1,424	1,424	1,424	1,424	1,424	1,424
Retained Earnings	134	302	508	754	1,044	1,384	1,776	2,226	2,740	3,323
Total Equity	**1,558**	**1,726**	**1,932**	**2,178**	**2,469**	**2,808**	**3,200**	**3,651**	**4,164**	**4,747**

TWO STAR ENERGY (PVT) LTD

10.11 Projected Cash Flows

Million PKR	1	2	3	4	5	6	7	8	9	10
Earning after tax	219	253	290	331	376	424	477	535	599	668
Add: Depreciation	237	237	237	237	237	237	237	237	237	237
Cashflows from operations	**456**	**490**	**528**	**568**	**613**	**662**	**715**	**773**	**836**	**905**
Repayment of LT debt	371	405	443	484	528	577	630	688	751	820
Net Cashflows	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**85**

11 Financial Summary

	1	2	3	4	5	6	7	8	9	10
Revenue	1,916	1,916	1,916	1,916	1,916	1,916	1,916	1,916	1,916	1,916
EBITDA	999	999	999	999	999	999	999	999	999	999
Net Income	219	253	290	331	376	424	477	535	599	668
Dividends	85	85	85	85	85	85	85	85	85	85
Annual Interest	504	470	433	392	348	299	246	188	125	56
Debt Servicing	876	876	876	876	876	876	876	876	876	876
Debt to Equity	3.42	2.85	2.32	1.83	1.40	1.03	0.71	0.43	0.20	0.00
Interest Cover	1.98	2.12	2.31	2.55	2.87	3.34	4.06	5.31	8.00	17.91
DSCR	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14

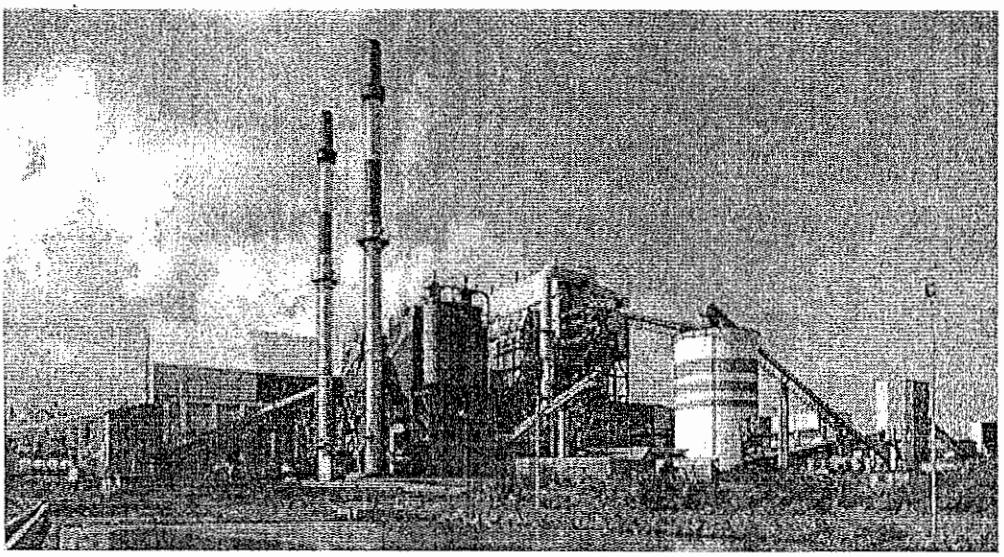
TWO STAR ENERGY (PVT) LTD

Report No. PPI-239.1-Draft/17

INTERCONNECTION STUDY

For

49.8 MW CO-GENERATION POWER PROJECT BY TWO STAR ENERGY (PRIVATE) LIMITED



Draft Report
(January 2017)

Power Planners International

UK Office:
3-Sylvester Road,
Sudbury Town, Middlesex,
HA0 3AQ, UK
Phone & Fax:+44-(0)208-9223219

Pakistan Office:
64-F/1, Wapda Town,
Lahore 54770, Pakistan
Phone: +92-42-35182835;
Fax: + 92-42-35183166

Email: info@powerplannersint.com
www.powerplannersint.com

Executive Summary

- The Draft Report of 49.8 MW Two Star Energy (Private) Limited, referred to as Two Star PP, is submitted herewith. The installed capacity of the plant would comprise of two unit of 24.9 MW which would deliver maximum net power of 45.3 MW to the grid.
- It would like to go for high pressure cogeneration in the sugar mill with the aim of exporting power nearly 33 MW to the national grid during the crushing season, from November to March. During the Non-crushing season Two Star PP will supply 45.3 MW power to the national grid, the operational period will depend on the availability of bagasse.
- The latest generation, transmission plan and load forecast of NTDC has been used for the study, attached in Appendix – A.
- The study objective, approach and methodology have been described and the plant's data received from the Client is validated.
- The nearest grid facility is the 132 kV substations of Kamalia. It lies at about 7 km from the site of Two Star PP.
- Due to the location of Two Star PP, the most feasible interconnection scheme would be 7 km 132 kV double circuit to Kamalia grid station from the proposed Two Star PP on Lynx conductor. The up-coming chapters discuss in detail the location and interconnection of the Two Star PP. A few approximate sketches are shown in Appendix-B.
- The proposed scheme will require two breaker bays of 132 kV at Two Star PP to connect with the 132 kV circuits each from Kamalia G/S.
- In view of planned COD, of the Two Star PP in September 2018, the above proposed interconnection scheme has been assessed for steady state conditions through detailed load flow studies, short circuit analysis and stability criterion for January 2019 for maximum thermal power dispatches in the grid during winter which is the crushing season.
- Steady state analysis by load flows, short circuit and stability criterion reveals that proposed scheme is adequate to export 45.3 MW output of the plant under normal and contingency conditions.

- Since the plant operates during summer as well, the high-water season, its detail analysis has also been carried out for September 2019.
- In an extended term scenario, September 2021 has been studied to evaluate the performance of the proposed interconnection scheme. The system conditions of normal and N-1 contingency have been examined for all scenarios to meet the reliability criteria. Along with it, short circuit and dynamic stability analysis have been carried out for a complete check of the system.
- Load Flow analysis indicates that power distribution is in local grids therefore losses are reduced and voltage are improved. Beside this it also has an advantage that demand from NTDC to FESCO will decrease as local generation is available.
- The short circuit level of the Two Star Power Project 132 kV is 10.69 kA and 9.34 kA for 3-phase and 1-phase faults respectively for the year 2021. Therefore industry standard switchgear of the short circuit rating of 40 kA would be fine to be installed at 132 kV switchyard of Two Star Power Project taking care of any future generation additions and system reinforcements in its electrical vicinity and also fulfill the NEPRA Grid Code requirements specified for 132 kV switchgears. There are no violations of exceeding the rating of the equipment in the vicinity of Two Star PP due to contribution of fault current from it.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out. The stability has been tested for the worst cases, i.e. three phase fault right on the 132 kV bus bar of Two Star PP substation followed by the final trip of 132/11 kV transformer emanating from this substation has been performed for fault clearing of 5 cycles (100 ms), as understood to be the normal fault clearing time of 132 kV protection system. Also the extreme worst case of stuck breaker (breaker failure) has been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms for single phase fault. The stability of system for far end faults of 3-phase occurring at Kamalia 132 kV bus bar and also stuck breaker faults of 1-phase occurring at Kamalia 132 kV bus bar has been checked.

Contents

Appendices

Appendix –A: Generation, Transmission Plan and Load Forecast for Chapter – 4

Appendix –B: Map & Sketches for Chapter – 4

Appendix –C: Plotted Results of Load Flow for Chapter – 5

Appendix –D: Plotted Results of Short Circuit for Chapter – 6

Appendix –E: Plotted Results of Stability Analysis for Chapter – 7

Appendix –F: Generator, Transformer and Dynamic Data

1. INTRODUCTION

1.1 Background

Two Star Energy (Private) Limited is a Cogeneration power plant near Kamalia in District Toba Tek Singh embedded in the distribution network of FESCO. The electricity generated from this project would be supplied to the grid system of FESCO through 132 kV grids available in the vicinity of this project. A general idea of the location of plant and grid stations in its vicinity can be viewed in sketch-1 attached in Appendix - B.

Two Star PP aims to install 49.8 MW units and go for high pressure cogeneration in the sugar mill with the aim of exporting 33 MW power to the grid during the crushing season and 45.3 MW after it, depending on the availability of bagasse. The project is expected to start commercial operation by September 2018. The electricity generated from this project would be supplied to the grid system of FESCO through 132 kV grids, as that of Kamalia, available in the vicinity of this project. The location of Two Star PP can be seen in sketch-2 attached in Appendix - B.

1.2 Objectives

The overall objective of the Study is to evolve an interconnection scheme between Two Star Power Project and FESCO network, for stable and reliable evacuation of 49.8 MW of electrical power generated from this plant, fulfilling N-1 reliability criteria. The specific objectives of this report are:

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

the short circuit ratings of the proposed equipment of the substation at Two Star PP.

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

1.3 Planning Criteria

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

Steady State:

Voltage	± 5 %, Normal Operating Condition
	± 10 %, Contingency Conditions
Frequency	50 Hz Nominal
	49.8 Hz to 50.2 Hz variation in steady state
	49.4 - 50.5Hz, Min/Max Contingency Freq. Band
Power Factor	0.8 Lagging; 0.9 Leading

Short Circuit:

132 kV Substation Equipment Rating 31.5 kA or 40 kA

Dynamic/Transient:

The system should revert back to normal condition after dying out of transients without losing synchronism with good damping

a) Permanent three-phase fault on any primary transmission element; including: transmission circuit, substation bus section, transformer or circuit breaker. It is assumed that such a fault shall be cleared by the associated circuit breaker action in 5 cycles.

b) Failure of a circuit breaker to clear a fault ("Stuck Breaker" condition) in 9 cycles after fault initiation.

2. ASSUMPTIONS OF DATA

The number of new generating units at Two Star PP will be two. As per the data provided by the client following data has been modeled:

2.1 Two Star PP Data

Installed capacity of power plant	= 2 x 24.9 = 49.8 MW
Net Capacity of power plant	= 49.8 MW
Power factor	= 0.80 lagging, 0.95 leading
Lump sum MVA capacity	= 2 x 31.25 MVA = 62.5 MVA
Inertia Constant	= 2.6420 MW-sec/MVA
Generating Voltage	= 11 kV
Transformer Rating	= 50 MVA

2.2 Network data

The 132 kV network in the area near Two Star Power Project are as shown in Sketches in Appendix-B. The latest Generation Expansion Plan and Load Forecast of NTDC has been used as shown in Appendix-A. The network of FESCO in the vicinity of Two Star PP was verified during a visit held on 21st December 2016 by PPI engineers.

3. STUDY APPROACH AND METHODOLOGY

3.1 Understanding of the Problem

Two Star Energy (Private) Limited would like to go for high pressure cogeneration with the aim of exporting a maximum of 45.3 MW supply to the grid during the Off-Season and 33 MW in Crushing Season. The site of proposed project is located at a distance of about 7 km from the 132 kV Kamalia G/S. The proposed Power Project is going to be embedded in the transmission network of FESCO through this nearest available 132 kV network.

The adequacy of FESCO network of 132 kV in and around the proposed site of Two Star PP has been investigated in this study for absorbing and transmitting this power fulfilling the reliability criteria.

3.2 Approach to the problem

The following approach has been applied to the problem:

- Month of January 2019 has been selected for the study because it represents the maximum thermal dispatch conditions during the crushing season after the COD, September 2018, of Two Star PP. Thus, lines in the vicinity of this plant will be loaded to the maximum extent, allowing us to judge the complete impact of the plant on the transmission system in its vicinity.
- The month of September 2019, has also been completely analyzed for the system, considering maximum hydel dispatches.
- Load flow and short circuit studies have also been performed for September 2021 to see the performance of the proposed plant in extended term scenario.
- Interconnection scheme without any physical constraints, like right of way or availability of space in the terminal substations, have been identified.
- Perform technical system studies for peak load conditions to confirm technical feasibility of the interconnections. The scheme will be subjected to standard analysis like load flow, short circuit, and transient stability study to check the strength of the machines and the proposed interconnection scheme under disturbed conditions.

- Determine the relevant equipment for the proposed technically feasible scheme.
- Recommend the technically most feasible scheme of interconnection.

4. DEVELOPMENT OF SCHEME OF INTERCONNECTION

4.1 The Existing and Ongoing Network

The existing 132 kV network available around Two Star PP. The network around the proposed location of Two Star PP is shown in Sketch-1 in Appendix-B.

Two Star PP is in District Toba Tek Singh embedded in the distribution network of FESCO. Network is being fed from the sources substation of T.T. Singh-New 220/132 kV and Kassowal 220/132 kV.

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

4.2 The Scheme of Interconnection of Two Star PP

Keeping in view of the above mentioned 132 kV network available in the vicinity of the site of the Two Star PP, the most feasible interconnection scheme would be 132 kV double circuit to Kamalia grid station from the proposed Two Star PP. The distance would be 7 km long using Lynx Conductor as shown in Sketch-2 in Appendix-B. The network of Two Star PP has been modeled at 132 kV and 11 kV.

5. DETAILED LOAD FLOW STUDIES

The base cases have been developed for the peak conditions of January 2019 using the network data of NTDC and FESCO available with PPI. The peak loads of the year 2019 for FESCO have been modeled as per the latest PMS Demand forecast as provided by NTDC. Detailed load flow studies have been carried out for January 2019, September 2019 and future case September 2021.

5.1 Peak Load Case January 2019

The peak load case in January 2019 has been studied in detail for the conditions of without and with Two Star PP.

5.1.1 Without Two Star Power Plant

The results of load flow analysis without Two Star PP have been plotted under normal conditions in Exhibit 0.0 in Appendix-C. The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.
N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit 0.1	Chicha Watni to Kamalia 132kV Single Circuit Out
Exhibit 0.2	Kamalia to Mureed-Wala 132kV Single Circuit Out
Exhibit 0.3	T.T Singh New to Mureed-Wala 132kV Single Circuit Out
Exhibit 0.4	T.T Singh New to T.T Singh 132kV Single Circuit Out
Exhibit 0.5	Kassowal to Chicha Watni 132kV Single Circuit Out

5.1.2 With Two Star Power Plant

The scenario of Two Star PP after the COD of the plant when it starts exporting 33MW during crushing season to the FESCO network has been studied. The results of load flows with Two Star PP under normal conditions have been plotted in Exhibit 1.0 in Appendix-C.

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

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

Exhibit 1.1	Two Star-PP 132/11 KV Single Transformer Out
Exhibit 1.2	Two Star-PP to Kamalia 132kV Single Circuit Out
Exhibit 1.3	Chicha Watni to Kamalia 132kV Single Circuit Out
Exhibit 1.4	Kamalia to Mureed-Wala 132kV Single Circuit Out
Exhibit 1.5	T.T Singh New to Mureed-Wala 132kV Single Circuit Out
Exhibit 1.6	T.T Singh New to T.T Singh 132kV Single Circuit Out
Exhibit 1.7	Kassowal to Chicha Watni 132kV Single Circuit Out

We find that power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria. We find no capacity constraints on 132 kV circuits under normal and contingency conditions.

5.2 Peak Load Case 2019: Summer Scenario

The scenario of Two Star PP during the summer season, for the month of September with maximum hydel dispatches, has been studied. The results of load flows with Two Star PP under normal conditions have been plotted in Exhibit 2.0 in Appendix-C.

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 132 kV circuits under normal conditions i.e. without any outages of circuits.

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

Exhibit-2.1	Two Star-PP 132/11 KV Single Transformer Out

Exhibit 2.2	Two Star-PP to Kamalia 132kV Single Circuit Out
Exhibit 2.3	Chicha Watni to Kamalia 132kV Single Circuit Out
Exhibit 2.4	Mureed-Wala to Kamalia 132kV Single Circuit Out
Exhibit 2.5	T.T Singh New to Mureed-Wala 132kV Single Circuit Out
Exhibit 2.6	T.T Singh New to T.T Singh 132kV Single Circuit Out
Exhibit 2.7	Kassowal to Chicha Watni 132kV Single Circuit Out

We find that power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria. We find no capacity constraints on 132 kV circuits under normal and contingency conditions.

5.3 Peak Load Case 2021: Extended Term Scenario

We have also studied the future scenario of September 2021 to assess the impact of the plant in the extended term of its installation as per NTDC requirement.

Exhibit 3.0 shows the normal case of 2021 of the region with Two Star PP. The total 45.3 MW of electrical power will be supplied to the national grid from Two Star PP.

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal.

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

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

Exhibit-3.1	Two Star-PP 132/11 KV Single Transformer Out
Exhibit 3.2	Two Star-PP to Kamalia 132kV Single Circuit Out
Exhibit 3.3	Kamalia to Chicha Watni 132kV Single Circuit Out
Exhibit 3.4	Mureed-Wala to Kamalia 132kV Single Circuit Out
Exhibit 3.5	T.T Singh New to Mureed-Wala 132kV Single Circuit Out
Exhibit 3.6	T.T Singh New to T.T Singh 132kV Single Circuit Out
Exhibit 3.7	Kassowal to Chicha Watni 132kV Single Circuit Out

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria.

We find that there are no capacity constraints in the proposed connectivity scheme even in the up-coming years i.e. 2021.

5.4 Conclusion of Load Flow Analysis

From the analysis discussed above, we conclude that the proposed interconnection scheme is adequate to evacuate the maximum 45.3 MW spillover power of Two Star PP under normal and contingency conditions.

It was found that in 2019 all the contingency cases the surrounding circuits remain within the rated capacity. Also the bus bar voltages were well within the permissible limits in all the contingency events.

The scenario of September 2019 and 2021 was also evaluated and found to be stable under normal and contingency cases.

Load Flow analysis indicates that power distribution is in local grids therefore losses are reduced and voltage are improved. Beside this, it also has an advantage that demand from NTDC to FESCO will decrease as local generation is available.

6. SHORT CIRCUIT ANALYSIS

6.1 Methodology and Assumptions

The methodology of IEC 909 has been applied in all short circuit analyses in this report for which provision is available in the PSS/E software used for these studies. The maximum fault currents have been calculated with the following assumptions under IEC 909:

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

For evaluation of maximum short circuit levels we have assumed contribution in the fault currents from all the installed generation capacity of hydel, thermal and nuclear plants in the system in the years 2019 and 2021 i.e. all the generating units have been assumed on-bar in fault calculation's simulations.

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

6.2 Fault Current Calculations without Two Star PP Year 2019

In order to assess the short circuit strength of the network of 132 kV without Two Star PP for FESCO in the vicinity of the site of the Plant near Kamalia, fault currents have been calculated for balanced three-phase and unbalanced single-phase short circuit conditions in the year 2019. These levels will give us the idea of the fault levels without Two Star PP and later on how much the contribution of fault current from Two Star PP may add to the existing levels. The results are attached in Appendix – D. The short circuit levels have been calculated and plotted on the bus bars of 132 kV of substations lying in the electrical vicinity of our area of interest and are shown plotted in the Exhibit 4.0 attached in Appendix-D. Both 3-phase and 1-phase fault currents

are indicated in the Exhibit 4.0 which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabular output of the short circuit calculations is also attached in Appendix-D for the 132 kV and 11 kV bus bars of our interest. The total maximum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 6.1. We see that the maximum fault currents do not exceed the short circuit ratings of the equipment at these 132 kV substations which normally are 31.5 kA for older substations and 40 kA for new substations.

Table-6.1
Maximum Short Circuit Levels without Two Star PP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
Kamalia 132kV	**11.12**	**7.32**
Kamalia 11kV	**17.17**	**17.90**
Mureedwala 132kV	**13.73**	**9.40**
Mureedwala 11kV	**17.50**	**18.13**
Chicha Watni 132kV	**17.07**	**11.79**
Chicha Watni 11kV	**17.93**	**18.44**
C. Rajana 132kV	**6.90**	**4.49**
Mamun Kanjan 132kV	**6.39**	**4.15**
Manjla Bagh 132kV	**4.60**	**2.95**
T.T Singh-N 132kV	**25.96**	**22.35**
T.T Singh 132kV	**8.14**	**5.81**
Kassowal 132kV	**18.52**	**13.57**

6.3 Fault Current Calculations with Two Star PP Year 2019

Fault currents have been calculated for the electrical interconnection of proposed scheme. Fault types applied are three phase and single-phase at the 132 kV bus bar of Two Star PP itself and other bus bars of the 132 kV and 11 kV substations in the electrical vicinity of Two Star PP. The graphic results are shown in Exhibit 4.1.

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

Table-6.2
Maximum Short Circuit Levels with Two Star PP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
Two Star PP 132kV	**10.44**	**9.10**
Two Star PP 11kV	**53.39**	**36.08**
Kamalia 132kV	**12.19**	**10.06**
Kamalia 11kV	**17.24**	**17.91**
Mureedwala 132kV	**14.01**	**9.90**
Mureedwala 11kV	**17.50**	**18.11**
Chicha Watni 132kV	**17.68**	**12.98**
Chicha Watni 11kV	**17.93**	**18.42**
C. Rajana 132kV	**6.96**	**4.60**
Mamun Kanjan 132kV	**6.44**	**4.24**
Manjla Bagh 132kV	**4.62**	**2.99**
T.T Singh-N 132kV	**26.19**	**22.64**
T.T Singh 132kV	**8.15**	**5.81**
Kassowal 132kV	**18.92**	**14.25**

6.4 Fault Current Calculations with Two Star PP Year 2021

Fault currents have been evaluated for the peak case of 2021 in order to observe the maximum fault current on Two Star PP and the bus bars in its vicinity considering the future additions in the system. Fault types applied are three phase and single-phase at 132 kV bus bars of Two Star PP itself and other bus bars of the 132 kV and 11kV substations in the electrical vicinity of Two Star PP. The graphic results showing maximum 3-phase and 1-phase fault levels are indicated in Exhibit 4.2. Both 3-phase and 1-phase fault currents are indicated in the Exhibit 4.2 which are given in polar

coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabulated results of short circuit analysis showing all the fault current contributions with short circuit impedances on 132 kV bus bars of the network in the electrical vicinity of Two Star PP are placed in Appendix-D. Brief summary of fault currents at significant bus bars of our interest are tabulated in Table 6.3

Table-6.3
Maximum Short Circuit Levels with Two Star PP

Substation	3-Phase fault current, kA	1-Phase fault current, kA
Two Star PP 132kV	**10.69**	**9.34**
Two Star PP 11kV	**54.61**	**36.83**
Kamalia 132kV	**12.52**	**10.38**
Kamalia 11kV	**17.37**	**18.04**
Mureedwala 132kV	**14.43**	**10.12**
Mureedwala 11kV	**17.60**	**18.21**
Chicha Watni 132kV	**18.59**	**14.34**
Chicha Watni 11kV	**18.05**	**18.53**
C. Rajana 132kV	**7.08**	**4.66**
Mamun Kanjan 132kV	**6.54**	**4.28**
Manjla Bagh 132kV	**4.67**	**3.02**
T.T Singh-N 132kV	**27.93**	**23.90**
T.T Singh 132kV	**12.95**	**9.33**
Kassowal 132kV	**19.97**	**16.28**

Comparison of Tables 6.1, 6.2 and 6.3 shows an increase in short circuit levels for three-phase and single-phase faults due to connection of Two Star PP on the 132 kV bus bars in its vicinity; and a rise on Kamalia 132 kV bus bars because of direct connection with Two Star PP. We find that even after some increase, these fault levels are much below the rated short circuit values of the equipment installed on these substations.

For Two Star PP 132 kV standard size switchgear of short circuit rating of 40 kA has already been proposed. It would provide large margin for any future increase in short circuit levels due to future generation additions and network reinforcements in this area.

6.5 Conclusion of Short Circuit Analysis

The short circuit analysis results show that for the proposed scheme of interconnection of Two Star PP with Kamalia 132 kV Substation, we don't find any problem of violations of short circuit ratings of the already installed equipment on the 132 kV equipment of substations in the vicinity of Two Star PP due to fault current contributions from this power house under three-phase faults as well as single phase faults.

The short circuit level of the Two Star PP 132 kV is 10.69 kA and 9.34 kA for 3-phase and 1-phase faults respectively in the year 2021. Therefore industry standard switchgear of the short circuit rating of 40 kA would serve the purpose as per NTDC requirement taking care of any future generation additions and system reinforcements in its electrical vicinity.

7. DYNAMIC STABILITY ANALYSIS

7.1 Assumptions & Methodology

7.1.1 Dynamic Models

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

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

Generator	GENROU
Excitation System	IEEET1
Speed Governing System	TGOV1
Inertia Constant	H = 2.6420 MW-sec/MVA

7.1.2 System Conditions

Month of January 2019 has been selected for the study because it represents the peak load season after the COD of Two Star Power Project and thus the loading on the lines in the vicinity of Two Star PP will be maximum allowing us to judge the full impact of the plant.

The proposed Two Star PP has been modeled in the dynamic simulation as per data provided by client.

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

7.1.3 Presentation of Results

The plotted results of the simulations runs are placed in Appendix-E. Each simulation is run for its first one second for the steady state conditions of the system prior to fault or disturbance. This is to establish the pre fault/disturbance conditions of the network under study were smooth and steady. Post fault recovery has been monitored for nine seconds. Usually all the transients due to non-linearity die out within 2-3 seconds after disturbance is cleared in the system.

7.1.4 Worst Fault Cases

Three phase faults are considered as the worst disturbance in the system. We have considered 3-phase fault in the closest vicinity of Two Star PP i.e. right at the 132 kV bus bar of Two Star PP substation, cleared in 5 cycles, as normal clearing time for 132 kV i.e. 100 ms, followed by a permanent trip of a 132/11 kV single transformer emanating from this substation. Also to fulfil the Grid Code criteria case of stuck breaker (breaker failure) single phase fault has also been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms.

7.2 Dynamic Stability Simulations' Results with Two Star PP interconnected - January 2019

7.2.1 Fault at 132 kV Two Star PP

We applied three-phase fault on Two Star PP 132 kV bus bar, cleared fault in 5 cycles (100 ms) followed by trip of a 132/11 kV one transformer of Two Star PP substations. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 1.1 Bus Voltages

The bus voltages of 132 kV bus bars of Two Star PP, Kamalia, Chicha Watni, Mureedwala, C. Rajana and T.T. Singh-New are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 1.2 Frequency

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

Fig. 1.3 MW/MVAR Output of Generators of Two Star PP

The MW/MVAR output of Two Star PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output.

Fig. 1.4 Speed and mechanical power of Generators at Two Star PP

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

Fig. 1.5 MW Flow on Two Star PP 132/11 kV second transformer

Followed by clearing of fault, the trip of a 132/11 kV one transformer of Two Star PP causes the entire output of Two Star PP to flow on the intact 132/11 kV second transformer of Two Star PP. This causes significant loading on the Two Star PP 132/11 kV second transformer. We plotted the flows of MW and MVAR on this intact transformer and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 1.6 Rotor Angles

The rotor angles of the generators of Two Star PP, Kashmir-PP, Hunza-PP, Liberty-PP and Chashmah 132 kV are plotted relative to machines at Guddu New 500 kV. The results show that the rotor angle of Two Star PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.2.2 Fault at 132kV Two Star PP (Stuck Breaker)

We applied single-phase fault on Two Star PP 132 kV bus bar, cleared fault in 9 cycles (180 ms), to simulate a stuck breaker case, followed by trip of a 132/11 kV one transformer of Two Star PP substations. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 2.1 Bus Voltages

The bus voltages of 132 kV bus bars of Two Star PP, Kamalia, Chicha Watni, Mureedwala, C. Rajana and T.T. Singh-New are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 2.2 Frequency

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

Fig. 2.3 MW/MVAR Output of Generators of Two Star PP

The MW/MVAR output of Two Star PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output.

Fig. 2.4 Speed and mechanical power of Generators at Two Star PP

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

Fig. 2.5 MW Flow on Two Star PP 132/11 kV second transformer

Followed by clearing of fault, the trip of a 132/11 kV one transformer of Two Star PP causes the entire output of Two Star PP to flow on the intact 132/11 kV second transformer of Two Star P P. This causes significant loading on the Two Star PP 132/11 kV second transformer. We plotted the flows of MW and MVAR on this intact transformer and see that the power flows on this circuit attains to steady state level with power swings damping down fast.

Fig. 2.6 Rotor Angles

The rotor angles of the generators of Two Star PP, Kashmir-PP, Hunza-PP, Liberty-PP and Chashmah 132 kV are plotted relative to machines at Guddu New 500 kV. The results show that the rotor angle of Two Star PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.2.3 Fault at Kamalia 132 kV

We applied three-phase fault on far 132 kV bus bar of Kamalia to study the impact of a disturbance in the grid on the performance of the plant. The fault is cleared in 5 cycles (100 ms) followed by trip of 132 kV one circuit between Kamalia and Two

Star PP. We monitored different quantities for one second pre-fault and nine cycles after clearance of fault (post-fault) conditions and plotted the results attached in Appendix – E and discussed as follows:

Fig. 3.1 Bus Voltages

The bus voltages of 132 kV bus bars of Kamalia, Two Star PP, Chicha Watni, Mureedwala, C. Rajana and T.T. Singh-New are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 3.2 Frequency

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

Fig. 3.3 MW/MVAR Output of Generators of Two Star PP

The MW/MVAR output of Two Star PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output.

Fig. 3.4 Speed and mechanical power of Generators at Two Star PP

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

Fig. 3.5 MW Flow on Kamalia to Two Star PP 132 kV second circuit

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

Fig. 3.6 Rotor Angles

The rotor angles of the generators of Two Star PP, Kashmir-PP, Hunza-PP, Liberty-PP and Chashmah 132 kV are plotted relative to machines at Guddu New 500 kV.

The results show that the rotor angle of Two Star PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.2.4 Fault at Kamalia 132 kV (Stuck Breaker)

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

Fig. 4.1 Bus Voltages

The bus voltages of 132 kV bus bars of Kamalia, Two Star PP, Chicha Watni, Mureedwala, C. Rajana and T.T. Singh-New are plotted. The results show quick recovery of the voltages after clearing of fault.

Fig. 4.2 Frequency

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

Fig. 4.3 MW/MVAR Output of Generators of Two Star PP

The MW/MVAR output of Two Star PP gets back to the pre-fault output quickly after fast damping of the oscillations in its output.

Fig. 4.4 Speed and mechanical power of Generators at Two Star PP

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

Fig. 4.5 MW Flow on Kamalia to Two Star PP 132 kV second circuit

Followed by clearing of fault, the trip of a 132 kV one circuit from Two Star PP to Kamalia causes the entire output of Two Star PP to flow on the intact 132 kV second

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

Fig. 4.6 Rotor Angles

The rotor angles of the generators of Two Star PP, Kashmir-PP, Hunza-PP, Liberty-PP and Chashmah 132 kV are plotted relative to machines at Guddu New 500 kV . The results show that the rotor angle of Two Star PP gets back after the first swing and damps down quickly. Similarly the rotor angles of other machines swing little after the fault and damp fast after clearing of fault. The system is strongly stable and very strong in damping the post fault oscillations.

7.3 Conclusion of Dynamic Stability Analysis

The results of dynamic stability carried out for January 2019 show that the system is very strong and stable for the proposed scheme for the severest possible faults of 132 kV systems near to and far of Two Star PP under all events of disturbances. Therefore there is no problem of dynamic stability for interconnection of Two Star PP; it fulfills all the criteria of dynamic stability.

8. CONCLUSIONS

- The study objective, approach and methodology have been described and the plant's data received from the Client is validated.
- The nearest grid facility is the 132 kV substations of Kamalia. It lies at about 7 km from the site of Two Star PP.
- Due to the location of Two Star PP, the most feasible interconnection scheme would be 7 km 132 kV double circuit to Kamalia grid station from the proposed Two Star PP on Lynx conductor. The up-coming chapters discuss in detail the location and interconnection of the Two Star PP. A few approximate sketches are shown in Appendix-B.
- The proposed scheme will require two breaker bays of 132 kV at Two Star PP to connect with the 132 kV circuits each from Kamalia G/S.
- In view of planned COD, of the Two Star PP in September 2018, the above proposed interconnection scheme has been assessed for steady state conditions through detailed load flow studies, short circuit analysis and stability criterion for January 2019 for maximum thermal power dispatches in the grid during winter which is the crushing season.
- Steady state analysis by load flows, short circuit and stability criterion reveals that proposed scheme is adequate to export 45.3 MW output of the plant under normal and contingency conditions.
- Since the plant operates during summer as well, the high-water season, its detail analysis has also been carried out for September 2019.
- In an extended term scenario, September 2021 has been studied to evaluate the performance of the proposed interconnection scheme. The system conditions of normal and N-1 contingency have been examined for all scenarios to meet the reliability criteria. Along with it, short circuit and dynamic stability analysis have been carried out for a complete check of the system.
- Load Flow analysis indicates that power distribution is in local grids therefore losses are reduced and voltage are improved. Beside this it also has an advantage that demand from NTDC to FESCO will decrease as local generation is available.

- The short circuit level of the Two Star Power Project 132 kV is 10.69 kA and 9.34 kA for 3-phase and 1-phase faults respectively for the year 2021. Therefore industry standard switchgear of the short circuit rating of 40 kA would be fine to be installed at 132 kV switchyard of Two Star Power Project taking care of any future generation additions and system reinforcements in its electrical vicinity and also fulfill the NEPRA Grid Code requirements specified for 132 kV switchgears. There are no violations of exceeding the rating of the equipment in the vicinity of Two Star PP due to contribution of fault current from it.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out. The stability has been tested for the worst cases, i.e. three phase fault right on the 132 kV bus bar of Two Star PP substation followed by the final trip of 132/11 kV transformer emanating from this substation has been performed for fault clearing of 5 cycles (100 ms), as understood to be the normal fault clearing time of 132 kV protection system. Also the extreme worst case of stuck breaker (breaker failure) has been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms for single phase fault. The stability of system for far end faults of 3-phase occurring at Kamalia 132 kV bus bar and also stuck breaker faults of 1-phase occurring at Kamalia 132 kV bus bar has been checked.

TWO STAR ENERGY (PVT.) LIMITED

Installation of 49.8 MW Co-Generation Power Plant At Toba-Chichawatni Road, Tehsil Kamalia, District Toba Tek Singh.

INITIAL ENVIRONMENT EXAMINATION (IEE) REPORT

JANUARY 2016

INTEGRATED ENVIRONMENT CONSULTANTS
2nd Floor, Office # 11, Anwar Tower, 99-Shadman, Lahore, Pakistan
E-mail: inenvconsultants@yahoo.com Tel: + 92 042 3596 0091

TWO STAR ENERGY (PVT) LTD

TWO STAR ENERGY (PVT.) LIMITED

Installation of 49.8 MW Co-Generation Power Plant At Toba-Chichawatni Road, Tehsil Kamalia, District Toba Tek Singh.

INITIAL ENVIRONMENT EXAMINATION (IEE) REPORT

JANUARY 2016

INTEGRATED ENVIRONMENT CONSULTANTS
2nd Floor, Office # 11, Anwar Tower, 99-Shadman, Lahore, Pakistan
E-mail: inenvconsultants@yahoo.com Tel: + 92 042 3596 0091

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

BMP	Best Management Practices
CCR	Central Control Room
DM	Dematerialize Water
dB	Decibel
EA	Environmental Approval
EHS	Environment, Health and Safety
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
EMtP	Environmental Monitoring Plan
EMMP	Environmental Management & Monitoring Plan
EOT	Electrical Operated Overhead Traveling
EPA	Environment Protection Agency
ESP	Electrostatic precipitator
ERT	Emergency Response Team
GFP	Grievance Focal Points
GRC	Grievance Redress Committee

HVAC	Heating, ventilation and air conditioning
IUCN	International Union for Conservation of Nature and Natural Resources
IEE	Initial Environmental Examination
LAA	Land Acquisition Act
TSIL	Two Star Industries Limited
mg	Milligram
MW	MegaWatt
NAAQS	National Ambient Air Quality Standards
NCS	National Conservation Strategy
NTU	Nephelometric Turbidity Units
NGOs	Non-Governmental Organizations
NOC	No Objection Certificate
P&D	Planning and Development
PCU	Public Complaints Unit
PEPA	Punjab Environment Protection Act
PEQS	Punjab Environmental Quality standards
PM	Project Management
pm	Particulate Matter
PVC	Polyvinyl chloride
RCC	Reinforce Concrete Cement
RE	Resident Engineer
RNR	Renewable Natural Resources
RO	Reverse Osmosis
DPDPI	Sustainable Development Policy Institute
TCD	Tons Crushing per Day
TMA	Tehsil Municipal Administration
TPH	Tons Per Hour
TSEPL	Two Star Energy (Pvt.) Limited
UET	University of Engineering and Technology
UNCED	United Nations Conference on the Environment and Development
WHO	World health organization
WWF	World Wide Fund

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Two Star Industries (Pvt.) Limited has acquired the rights and assets of and accordingly own and operates the assets of Kamalia Sugar Mills Limited (KSML). TSIL is one of the larger sugar mills in the country with crushing capacity of 14,000 TCD (Tons Cane Crushing per Day). TSIL already owns and operate a 12MW bagasse base power plant to meet its captive requirements. TSIL has formed a Special Purpose Vehicle Company (SPV) with the name of Two Star Energy (Pvt.) Limited **("TSEPL") for the project**.

M/S Two Star Energy (Pvt.) Limited (TSEPL) intends to install an approximately 49.8MW high pressure bagasse based cogeneration power project at Toba-Chichawatni road, Tehsil Kamalia, District Toba Tek Singh.

The power & steam system is well balanced and sizable quantity of bagasse is saved and stored due to Energy Efficiency measure adopted by the company. A part from modernization exercise, the management has now decided to take up the installation of highly efficient, high pressure cycle cogeneration plant in the sugar mill. This will help in optimum utilization of Bagasse & generation of surplus power. Based on 14,000 TCD crushing capacity & process steam demand of 40 % on cane, the optimum Co-gen project capacity has been estimated at 49.8-MW.

Keeping in view the regulatory requirements of the Punjab Environment Protection Act 2012 (amended act), Section 12, and this Initial Environmental Examination Report has been prepared to get the environmental approval from the Environment Protection Agency (EPA), Government of the Punjab.

I. Title and location of project

Two Star Industries (Pvt.) Limited is planning to set up 49.8 MW co generation bagasse based power plant in Tehsil Kamalia of District Toba Tek Singh.

II. Name of the Proponent

M/S Two Stars Energy (Pvt.) Ltd

Office: 9th Floor, City Towers, 6-K, Main Boulevard, Gulberg II, Lahore

III. Name of organization preparing the report

Integrated Environment Consultants

Office: Office # 11, 2nd Floor, Anwar Tower, 99-Shadman Chowk, Lahore, Pakistan.
Phone: (042)-35960091
Email: inenvconsultants@yahoo.com

IV. A Brief Outline of the Proposal

The project envisages the installation of 49.8-MW bagasse based cogeneration power project at Tehsil Kamalia of District Toba Tek Singh. In accordance with the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000, SRO # 339 (1)/2000, the project falls in Schedule –I, Part-A 'Energy' Serial 2 'Thermal power generation less 200 MW; therefore, requires the Initial Environmental Examination (IEE) study for sustainable development and to submit in provincial Environmental Protection Agency (EPA), for issuance of Environmental Approval (EA).

V. Major Impacts and their mitigations

Table given below shows the project impacts; related with construction and operational phase of the Project.

Major Impacts and Mitigation Measures

Impacts	Magnitude	Recommendation Measure	Responsible Authority
CONSTRUCTION PHASE			
Air Pollution • Dust resulting from construction work • Use of heavy machinery can generate exhaust and dust emissions	Minor	• Sprinkling of water on regular basis especially during dry climatic conditions • Periodic maintenance and management of all the construction machinery and vehicles • Covering or use of wind sheets around the stockpiles to avoid air pollution through dispersion	Contractor/ Consultant
Solid waste • Construction waste and domestic waste from worker camps	Minor	• Conduct separate collection of construction and domestic waste to promote recycling and re-use • Dispose non-recyclable and hazardous waste material properly according to waste management rules	Contractor/ Consultant
Water Quality • Run-off water from construction area • Wastewater from camp site • Leakage of oil and chemical materials from construction	Minor	• Use of spill prevention trays and impermeable sheets to avoid contamination of the groundwater/surface water • septic tanks should be constructed with cemented wall to prevent the groundwater contamination	Contractor/ Consultant

Impacts	Magnitude	Recommendation Measure	Responsible Authority
activity			
Noise • Noise caused by construction machinery • vehicles used for mobilization of construction equipment and workers	Minor	• Control noise through control of working hours and selection of less noisy equipment. • Proper maintenance of vehicles and construction equipment	Contractor/ Consultant
OPERATIONAL PHASE			
Air Pollution • Exhaust gas from stacks • Dust from ash disposal activity • Dust from bagasse handling activities and baggase yard	Minor	• Periodic maintenance of the generator and should be fitted with appropriate exhaust systems and devices • To reduce PM emissions, Electrostatic precipitator of 99.8% efficiency will be installed • To reduce NO2 emissions, firing system will use low combust technology • For stack design, height will be 90 m	EHS officer of Project Proponent
Solid waste • Fly ash and bottom ash • Sewage and garbage from	Minor	• Ash pond is designed with capacity of 5 years of operation • Implementation of waste management program	EHS officer of Project Proponent

Impacts	Magnitude	Recommendation Measure	Responsible Authority
workers		consisting of reduce, reuse and re-cycling of materials	
Odour Management	Minor	• Odour will be control through proper plantation, ventilation system	EHS officer of Project Proponent
Water Quality • Thermal effluent from cooling system • Wastewater from plant process • Rainwater drainage from ash pond and baggase yard	Minor	• Thermal effluents will be discharge far from the intake point of cooling water to reduce the impact on surrounding area • Installation of wastewater treatment system by neutralization, settling and oil separation so any wastewater produced complies with wastewater standards of PEQS • The bottom of the ash pond shall have an impermeable layer	EHS officer of Project Proponent
Noise • Noise and vibration from steam turbines, generators and pumps etc. • Noise by ash disposal/ baggase handling activity	Minor	• Installation of low noise/ low vibration type equipment • Proper maintenance of equipments • Adequate basis of equipment to reduce the vibration • Adequate enclosure of equipment to reduce noise	EHS officer of Project Proponent

Impacts	Magnitude	Recommendation Measure	Responsible Authority
• Noise from vehicles used for mobilization of equipment			

VI. Proposed Monitoring

The monitoring program is designed to ensure that the requirements of the environmental approval awarded by the EPA are met. Monitoring Program (MP) provides important information that allows for more effective planning and an adaptive response based on the assessment of the effectiveness of mitigation measures. The monitoring of various parameters will help to determine the extent to which project construction/operation activities will cause environmental disturbance.

Sr. No.	Monitoring Parameters	Monitoring Mechanism	Responsibility
1.	Water Quality	Discrete grab sampling and laboratory testing of water samples.	Proponent/ EPA
2.	Dust Emissions	Ambient Particulate Matter Monitoring System.	Proponent/ EPA
3.	Noise Levels	Noise meter	Proponent/ EPA
4.	Stack emission	Emissions monitoring system. Monitoring of ambient air quality.	Proponent/ EPA
5.	Inconvenience to community	Consultations with community to get feedback about inconvenience due to the construction activities to perform their daily routine chores.	Proponent/ EPA

VII. Environmental Management Cost

The cost for environmental management and monitoring will be the part of contract of Contractor and Consultants respectively. However, a lump sum amount of Rs. 2.5 million will be allocated by the project proponent as cost for environmental training and monitoring for a period of two years during construction and operation of the project.

VIII. Stakeholder Consultations

Public Discussions were held with the inhabitant of the surrounding area. They are quite positive to the project and see the project as growing business and accomplishing towards the positive development in the area at local and in country as whole. The people observe strong positive impacts regarding employment, business and structural development due to this project. IEE findings depict that people perceive overall positive social and economic impacts by the project. Their attitude towards the project installation is highly optimistic. Majority of the people are convinced for development in the area and they correlate this progress with the pace of their social mobility.

SECTION-1
INTRODUCTION

1 INTRODUCTION

Two Star Industries (Pvt.) Limited has acquired the rights and assets of and accordingly own and operates the assets of Kamalia Sugar Mills Limited (KSML). TSIL is one of the larger sugar mills in the country with crushing capacity of 14,000 TCD (Tons Cane Crushing per Day). TSIL already owns and operate a 12MW bagasse base power plant to meet its captive requirements. TSIL has formed a Special Purpose Vehicle Company (SPV) with the name of Two Star Energy (Pvt.) Limited **("TSEPL") for the project.**

M/S Two Star Energy (Pvt.) Limited (TSEPL) intends to install an approximately 49.8MW high pressure bagasse based cogeneration power project at Toba-Chichawatni road, Tehsil Kamalia, District Toba Tek Singh.

The power & steam system is well balanced and sizable quantity of bagasse is saved and stored due to Energy Efficiency measure adopted by the company. A part from modernization exercise, the management has now decided to take up the installation of highly efficient, high pressure cycle cogeneration plant in the sugar mill. This will help in optimum utilization of Bagasse & generation of surplus power. Based on 14,000 TCD crushing capacity & process steam demand of 40 % on cane, the optimum Co-gen project capacity has been estimated at 49.8-MW.

Keeping in view the regulatory requirements of the Punjab Environment Protection Act 2012 (amended act), Section 12, and this Initial Environmental Examination Report has been prepared to get the environmental approval from the Environment Protection Agency (EPA), Government of the Punjab.

1.1 IMPORTANCE & BACKGROUND OF PROJECT

The on-going power supply shortage in the country besides the high fuel costs and low quality oil are causing a significant loss of production resulting in negative economic impact. The use of Bagasse as source of energy production is on high priority of government. Thus, use of Bagasse may provide cost component energy units. Therefore, as a responsible corporate citizen company, the management has focused on energy efficiency using best available resource. The proponent's environment friendly initiatives has already recognized by many local and international organizations. Therefore, Two Star Energy (Pvt.) Limited is planning to set up 49.8 MW co-generation bagasse based power plant in Tehsil Kamalia of District Toba Tek Singh.

1.2 OBJECTIVES OF THE PROJECT

The main object of the proposed project is to generate cleaner, economical and reliable energy from indigenous fuel which will not only provide a better source of energy but also cause a compensatory role in reducing the shortage of energy demand.

1.3 PURPOSE OF REPORT

Initial Environmental Examination (**IEE**) report is being submitted to the Environmental Protection Agency (**EPA**), Government of the Punjab, Lahore in compliance with the legal requirement for Punjab Environment Protection Act-2012 (amended act), Section-12 for obtaining the Environmental Approval (**EA**)/No Objection Certificate (**NOC**) before commencement of the project work at the proposed project site. The other relevant regulations and guidelines considered while preparing this IEE report include:

1. Policy and procedures for filing, review and approval of environmental assessments.
2. Guidelines for the preparation and review of environmental reports.
3. Guidelines for public participation.
4. Guidelines for sensitive and critical areas.
5. Detailed sectoral guidelines.

Different environmental aspects like social, physical, biological and other related features of the project both during construction and its regular occupancy are highlighted in this IEE report. Measures necessary to be adopted to mitigate negative environmental impacts on any part of the environment around are also described. All the important information is also provided as described under present format used to help decision makers, EPA Punjab in the present case, before issuing the desired Environmental Approval (EA).

1.4 IDENTIFICATION OF PROJECT PROPONENT

M/S. Two Stars Energy (Pvt.) Ltd
Office: 9th Floor, City Towers, 6-K, Main Boulevard, Gulberg II, Lahore

1.5 CONSULTANTS PREPARING ENVIRONMENTAL REPORT

Integrated Environment Consultants
Office: Office # 11, 2nd Floor, Anwar Tower, 99-Shadman Chowk, Lahore, Pakistan.
Phone: (042)-35960091
Email: inenvconsultants@yahoo.com

1.6 NEED OF THE EIA STUDY

Government of Pakistan in the year 2000 has adopted the regulations for the Review of Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA), under these review regulations, the Environmental Protection Agency (EPA) stipulated relevant procedures for the proponents to be compliance with environmental quality requirements for the preparation of environmental assessment studies (either IEE or EIA). These environmental studies are planning

instruments that aim to contribute to design phases of the development as well as functions as management tools to minimize potential negative impacts and maximize benefits during construction and operational phases of a project. To be effective in this role the IEE or EIA needs to form an integral part of the project design process. In this way the environmental implications of various design alternatives can be evaluated and the cost benefits of different trade-offs assessed. The result is the potentially negative impacts can often be avoided and almost always reduced, without compromising the real cost of the project. Conversely, positive environmental outcomes associated with the project can be enhanced.

1.7 OBJECTIVE OF THE REPORT

Objectives to conduct this IEE are as following:

i. A legal binding in accordance to Punjab Environmental Protection Act-2012 (amended Act).

ii. To identify the potential environmental issues pertaining to the proposed site.

iii. To evaluate the ability of the site in view of social acceptance and environmental soundness.

iv. To provide the maximum information to the proponent and other stakeholders about the existing environmental conditions and the implications of the proposed project.

v. Collection of available data, reports, drawings and other relevant information about area of proposed project.

vi. Review of applicable existing environmental legislation and Punjab Environmental Quality standards (PEQS).

vii. Propose mitigation measures to eliminate or to reduce the negative impacts to an acceptable level.

viii. Development of well resourced environmental management and monitoring plans to identify mitigation strategies targeted towards avoidance, minimization and rehabilitation of the impacts.

1.8 EXTENT OF THE STUDY

In compliance with PEPA-2012 (amended act) requirements, an IEE report has been prepared by M/S Integrated Environment Consultants, Lahore. This document covers all environmental impacts, due to installation of the 49.8 MW co-gen power project, in and around the project area comprising the physical, ecological and socio-economic aspects together with identification of the potential positive and negative impacts. Any developmental activities outside the project area, the transmission lines for dispatch of electricity and establishment of the

other factories outside the project vicinity have not been covered under this IEE study.

1.9 METHODOLOGY

The methodology adopted to carry out the IEE study of the proposed project was as follow:

a) Orientation
b) Planning of Data Collection
c) Data Collection
d) Site Reconnaissance
e) Analysis of Maps
f) Literature Review
g) Desk Top Research
h) Stakeholders Consultations
i) Field Studies
j) Laboratory Analysis
k) Evaluation of Impacts and their analysis
l) Categorization of impacts based on their potential environmental significance and prescription of preventive / mitigation measures

In addition to the evaluation and review of the available records, data and the facts for the previous project, detailed discussions were held with the concerned members of the project management as well as other project stakeholders. Notes and proposals for measures to be taken to mitigate and compensate for any detrimental environmental impacts are contained in the Environmental Management Plan (EMP) as well as a Monitoring Plan, including all parameters that need to be measured, and the frequency of monitoring actions.

A comprehensive qualitative and quantitative methodology was adopted to conduct this study inter-alia in due compliance with the IEE requirements. The study included collection of both primary and secondary data regarding environmental status and other relevant factors. This IEE report has been accomplished after carrying out thorough visit to the proposed site and detailed investigation to identify the following Environmental areas of concern:

1) To achieve the desired environmental compliance standards; as per the national environmental regulatory requirements; as applicable to the project.

2) Plans and activities to prevent/mitigate any potential impacts and the gaps that could probably remain after implementation.

3) Any other points/steps to be taken which could be beneficial to mitigate environmental adverse impacts that may accrue both during construction and regular operation of the project.

A view of methodology for environmental assessment is given in **Table - 1.1**:

Table - 1.1: Environmental and Social Assessment Process

Phase	Activities	Status	Responsibility
Screening and Scoping	Reconnaissance and initial site visit and consultations, identification of environmental and social issues & applicable safeguard environment policy, categorization and working out an action plan.	carried out during the present IEE	Project Management (PM) Consultants
Impact Assessment	Identification of potential environmental and social impacts through site visits, stakeholders consultations, review of drawings, alternatives etc	during the present IEE	PM Consultants
Impact categorization	The significant potential impacts were tabulated and mitigation/preventive measures were prescribed	during the present IEE	PM Consultants
EMP Preparation	Stakeholders/Women consultation	carried out during/prepared as	PM Consultants

Phase	Activities	Status	Responsibility
	EMP	part of the present EIA	
Final EMP	Final version of EMP produced	included in the present EIA	PM Consultants

1.10 SCOPE OF THE STUDY

The purpose of this IEE study is identification of key environmental and social issues which will likely arise during construction and operation of the power plant along with the assessment of the significant negative impacts and mitigation measures to be adopted for their minimization.

The ultimate goal of this IEE report, among others, is also to produce an Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMtP) for the construction and operation stages of the proposed project. Compliance of EMP together with the provisions for mitigation measures for the significant negative impacts will ensure the implementation of this project in an environmentally sustainable manner both at construction as well as operation stages of the project.

The IEE report ensures compliance to all national and local regulations enforced in Pakistan, especially Punjab for such report. While taking into consideration the corporate standards, it was further sought to ensure that the project under reference of this IEE report, is to be developed in a manner that is socially responsible and reflects sound environmental management practices.

This IEE report also discusses the legal and administrative framework within which the IEE has been prepared. A brief project description is included in the IEE report together with a description of the baseline environmental conditions and the actual environmental situation at the proposed site for the project. The technical section of the report and the environmental baseline situation form the basis for the detailed impact assessment during construction and operation phases of the project. Based on the findings of this report, an environmental management system has been devised, outlining necessary mitigation and compensation measures together with monitoring practices.

1.11 PERSONS PERFORMING THE STUDY (TEAM MEMBERS)

The proponent has assigned the task of preparing EIA report to M/S **Integrated Environment Consultants, Lahore.** The EIA study of the proposed project has been conducted according to Environmental Assessment Procedures, 1997, Review of IEE and EIA Regulation 2000 as prescribed by the Federal

Environmental Protection Agency (Pak EPA), Government of Pakistan. The EIA guidelines for Bagasse fired power plant published through National Impact Assessment Program was also considered during this EIA process.

The study team of M/S **Integrated Environment Consultants** which completed the IEE report consists of experts as mentioned in **Table - 1.2**.

Table - 1.2: Members Completed IEE Process

Name	Qualification	Status in Project
Mr. Ahtasham Raza	M.Phil (Env. Sciences) GC University, Lahore Ph.D Scholar, (Env. Sciences) University of the Punjab, Pakistan	Project Incharge
Mr. M. A. Nouman	M.Sc Environmental Sciences. M.Phil Environmental Sciences University of the Punjab, Lahore	Team Leader
Mr. Asher Azad	M.Sc Chemistry GC University, Lahore	Monitoring Incharge
Mr. Zaheer Bhati	M.Sc Chemistry GC University, Lahore	Monitoring incharge
Mr. Mubroor Hassan	M.Sc Chemistry M.Phil Environmental Sciences	Monitoring Engineer
Mr. Hamaza Ahmad	B.Sc. Civil Engineering (UET) M.Sc. Env. Engineering (UET)	Geo Technical Engineer
Mr. M.A. Sheraz	M.A Sociology University of the Punjab, Lahore	Sociologist
Ms. Adeeba Batool	M.Phil (Env. Sciences) GC University, Lahore	Environmentalist
Mr. Bilal Tahir	BSc Environmental Engineering (UET Taxila)	Environmentalist
Mr. Adnan Sharif	Bs Environmental Sciences	Environmentalist

*Only the main roles of the team members are given. However, their role was not restricted to these, rather it also includes many other studies in their respective fields in the context of this IEE studies.

1.12 PROJECT CLASSIFICATION

The project envisages the installation of 49.8-MW bagasse based cogeneration power project at Tehsil Kamalia of District Toba Tek Singh. In accordance with the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000, SRO # 339 (1)/2000, the project falls in Schedule –I, Part-A 'Energy' Serial 2 'Thermal power generation less 200 MW; therefore, requires the Initial Environmental Examination (IEE) study for sustainable development and to submit in provincial Environmental Protection Agency (EPA), for issuance of Environmental Approval (EA).

1.13 BRIEF DESCRIPTION OF NATURE, SIZE AND LOCATION OF PROJECT

1.13.1 Location

The proposed project is located within the boundary limits of the Two Star Industries Pvt. Limited located at Toba-Chichawatni road, Tehsil Kamalia of District Toba Tek Singh (Figure-1). The site is situated about 45-Km off from main Lahore-Multan road and 245 KM from Lahore. Location of project is shown in **Figure - 1.1.**

1.13.2 Nature & Size of the Project

The project envisages on the installation of 49.8-MW, bagasse shall be fired in 2 high pressure boiler to produce the steam. The steam shall be used for generating electricity with 2 × 24.9 MW Steam Turbo generators. Sufficient additional vacant space is available to install necessary plant & machinery required for 49.8-MW Co-gen plant. Layout of various sections for all the plant & machinery has been worked out in order to utilize the land very economically, without sacrificing the ease of operation & maintenance.

1.14 THE REPORT STRUCTURE

This IEE document is structured as follow:

Section - 1:

Introduction: Containing general information about the project and process of carrying out the study.

Section - 2:

National Environmental Policy, Legal And Administrative Framework: Describes the national policy, laws and regulations governing this IEE.

Figure - 1.1: Location Map of the Project

Section - 3:

The Project Description: Describes an overall detail of the works to be done pertaining to the proposed project.

Section - 4:

The Description of the Environment: Gives information on Physical, Biological and Social conditions collected through survey of the Project Area.

Section - 5:

Environmental Impacts Due To Project & Mitigation Measures: Identifies various environmental impacts and their preventive actions. This makes the basis of the Environment Management Plan.

Section - 6:

Analysis of Alternatives: The technology and project site alternatives are discussed in the chapter

Section - 7:

Environment Management Plan (EMP): Contains comprehensive prescriptions regarding environmental impacts and their mitigation measures. This also includes institutional arrangements and Environmental Management & Monitoring Plan.

Section - 8:

Stakeholders Consultations: Explains the process of public consultation and disclosure of the project in related stakeholder. It makes this document a legal public document.

Chapter - 9:

Emergency Response Plan & Evacuation/Exit Plan: Explains about the arrangements to avoid any natural or anthropogenic emergency.

Chapter - 10:

Conclusion and Recommendation: Concludes the IEE report with some practical recommendation.

SECTION- 2
NATIONAL ENVIRONMENTAL POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2 NATIONAL ENVIRONMENTAL POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 GENERAL

This section deals with the policy and legal framework which apply for protection, conservation, restoration, rehabilitation and also related to sustainable development in context of project implementation and its operation. The Project is expected to comply with all the legislations related to the environmental aspects as regards of Pakistan.

2.2 NATIONAL POLICY FRAMEWORK

Following elements of national policy framework are considered the most relevant to this project:

2.2.1 National Conservation Strategy

The Pakistan National Conservation Strategy (NCS), which was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992).

The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources.

The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed project are:

- Pollution prevention and abatement,
- Restoration of rangelands,
- Increasing energy efficiency,
- Conserving biodiversity,
- Supporting forestry and plantations, and
- The preservation of the cultural heritage.

2.2.2 National Environment Policy 2005

The national environmental policy 2005 aims to protect conserve and restore the environment in order to improve quality of the life of citizens through sustainable development and resource conservation.

The main objectives of the policy are;

- Conservation, restoration and efficient management of the natural resources.
- Integration of the environmental considerations in policy making and planning process.
- Capacity building of government agencies and other stakeholders at all levels for the better environmental management.
- Meeting international obligations effectively in line with the national aspirations.
- Creation of a demand for environment through mass awareness and community mobilization.

2.2.3 The National Forest Policy 2001 of Pakistan

This policy covers the Renewable Natural Resources (RNR) of Pakistan i.e. Forests, Watersheds, Rangelands, Wildlife, Biodiversity and their habitats. The policy seeks to launch a process for eliminating the fundamental causes of the depletion of RNR through the active participation of all the concerned agencies and stakeholders, to realize the sustainable development of the resources. It is an umbrella policy providing guidelines to the Federal Government, Provincial Governments and territories for the management of their RNR. In consonance with it, the Provincial and District Governments may devise their own policies in accordance with their circumstances.

The goal of this policy is to foster the sustainable development of RNR of Pakistan, for the maintenance and rehabilitation of its environment and the enhancement of the sustainable livelihoods of its rural masses especially women, children and other deprived groups.

The elements of the policy are as follow:

- Population planning in critical eco-systems.
- Providing substitutes to firewood in the wooded mountains.
- Reducing the impact of socio-economic causes.
- Reducing poverty, poverty of opportunity, and powerlessness.
- Reducing political interference in the Forestry and Wildlife Departments.
- Renovating and invigorating the institutions of RNR.
- Supporting Local Governments in the sustainable development of their RNR.
- Policies for fragile natural Eco-systems.

- Riverain forests.
- Irrigated Plantations.
- Preservation of relict and unique forests.
- Wildlife.
- Rangelands and desert eco-systems.
- Planting of trees and fodders on farmlands.

2.3 PUNJAB ENVIRONMENTAL PROTECTION ACT (PEPA), 2012 AND ADMINISTRATIVE FRAMEWORK

2.3.1 General

PEPA 2012 (amended act) is a fairly comprehensive legislation and provides legislative framework for protection, conservation, rehabilitation and improvement of the environment. It contains concrete action plans and programs for the prevention of pollution and promotes sustainable development.

The salient features of the law are:

- No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Provincial Environmental Protection Agency (EPA) an EIA, and has obtained a No Objection Certificate (NOC)/Environmental Approval (EA).
- Establishment and Formation of the Punjab Environmental Protection Council.
- Powers and Functions of the Provincial Environmental Protection Agency.
- Prohibition of certain discharges or emissions.
- Punjab Environmental Quality Standards (PEQS) for wastewater, air emissions and noise.
- This act also empowers Provincial EPA to issue notices and to enforce them for the protection of the environment and resource conservation.

For the effective implementation of the provisions of PEPA 2012, EPA headed by a Director General has been constituted.

The capability of regulatory institutions for environmental management largely achieves the success of environmental assessment for ensuring that development projects are environmentally sound and sustainable. For decision-making and policy formulation in the environmental and conservation issues, the institutional framework is described in following paragraphs.

2.4 PAKISTAN ENVIRONMENTAL PROTECTION AGENCY REGULATIONS, 2000 FOR REVIEW OF INITIAL ENVIRONMENTAL EXAMINATION (IEE)/ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Under Section 12 (and subsequent amendment) of the 2012 amended Act, a project falling under any category specified in Schedule I or II requires the proponent to file an IEE or EIA, as the case may be, with the provincial agency. Within ten working days of the IEE or EIA having been submitted, the provincial agency will confirm that the documents submitted are complete for the purpose of review. During this time, should the provincial agency requires the proponent to submit any additional information; the IEE or EIA will be returned to the proponent for revision, clearly listing those aspects that need further discussion. Subsequently, the provincial agency shall make every effort to complete an IEE review within 45 days and an EIA review within 90 days of filing of the complete information of report.

After the successful review, the EPA will issue the NOC/EA according to the rules and regulations as prescribed in Regulation 2000. During the project execution the proponents are required to comply with the recommendations of the IEE/EIA and also the conditions of the NOC/EA set forth by the relevant EPA, in present case, EPA, Lahore, Punjab. During the construction or post EIA monitoring and reporting is mandatory according to clause 19 of Regulation-2000. These Regulations requires proponent of all projects to submit environmental monitoring reports during and on completion of construction, and regular operation of the project. Any additional requirements of the report as desired by the EPA are also necessary for the proponent, however, the format and contents of such reports are not specified in the law.

2.5 PAKISTAN ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

These guidelines are descriptive documents describing the format and content of IEE/EIA reports to be submitted to Provincial EPA for obtaining NOC. Following are the major areas, which are covered by these guidelines:

- The Environmental Assessment report formation (scoping, type and category of project, description of project, alternatives, site selection, baseline data).
- Assessing impacts (identification, analysis and significance).
- Mitigation and impact management and preparing an environmental management plan.
- Reporting (format, main features, shortcomings, other forms of presentation).
- Review and decision making (role, steps, remedial options, checks and balances).

- Monitoring and auditing (systematic follow up, effective data management).
- Project Management (inter-disciplinary teams, programming and budgeting).

2.6 GUIDELINES FOR PUBLIC CONSULTATION

The Federal EPA provides these guidelines to deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in any impact assessment study.

These guidelines cover:

- Consultation, involvement and participation of stakeholders
- Effective public consultation (planning, stages of EIA/IEE where consultation is appropriate)
- Facilitation involvement (including the poor, women and Non-Governmental Organizations (NGOs)

2.7 PUNJAB ENVIRONMENTAL QUALITY STANDARDS (PEQS)-2016,

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 the industrial sources.

2.7.1 Punjab Environmental Quality Standards for Ambient Air-2016

The Ministry of Environment, Government of Punjab vide its Notification, Islamabad, the 5th August, 2016 under SO(G)/EPD/7-26/2013 established standards which provide the maximum allowable limits, in the ambient air, of Sulphur Dioxide (SO_2), Oxides of Nitrogen as (NOx) and as (NO), Suspended Particulate Matter-(SPM), Respirable Particulate Matter - PM10, Respirable Particulate Matter-PM2.5, Lead and Carbon Monoxide (CO).

Table - 2.1: Punjab Environmental Quality Standards Ambient Air

Pollutants	Time-Weighted Average	Concentration in Ambient Air	Method of Measurement
Sulfur Dioxide (SO_2)	Annual Average*	80 µg/m^3	Ultraviolet Fluorescence
	24 hours**	120 µg/m^3	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	40 µg/m^3	
Oxides of Nitrogen as (NO_2)	Annual Average*	40 µg/m^3	Gas Phase Chemiluminescence
	24 hours**	80 µg/m^3	
Ozone (O_3)	1 hour	130 µg/m^3	Non dispersive UV absorption
Suspended Particulate Matter (SPM)	Annual Average*	360 µg/m^3	High Volume Sampling, (Average flow rate not less than 1.1m^3/minute)
	24 hours**	500 µg/m^3	
Respirable Particulate Matter. PM_{10}	Annual Average*	120 µg/m^3	βRay absorption
	24 hours**	150 µg/m^3	
Respirable Particulate Matter. $PM_{2.5}$	Annual Average*	15 µg/m^3	βRay absorption
	24 hours**	35 µg/m^3	
		15 µg/m^3	
Lead (Pb)	Annual Average*	1.0 µg/m^3	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	1.5 µg/m^3	
Carbon Monoxide (CO)	8 hour	5 µg/m^3	Non Dispersive Infra Red (NDIR)

2.7.2 Punjab Standards for Drinking Water Quality - August, 2016

The Ministry of Environment, Government of Punjab vide its Notification, Islamabad, the 5th August, 2016 under SO(G)/EPD/7-26/2013 established standards for Drinking Water Quality. The major quality parameters fixed depend upon Bacterial, Physical and Chemical ones.

Table - 2.2: Punjab Standards for Drinking Water Quality

Properties/Parameters	Standard Values for Pakistan
All water intended for drinking (E.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml samples
Treated water entering the distribution system (E.Coli or thermotolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100 ml samples
Treated water in the distribution system (E.Coli or thermo tolerant coliform and total Coliform bacteria)	Must not be detectable in any 100 ml samples In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.
Physical	
Color	< 15 NTU
Taste	Non objectionable/Acceptable
Odor	Non objectionable/Accept able
Turbidity	< 5 NTU
Total hardness as $CaCO_3$	< 500 mg/l
TDS	< 1000
pH	6.5 – 8.5
Chemical	
Essential Inorganic	mg/Litre
Aluminum (Al)	≤0.2
Antimony (Sb)	≤0.005 (P)
Arsenic (As)	≤0.05 (P)
Barium (Ba)	0.7
Boron (B)	0.3
Cadmium (Cd)	0.01

Properties/Parameters	Standard Values for Pakistan
Chloride (Cl)	<250
Chromium (Cr)	≤0.05
Copper (Cu)	2
Toxic Inorganic	**mg/Litre**
Cyanide (Cn)	≤0.05
Fluoride (F)*	≤1.5
Lead (Pb)	≤0.05
Manganese (Mn)	≤0.5
Mercury (Hg)	≤0.001
Nickel (Ni)	≤0.02
Nitrate (NO_3)*	≤50
Nitrite (NO_2)*	≤3 (P)
Selenium (Se)	0.01 (P)
Residual chlorine	0.2-0.5 at consumer end; 0.5-1.5 at source
Zinc (Zn)	5.0
Organic	
Pesticides mg/l	PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20- 58 may be consulted.
Phenolic compound (as phenols) mg/l	WHO standards: ≤0.002
Polynuclear Aromatic hydrocarbon(as PAH) g/L	WHO standards: ≤0.01v(by GC/MS method)
Radioactive	
Alpha Emitters bq/L or pCi	0.1
Beta Emitters	1

2.7.3 Punjab Environmental Quality Standards for Noise - August, 2016

The Ministry of Environment, Government of Punjab vide its Notification, Islamabad, the 5th August, 2016 under SO(G)/EPD/7-26/2013 established standards for Noise. These standards are based on Category/zone i.e. Residential area, Commercial area, Industrial area and Silence zone. The limiting values for day and night have also been fixed for all categories/zones.

Table - 2.3: Punjab Environmental Quality Standards - Noise

Category of Area/Zone	Effective from 1st July 2013	
	Day time	Night time
Residential area	55	45
Commercial area	65	55
Industrial area	75	65
Silence zone	50	45

Limit in dB (A) Leq*

Notes:

1. Day time hours: 6:00 a.m. to 10:00 p.m.
2. Night time hours: 10:00 p.m. to 6:00 a.m.
3. Silence zone::Zones that is declared as such by the competent authority. An area comprising not less than 100 m around the hospitals, educational institutions, and courts.
4. Mixed categories of areas may be declared as one of the four above-listed 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.

2.8 NATIONAL RESETTLEMENT POLICY AND ORDINANCE

As referred above, at present the only legislation relating to land acquisition and compensation is the Land Acquisition Act (LAA) of 1894. Experience with large-scale infrastructure development projects implemented by institutions such as WAPDA has demonstrated the need for a cohesive national policy for resettlement. Following a national consultative process, a national resettlement policy and a related ordinance were drafted known as Draft Resettlement Policy, 2002 which still has to be approved by the government.

The salient applicable features of the Draft Resettlement Policy are given below:

- The Pak-EPA will be responsible for both environment-related as well as resettlement-related matters.
- The responsibilities for implementation at a provincial level are to be delegated to the concerned provincial EPAs with overall control of the provincial Planning and Development (P&D) Departments.
- All categories of 'loss' arising from development projects that entail resettlement, need to be addressed: these include not only loss of land, built-up property, other infrastructure, and crops and trees, but also loss of income, job opportunities, and access to natural resources, etc.
- Vulnerable groups whose issues need to be addressed in particular include: women, children, destitute persons, tribal communities, squatters, those with usurper rights, and landless groups.
- There should be a special emphasis on consultation with affected groups when preparing a Resettlement Action Plan.

2.9 OTHER ENVIRONMENT RELATED STATUTES

This section outlines the other statutes apart from Pakistan Environmental Protection Act, 1997, which are relevant to the project.

2.9.1 The Land Acquisition Act (LAA), 1894

At this point, the only legislation relating to land acquisition and compensation is the LAA of 1894. The LAA is, however, limited to a cash compensation policy for the acquisition of land and built-up property, and damage to other assets, such as crops, trees, and infrastructure. The LAA does not consider the rehabilitation and resettlement of disrupted populations and the restoration of their livelihoods.

2.9.2 Pakistan Explosives Act, 1884

Under the Explosives Act, the project contractors are bound by regulations on handling, transportation and using explosives during quarrying, blasting, and other purposes.

2.9.3 The Forest Act, 1927

The Forest Act empowers provincial governments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce; quarrying and felling, lopping and toping of trees, branches in reserved or protected areas.

2.9.4 Pakistan Penal Code, 1860

The Pakistan Penal Code deals with offences where public or private property and/or human lives are affected due to the intentional or accidental misconduct of an individual or body of people. In the context of environment, the Penal Code empowers the local authorities to control noise, noxious emissions and disposal of effluents. The PEQS enforced by the EPAs supersede the application of this legislation on industries and municipalities.

2.9.5 Provincial Wildlife Act, 1974

In addition to empowering the provincial wildlife departments to establish game reserves, parks, and wildlife sanctuaries, this Act regulates the hunting and disturbance of wildlife.

2.10 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 role with regard to the formulation of

environmental and conservation policies. And last but not the least, another the most prominent NGO namely "Sustainable Development Policy Institute (SDPI) "has also played 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.

2.11 PROVINCIAL LOCAL GOVERNMENT ORDINANCES, 2001

These ordinances, issued following the devolution process, establish regulations for land use, the conservation of natural vegetation, air, water, and land pollution, the disposal of solid waste and wastewater effluents, as well as matters related to public health and safety.

2.12 PUNJAB INDUSTRIAL RELATIONS BILL 2010

In December 2010 Punjab Assembly passed new legislation that will govern the formation of trade unions, relations between industries and their workers, and the process for the settlement of labour disputes.

2.13 INDUSTRIAL RELATIONS ORDINANCE 2011 PROMULGATION

The Government has promulgated Industrial Relations Ordinance 2011. The Ordinance has been approved by the President on the Advice of the Prime Minister. The Government has promulgated Industrial Relations Ordinance, 2011 in view of the current legal vacuum created due to deletion of the concurrent Legislative List through the 18th Constitutional Amendment. The Industrial Relations has also been transferred to the Provinces which have promulgated provincial laws to regulate industrial relations. However, there is no law in place to deal with Industrial Relations in the Islamabad Capital Territory or in respect of national level trade federations and for resolutions of trans-provincial industrial issues. The Parliament has yet to promulgate the Ordinance as law.

2.14 NATIONAL ELECTRIC POWER REGULATORY AUTHORITY ACT 1997

The NEPRA Act was approved by Parliament and signed into law in December 1997. It seeks to create an autonomous, independent regulatory authority, which will be solely responsible for the power sector. It will be responsible for the oversight of the power sector and will exercise control through its power to license power generation, transmission and distribution. It will regulate tariffs for all these activities. It will perform its functions through transparent processes to be enshrined in rules that are being framed in a transparent manner through appropriate rules.

2.15 LAND USE

The project site is situated in the area where agriculture activities are present and in surroundings the industrial activities are lacking. The land is agricultural in nature productive; some land is non-productive due to absence of fresh water and presence of highly saline soil.

SECTION-3
DESCRIPTION OF THE PROJECT

3 DESCRIPTION OF THE PROJECT

3.1 GENERAL

This section deals with project components, which are the part of installation of 49.8-MW bagasse based cogeneration power plant and its related construction activities for execution of this project. It also describes the category of the project, availability of construction materials, type of vegetation in the project area, construction time and cost of the project, construction and operation equipments etc. The information presented in this section is based on project site survey, preliminary design report, and the information provided by the client.

3.2 TYPE AND CATEGORY OF THE PROJECT

Acute shortage of energy in the country besides the high fuel costs and use of low quality oil is causing a significant loss of production resulting in negative economic impact. Thus, use of bagasse from local source may provide cost efficient energy. The use of bagasse as source of energy production is on high priority of government to overcome this energy shortage. Therefore, TSEPL is planning to set up 49.8 MW co-generation power plant. The purpose of the project is to provide the reliable bagasse energy with affordable cost. In accordance with the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000, SRO # 339 (1)/2000, the project falls in Schedule –I, Part-A 'Energy' Serial 2 'Thermal power generation less 200 MW; therefore, requires the Initial Environmental Examination (IEE) study for sustainable development and to submit in provincial Environmental Protection Agency (EPA), for issuance of Environmental Approval (EA).

3.3 OBJECTIVE OF THE PROJECT

The main objective of the proposed project is to generate cleaner, economical and reliable energy from available fuel which will not only provide a better alternate source of energy but also provide a relief to overcome acute shortage of energy and save millions of dollars which is being wasted to import expensive oil being used as fuel for producing electricity. By using a cleaner technology and fuel it will also reduce environmental hazards caused by burning of fossil fuel for producing electricity.

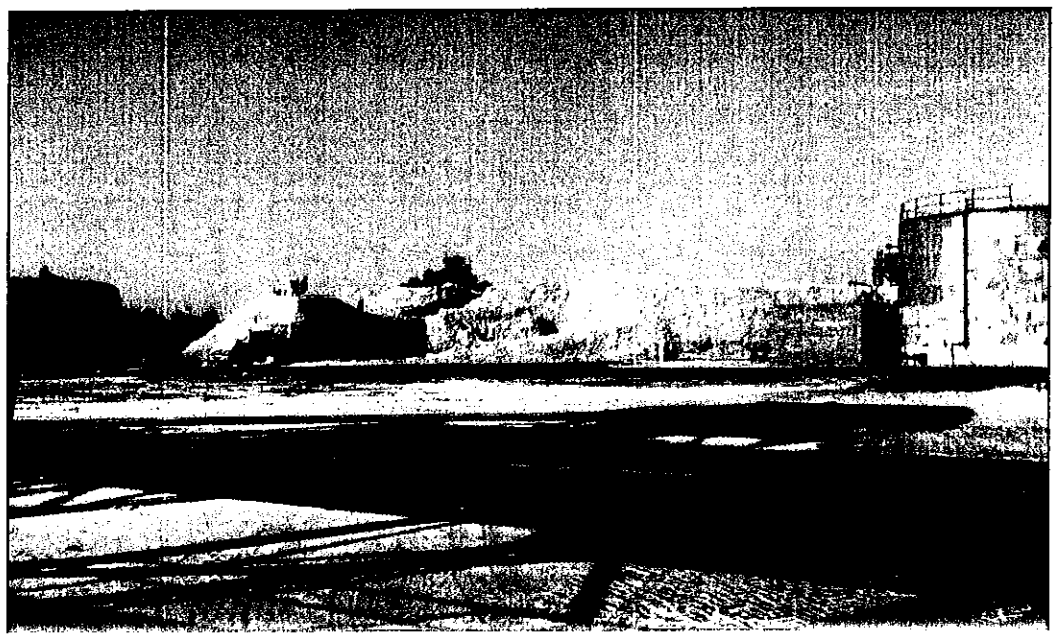


Figure - 3.1: View of Site

3.4 LAND USE ON THE SITE

Currently, the proposed land for installation of power project is open land where the raw material bagasse generated from the sugar milling process is stored.

3.5 VEGETATION FEATURES OF THE SITE

The project site and its vicinity have some sort of shrubs with no significant importance. The land is barren and non-cultivated except some part of land which is far away from the proposed project site.

3.6 COST AND MAGNITUDE OF OPERATION

The project cost as initially estimated will be Rs. 6,000.0 million. This cost estimate has been prepared in November 2016. The quantities have been worked out from the design drawings. The rates for cost estimates are based on construction work, contractor cost, cost of land, and cost of the raw materials, environmental cost and with about 10% escalation for the year 2016.

3.7 SCHEDULE OF IMPLEMENTATION

It is planned that the following schedule of project implementation will be adhered to. This is subject to the conditions that everything goes according to planning and no serious bottlenecks are encountered.

The implementation stages of the project activity include:

1st Stage

The stage - 1 comprises the onsite contouring studies and soil investigations.

2nd Stage

The stage - 2 comprises the following task:

- **i-** Laying of foundations excavation and commencement of erection work.
- **ii-** Start of civil, electrical and mechanical work.
- **iii-** Development of basic infrastructure.
- **iv-** Fitting of instrumentation.

3rd Stage

The stage - 3 comprises the following task:

- **v-** Plant Equipment erection completion.
- **vi-** Completion of the basic infrastructures water supply system, electricity supply etc.

4th Stage

The stage - 3 comprises the Tests & Commissioning.

5th Stage

The Last stage will be commencement of regular production (December 2019).

3.8 DESCRIPTION OF THE PROJECT (PROCESS FLOW CHART/STEPS)

Project is installation of 49.8 MW bagasse fired power plant. A flow sheet diagram of the proposed project is given in **Figure - 3.2.**

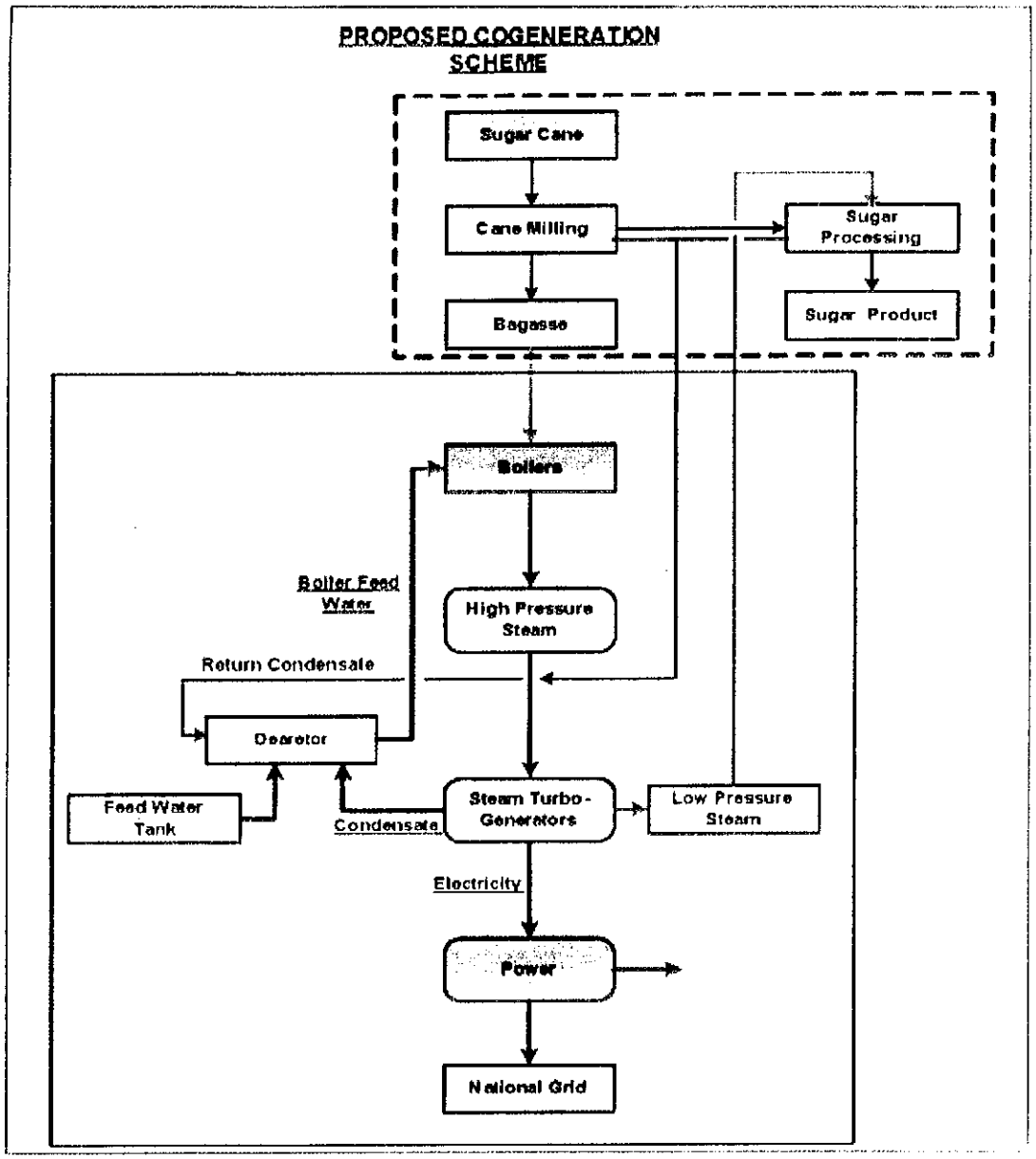


Figure - 3.2: Process Flow Sheet Diagram of the Project

3.9 CONSTRUCTION ASPECTS & OPERATIONAL ARRANGEMENTS

3.9.1 Construction Materials

Comparatively reasonable quantities of buildings and other facility construction materials will be required for construction of the proposed facility. The materials mainly required are listed below:

- Coarse and fine aggregate for concrete works
- Sandy gravel for backfilling, embankment raising, etc.
- Cement

- Steel
- Bitumen
- Electric Equipments
- Lights
- Other materials etc.

3.9.2 Construction Camps

The establishment of the construction camp will be done within the plant facility. Location of the camp will be selected in a way that there will not be any disturbance to the nearest community and it is also close to the site of work or within the project site. Camp will be properly fenced and guarded. This site camp will be constructed mainly for construction staff and to accommodate Contractor's machinery. The area of the camp will be kept sufficiently large to accommodate parking areas for machinery, construction materials and workshops.

3.9.3 Work Force and Work Machinery

The details of the construction staff has been shown below in **Table - 3.1**. The labour will work in one shift of eight (8) hours. The construction machinery which will be utilized for construction is shown in **Table - 3.2.**

Table - 3.1: List of Construction Staff

Sr. No.	Category of Staff	Tentative Number
1	Engineer	5
2	Construction Manager	1
3	Planning Engineer	3
4	Material Engineer	3
5	Site Engineer	2
6	Supervisor	5
7	Foreman	15
8	Skilled Worker	30
9	Semi Skilled Worker	50
10	Machinery Operator	16
11	Admin.	2

Table - 3.2: List of Construction Machinery to be used for Construction

Sr. No.	Type of Machinery	Quantity
1	Excavator	1
2	Dumper & Loader	1
3	Tractor & Trolley	4
4	Water Bowser	1
5	Lift/Crane	1
6	Generator	1
7	Concrete Pump	3
8	Water Pump	3
9	Welding Plant	5
10	Concrete Mixing Plant	1

At operation stage, the project proponent will be involved for operation and maintenance of the proposed facility.

3.10 GOVERNMENT APPROVALS AND LEASES REQUIRED BY PROJECT

The approvals have been applied for. The environmental approval according to the Section 12 of Punjab Environmental Protection Act-2012 is the mandatory requirement of the project. All the other approvals pertaining to the project are under process from various departments.

3.11 COGENERATION PROPOSAL

A new Efficient, high pressure Co-generation plant is proposed to be added, which will provide the low pressure steam for the Process & generate Surplus Power.

The proposed Co-gen Plant will consist of 2x160 TPH, minimum 60Kg/cm^2, 485+°C Bagasse fired Boiler, 11KV, 50-Hz Extraction cum Condensing Turbine Generator sets.

The bagasse generated from sugar mill will be sufficient to meet requirements of both the Boilers and some quantity will be saved during season. The co-gen plant will be operated in condensing mode during the Off-season using the saved bagasse.

3.12 LAND & BUILDING REQUIREMENTS

Sufficient additional vacant space is available to install necessary plant & machinery required for 49.8 MW Co-gen plants. Layout of the various sections for all the plants & machinery have been worked out in order to utilize the land very economically, without sacrificing the ease of operation & maintenance. The Civil works in Cogen plant will mainly include the main building for the Turbine-generator house, Control Room and Machinery & Equipment Foundations, the Boiler, Turbo-generator set, Switch yard, Cooling Tower basin, Chimney & Ash Silo, etc.

Non-factory buildings, like time office, security office, administrative office, guest house and the residential quarters already exist & will be used without any additions / alterations.

3.13 PLANT AND MACHINERY

3.13.1 Boiler

Sufficient Bagasse Storage & Handling Space is available near the proposed Boiler area. Supply & Return Bagasse Feeding Conveyers, etc, are proposed to be suitably modified for feeding Bagasse to the new Boiler during Season & Off – Season operations. The Boiler operations will be fully automatic.

The Boiler Plant will be complete with fuel storage, fuel conveying & firing systems, ash handling and storage system, HP & LP chemical dosing systems, Electro Static Precipitator, ID, FD & SA fans, Boiler Feed Tank, De-aerator, BFW pumps, etc. with necessary controls and safety devices. Boiler control panel will be housed in the boiler House to facilitate operational convince. Facilities will also be provided for storage, Handling & Feeding of Alternate Fuels for the proposed Boiler, so as to achieve continuous plant operation during the period of low Cane/Bagasse availability & also during the Off-season.

3.13.2 Turbine Generator

The proposed TG set will be capable of meeting the balance Process Steam & Power requirements of the Sugar Mill & Cogen Plant Auxiliaries.

Part of the steam will be condensed in the condenser and recycled back to the boiler. Bleed steam is used for heating the broiler feed water in the Heaters and Ejector to create vacuum in condenser. Extracted steam will be used in the process house for making sugar as well as in the de-aerator for feed water heating.

The TG set will be provided with Electronic Speed Governor, 11KV switchgear with VCB, control panels, synchronizing facility, safety devices, earthing network & grid interfacing facility, etc.

3.13.3 Bagasse Handling System:

Bagasse generated from the Sugar Mill is fed to the existing boilers through a conveying system & surplus bagasse is conveyed to the storage area. The conveyor is proposed to be modified to handle the additional quantity & extended to feed the new Boiler.

Excess bagasse from the New Boiler will be fed to a conveyor and conveyed to the Yard in parallel to the existing Conveyer.

During off season/ stoppage of Mill, the stored Bagasse will be fed using the existing Return Conveyor and dropped to a new conveyor proposed for the Boiler.

3.13.4 Ash Handling System

Ash handling system will comprise;

A. Bed Ash: Submerged Ash conveyor

The bed ash is collected in front of the boiler in a submerged Ash Conveyor and conveyed to MS Ah Silo of about minimum 8 hrs storage (Keeping future expansion) through a Belt Conveyor.

B. Fly Ash: Pneumatic Ash Handling

It is envisaged to provide Dense Phase type Ash Handling System for handling Fly ash generated from Air pre-heater, Economizer & Electro static precipitator (ESP). The system will consist of Surge Hoppers below Air pre-heater, Economizer and ESP hopper, Conveying Pipes and Ash storage Silo for minimum 8 hrs storage capacity (Keeping future expansion).

3.13.5 Water Treatment System

Water treatment plant will comprise of a RO based DM plant.

3.13.6 Cooling Tower

Cooling towers of induced Draft, Counter Flow type shall be provided. The cooling tower will have RCC basin & filled with PVC film. The cooling tower shall be designed for catering the cooling water requirement for the Cogen plant auxiliaries including condenser, oil coolers, air coolers, air compressors, Boiler feed pumps, etc.

The cooling water system will be provided with chlorination dosing system and circulating water chemical treatment system to prevent against algae growth and to maintain circulating water quality.

3.13.7 EOT Crane

One EOT (Electrical Operated Overhead Traveling) Crane will be provided in the power house for undertaking maintenance of the turbine and Generator. Capacity of the Crane is considered at 30/5 (approximately) Tones, for lifting heaviest component during maintenance. An auxiliary hoist of 5 Tones is also foreseen along with main hoist.

3.13.8 Compressed Air System

This compressor system will meet with both instrument air as well as the service air requirement of the plant. The service air shall be tapped off from the air receiver, without passing through the air dryer. Compressed air system will consist of Compressors, inter & after Cooler, Refrigeration Type air Drier, Air receiver & Instrument Air Distribution Network. The distribution Network will cover instrument air requirement for the pneumatic devices in power plant.

3.13.9 Thermal Insulation

All exposed portions of the plant, which operate at temperature of 600°C and above during normal operation will be thermally insulated. The thermal insulation is carried out to restrict the temperature on the souter surface of the cladding to 200°C above ambient. The insulation is designed based on a wind velocity of 3m/sec.

3.13.10 Personal Protection

Piping and equipment within reach that do not require insulation to prevent heat loss, but having a surface temperature exceeding 600°C will be insulated for personal protection

3.13.11 Ventilation and Air Conditioning System

Ventilation and Air conditioning facilities will be provided for the various plant premises to ensure proper working environment both for men & machines and to maintain necessary environmental conditions for proper storage of plant machinery, Equipment and Materials. While the Control Room will be provided with Floor standing / wall mounted Split ACs. Redial Exhaust Fans will be provided in the TG Hall & Electrical Switchgear Room for proper ventilation

SECTION - 4
DESCRIPTION OF ENVIRONMENT

4 DESCRIPTION OF ENVIRONMENT

4.1 INTRODUCTION

This chapter describes the baseline conditions, which cover the existing physical, ecological and socio-economic environment of the Study Area. Information on these aspects has been derived from the desk study of available data, field visits to the project area as well as information obtained through visits to the Government departments and other agencies namely Irrigation Department, Meteorological Department, Forest offices and prevailing environmental laws and environmental quality standards etc.

4.1.1 Desk Studies

Building design data was collected from proponent. This data included the available documents, drawings, reports, etc related to the proposed project of commercial and related utilities. The experts conducted a detailed desk study of the above available data before the field visit. Salient features of the project were thoroughly reviewed to assess their environmental implications. The documents which were consulted and departments visited are project site, Irrigation Department, Meteorological Department, Forest offices and other related officials.

4.1.2 Site Visits

A team of experts visited to the proposed site for collection of baseline environmental data for ambient air, noise levels, drinking water and waste water sampling, public consultation, baseline ecological environment data etc.

After the survey of the project area the environmental data regarding physical, ecological and socioeconomic aspects were collected for carrying out environmental assessment. Secondary data were also collected from various sources mainly studies carried out by project proponents and reports of other line Departments. A social survey of the proposed area was carried in which people living around the proposed site were interviewed to ascertain their views about the building and utility facilities commissioning and operational activities to perceive the impacts on the natural and socioeconomic environment around the proposed project site. This included information on land, surface water, groundwater, air, vegetation, animals and human.

4.2 PHYSICAL ENVIRONMENT

4.2.1 Topography

Toba Tek Singh District is a district in the Punjab province of Pakistan. It is located between 30 33' to 31 2' Degree north latitudes and 72 08' to 72 48' Degree longitudes. It became a separate district in 1982.

The city and district is named after a Sikh religious figure Tek Singh. Legend has it that Mr. Singh a kind-hearted man served water and provided shelter to the worn out and thirsty travelers passing by a small pond ("TOBA" in Punjabi) which eventually was called Toba Tek Singh, and the surrounding settlement acquired the same name. There is also a park here named after the Sardar Tek Singh.

The district consists of an area of 3252 square. It has three Tehsils/TMAs.

- Toba Tek Singh
- Gojra
- Kamalia.

Kamalia is a city found in Toba Tek Singh District. It is located 30.73 latitude and 72.65 longitudes and it is situated at elevation 158 meters above sea level. Kamalia has a population of 112,426 making it the 36th biggest city in Punjab.

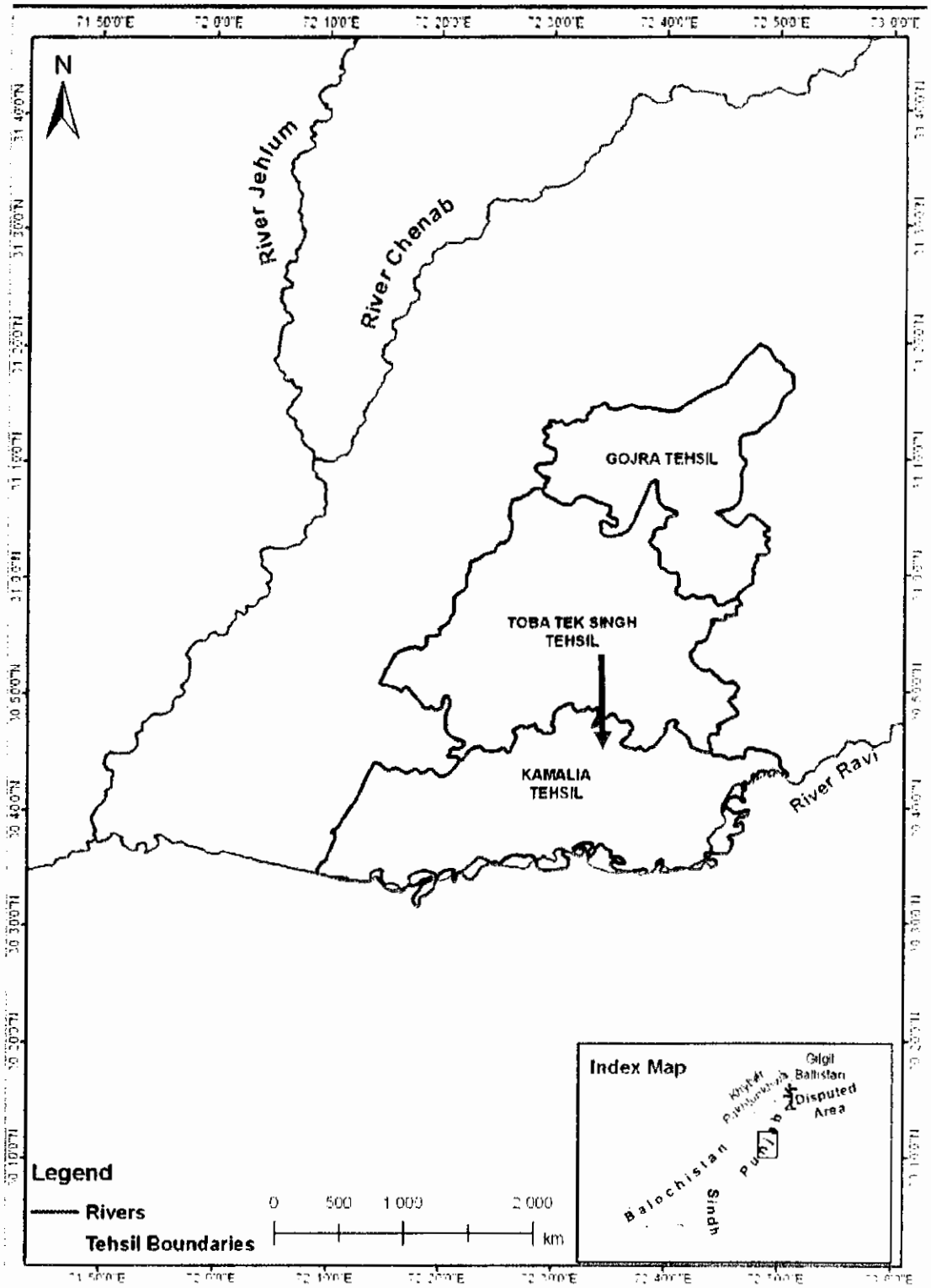


Figure - 4.1: Location of Project Tehsil

4.2.2 Soils

Soils form major part of environment. Their fertility and other special characteristics have great relationship with environment. Climate has great influence on the formation of soil, therefore, study of these factors is of great importance. Soil is dynamic layer in which many complex physical, chemical and biological activities are taking place. Therefore, soil is a dynamic changing body.

Soil scientists restrict the word soil or solum to the surface materials which over the ages have adopted the distinctive layers or horizon. Soils are made up of solids, liquids and gases. The solid part of the soil is made up of both inorganic and organic. While weathering of rocks make inorganic particles, the organic solids consist of living and decayed plants. In order to classify the entire soils in Pakistan, the Soil Survey of Pakistan has divided the entire country into nine ecological zones. The soil of area on the whole is very fertile.

The geotechnical investigations carried out at the site for this project have revealed the presence of the three distinct lithological units. First one is Lean Clay (CL) present in a firm to stiff state up to a depth of 3.0 to 4.0 m below NSL. Second is Silty fine Sand (SM) and poorly graded Sand with Silt (SP-SM) present in medium dense to very dense state following the top layer and extending up to maximum investigation depth of 30 m. Third layer is Lean Clay/Sandy Lean Clay (CL) of thickness ranging from 1.0 to 9.0 m is present at depths ranges from 14.0 to 23.0 m. The groundwater table was observed at a depth of 25 to 38 m below of earth.

Figure - 4.2: Soil Map of Punjab

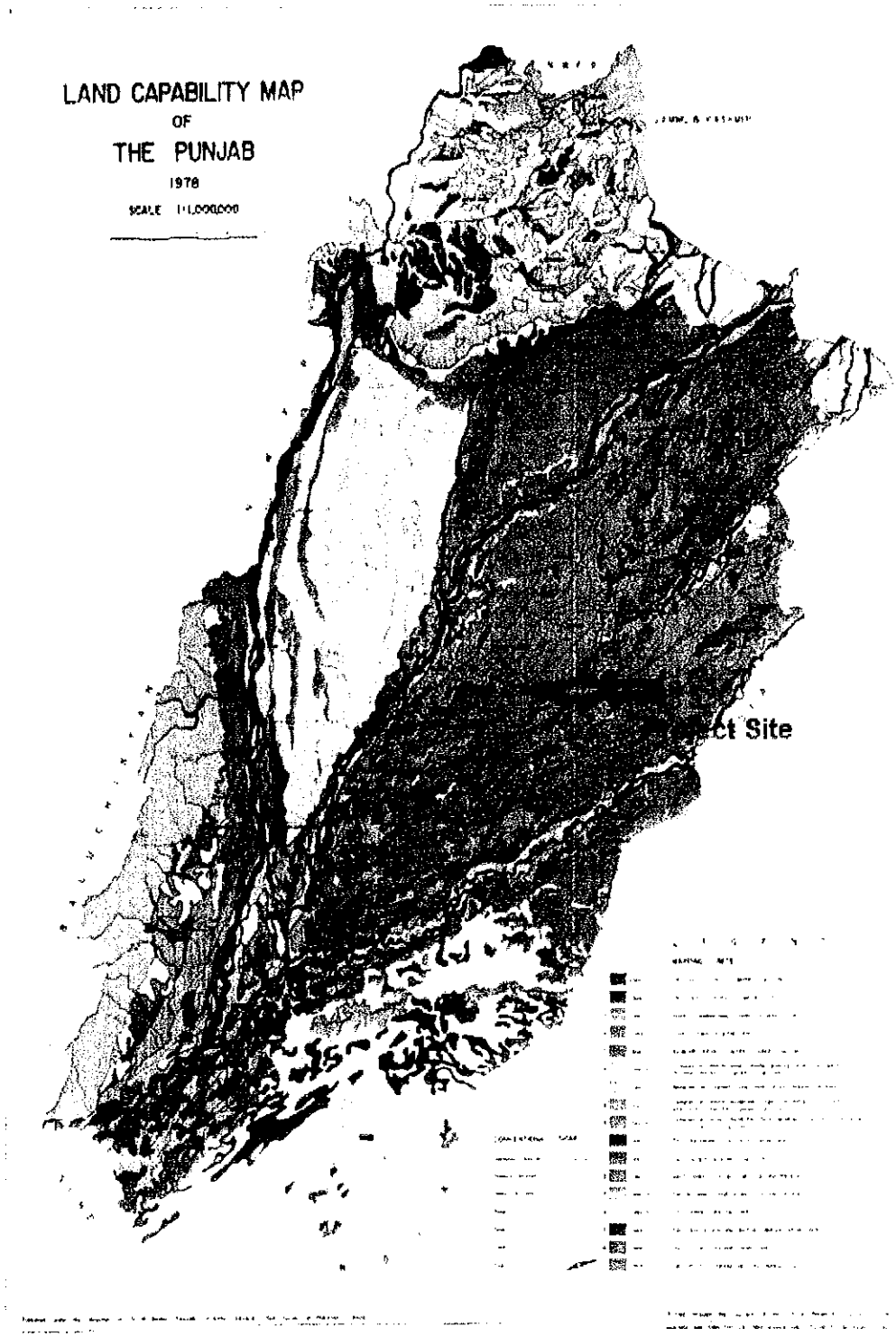


Figure - 4.3: Land Capability Map of Punjab

4.2.3 Seismology

Earthquakes are generated due to tectonic processes in the upper part of the earth called lithosphere, which is divided into several rigid parts called "Plates". Due to the movement of these plates, stress build up takes place and results in

the deformation of the crustal mass in the form of folding and faulting. The energy produced due to movement along the faults is depicted in the form of earthquakes.

A minor to moderate earthquake originated from the Basement rocks in Punjab Plain could also produce appreciable ground shaking due to thick alluvial deposits. The Two Star site lies in **2A** category as shown in the **Figure - 4.4**.

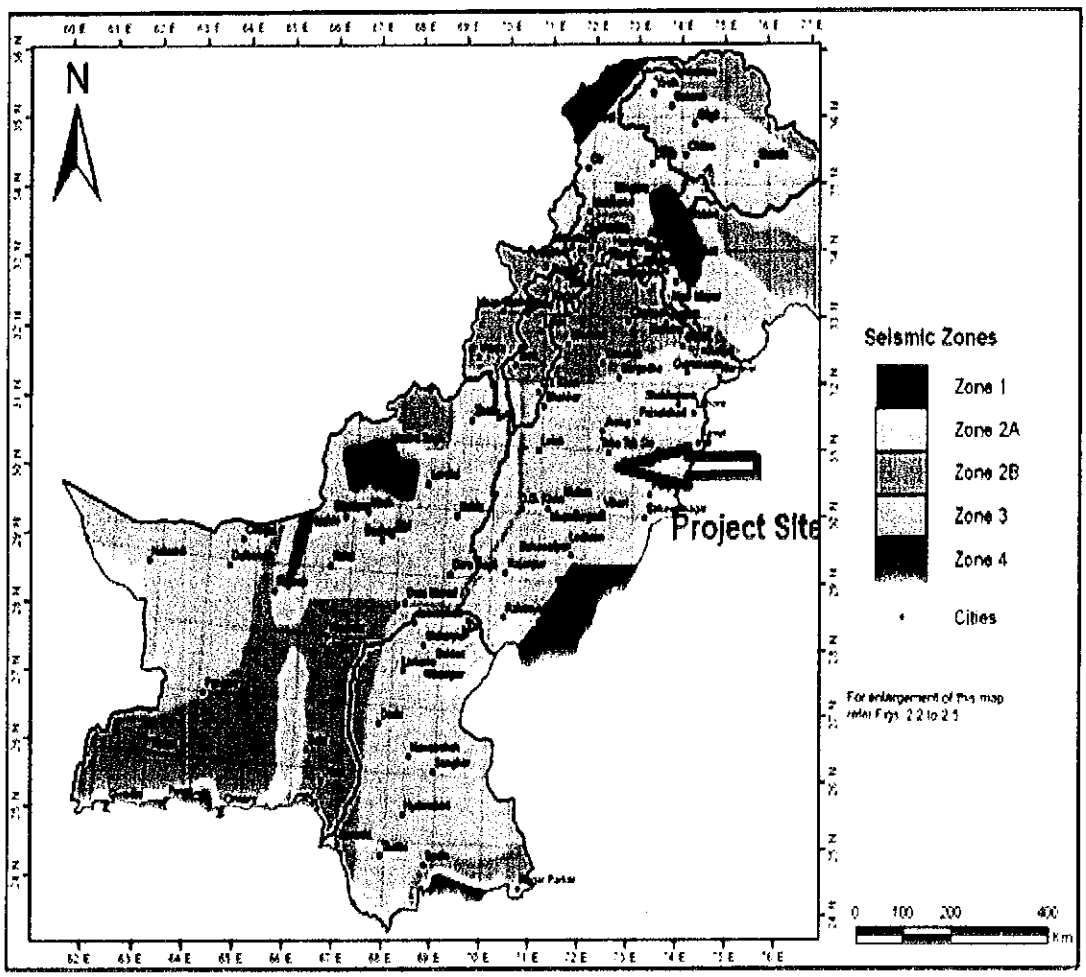


Figure - 4.4: Seismic Map of Pakistan

According to Seismic Zoning Map of Pakistan included in the Pakistan Building Code Seismic Provisions (2007), the project site falls in Zone 2A, therefore project structures should be designed in accordance with the requirement of seismic designing Zone 2A after giving due consideration to the foundation material.

4.2.4 Meteorology and Climatology

Kamalia's climate is a desert one. During the year, there is virtually no rainfall in Kamalia. The climate here is classified as BWh by the Köppen-Geiger system. In

Kamalia, the average annual temperature is 24.9 °C. Precipitation here averages 270 mm.

Precipitation is the lowest in October, with an average of 3 mm. Most precipitation falls in July, with an average of 76 mm. At an average temperature of 34.8 °C, June is the hottest month of the year. In January, the average temperature is 12.7 °C. It is the lowest average temperature of the whole year.

Table - 4.1: Climate Weather Data of Toba Tek Singh

month	1	2	3	4	5	6	7	8	9	10	11	12
mm	12	12	14	9	8	24	76	74	39	3	8	7
°C	12.7	15.5	20.8	26.8	31.8	34.8	33.7	32.4	30.7	26.7	19.4	14.1
°C (min)	5.1	8.0	13.3	18.8	23.7	28.0	28.0	27.4	24.6	18.0	10.7	6.0
°C (max)	20.3	23.1	28.4	34.8	39.9	41.7	38.5	37.4	36.9	34.5	28.2	22.3
°F	54.9	59.9	69.4	80.2	89.2	94.6	91.8	90.3	87.3	78.2	66.9	57.4
°F (min)	41.2	46.4	55.9	65.8	74.7	82.4	82.4	81.3	76.2	64.4	51.3	42.8
°F (max)	68.5	73.6	83.1	94.6	103.8	107.1	101.3	99.3	98.2	94.1	82.8	72.1

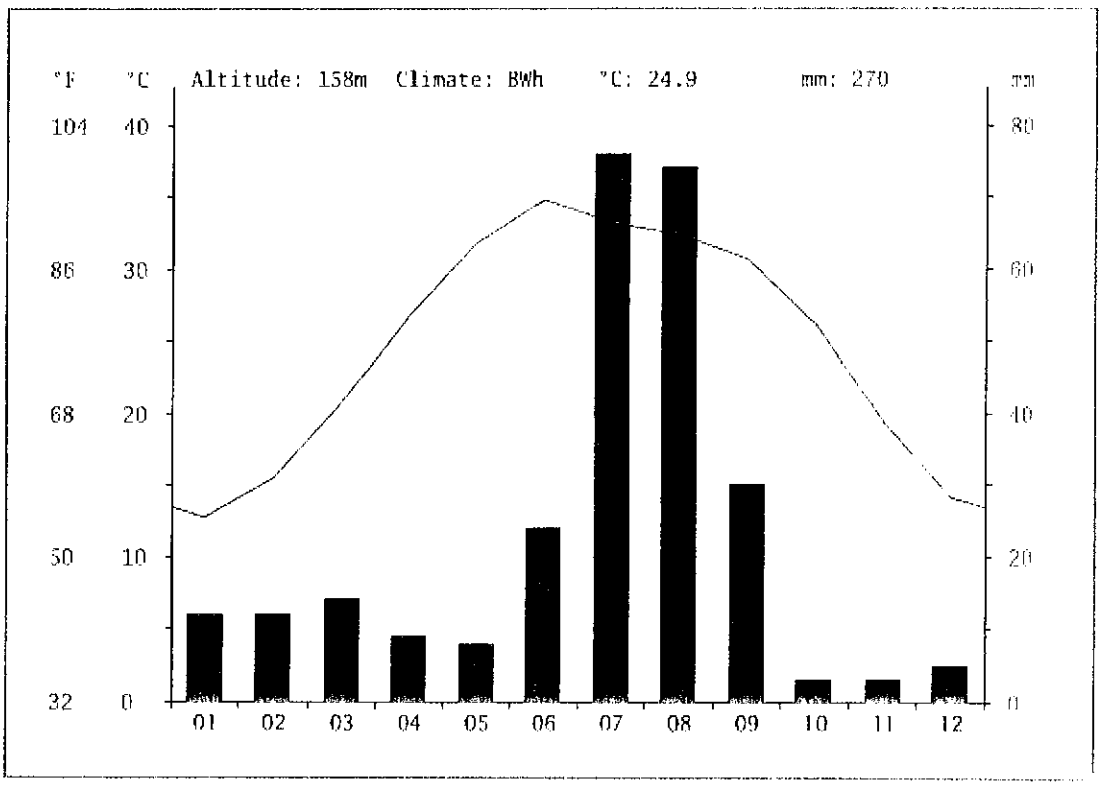


Figure - 4.5a: Climate Graph of Toba Tek Singh

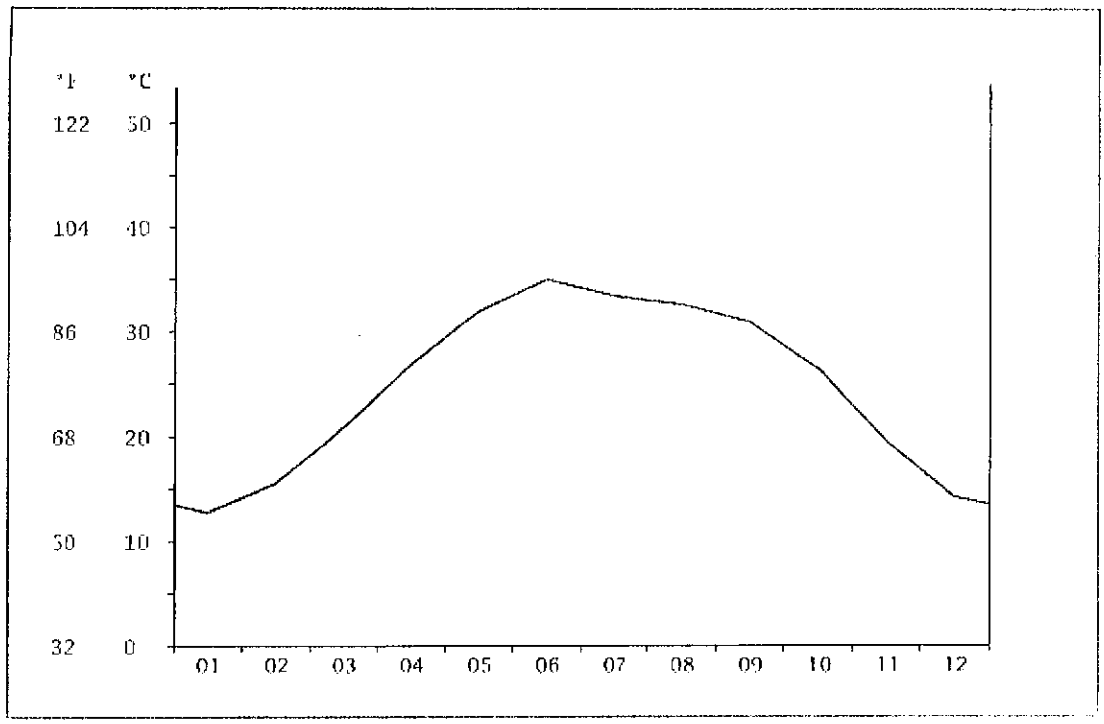


Figure - 4.5b: Temperature Graph of Toba Tek Singh

4.3 BASELINE ENVIRONMENTAL DATA

4.3.1 Noise Levels

The major source of noise at the project Site is the vehicular traffic on the main road and crushing plant near to the project site. Mostly, the noise level reaches its peak during the daytime and afternoon in rush hours. Overall, the noise level at this Road is presently much less than the other congested roads in city.

Table - 4.2: Noise Levels Monitored Data

REFERENCE POINT	DATE	TIME HOURS	DB(A)									LEQ / AVERAGE
Project Site	15.12.2016	06:00	45	46	46	46	47	45	47	47	45	46.0
	15.12.2016	09:00	61	63	63	62	68	70	70	61	66	64.88
	15.12.2016	12:00	70	68	68	68	61	59	59	60	61	63.77
	15.12.2016	15:00	62	69	72	62	60	61	60	59	60	62.77
	15.12.2016	18:20	64	63	63	62	68	73	74	61	63	65.66
	15.12.2016	21:30	45	46	49	49	48	45	41	42	42	45.22

REFERENCE POINT	DATE	TIME HOURS	DB(A)									LEQ / AVERAGE
	15.12.2016	24:00	35	36	36	36	37	35	37	37	35	36.0
	15.12.2016	03:00	34	33	31	31	31	32	33	31	32	32.0
	15.12.2016	06:00	45	46	46	46	47	45	47	47	45	46.0

* High Noise levels were associated with moving of Bicycle and Heavy Tractors during the monitoring hours.

4.3.2 Air Quality

The project area is thinly populated and mainly surrounded by agricultural dwelling. The containment in the air could be particulate matter which is naturally occurring from the loose surface soil and gets suspended in the air due to human activities (traffic and others) and wind flow.

Table - 4.3: Ambient Air Monitored Data

REFERENCE POINT	DATE	TIME HOURS	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO (mg/Nm^3)	PM_{10} ($\mu g/m^3$)
Project Site	15.12.2016	06:00	22.4	23.2	1.2	26.3
	15.12.2016	09:00	34.8	29.6	2.3	42.7
	15.12.2016	12:00	35.8	36.7	2.6	42.5
	15.12.2016	15:00	36.1	37.2	0.1	43.1
	15.12.2016	18:20	25.7	25.3	1.8	42.8
	15.12.2016	21:30	11.1	12.3	2.5	23.8
	15.12.2016	24:00	21.0	22.2	2.3	23.7
	15.12.2016	03:00	20.9	21.9	1.0	23.1
	15.12.2016	06:00	22.6	23.6	1.3	27.3
NEQS			**80 $\mu g/m^3$**	**80 $\mu g/m^3$**	**10 mg/Nm^3**	**150 $\mu g/m^3$**

NEQS = National Environmental Quality Standards for Ambient Air.

* High concentration of air pollutants are associated with burring of the post cultivated land, ruing moving of Heavy Tractors during the monitoring hours.

4.4 ECOLOGICAL RESOURCES/BIODIVERSITY

The project area lies in the commercial and agricultural area having dominant trends of commercialization. The surrounding area of project site consists of agricultural land.

4.4.1 Fauna

The major fauna of the project site is list in below table.

Table - 4.4: List of Birds

#	Common Name	Zoological Name
1	Bank Myna	*Acridotheresginginianus*
2	Blackbird	*Turdusmerula*
3	Black drongo	*Dicrurusmacrocerus*
4	Rock Pigeon	*Columbia livia*
5	Common babbler	*Turdoides caudate*
6	Common Myna	*Acridotherestristis*
7	Garden Warbler	*Sylvia borin*
8	Indian Robin	*Saxicoloides*
9	Whiite-browed wagtail	*Motacillamadaraspatensis*
10	Little green bee-eater	*Meropsorientalis*
11	Asian Pied Starling	*Sturnus contra*
12	Red turtle dove	*Streptopeliatranquebarica*
13	Red-vented bulbul	*Pycnonotuscafer*
14	Ring-necked dove	*Streptopeliacapicola*
15	Lang-tailed Shrike	*Laniusschach*
16	Great spotted woodpecker	*Dendrocopos major*
17	White-browed wagtail	*Motacillamaderaspatensis*
18	Asian Koel	*Eudynamysscolopacea*

#	Common Name	Zoological Name
19	Common hawk-cuckoo	*Cuculusvarius*
20	Coomon Koel	*Eudynamysscolopacea*
21	Pied Cuckoo	*Clamatorjacobinus*
22	Red turtle dove	*Streptopeliatranquebarica*
23	Ring-neck dove	*Streptopeliarisoria*
24	Rose-ring parakeet	*Psittaculakrameri*
25	White-backed vulture	*Gyps africanus*
26	White-breasted kingfisher	*Halcyon smynensis*

Not only the birds, but different other classes of the animal species also play an important role for the habitat of the area as shown in **Table - 4.5**.

Table - 4.5: List of Different Classes of Animals

Mammals	Reptiles	Amphibians	Insects
Stray dogs	Monitor Lizard	Indus valley bullfrog	Dragonfly
Feral cats	Geckos	Common frogs	Damselfly
Donkeys	-	Toads	Butterflies
Cows	-	-	Honey bees
Bats	-	-	Earthworms
Goats	-	-	Centipedes
Small Indian mongoose	-	-	-
Indian palm squirrel	-	-	-
Buffalo	-	-	-
Mole	-	-	-
Horse	-	-	-
Sheep	-	-	-

Source: WWF

4.4.2 Flora

Among trees shisham (Delbergia sisso) and kikar (Acacia) are tha main species.other species growing in this area are Eucalyptus, Semul (Bombax ceiba), Bakin/Dharek (Melia Azerdarac), Jaman, Sukhchain(Pongamia glabra), Mulbery (Morus alba), Beri (zizipus maurities) , Beri and Bakain are commonly found there.

4.5 AGRICULTURAL

District Toba Tek Singh is one of the best producers of orange "locally known as kenno". It contributes towards export standard quality of orange produced in all Pakistan. The majority of people living in this district have profession of agriculture and it produce several kind of agricultural and dairy products like meat, eggs, cotton, maize, several pulses, peach, guava, tomato, melon, water melon, mango, tobacco and onion, sugar cane. Toba Tek Singh is very well known for Poultry and Tunnel farming too.

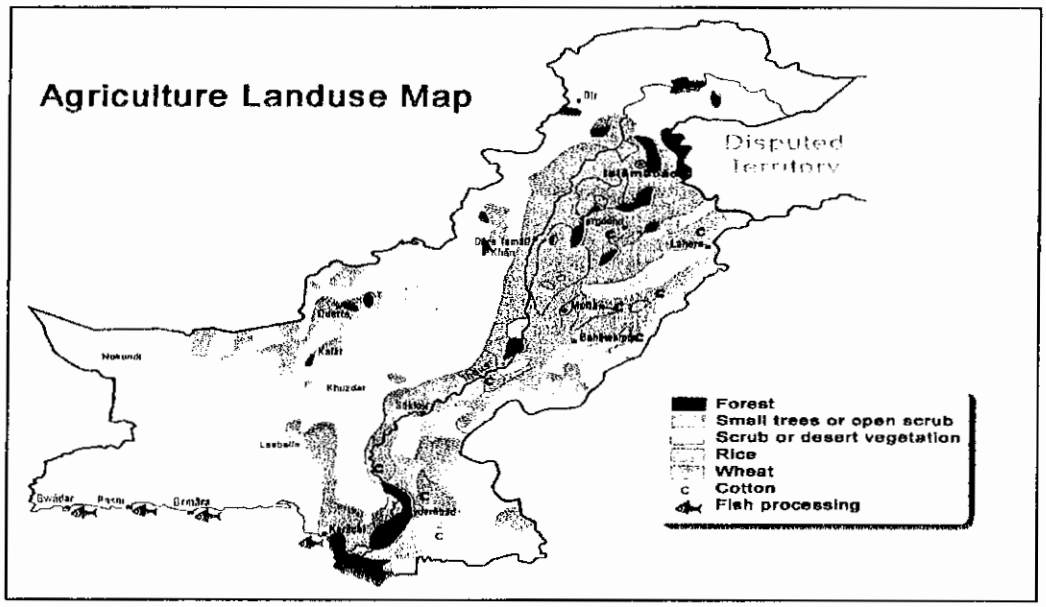


Figure - 4.6: Agricultural Land Use Map

4.6 EXISTING SOCIO- ECONOMIC CONDITIONS

4.6.1 Demographic information

Demographic information is given in the following tables;

Table - 4.6: Demographic Information

Indicators	Value	Indicators	Value
Total population	1.86 million	Urban population	350,963
Population of tehsil Gojra	568,693	Rural population	1515701
Population of tehsil TT Singh	710,572	Population density (persons per sq.km)	573
Population of tehsil Kamalia	587,399	Sex ratio (number of males over 100 females) at birth	108

4.6.2 Socioeconomic and health indicators

Table - 4.7: Detail of Socioeconomic and health indicators

Indicators	Value
District specific figures	MICS 2007-08
Literacy rate	63%
Infant mortality rate (IMR)	64 per 1000 live births
Under 5 mortality rate (U5MR)	90 per 1000 live births
Maternal mortality ratio	227 per 100,000 live births

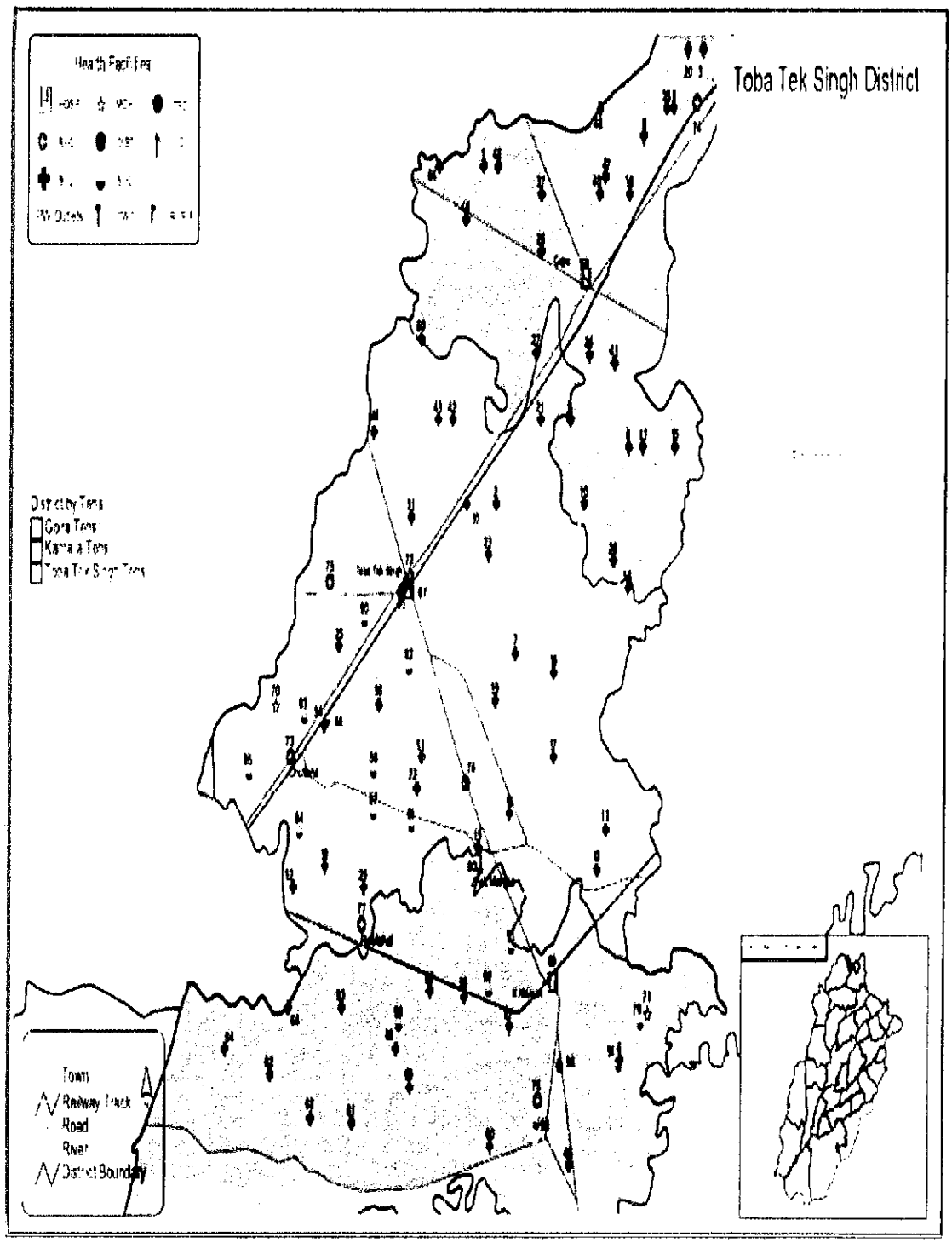


Figure - 4.7: Map of District with Health Facilities

4.7 QUALITY OF LIFE VALUES

4.7.1 Health of the Project Area

The health of the project area is very much sound, private and government medical facilities are available in colossal quantity within the project area.

4.7.2 Employment Sources in the Project Study Area

Most of the people have adopted multiple sources of income to sustain their lives. Government and private services, agriculture business and transport are the other sources of income of the people.

4.7.3 Basic Facilities Available In the Study Area

Basic facilities including electricity, water, gas, telephone, roads and transport are available to every pocket of the area. Cellular/mobile telephones are available with a large number of the people.

4.7.4 Educational Institute

Toba Tek Singh has several institutions of higher education including

- Agriculture University sub campus T.T. singh
- Jamia Masjid Usmanaia, Assistant Commissioner Office Toba Tek Singh
- Islamia Group of colleges Toba Tek Singh
- Convent Of Jesus And Mary High School
- Govt. College of Commerce
- Shakila Ghafar National College T.T.S

4.7.5 Cultural and Aesthetic Values

Because of limited income, most of the common people live marginalized status of life. Agriculture and work in industries are the main livelihood earning source with limited land holdings. Old traditional and simple life typical of the Punjab villages is the prevailing cultural and aesthetic characteristic of life style of majority of the people. In spite of all the modernized way of style even now virtually elders are responsible to make decisions and the decision is valued by the family members. Elderly people command respect and are the deciding factor in most of the decisions.

Decades old culture and customs in every walks life are dominant. Old people prefer to live conservative life style. However, due to awareness and education through TV and print media, the young generation is in the process of transition in their life style. General attitude to visitors especially is quite welcoming.

Arranged marriages are mostly in practice. And these are quite successful. Print and electronic media are influencing almost all walks of life of the people of all categories. There is a lot of awareness about the value of education. Rich or poor, all families are trying hard to get their children educated. Mostly joint family system prevails and people reap the fruits of this system. Most of the families are quite coherent. There is a rising trend in the society to change their old traditional socioeconomic pattern of life. Print and electronic media are playing great role in bringing tangible change in the old pattern of life.

SECTION - 5
ENVIRONMENTAL IMPACTS DUE TO THE PROJECT & MITIGATION MEASURES

5 ENVIRONMENTAL IMPACTS DUE TO PROJECT & MITIGATION MEASURES

5.1 METHODOLOGY FOR ANTICIPATING ENVIRONMENTAL IMPACTS

Baseline data and conditions form the basis for evaluation of the environmental impacts of the proposed bagasse fired cogeneration power project.

A tabulated evaluation procedure has been used for purpose of presentation. The severity of the impact is presented on point scale. The evaluation scale, that is used for the IEE Study is given below:

Scale: Extent of Impact

▲▲▲	=	High
▲▲	=	Medium
▲	=	Low
O	=	No impact
▼▼	=	locally favorable
▼	=	regionally favorable.

For evaluation rating, the Punjab Environmental Quality Standards (PEQS) and National Ambient Air Quality Standards (NAAQS)-Pakistan, are used as guidelines. Various parameters of extent of environmental impacts are described below:

Table - 5.1: Evaluation of Impacts

Extent of Environmental Impact	Description
High (▲▲▲)	National Standards are exceeded.
Medium (▲▲)	Between National Standards.
Low (▲)	National Standards are met.

5.2 ENVIRONMENTAL IMPACTS ASSESSMENT DURING CONSTRUCTION PHASE

This section discusses the potential impacts anticipated due to the installation of 49.8-MW power plant and associated facilities on the natural resources and various environmental segments of the site and its vicinity.

5.2.1 Soil Erosion

The proposed project requires minor land clearing, leveling and site preparation for the installation of the power house its associated facilities. No wetlands are

present within the project boundaries or up to long distances (15-km) around the project site. The proposed construction area is not anticipated to impact the entire area available. General site preparation and construction activities associated with the overall development of the project site include the following:

- Clearing/grubbing of all un-cleared portions of the construction area and lay-down area;
- Stabilizing, grading, filling, and contouring the area for power plant facilities;
- Construction of permanent storm water management system;
- Performing groundwork as necessary for construction of facility footings, foundations and underground utilities including electrical, water, wastewater, and other piping systems;
- Power plant facilities construction and
- Earthmoving, grading, re-contouring and landscaping.

Site preparation will consist of clearing and grubbing, followed by grading and leveling. Topsoil that is suitable for reuse will be stockpiled for landscaping and for establishing vegetation after construction has been completed.

Mitigation Measures

During early site preparation activities, temporary storm water management structures and soil erosion and sedimentation control devices (e.g. ditches, retention basins, berms, and siltation fencing) will be used to minimize runoff during the construction phase.

Site preparation and construction activities will not require any explosives. Rough grading, excavation, and backfill activities will be performed to prepare the site for underground utilities, concrete foundations, and surface drainage. Structural backfill materials may be imported to the site for constructing concrete foundations and to raise grade site elevation to achieve proper drainage.

After construction of the bagasse boiler project is complete, any remaining areas that do not have an impervious surface will be vegetated with native plants, ornamental shrubs, flowers, trees and grass materials. The plant site will be altered to construct new facilities. Structural and general fill will be added to elevate the site to design elevations. Soils excavated for the major equipment foundations may be used as general backfill or structural fill, if appropriate. Fill may be required to raise portions of the site to grade.

Since the site is in a flat area, the fill should not cause adverse impacts to site topographic conditions. Very little, if any, runoff flows onto the proposed site. Therefore, the fill will not impede existing drainage patterns. Added fill, with

compaction, will shift areas of percolation within the site. Runoff will be managed with the storm water management system to mimic pre-construction conditions. During construction, erosion at the site will be managed with the erosion control plan. After construction, pervious areas will be planted predominantly with native vegetation, trees, grass and flowers to control erosion.

Extent of Impact on Erosion/Sedimentation = ▲ (Low)

5.2.2 Air Quality

Expected impacts on air quality during the construction phase of the proposed project are:

- dust engraftation during construction activities including leveling, excavation for foundations of the boiler and its associated equipment, compaction, backfilling etc, and
- emissions of Sulphur Dioxide (SO_2) , Nitrogen Oxides (NO_x), Carbon Monoxide (CO),and unburnt hydrocarbons , Particulate Matter (PM) and noise from vehicles and construction machines to be deployed during construction activities.

Dust generation from construction activities is an important concern during construction phase. Dust particles generally larger than 10 µm will be thrown up, resulting in visible deposition close to the construction activities.

The quantity of any emissions released during the construction process will generally be very low, but will vary on an hourly and daily basis as construction progresses. Fugitive dust emissions will be greater during land clearing and site preparation phases. Fugitive dust emissions will also be greater during the more active construction periods as a result of increased vehicle traffic on the site. The dust to be generated during construction activities will be mostly inorganic. quantum dust generation will depend on weather conditions, wind velocity, precipitation rate, and type of construction activities. Expected main sources of site of dust emissions during construction are:

- land clearing
- excavation
- earthwork
- ground leveling
- vehicles movement.

Dust and grit are expected to be present in the air during the construction phase in dry months. This will end when the major civil works finish. Some dampening of the exposed areas, by employing dust control methods, may therefore be

necessary during periods of dry weather in order to reduce the risk of dust entrainment in the ambient air. Peak dust generation, if construction activities coincide, will be during the drier months and this dust will tend to become dispersed within the ambient air as a result of vehicle movements. It will therefore be necessary to ensure that loads are duly covered to prevent fine dust blowing from open-top trucks and through vehicles tires. In dry periods, it may also be necessary to employ dust control measures. There will be an overall increase in traffic and heavy machinery movement during construction phase for a limited period leading to rise in emission level. These emissions together with exhaust emissions from equipment deployed during the construction phase are likely to result in marginal increases in the levels of sulphur dioxide (SO_2), nitrogen oxides (NO_X), carbon monoxide (CO), and unburnt hydrocarbons (HCs). Potential minor sources of volatile organic compounds include evaporative losses from onsite painting, refueling of construction equipment and the application of adhesives and waterproofing chemicals. The background levels of these pollutants are considered to be non-existent based upon the low frequency of traffic use proximal to the site. However, even with the predicted increase in construction related traffic and associated site activities, any increase in these pollutants is considered to be insignificant. The project site is very vast and carrying capacity of air around has not yet been utilized because no worth mentioning industry is in functioning around. This will be an additional advantage to the project for dissipating the emissions into the air and reducing emissions in such virgin air.

Mitigation Measures:

Fugitive dust emissions from the construction site will be minimized using appropriate dust suppression control methods. These standard control methods will include;

- paving or placement of gravel on roads,
- applying dust suppressing agents or water to roads and other exposed surfaces, or other methods, as needed.
- existing public road upon exiting the site is paved.
- spilled and tracked dirt (or other materials) will be removed from the adjacent road in a timely manner.
- all construction related fugitive dust emissions will be temporary and will stop once construction is completed. Emissions from open burning will be limited by removing materials whose burning would produce excessive smoke e.g., green vegetative materials.
- regular sprinkling of water with time intervals will reduce the impacts of the dust during construction.

The proposed mitigation measures will reduce the impacts to an acceptable level, especially as they are limited to the construction phase. The overall construction period is expected to have duration of 18-months.

Extent of Impact on Air Quality = ▲(Low) [with adoption of mitigation measures.]

5.2.3 Groundwater

The proposed project site is located within the aquifer that is still un-explored for surrounding communities. The subsoil water is highly saline and cannot be use for drinking purpose. Based upon the importance and sensitivity of this aquifer, as well as a good construction practices, all precautions necessary will be required to reduce the potential for site impacts on ground water to a minimum. While the proposed site preparation and facility construction activities for the Proposed Project are not anticipated to cause any short-term or long-term groundwater impacts to the site, Best Management Practices (BMP) will need to be employed during construction to ensure impacts (if any) are minimal and are properly mitigated.

Mitigation Measures:

During construction all contractors, technicians and laborers will be required to implement best practices to minimize the potential for spills of fuels or chemicals. Maintenance will be performed only in designated areas. In the unlikely event that spills do occur, they will be managed in accordance with the project's Environmental Management & Monitoring Plan (EMMP). To further minimize potential environmental impacts, it is recommended that full-time environmental monitoring is conducted during construction, particularly during all refueling operations to minimize potential concern. The environmental monitoring could be under the Environmental & Safety Department or a member of the safety department with the authority of "Stopping the Job" in the event that noncompliance of environmental regulation is being observed.

Extent of Impact on Ground Water = ▲(Low) [with adoption of mitigation measures.]

5.2.4 Solid Waste

The major solid wastes to be generated during construction activities are:

- Bricks waste
- Waste from Quality Control
- Paper bags
- Used oil/lubricants

- Metal/wooden waste
- Medical waste
- Empty drums or containers
- Cotton rags
- Miscellaneous waste: Miscellaneous solid wastes include batteries, tires, tubes, filters, belts, nylon strips, bag filters, scrap wood, steel scrap, house hold articles etc., which will be sold in the market through scrap dealers.

Mitigation Measures:

- During the site clearance stage, it is anticipated that relatively large quantities of solid waste would be generated from labour camps, top-soil and sub-soil. Part of the excavated material would be used for leveling and grading and the balance would be stockpiled at designated locations on the site. Other solid wastes including, cooking waste and general solid waste are often associated with a relatively large work forces. Cooking wastes and general garbage will be collected at regular intervals and land filled at an approved disposal site.
- Adequate number of solid waste container should be provided at the project site at various places and shall not in any case dispose of waste indiscriminately outside of the boundary wall of the project site.
- The wastes like organic, inorganic, hazardous, non-hazardous waste etc should be collated and stored according to the nature of the wastes. These waste should be dispose off through a certified contractor who shall dispose the waste in consultation of Tehsil Municipal Administration (TMA) with environment sustainable manner. However, while disposing any waste material, all environmental aspects/impacts of such wastes should be communicated clearly to the concerned contractor. Record of all such sales shall be maintained for later use if and when required.

Extent of Impact Due Solid Waste = ▲ (Low) [with adoption of mitigation measures.]

5.2.5 Noise Impact

Construction of the proposed project is expected to take place for about 48-months, with varying degrees of activity occurring during different phases of construction. Construction phases are expected to include excavation, concrete pouring, steel erection, mechanical/electrical installation and cleanup. Noise will be generated by operation of heavy equipment and increased frequency of vehicular traffic in the area during construction activities. Vibration levels will also increase due to these activities. However, these impacts are short term, intermittent and temporary in nature and are not likely to be felt outside the

boundary of the proposed project. The exact noise levels are a complex function of variables such as the actual noise levels emitted from each major noise-emitting equipment, their location and orientation within the construction area, and their operation and load.

Mitigation Measures:

The adjoining localities are outside the range of impact of noise emissions due to construction activities. Overall, the impact of noise generated during construction on the environment is temporary and mainly confined to daylight hours. It is anticipated that it will be possible to reduce noise impacts during construction to an acceptable minimum by properly examine and tuning of the noise producing machinery, installation of noise barriers and noise abatement measures. It is recommended that project noise should meet the PEQS for noise as mentioned in **Table - 5.2** of this section.

Table - 5.2: Punjab Environmental Quality Standards - Noise

Category of Area/Zone	Effective from 1st July 2013	
	Day time	Night time
Residential area	55	45
Commercial area	65	55
Industrial area	75	65
Silence zone	50	45

Extent of Impact on Noise = ▲ (Low) [with adoption of mitigation measures.]

5.2.6 Fire Risk

Fire and explosion hazard impacts are not expected during the construction phase due to the limited quantities of flammable and combustible materials to be imported to the site. The availability and use of portable extinguishing systems would limit the impacts of small fires, and personnel will be required to receive training on the proper use and locations of this equipment.

Mitigation Measures:

During construction, any waste disposal burning will be conducted in a cleared and dedicated area under controlled conditions, on those days when ambient air conditions will not permit embers to drift into the surroundings.

Extent of Impact on Noise = ▲ (Low) [with adoption of mitigation measures.]

5.2.7 Ecological Impacts

5.2.7.1 Terrestrial Systems

During construction activities, only very minor land clearing is required as a component of the proposed development activity. Land clearing, as proposed, will be limited to that required for the needs of the project, and will be conducted in such a manner that is protective of the environment.

5.2.7.2 Fauna and Flora

No ecological important flora and fauna is present at the site. The construction area is not perceived as including sensitive habitat. Under normal dry weather conditions, a significant amount of dust will be thrown up by excavating activities. Hence, vegetation and animal habitats in the vicinity village near the site and roads will be affected by wind-blown dust and its deposition. The contribution to the natural dust concentration in the air will only be of relevance at the beginning of the construction phase, during the main excavation activities. During this period, dust can be expected to settle on plant leaves and aerial roots, which could hinder air exchange and assimilation by the plants. The temporarily increased vehicular traffic coupled with high noise levels due to various construction activities may also have some negative impacts on animals. Especially birds and other acoustically orientated animals living in the vicinity of the site and the roads used can be disturbed by noise. Disturbances during the period of construction could drive noise sensitive bird species from their habitats, but these are expected to return after construction has finished. No endangered species were found in the construction area. During the visual inspections of the site no nests or nesting was observed. No birds or wild animals were discerned in the site vicinity. The influence of dust is unavoidable but mainly restricted to the first period of the construction phase. No major impacts by dust and noise on the flora and fauna in the vicinity of the site and the used roads are to be expected. The construction related impacts on fauna and flora may be considered to be low.

Mitigation Measures:

- It is suggested that extensive tree plantation should be carry out to maintain the natural habitat.

Extent of Impact on Fauna & Flora = ▲(Low) [with adoption of mitigation measures.]

5.2.8 Impacts on Human Population

Construction related noise is not anticipated to be a concern to the nearest receptor, but to mitigate this potential concern, construction will normally occur during daylight hours and will run during one shift per day. In addition, any excessive noise generated by construction related activities will be short term and short duration, and will generally not expected to exceed the PEQS. However, there might be a notable increase in road traffic as freight is moving to the site. No direct impacts to the communities or neighborhoods are anticipated.

Based upon visual inspection of the site and site vicinity, the proposed power plant site and roadway are absent of any residences. As a result, no relocation impacts are anticipated.

Extent of Impact on Human Population = ▲(Low) [with adoption of mitigation measures.]

5.2.9 Traffic Impact

It may be anticipated that an overall increase in traffic would occur directly as a consequence of the proposed construction. An increase in traffic will occur to and from the project site subsequent to freight arrival. The temporary traffic impacts are not expected to affect significantly the local residents since residential development is sparse in the immediate site vicinity. No significant traffic problems are expected during the construction period, other than minimal delays for start and stop time for the workers commuting to their residences and due to occasional heavy equipment and materials moving to and from the site. Construction traffic generation should be viewed at the most as a temporary inconvenience.

Mitigation Measures:

The constructor should prepare a traffic management plan in consultation with the local population and project proponents.

Extent of Impact on Traffic = ▲(Low) [with adoption of mitigation measures.]

5.2.10 Socio-economic Impacts

Most of construction workers are anticipated to be hired from within the Kamalia city. In addition, general contractors/vendors, consultants and engineers from within the country will provide technical and specialized services. The construction impacts on the local employment opportunities are beneficial, although relatively short term. Indirect employment in the local area will also occur primarily in retail, eating and drinking establishments. During construction of the plant an estimated employment opportunities (of 500 - 700 workers) will be created both for skilled and unskilled local workers.

Extent of Socio-Economic Impact = ▼▼ (Locally Favorable)

5.2.11 Public Services and Facilities

Construction related impacts to public services and facilities, such as police, fire, and medical services and water, wastewater and solid waste disposal are not expected to be significant. With minimal relocations to the project area expected, existing facilities and services will be adequate to meet the demands on these services. The selected general contractor will be responsible for removing and disposing of construction related debris, in environmentally safe manner and at some suitable designated site.

Extent of Public Services and Facilities Impact = ▲(Low) [with adoption of mitigation measures.]

5.2.12 Cultural Resource Impacts

Fugitive dust emissions will be properly controlled so that no impact on visibility will occur. Also as discussed, due to attenuation with distance, construction noise will not affect the quality of life at the nearest habitats. Some minor inconvenience may occur through increased traffic and equipment creating conflicts on Indus Highway/Road. However, during construction of the power plant, no conflicts are anticipated with cultural resources in the area.

Extent of Cultural Resource Impacts = ▲(Low) [with adoption of mitigation measures.]

5.2.13 Waste Water

Sewage and waste water will be generated at the construction camps and from construction activities. If generate effluents are not properly treated or disposed off this may contaminate the surface and any other source of water and land. It is anticipated the following estimated effluents will be generate during the construction of the site.

Table - 5.3: Estimated Effluent Generation

Source	Estimated Quantity (liter/day)	Disposal Practice
Workers/Labour Staff (about 500 maximum)	40,00	✓ Disposal through Septic Tanks ✓ Sewage Disposal facility
Construction Waste	200	Disposal through Sprinkling on unpaved area and septic tanks

Mitigation Measures:

- For effluents draining installation of proper sewage disposal facility for the entire site should be considered.
- Proper septic tanks of adequate size should be established.

Extent of Impact on Ground Water = ▲(Low) [with adoption of mitigation measures.]

5.3 ENVIRONMENTAL IMPACTS ASSESSMENT DURING OPERATION PHASE

This section discusses the potential impacts from regular operation of the proposed project and associated facilities on the natural resources and environment of the site and vicinity. The power plant invariably has potential for environmental impacts during the operational phase of the project. During the operational phase the following impacts are normally the most significance:

- Air quality impacts
- Ecological impacts
- Impacts associated with the abstraction and discharge of water
- Impacts arising from solid waste management
- Noise and vibration impacts
- Soil, groundwater and surface water contamination
- Accidents
- Socio economic impacts

5.3.1 Air Quality Impacts

The combustion of Bagasse fired boiler operation inevitably results in emission of gaseous pollutants to the atmosphere. The pollutants of potential concern are sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO_2) and particulate matter (PM).

In general, the most significant emissions from the combustion in boiler of the proposed project are sulfur dioxide (SO_2), oxides of nitrogen (NOx), carbon dioxide (CO_2) and particulate matter. Carbon monoxide (CO) is much less problematic as developments aimed at improving combustion efficiency in the boilers have also addressed these pollutants. Electrostatic precipitator (ESP) will be installed to control the emissions of the boiler.

➢ Electrostatic Precipitator (ESP)

ESPs are common installations on power plants to remove over 99% of ash particles from million ft3 per minute of fumes. Electrostatic precipitators work better than the alternative, the fabric filter bag house especially when the gas to be treated and its particles are hot or wet.

Advantages

- Low operating cost (except at very high efficiencies)
- Very high efficiency, even for smaller particles
- Ability to handle very large gas flow rates with low pressure losses
- Ability to remove dry as well as wet particles
- Temperature flexibility in design

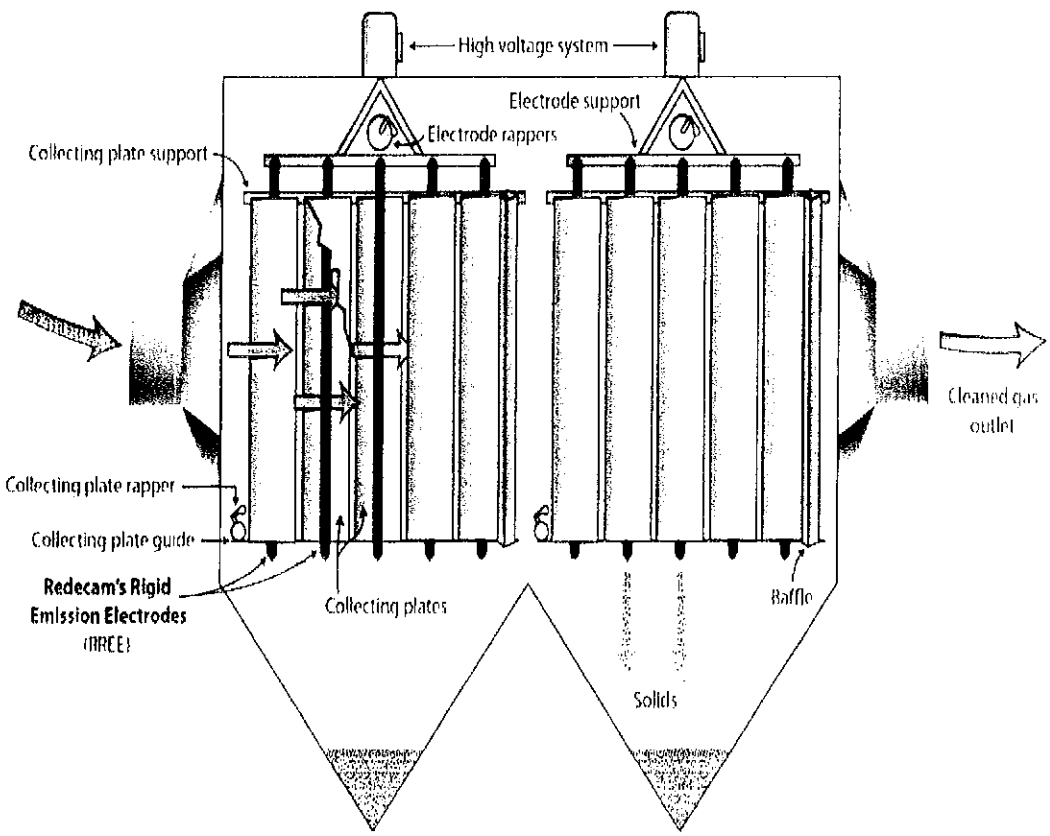


Figure - 5.1: Layout Diagram of Electro Static Precipitator

➢ **Design Parameters of Electrostatic Precipitator (ESP)**

Table 5.4: Design Parameters of ESP

Parameters	Design Value	Unit
Reservoir Depth (D)	10.00	ft
Reservoir Pressure(p_{bar})	4.350	psia
IPR (q_{max})	15.0	stb/day
Production field gravity (∂_l)	0.865	1 for H_2O
Volume factor for Production liquid (B_L)	1,25	Rb/stb
Tubing inner diameter (d_{ti})	2,992	In.
Well Head Pressure (p_{wh})	100	psia
Pump Section pressure($p_{suction}$)	200	psia
Production Rate (q_{Ld})	8,000	Stb/day
Bottom hole pressure from IPR (p_{wfd})	2.823	psia
Production rate at pump (q_{Ld})	10.00	bbl/day
Minimum capacity of selected pump (q_{LP})	10.00	bbl/day
Minimum Pump setting depth (D_{pump})	2.997	ft
Input pump setting depth (D_{pump})	9.800	ft
Pump Section Pressure ($p_{suction}$)	2.748	psia
Pump discharge pressure ($p_{discharge}$)	3.728	psia
Pressure differential (Δp)	980	psia
Pumping head (h)	2.263	Ft H_2O
Pumping head per stage (h_s)	60,00	Ft/stage
Horse power per stage (hp_s)	6,00	hp
Efficiency (E_p)	0.86	
Required number of stages (N_s)	38	

5.3.2 Ecological Impacts

5.3.2.1 Impacts on Fauna and Flora of

a) Air Emissions

The effect of air emissions from the stacks upon breeding birds (if any) proximal to the site will not be clear without careful monitoring. During the preparation of the IEE, no nest or nesting birds were observed on or proximal to the project site. Recommendations for a monitoring program include review of areas immediately adjacent and proximal to the site. Since birds are generally mobile, it is anticipated that they will relocate beyond the sphere of influence of the plant. The effect of gaseous and PM emissions on the adjacent areas, after adoption of necessary mitigation measures, is not anticipated to be a concern, because the air quality

levels are predicted to remain within those approved by PEQS for human health. Consequently, air emissions are not likely to affect local fauna and flora.

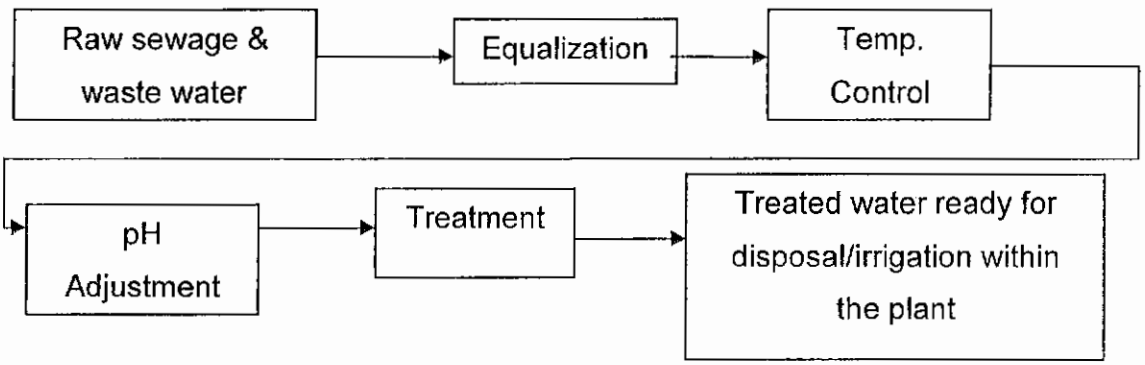
b) Noise

Noise from the operation of the proposed project, after adoption of necessary measures, will result in its level not exceeding the limits set by the PEQS. Thus, noise from the project activity will not give rise to any serious adverse impacts on the surrounding fauna and flora.

c) Waste Water

Waste Water and Sewage from all sources will be treated in effluent treatment plant. It is anticipated that about eight hundred gallon (800 g) per day of domestic sewerage will be generated which will be treated till the PEQS levels before its final discharge, therefore, there is no question of any adverse impacts from waste water to fauna and flora.

A tentative summary flow sheet (sketch) of the effluent treatment process:



Source of Effluent	Estimated Quantity (gallon/day)	Standard Meeting before dispoal
Workers/ Labour Staff Colony	800	✓ Less than PEQS.

Extent of Impact on Fauna & Flora = ▲(Low) [with adoption of mitigation measures.]

5.3.2.2 Landscaping

At the completion of construction activities, landscaping should include use of native plant species.

After completion of construction phase, the site will be mostly dominated by buildings, plant & machinery, stacks and Bagasse storage. Within this area of low visual impact, the additional visual intrusion due to realization of the project may be assessed as low.

Extent of Impact of Landscape = ▲ (Low)

5.3.3 Solid Waste Management

The types, sources, and management of solid wastes anticipated to be generated during the operation of the proposed project facilities are as follows:

- Plant wastes such as office wastes, packaging materials, ashes, garbage, refuse, redundant electric gadgets, various types of wastes of a large variety and rubbish/trash will be generated during the operational phase of the proposed project in addition to general solid waste. According to nature of solid waste, some of these will be recycled on the site while others will be sold in the market through an approved contractor while keeping all the records. The contractor will be fully informed/educated about the nature of the wastes. Other plant wastes, such as lead acid batteries will be segregated from other waste streams, collected and stored in suitable containers, and will be transported off-site and disposed at an approved land fill site by an approved waste transporter and contractor.
- Special wastes such as hazardous waste, industrial solvents and other chemical wastes, and used oil, will be generated during the operational phases of the proposed project. Special wastes could also include items such as waste oils, waste lubricants, paints, maintenance-related wastes, used air and liquid filtration media, and empty or nearly empty chemical containers. Most, if not all, of these materials will be disposed of by incineration through contractor. While others will be sold in the market through a contractor, keeping record of them and informing the contractor of their hazards and rational use.

Extent of Impact of Solid Waste = ▲ (Low) [with adoption of mitigation measures proposed.]

5.3.4 Noise & Vibration Impacts

Once operational, additional ambient noises may be of concern. According to the project feasibility study, ambient noise measurements of the equipment/machinery will be designed to operate with a total noise level not exceeding 50 to 65 dB (A) in the very near vicinity of the machinery. While at the property boundary, the noise level is expected to be less than 60 dB (A) as against the limiting value of 65 dB (A) by the PEQS for industrial areas. Therefore, in case the built in design of the plant achieves these noise levels then no excessive ambient noise impacts

are anticipated at the receptors especially the human settlements near to the project site.

Extent of Impact on Noise Level = ▲(Low) [with adoption of mitigation and control measures.]

5.3.5 Societal Impacts during Operations

5.3.5.1 Neighborhood and Communities

Human settlements are present with in the distance of about 3 to 5 kilo meters (KM) from the project boundary line. None of these villages have any health facility or adequate drinking water supply. Education facilities are not adequate. Being very near to the project site, any environmental catastrophe or routine type pollutant emissions and their concentration above the limiting values of PEQS-Pakistan can cause adverse impacts on human health or any element of the environment around. Therefore, the project needs to be operated seriously keeping in view the environmental management plan and sticking to the PEQS emissions standards. Failing which to operate without following strict environmental control, there could be adverse effects of human health, wild flora and fauna, ecology and whatever comes in contact with the emissions from the project.

Extent of Impact = ▲ (Low after strict compliance with the required environmental management systems)

5.3.5.2 Relocation Impact

As mentioned earlier, since relocation will not be required during implementation of the project, no impacts are anticipated in the project area of influence during operation phase.

Extent of Impact = ▲ (Low)

5.3.5.3 Economic Impact

The establishment of proposed project will provide new jobs at the plant site. Most people of the area make their living directly or indirectly from agriculture and cottage industry. Short-term economic benefit will be realized by providing janitorial services, horticultural services, loading/unloading workers, canteen, and semi-skilled & some skilled activities, as well as by increased use of available rental property. There are no negative or detrimental potential impacts on the socio-economic setting of the area arising as a result of the proposed project. As such no mitigation measures are required.

Extent of Socio-Economic Impact = ▼▼ (Locally Favorable)

5.4 POSITIVE SOCIO–ECONOMIC IMPACTS ON THE OVERALL PROJECT AREA

In ultimate analysis the impacts of project on social and economic activities in the project area will be mostly positive. The economic analysis shows very high economic benefits compared to the cost. Salient economic benefits of the project are:

❖ **Electric Generation**

The power plant is expected to generate 49.8 MW of electricity. Given that Pakistan is facing the acute shortage of the energy this project will help towards meeting a portion of the shortfall, thus providing some measures of relief to the people of Pakistan. The generation of electricity will not only help the industrial sector and its outputs but will also help to raise the standards of living as it will reduce load shedding.

Furthermore, the proposed power plant is based on imported or some extent local Bagasse which will prove to be less costly than the thermal power plants based on furnace oil.

❖ **Economic Boost**

Increased economic activity with improved transport will ensure easy marketing of agriculture and livestock produce. With improved economy, there will be further improvement in services in the area and opportunities for employment, education, healthcare, especially for women and children, will improve.

❖ **Employment Generation**

Employment during construction phase will take up and train a large number of unemployed youth. They will receive a life time benefit through skill training, capacity building and poverty alleviation. A large number of semi and unskilled workers in the project area will be hired.

❖ **Health Awareness**

Greater awareness about Health care including HIV/AIDS and infectious diseases amongst the labor and the close by community will be created.

❖ **Improvement in Livelihood**

At micro–level the hustle and bustle and increase in economic activities may bring the cost of living down by making essential commodities available at cheaper rates. This combined with higher incidence of employments will bring the poverty line and crime rate much lower.

Extent of Socio-Economic Impact = ▼▼ (Locally Favorable)

SECTION-6
COMPARATIVE EVALUATION OF ALTERNATIVE SITE

6 COMPARATIVE EVALUATION OF SITE ALTERNATIVES

This chapter presents a systematic comparison of feasible project alternatives, in terms of both the project (i.e., technology, design, operation, etc.) and site selection. The assessment of alternatives and site selection includes environmental and social factors.

6.1 PROJECT SITE OPTION.

Site selection requires careful, well thought out and wise decision. Any over sight may lead to major failure. The proposed project is located adjacent to Two Star Industries (Pvt.) Ltd located at Toba-Chichawatni road, Tehsil Kamalia of District Toba Tek Singh. The site is situated about 45-Km off from main Lahore-Multan road and 245 KM from Lahore. TSEPL has proposed the three different sites for the power plant. Locations of sites are shown in the **Fig - 6.1, 6.2** and **6.3.**

- **Proposed Site 1**

  Proposed Site 1 is located near the molasses pound and far away from the Bagasse source point.

- **Proposed Site 2**

  This site is located near the Bagasse source point.

- **Proposed Site 3**

  This site is located near the housing colony at ground and far away from Bagasse source point,

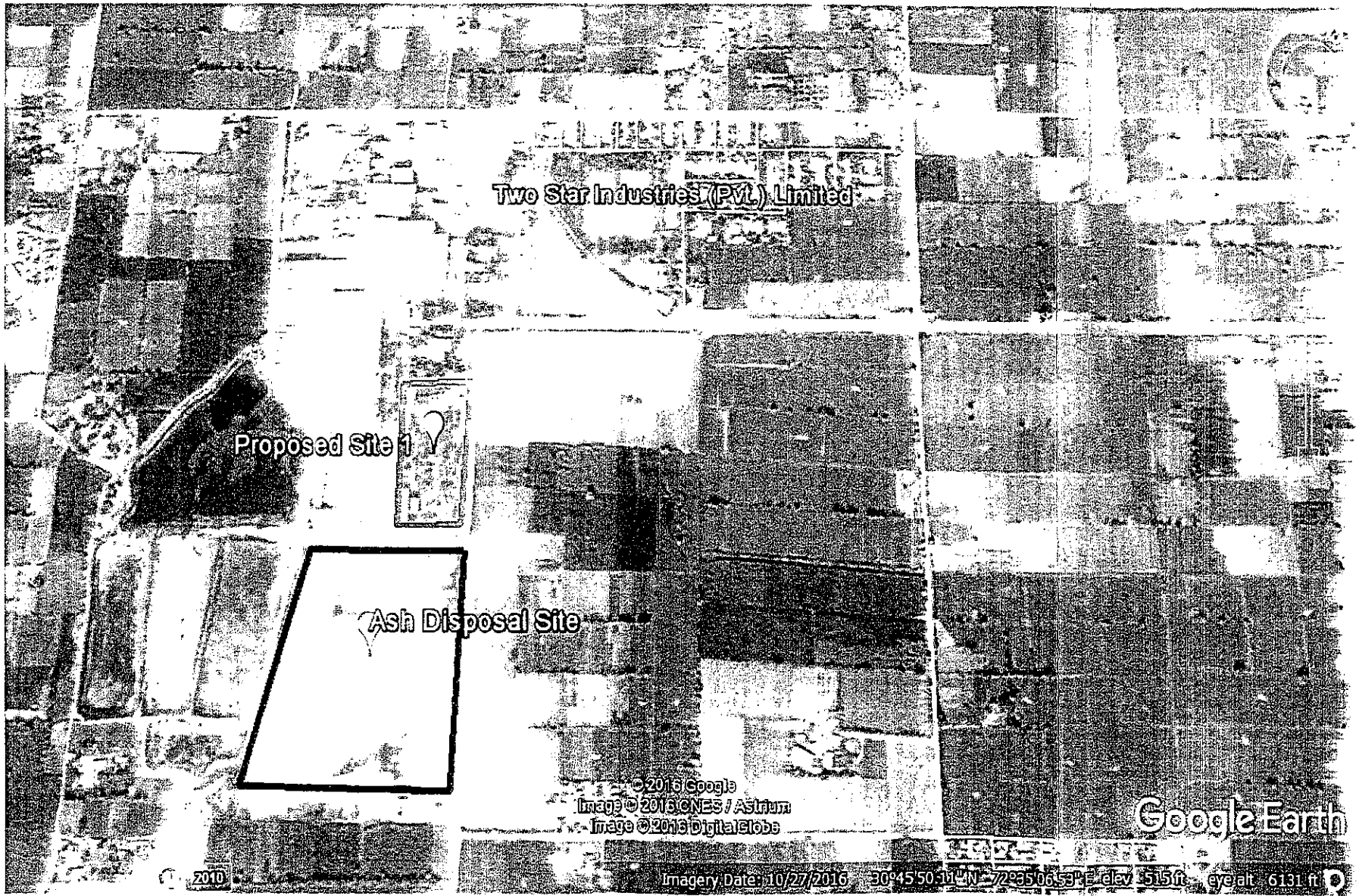


Figure - 6.1: Location of Proposed Site 1

Figure - 6.2: Location of Proposed Site 2

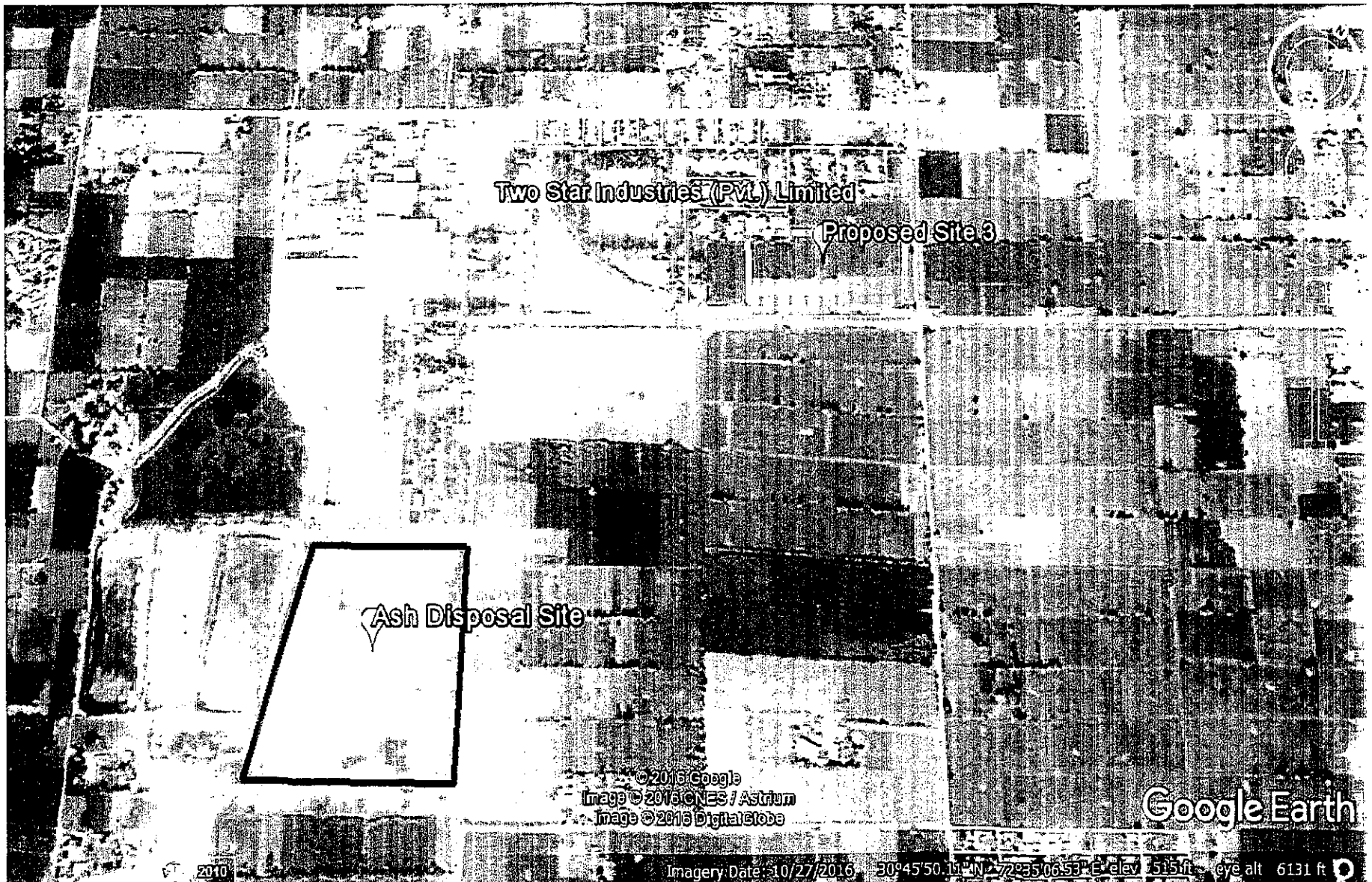


Figure - 6.3: Location of Proposed Site 3

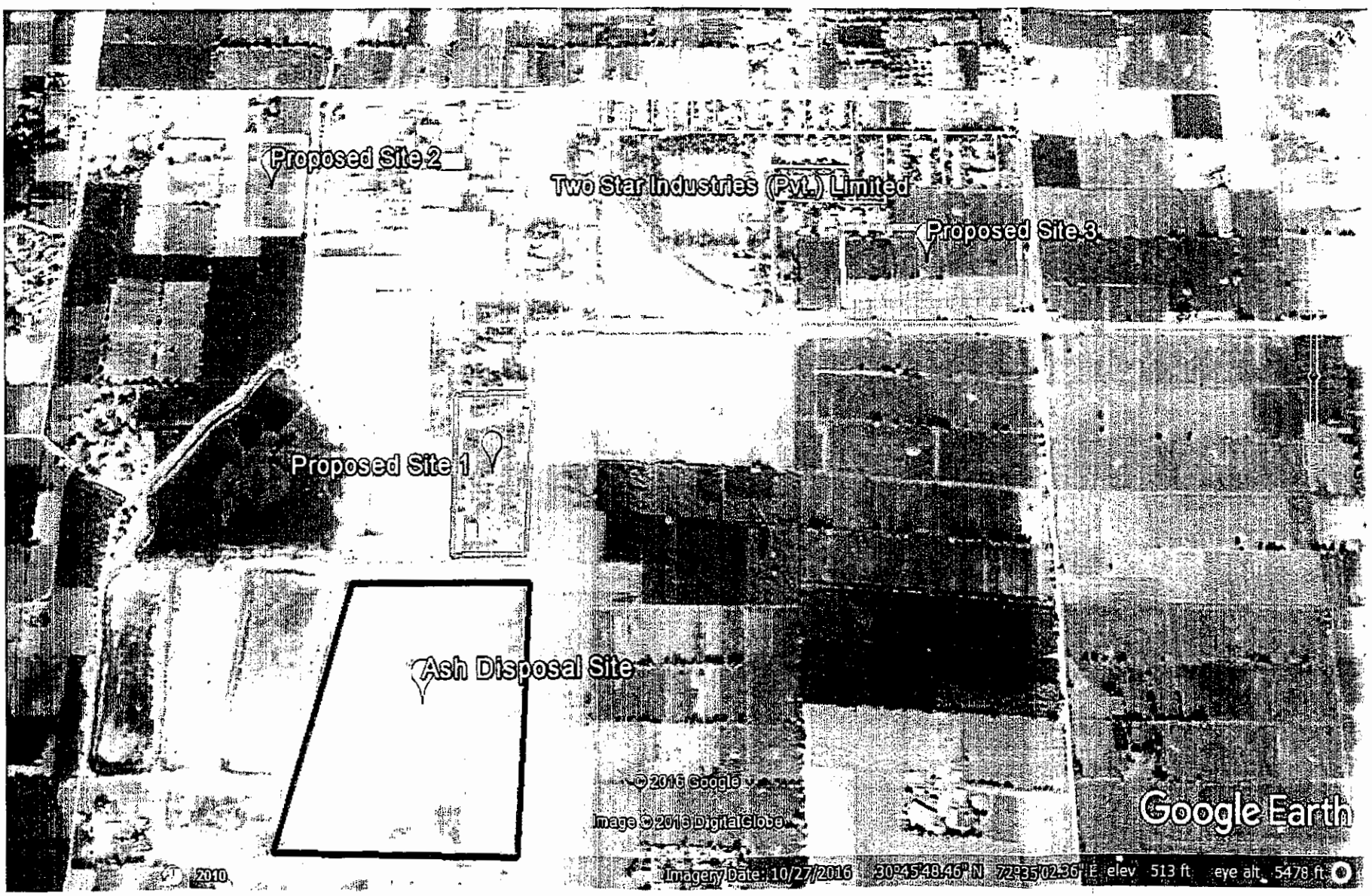


Figure - 6.4: Location of Proposed Site 1, 2 and 3

6.1.1 Proposed Site 1

- **Pros of Site**
  - Availability of land for proposed project.
  - Availability of adequate water for process
  - No displacement of people required.
- **Cons of Site**
  - Cutting of Trees involve
  - Away from the raw material such as Bagasse
  - Away from the main road
  - Near the Dense Infrastructure

The above Pros and Cons of proposed site 1 revealed that trees cutting and large distance between bagasse source point and proposed site is present. This will cause the increase in project operational cost and disturb the environment.

6.1.2 Proposed Site 2

- **Pros of Site**
  - No requirement for cutting of trees
  - Near the facility of raw material such as Bagasse
  - Near the main road
  - No displacement of people required.
  - Availability of adequate water for process
- **Cons of Site**
  - Land acquisition required for proposed project

Keeping in view the availability of land near the bagasse source point and no removal of trees at site 2 made the preferred site for bagasse power plant.

6.1.3 Proposed Site 3

- **Pros of Site**
  - Availability of land for proposed project.
  - Availability of adequate water for process
  - Near the main road

➢ **Cons of Site**

- Cutting of Trees involve
- Away from the raw material such as Bagasse
- Near the Colony area
- Displacement of peoples

The above Pros and Cons of proposed site 3 revealed that cutting of trees and colony area is present. If the proposed site (3) is selected, this will cause the increase in project operational cost and disturb the environment.

6.2 ANALYSIS OF COGENERATION

Cogeneration has been adopted as standard means of energy generation since long by the sugar industry. With the use of efficient processing and energy management systems, energy from bagasse, over and above the sugar factory needs, is available and can be exported conveniently in the form of electric power. Application of sugar cogeneration will replace a part of fossil-based electricity generation leading to a more sustainable mix in power generation. Cogeneration with power export will assist in reducing greenhouse gases (GHGs) emissions.

6.3 ANALYSIS OF FUEL

Fossil energy resources consist primarily of natural gas and furnace oil. Domestic oil supply is considered negligible and natural gas resources are becoming scarce in Punjab. Moreover, domestic coal is very high in sulphur and ash content, which will lead to severe environmental hazards. The project's proposal for using bagasse, is the best option for environmental and economic reasons. In the absence of any cheaper fuel, bagasse utilization is of prime importance.

6.4 ANALYSIS OF RENEWABLE ENERGY

Renewable resources such as wind power, micro hydro, and solar photovoltaic are not feasible options at the current time, but are subject to future consideration, particularly with respect to the price of fuel. With availability of bagasse for the all operation days, the option of using other renewable energy sources will be highly cost ineffective. Moreover, high wind speed is only apparent for short periods of time in the project site area and hydro potential does not exist.

SECTION-7
ENVIRONMENTAL MANAGEMENT PLAN
(EMP)

7 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

This EMP describes the mitigation and management measures to address the environmental issues during construction, its regular operation phases of the proposed project.

7.1 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT PLAN

The objectives of the EMP are as follow:

a) To outline functions and responsibilities of responsible persons.

b) To state standards and guidelines, which are required to be achieved in term of environmental legislation.

c) To outline mitigation measures and environmental specifications which are required to be implementation for all phase of the project in order to minimize the extent of environmental impacts and to manage environmental impact associated with the proposed project.

d) To prevent long term or permanent environmental degradation.

e) To identify training requirement at various levels.

7.2 SCOPE OF ENVIRONMENTAL MANAGEMENT PLAN

The EMP provides mitigation and management measures for the following phases of the project:

7.2.1 Construction Phase

This section of EMP provides management principles for the construction phase of the project. Environmental actions, procedures and responsibilities as required within the construction phase are specified. These specifications will form part of the contract documentation and therefore, the contractor will be required to comply with the specifications to the satisfaction of the project Manager and Environmental Control Officer, in terms of the construction contract.

7.2.2 Operation and Mitigation Phase

This section of EMP provides management principles for the operation and maintenance phase of the project. Environmental actions, procedure and responsibilities are required from proponent within the operation and maintenance phase are satisfied.

Table - 7.1: Environmental Management Plan for 49.8 MW Bagasse Based Cogen Power Project

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
Pre-Construction Phase						
1.	Legislation, permits and agreements	• Full compliance with all relevant National & Local Legislation	• In all instances, Proponent, service providers, contractors and consultants require to remain in compliance with relevant local and national legislation.	Once at Design Stage and prior to moving onto site by proponent.	Proponent, Contractor/ Engineers, Consultants	Project Proponent
2.	Land Acquisition, Loss of private land, agriculture field, trees, residential/ commercial structures	• Site preparation/ clearance and proper landscaping without any kind of grievance for construction of proposed thermal power plant	• Develop an appropriate "land acquisition & Resettlement Action Plan" • Land acquisition (if any) must be conducted in compliance with	Prior to start construction by Proponent.	Contractor and Design Engineers & Supervision Consultants	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			relevant laws and legislation • The cost related to relocation will be given to the relocated residents • Ensure maximum possible employment to local residents			
3.	Planning & Design	• High degree of structural competence, reliability, safety and ease	• The design specification will be followed to withstand local standards regarding noise and vibration and use of familiar and culturally relevant materials wherever consistent with functional needs • Project performance	• At Design Stage by proponent with coordination of Design Engineers	Design Engineers & Supervision Consultants	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			must be enhanced by incorporating innovative and sustainable design strategies.			
4.	Local Conflicts of interest among residents, workers, government officers & local politician	• Settle down each of conflict arise to best possible extent	• Ensure consideration of affected people's emotions • Provide maximum project benefits to local affected person (e.g. employment)	Prior to start construction by contractor with coordination of proponent	Contractors and Design Engineers & Supervision Consultants	Project Proponent
5.	Misdistribution of Benefits and Compensation among residents, workers, government officers and others.	• Equal and fair distribution of benefits and compensation	• Implement the same mitigation as outlined in the "Local conflict of interest"	Prior to commence construction activity by contractor with coordination of proponent	Contractors and Design Engineers & Supervision Consultants	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
6.	Access to Site may result in damage to existing roads due to heavy machinery/ equipments mobilization	• Ascertain existing conditions of road for safe access to site for transportation of construction equipments and materials	• Access to site will be via existing roads. The Contractor will need to ascertain the existing condition of the roads and repair major damage to avoid delays in transporting construction materials • All roads for construction access must be planned and approved by the Engineer and Consultant • No trees, shrubs or groundcover may be removed or vegetation stripped without the prior permission of	Contractor with coordination of Engineer and Consultant	Design Engineers & Supervision Consultants	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			Engineer/ Consultant • The Local Traffic Police Department shall be involved in the planning stages of the road closure and detour and shall be available on site for the monitoring of traffic in the early stages of the operations during road closure • The Local Traffic Department must be informed at least a week in advance if the traffic in the area will be affected			
7.	Setting up of Construction Camps	• Availability of environmentally	• Choice of site for the Contractor's camp	Contractor with coordination of	Design Engineers &	Project Proponent

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
		sound construction camp facilities	requires the Engineer's permission and must take into account location of local residents, businesses and existing land uses, if any. • If the Contractor chooses to locate the camp site on private land, he must get prior permission from both the Engineer and the landowner • Cut and fill must be avoided where possible during the set up of the construction camp • Camp must be	proponent	Supervision Consultant	

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			properly fenced and secured • The Contractor shall make adequate provision for temporary toilets for the use of their employees. Such facilities, which shall comply with local authority regulations, shall be maintained in a clean and hygienic condition. Their use shall be strictly enforced • Bins and/ or skips shall be provided at convenient intervals for disposal of waste within the construction			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			camp • Bins shall have liner bags for efficient control and safe disposal of waste • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.			
Construction Phase						
1.	**Air Quality** • Dust resulting from construction work • Use of heavy machinery can generate exhaust	– Compliance with prescribed PEQs to control air pollution	– Necessary measures like sprinkling of water on regular basis especially during dry climatic conditions should be taken to limit pollution	During Construction Phase by Contractor with coordination of Proponent staff	Engineers & Supervision Consultants	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	and dust emissions – Dispersion of particles from stockpiles during high velocity wind – Smoke from burning of waste materials or burning of firewood in the labor camp		from dust and other windblown materials. – Covering or use of wind sheets around the stockpiles to avoid air pollution through dispersion – Periodic maintenance and management of all the construction machinery and vehicles – Cutting and burning shrubs for fuel will be prohibited. Instead gas cylinders should be used in the labor camp for cooking purposes. Similarly waste burning will not			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			be allowed.			
2.	**Water Quality** • Run-off water from construction area – Drainage of wastewater on ground can contaminate the soil and groundwater. – Inappropriate disposal of waste. – Open sewerage water disposal on land can contaminate ground water and cause	– Control of groundwater or surface water pollution from construction activities	– Use of spill prevention trays and impermeable sheets to avoid contamination of the groundwater/surface water – Furthermore, septic tanks will need to be constructed which will be cemented to prevent the groundwater contamination – Proper disposal of waste material on dumping sites to avoid leachate generation and	During Construction Phase by Contractor with coordination of Proponent staff	Engineers & Supervision Consultants	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	generation of mosquitoes and various other insects in the area. • Leakage of oil and chemical materials from construction activity		contamination of groundwater/surface water – Prohibit illegal dumping of waste – The contractor will repair / replace / compensate for any damages caused by the Construction activities to the drinking water source/s.			
3.	**Waste** • Construction waste from construction activities • Domestic waste from workers	– Proper & safe handling and disposal of construction related waste – Compliance with applicable waste	– Ensure prevention of inappropriate disposal of waste material – Conduct separate collection of construction and	During Construction Phase by Contractor with coordination of Proponent staff	Engineers & Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	camp • Hazardous waste such as dry batteries, chemicals etc.	management rules for hazardous and non-hazardous waste disposal – Implementation of waste management plan	domestic waste to promote recycling and re-use – Dispose non-recyclable and hazardous waste material properly according to waste management rules – Proper disposal of waste on agreed site as per agreed method. The area to be leveled and contoured after disposing excess material. No waste or debris will be thrown in the nearest canal water or other water			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			bodies – Contractor will prepare waste management plan related to construction activities; get its approval from site engineer and ensure its full implementation			
4.	**Noise** • Noise caused by construction machinery and vehicles used for mobilization of construction equipment and workers	– Compliance with prescribed PEQs to control Noise pollution	– The contractor will strictly follow the PEQS for ambient noise – Control noise through con-trol of working hours and selection of less noisy equipment. – Prohibit use of	During Construction Phase by Contractor with coordination of Proponent staff	Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			pressure horns – Provision of acoustic enclosures (hood and shrouds) on generator – Proper maintenance of vehicles and construction equipment. – Minimize/avoid unnecessary use of pneumatic drills and other noisy machinery – The personal protective equipment (PPE) will be provided to the construction workers and its usage will be			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			made mandatory			
5.	Materials Management	– Safe and secure environment for construction workers	– Stockpiles shall not be situated such that they obstruct natural water pathways – Stockpiles shall not exceed 2m in height unless permitted by Concerned Engineer on site – If stockpiles are exposed to windy conditions or heavy rain, they shall be covered either depending on the duration of the project. Stockpiles may further be protected by the	Contractor with coordination of proponent and Engineer	Engineer & Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			construction of low brick walls around their bases – All substances required for vehicle/ machinery maintenance and repair must be stored in sealed containers until they can be disposed of / removed from the site – Hazardous substances / materials are to be transported in sealed containers or bags – Spraying of insecticide shall not take place under			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			windy conditions			
6.	**Biological Resources** – Removal of vegetation covers by cutting of trees, crops, herbs and shrubs – Fauna including birds and animals will be affected during excavation, movement of labor and carriage of goods and machinery	– Obligation to respect wildlife, Forest and Fisheries Laws. – Conserve biodiversity and its terrestrial as well as aquatic habitat	– Re-plantation of maximum number of trees. – Staff and workers should be instructed not to damage nearby vegetation of the surrounding area. – Open fires should be prohibited in the area to avoid the hazard of fire and impact on nearby flora and fauna. – Contractor staff should be given clear instructions that they should not hunt any birds/ animal in the	Contractor with coordination of proponent staff	Design Engineer & Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			project area/ site – Barriers/ fencing/ or boundary wall should be installed at project site to protect movement of animals at the project site during constructions. – Proper disposal of organic waste (if any) generated during the construction stage to avoid rodents and other insects' generation.			
7.	Staff Conduct	– Timely completion of project activities	– The Contractor must monitor the performance of construction workers to ensure that point	Contractor	Design Engineer & Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			relayed during their induction have been properly understood and being followed			
8.	Leakages/ spills/ Paints/ Used oil	– Compliance with standards set forth by "Guide Lines for Oil Spill Waste Minimization and Management" issued by International Petroleum Industry Environmental Conservation Associate	– Contractor will apply strict rules on his workers and labor to ensure that no spill or leakages are caused – All fuels, oils and bitumen will be stored appropriately, with concrete padding and bunding for containment in case of leakage – Proper maintenance of vehicles and machinery – Chemical waste will			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			be disposed off in approved disposal site. – All fuel tanks, chemicals including paints, pesticides or other hazardous substances will be properly marked to highlight their content – PPE will be enforced to use during the handling and application of chemicals – Used oil/ oil rags will be disposed through approved recyclable waste vendors – The contractor will			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			employ the general criteria for oil and leakage at construction sites, as per standards			
9.	Workers Health & Safety	– Prevention of any possibility of work site accident /impact on worker's health	– Provision of Personal Protective Equipment to the workers – Provision of first aid box at work site to cope with emergency situation – Safety training to the workers – Safe driving training to the drivers – Adequate safety signs on site – Provide training regarding proper	Contractor	Engineer & Supervision Consultant	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			handling and use of chemicals/ paints – Install fire extinguishers at fire handling places – Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads – Any loss of public/ private property will be compensated by the contractor – Regular checks should be carried out to ensure a contractor's is following safe			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			working procedures and practices.			
10.	Socio-economic Impacts	– Prevention of conflicts among locals and make the project socially acceptable – Empowerment of locals to possible extent – Increase in employment and business opportunities for locals	– Contractor's activities and movement of staff to be restricted to designated construction areas – The conduct of the construction staff when dealing with the public or other stakeholders shall be in a manner that is polite and courteous all the time – Lighting on the construction site shall be pointed downwards and away from oncoming traffic.	Contractor with coordination of proponent staff	Supervision Engineer	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			– The site must be kept clean to minimize the visual impact of site – Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors – Noisy activities must be restricted to the times given in the Project Specification or General Conditions of contract – The Contractor are responsible for ongoing			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			communication with those people that are interested in / affected by the projects – Employ local residents as much as possible – Promote communication between external workers and local people (e.g. join local events).			
11.	Clearance of site from extra / surplus material and construction equipment	– Restoration of site to a similar condition prior to the commencement of the work or to a condition agreed	– Timely removal of waste from the site to avoid congestion at work place. – Construction waste should be collected	Contractor	Supervision Engineers	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
		with the project management and landscaping of the site	and disposed separately from other waste. – Care will be taken during handling and disposal of waste. – Contaminated soil (if generated) due to accidental spills will be removed and transported to suitable site for disposal. – Avoid mixing of hazardous waste with non-hazardous waste. – Safe transportation of construction equipment from the			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			site. – The contractor must ensures that all structure, equipment, materials and facilities used or created on site for/or during construction activities are removed. – Empty/available space will be covered with grassy lawns. – Use of native vegetation as a part of landscape. Ornamental plant species like roses, jasmine, and seasonal flowers can			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			be used in proposed landscaping, which is a common practice in this part.			
Operational Phase						
1.	**Air Quality** – Exhaust gas from stacks – Dust from ash disposal activity – Exhaust gas from vehicles used for mobilization of equipment – Dust from bagasse handling activities and	– Compliance With Emission gas standards, Ambient air quality (PEQs) standards, Prevention of air pollution in surrounding area; appropriate handling of ash; appropriate bagasse handling during stock and unloading activities	❖ **Power Plant Operational Activities** – To reduce PM emissions, Electrostatic precipitator of 99.8% efficiency will be installed – To reduce NO_2 emissions, firing system will use low combust technology – For stack design,	EHS officer of Project Proponent	Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	Bagasse yard		height will be 90 m – Duct will be provided with Electrostatic Precipitator with the supported infrastructure as required under the gas emission standards of PEQS ❖ **Ash Handling** – Shifting the fly ash and bottom ash to the ash pond[1] using air sealed conveyer			

[1] An ash disposal pond (10 ha) will be built at the project site. The nominal capacity of the ash disposal pond is calculated based on the total volume of the ash to be accumulated for the duration of 5 years operation with 5000 hours of full load factor each. Leakage from the bottom of the ash pond will be prevented by using an impermeable layer, such as high density polyethylene (HDPE) sheet or silt layer.

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			– Watering in the ash pond as required for dry season – Re-greening especially along the boundary of the plant site surrounding ash pond with domestic plants according to local climate conditions ❖ **Gas Emissions from Vehicles** – Periodic maintenance and management of vehicles			
2.	**Water Quality**	– Compliance with	❖ **Thermal Effluents**	EHS officer of Project	Environment	Project

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	– Thermal effluent from cooling system – Wastewater from plant process – Rainwater drainage from ash pond and Bagasse yard – Leakages of oil and chemical materials	Wastewater standards of PEQS	– Thermal effluents will be discharge far from the intake point of cooling water to reduce the impact on surrounding area ❖ **Wastewater** – Installation of wastewater treatment system by neutralization, settling and oil separation so any wastewater produced complies with wastewater standards of PEQS	Proponent	Consultant hired by Project Proponent	Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			❖ **Runoff water** – Runoff water is collected in the pond and discharged after appropriate treatment – The bottom of the ash pond shall have an impermeable layer (less than 10^{-6}cm/sec) such as impermeable geo-membrane, sheet and clay ❖ **Oil & chemical materials leakage** – Storage of oil and chemical material			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			in appropriate tank with retaining wall and method to prevent permeation into ground			
3.	**Waste** – Fly ash and bottom ash – Sludge from wastewater treatment and waste oil from equipment etc. – Sewage and garbage from workers	– Compliance with waste management rules – Appropriate handling of Bagasse ash – Management of waste, especially hazardous waste – Prevention of inappropriate waste disposal	❖ **Ash disposal** – Ash pond is designed with capacity of 5 years of operation ❖ **Waste management** – Implementation o waste managemen program consisting o reduce, reuse and re cycling of materials – Systematic collection and	EHS officer of Project Proponent	Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			protected storage of waste – Waste disposal at appropriate and designated site – Hazardous waste must be treated under related regulation – Prohibition of dumping of any contaminating material			
4.	**Noise & Vibration** – Noise and vibration from steam turbines, generators and pumps etc. – Noise by ash	– Compliance with prescribed PEQs to control Noise pollution	– Installation of low noise/ low vibration type equipment – Proper maintenance of equipments – Adequate basis of equipment to reduce	EHS officer of Project Proponent	Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	disposal/ Bagasse handling activity – Noise from vehicles used for mobilization of equipment		the vibration – Adequate enclosure of equipment to reduce noise – Provision of PPEs to workers like ear muffles – Ensure use of PPEs by workers			
5.	**Access to social services** – Social facilities like road, school etc. – Employment opportunities	– Improved social infrastructure and living standards of local residents along with power plant	❖ Increased access to social services – Construction of access road, community road, and road around the power plant boundary – Service facilities such as school and medical	Project Proponent	EHS officer/ Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			centre are made available to the local residents as required – Electrification of surrounding area must be examined – Provision of employment to every affected person on fair basis			
6.	**Work environment (including work safety)** – Labor accidents due to handling heavy loads; working at heights; electric	– Prevention measures against labor accidents and health problems	❖ **Labor accidents** – Prepare a manual for labor accident prevention including safety education and training – Provide workers	EHS officer of Project Proponent	Environment Consultant hired by Project Proponent	Project Proponent/ EPA

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
	shocks – Diseases caused by air pollutants, water pollutants, and noise from the operation of the power plant – Fire Hazards		with appropriate protective equipment – Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads – Keep lifting devices well maintained and perform maintenance checks as appropriate – Use equipment that protects against electric shock			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			❖ **Environment Pollution** – Observe related standards and provide workers with appropriate facilities\ ❖ **Fire Hazards** – Installing fire extinguishers in fire handling places – Installing fire fighting system – Developing fire fighting organization and implementing fire drills – Spraying water in			

Sr. No.	Project Component/ Impact	Targets to be Achieved	Mitigation/ Preventive Action	Responsibility		
				Implementation	Supervision	Monitoring
			Bagasse yard			

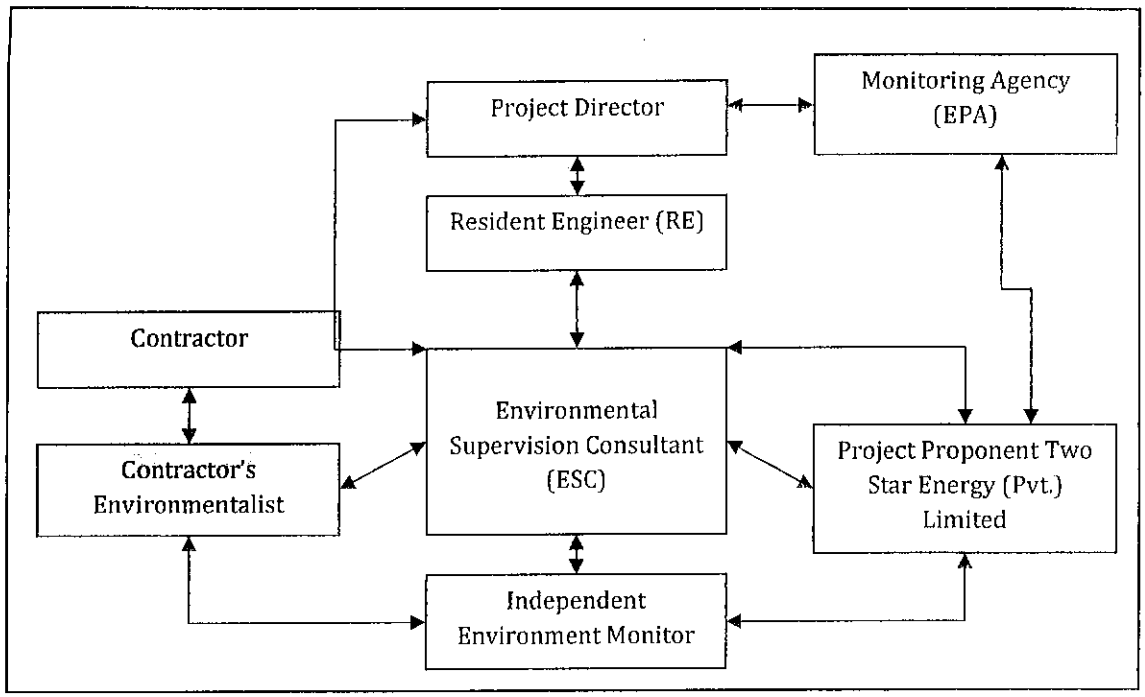


Figure - 7.1: Organogram for Implementation of EMP

7.3 ENVIRONMENTAL MONITORING PROGRAM

It will be in the fitness of the things to operate this project under the Environmental Management Plan (EMP). The EMP will ensure that even all type of pollutants from project is within the prescribed limiting values of the PEQS. Thus, the environment and human health around the project will be safeguarded.

Regular monitoring of all the significant environmental issues is essential to check the compliance status of EMP.

The main objective of the monitoring will be;

- To verify the results of the environmental study with respects to the proposed project.
- To estimate the trends of concentrated values of the issues, which have been identified as critical and then planning the mitigating measures.
- To assess the efficiency of pollution control mechanism.
- To ensure that any additional parameters, other than those identified in the IEE report, do not turn critical after the commissioning of proposed project.

Table - 7.2: Recommended Activities of Environmental Monitoring

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Water Quality	▪ Ground Water ▪ Surface Water	Discrete grab sampling and laboratory testing of water samples.	▪ Sampling and laboratory testing should be done on monthly basis during the construction and annually during the operational stage. ▪ Discharges from the construction sites should be tested for temperature, pH and turbidity. ▪ Treated effluent discharges from the worker's camp to be tested for pH, TSS and BOD_5.
Dust Emissions	▪ Tracks along the roads during construction period.	Ambient Particulate Matter Monitoring.	▪ Sampling and laboratory testing should be done on monthly basis during the construction and through Quarterly basis during the operational stage.

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Noise Levels	▪ Camp sites, ▪ Selected locations along the project access.	Noise meter	▪ Monthly during the construction and operational stage.
Stack emission	Silencers of heavy machinery, trucks and other vehicles.	Emissions monitoring system. Monitoring of ambient air quality.	▪ Monthly monitoring of air pollution parameters including PM_{10}, NO_X, SO_X, CO, Hydrocarbons during the construction period, and through the online monitoring system of PM_{10}, NO_X, CO, during the operation stage.
Ecological Environment			
Cutting of trees	In all Project Area during the construction stage and operation stage.	Periodic visits at site to ensure that only those trees should be cut, which are demarcated for cutting.	▪ Weekly during routine monitoring and reported on monthly basis during the construction period, and once in a year monitoring and reporting during the operation

Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
			period.
Socio-Cultural Environment			
Inconvenience to community	All around the Project Area	Consultations with community to get feedback about inconvenience due to the construction activities to perform their daily routine chores.	• Monthly monitoring and reporting during the construction period.

7.4 ENVIRONMENT MANAGEMENT COST

The total cost for the environmental management is estimated as 2.5 million Pak Rupees. The estimations are as followings;

Table - 7.3: Environmental Management Cost

Environmental Component	Quantity	Amount (PKR)
i. Tree Plantation (local species)	1500	700,000.0
ii. Health and Safety Measures and Provision of PPEs	L.S.	500,000.0
iii. Air and Water Quality & Noise Monitoring	L.S.	800,000.0
iv. Environmental Trainings	L.S	500,000.0
Total Environmental Management and Monitoring Cost		**2,500,000.0**

7.5 TRAINING NEEDS

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

The designated HSE Officer will be charged with an ongoing program of environmental training. This will include:

- General promotion of environmental awareness;
- Specific training for staff working in sensitive areas;
- Updating staff on changes to environmental standards; and
- Reporting to staff on the station's environmental performance.

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

7.6 MONITORING & EVALUATION (INSTITUTIONAL ARRANGEMENT)

Project Director will be responsible for Monitoring and Evaluation, but Environment consultant (of the proponent) will responsible to monitor EMP implementation in the field and reporting to the Project Director. The Project Director will integrate monitoring reports in the main monthly reports of the project. The Environment Specialist of Supervision Consultant will carry out a final evaluation at the end of the Project. In addition, for external monitoring, proponent is to engage an independent agency (an NGO, an academic institute or an individual consultant) to conduct 3rd party validation of EMP implementation. District Office of the EPA will monitor the overall activity at the site.

7.7 SOCIAL MANAGEMENT PLAN

7.7.1 Recommendations and Mitigation Measures

Based on the initial benchmark study the recommendations are made:

- The management of the Project can capitalize on the positive attitude of the people of area towards proposed Project by offering them maximum employment opportunities at the construction stage and stage of operational phase of the power plant.

- Insufficient and inadequate socio-economic structure of the community of the area also provides ample opportunities to project management to win sympathies of local people in their favor, by introducing meaningful and manageable plan of community development.
- Aggressive and comprehensive plantation plan can also lessen fear of local people towards environmental issues.
- Plant management can explore direct or indirect chances of female employment opportunities. Such efforts can be fruitful to minimize negative social impacts.
- Sustainable development approach through conservation of natural resources would be the best strategy to compensate negative socio-environmental impacts.
- Plant management should offer technical training opportunities to the local youth, if possible, to remove relative sense of deprivation.

Project Impact Matrix

Environmental Components / Components/ Activities	Physical Environment												Biological Environment							Social Environment					
	Agricultural Lands	Soil (Erosion/Stability)	Housing	Cultural/Religious Properties	Infra structure	Mineral Resources	Downstream River Flows	Flooding	Surface water quality	Ground water quality	Air quality	Noise	Aquatic Ecosystem	Wetland Ecosystem	Terrestrial Ecosystem	Endangered Species	Natural Flora	Wildlife	Disease Vectors	Public Health	Land Use	Communication System	Employment	Community Stability	Cultural and Religious Value
Construction Phase																									
Construction Camp	MA	LA	O	O	LA	O	O	O	LA	LA	LA	LA	LA	O	O	O	LA	LA	LA	O	LA	LB	LB	O	LA
Storage Site	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	LA	O	O	O	O
Boiler	LA	O	O	O	O	O	O	O	O	O	LA	LA	O	O	O	O	LA	LA	O	O	LA	O	LB	O	o
Feed Water Tank	LA	O	O	O	O	O	O	O	LA	LA	LA	LA	O	O	O	O	LA	o	O	O	LA	O	LB	o	O
Steam Turbo Generator	LA	O	O	O	O	O	O	O	O	O	O	LA	O	O	O	O	O	O	O	O	LA	O	LB	O	O
Vehicular Movement	LA	O	O	O	O	O	O	O	LA	O	LA	LA	O	O	O	O	O	O	O	LA	LA	LB	O	O	O
Operation Phase																									
Loading/ Unloading	LA	O	o	O	o	O	o	O	LA	o	LA	LA	O	o	O	o	O	O	o	LA	LA	MB	MB	o	O
Transportation	LA	O	O	O	O	O	O	O	O	O	LA	LA	O	O	O	O	O	O	O	O	O	O	LB	O	o
Main Transmission Line	LA	o	O	o	O	o	O	o	O	o	o	O	o	O	o	O	o	o	O	o	o	O	LB	O	o

LA: Low Adverse MA: Medium Adverse HA: High Adverse NA: Not Applicable O: None or Insignificant

LB: Low Beneficial Medium Beneficial HB: High Beneficial ND: Not Determinable

SECTION-8
PROJECT SOCIAL SOUNDNESS

8 PROJECT SOCIAL SOUNDNESS

Stakeholder consultation is a means of involving all primary and secondary stakeholders in the project's decision-making process in order to address their concerns, improve project design, and give the project legitimacy. Stakeholder consultation, if conducted in a participatory and objective manner, is a means of enhancing project sustainability. Community input (both of knowledge and values) on socioeconomic and environmental issues can greatly enhance the quality of decision-making. Stakeholder consultation was therefore conducted in the project area not only to satisfy the legal requirements of the IEE process in Punjab province but also to improve and enhance the social and environmental design of the project.

8.1 OBJECTIVES OF STAKEHOLDERS CONSULTATION

The process of public participation and consultation was endorsed in the United Nations Conference on the Environment and Development (UNCED) in 1992 through one of the key documents of the conference named as Agenda 21.

Agenda 21 is a comprehensive strategy for global action on sustainable development and deals with issues regarding human interaction with the environment. It emphasizes the role of public participation in environmental decision-making for the achievement of sustainable development.

A study was carried out with the broad objective to evaluate the impact of the project on the local population through public consultation process. The specific impact assessment aims were:

- Promote better understanding of the project, its objective, and its likely impact
- Identify and address concerns of all interested and affected parties of project area.
- Provide a means to identify and resolve issues before plans are finalized and potentially costly delays development commences, thus avoiding public anger and resentment.
- Encourage transparency and inculcate trust among various stakeholders to promote cooperation and partnership with the communities and local leadership.

8.2 PUNJAB ENVIRONMENTAL PROTECTION ACT 2012 (AMENDED ACT)

Public consultation is mandated under Punjab's environmental law. The Provincial Agency, under Regulation 6 of the IEE-EIA Regulations 2000, has issued a set of guidelines of general applicability and sectoral guidelines indicating specific

assessment requirements. This includes Guidelines for Public Consultation, 1997 (the 'Guidelines'), that are summarized below:

a) Objectives of Public Involvement

To inform stakeholders about the proposed project, to provide an opportunity for those otherwise unrepresented to present their views and values, providing better transparency and accountability in decision making, creating a sense of ownership with the stakeholders.

b) Stakeholders

People who may be directly or indirectly affected by the proposed project will clearly be the focus of public involvement. Those who are directly affected may be project beneficiaries, those likely to be adversely affected, or other stakeholders. The identification of those indirectly affected is more difficult, and to some extent it will be a subjective judgment. For this reason it is good practice to have a very wide definition of who should be involved and to include any person or group who thinks that they have an interest. Sometimes it may be necessary to consult with a representative from a particular interest group. In such cases the choice of representative should be left to the group itself. Consultation should include not only those likely to be affected, positively or negatively, by the outcome of proposed project, but should also include those who can affect the outcome of a proposal.

c) Mechanism

Provide sufficient relevant information in a form that is easily understood by non-experts (without being simplistic or insulting), allow sufficient time for stakeholders to read, discuss, consider the information and its implications and to present their views, responses should be provided to issues and problems raised or comments made by stakeholders, selection of venues and timings of events should encourage maximum attendance.

d) Timing and Frequency

Planning for the public consultation program needs to begin at a very early stage; ideally it should commence at the screening stage of the proposal and continue throughout the IEE process. In particular for present project the consultation was carried for six consecutive days.

e) Consultation Tools

Some specific consultation tools that can be used for conducting consultations include; focus group meetings, needs assessment, semi-structured interviews; community meetings and workshops. In particular for this a performa was developed to get the related information.

f) Important Considerations

The development of a public involvement program would typically involve consideration of the following issues;

- objectives of the proposal and the study;
- identification of stakeholders;
- identification of appropriate techniques to consult with the stakeholders
- identification of approaches to ensure feedback to involved stakeholders; and
- mechanisms to ensure stakeholders consideration are taken into account.

8.3 CONSULTATION PROCESS

Primary stakeholders were consulted during informal and formal meetings held in the project area. The consultation process was carried out in the Punjabi and Urdu languages. During these meetings a simple, non-technical, description of the project was given, with an overview of the project's likely human and environmental impact. This was followed by an open discussion allowing participants to voice their concerns and opinions. In addition to providing communities with information on the proposed project, their feedback was documented during the primary stakeholder consultation. The issues and suggestions raised were recorded in field notes for analysis, and interpretation.

By reaching out to a wider segment of the population and using various communication tools such as participatory needs assessment, community consultation meetings, focus group discussions, in-depth interviews, and participatory rural appraisal; present IEE involved the community in active decision-making. This process will continue even after this IEE has been submitted, as well as during future EIAs in which similar tools will be used to create consensus among stakeholders on specific environmental and social issues.

In the Secondary stakeholder consultations were more formal as they involved government representatives and local welfare organizations, NGO's consulted during face-to-face meetings and through telephonic conversations. They were briefed on the IEE process, the project design, and the potential negative and positive impact of the project on the area's environment and communities. It was important not to raise community expectations unnecessarily or unrealistically during the stakeholder consultation meetings in order to avoid undue conflict with community's leaders or local administrators. The issues recorded in the consultation process were examined, validated, and addressed in the IEE report.

8.3.1 Points Discussed

Following points were discussed during the public consultations:

- Project components, its activities and impacts.
- Needs, priorities and reactions of the affected population regarding the proposed Project.
- Grievances redress procedures.
- Entitlement checklist development for the affectees of the Project.
- Evaluation criteria of the buildings.
- Basis for determining the rates of the land, houses, and other infrastructures.
- Compensation framework for the Project affectees.
- Compensation criteria to be followed for the payment to the affectees.
- Role of the affectees in implementation of the project.

8.4 STAKEHOLDER CONSULTATION TECHNIQUE

In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved in some or all of the project and its planning process. It is important to be aware of how different power relations can distort participation. It is also important to examine how community skills, resources, and 'local knowledge' can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation. Therefore, the following participatory techniques were employed during stakeholder consultations:

- Informal meetings with communities.
- Focus Groups with participants in communities.

In the consultation process for IEE, following key stakeholders were consulted:

- Local communities,
- Men
- Women and
- Community's elders attended meetings.

Meetings with stakeholders consisted of community consultation meetings, focus group discussions, and in-depth interviews with men and limited focus-group discussions with women.

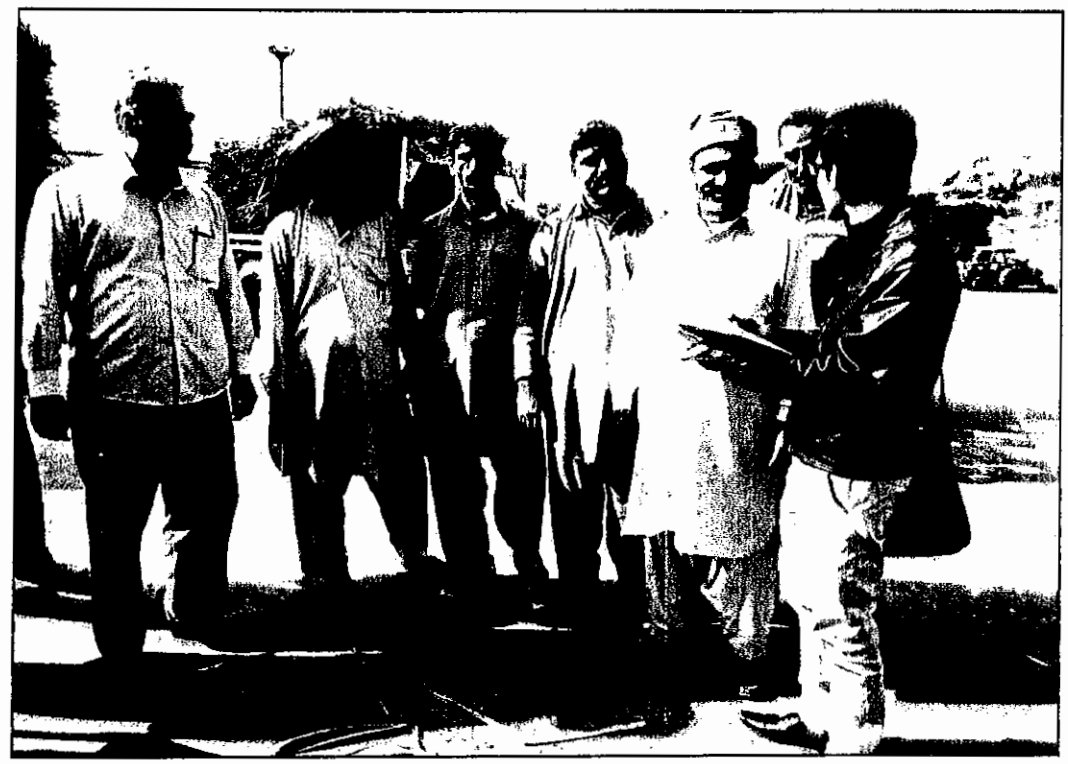


Figure - 8.1: View of Public Consultation

8.4.1 Government Representatives

The consultations were carried out with the local government officials and officials of the following departments:

- Forestry
- Fisheries
- Irrigation
- Wild Life

The officials of Wildlife and Forest department perceived that the employment opportunities and business development would be the positive impacts on the community and people during the construction phase of the proposed project. Among the perceived negative impacts during construction phase of the project include especially road blockage, dust emissions, noise and nuisance due to heavy traffic. All officials of project study area were in favor of the project. They expect many positive, conducive and constructive impacts on socio-economic life of local community regarding jobs, business opportunity and social structure development. They were in opinion that project would improve area development through development of existing infrastructure etc. The project will also raise their level of awareness, initiate cultural diffusion, activate social mobility and bring social change regarding various aspects of their life.

The officials from Fisheries and Irrigation departments appreciated the proposed activity. They also expressed that the jobs and business opportunities for the local community will be increased due to project activities and that the infrastructure will developed that automatically lead to the development of the project area. They also expressed the concern that most of the unskilled and skill jobs should be provided for the local communities.

8.4.2 Stakeholder Concerns and Recommendations

The findings of the Community consultations are given as followed. All these have been addressed in various sections of the IEE and the mitigation plans have been incorporated into the EMP.

The summary of the various stakeholder consultations is given below.

- The people foresee positive impacts like employment opportunities, business, development of the area etc.
- Study findings depict that the people of the study area perceive overall positive impacts as a result of power plant siting. Therefore, their attitude towards the project establishment is quite positive.

- As far as the Environmental Assessment is concerned, positive social impacts are dominant over hardly conceived any negative social impacts observed during the study.
- The people have high expectations and hope from the project activity and its management.
- They correlate their positive attitude towards the project with many socio-economic opportunities and benefits.
- The people believe that the project in the area will open up vast employment opportunities which in turn follow a chain of indirect socio-economic benefits.
- They also perceive accelerated economic activity due to the business opportunities likely to emerge in the area. Directly or indirectly, hundreds of the local people will get employment and business from the project e.g, shopkeepers, traders, suppliers, contractors, transporters, technicians, etc.
- People foresee many socio-cultural and psychological positive impacts on their lives and the community.
- They feel that the project and its related activities will provide a strong base for social change.
- They reckon that invasion of the people and technology in the area will improve the quality of life of the people. It will also improve the level of general awareness of the people about different aspects of life.

From the above facts one can conclude that many positive economic and social impacts will appear in the quality of the lives of the people of the Study Area due to proposed power project. These positive impacts include improvement in female status, employment and business opportunities, infrastructure development, reducing rural urban migration, generating income resources and improving quality of life.

8.5 PROCEDURE FOR REDRESS OF GRIEVANCES

Suggested procedures to be adopted for the redressal of the grievances are given below:

- Project affectee will submit his/her application to the Field Implementation Unit for consideration. Within 15 days of the receipt of the complaint, action will be taken up for redressal of the grievance. Wherever policy matters are involved, the case will be referred to the appropriate authority or committee appointed by the Project to decide the matter.
- In case some response on the complaint is not received within 15 days of the receipt of the complaint, the complainant may also send a reminder to within 15 days notice to take legal remedial measures.

- In case the matter has been decided but the complainant is not satisfied, he/she may go to the court of law.
- In case of such eventualities, all affected persons should be exempted from legal and administrative fees made/paid/incurred pursuant to the grievance redressal procedures.
- All complaints received in writing or written when received verbally will be properly recorded and documented.

8.6 PROPOSED MECHANISM FOR GRIEVANCE REDRESS

Under the Project the following will be established or appointed to ensure timely and effective handling of grievances:

- A Public Complaints Unit (PCU), which will be responsible to receive, log, and resolve complaints; and,
- A Grievance Redress Committee (GRC), responsible to oversee the functioning of the PCU as well as the final non-judicial authority on resolving grievances that cannot be resolved by PCU;
- Grievance Focal Points (GFPs) having educated people from each community that can be approached by the community members for their grievances against the Project. The GFPs will be provided training by the Project in facilitating grievance redress.

Details of the proposed mechanism are given below.

8.6.1 PCU – Function and Structure

PCU will be set up as part of the environment, health and safety department of the Project. A senior official with experience in community and public liaison will lead the unit. Two assistants, one male and one female will be responsible for coordinating correspondence and preparing documentation work and will assist the senior official. The senior official will be responsible to review all documentation. The PCU will be responsible to receive, log, and resolve grievances. Given that the female community members have restricted mobility outside of their homes, the female PCU staff will be required to undertake visits to the local communities. The frequency of visits will depend on the nature and magnitude of activity in an area and the frequency of grievances.

8.6.2 GRC – Function and Structure

The GRC will function as an independent body that will regulate PCU and the grievance redress process. It will comprise of:

- Officials of environment, health and safety of the proposed Project.
- Senior engineer that is responsible to oversee the contractors.

- Two literate representatives from the communities residing near the project site;
- A representative of the local government. In case the local government elections take place, this could be the Naib-Nazim or Nazim (the district governor). If not, this would be the District Coordinating Officer (DCO) or an appointed representative;
- Senior member from the local civil society with experience in community relations;
- A female member from the local civil society.
- The GRC will meet once every three months to review the performance of the PCU; the frequency can be changed depending on the nature and frequency of grievances received. The performance will be gauged in terms of the effectiveness and the timeliness with which grievances were managed. In case there are any unresolved or pending issues, the GRC will deliberate on mechanisms to resolve those and come up with solutions acceptable to everyone.

8.6.3 Grievance Focal Points

The GFPs will be literate people from each community that will facilitate their community members in reporting grievances from the Project. The GFPs will be provided training by the Project in facilitating grievance redress. Each community will have a male and female GFP appointed for this purpose.

8.6.4 Procedure of Filing and Resolving Grievances

Grievances will be logged and resolved in the following steps:

Step 1: Receive and Acknowledge Complaint

Once the PCU receives a complaint, which could be the complainant giving it in person, via letter or email, through phone call, or through a GFP, an acknowledgement of receipt of the complaint has to be sent within two working days to the complainant. The complainant will be issued a unique complaint tracking number for their and PCU's record.

Step 2: Investigation

PCU will work to understand the cause of the grievance for which the PCU may need to contact the complainant again and obtain details. The PCU will be required to complete preliminary investigations within five working days of receiving the complaint and send a response to the complainant documenting the results of their investigations and what the PCU plans to do ahead.

Step 3: Resolution through PCU

Once the PCU have investigated a grievance, it will share with the complainant the proposed course of action to resolve the complaint, should PCU believe any to be necessary. If the complainant considers the grievance to be satisfactorily resolved, the PCU will log the complaint as resolved in their records. In case the grievance remains unresolved it will be reassessed and GRC will have further dialogue with the complainant to discuss if there are any further steps, which may be taken to reach a mutually agreed resolution to the problem.

For minor grievances, Steps 1, 2 and 3 or Steps 2 and 3 can be merged.

Step 4: Resolution through GRC

In case the PCU is unable to resolve the issue, the matter will be referred to GRC. All complaints that could not be resolved within four weeks will by default be referred to GRC. However, the complainant or the PCU can convene the GRC at any point in time, depending on the nature and urgency of the issue.

8.6.5 Operating Principles for PCU

The PCU will operate on the principles of transparency, approachability and accountability. To achieve these, the PCU will be required to:

- Be equipped to handle grievances in the local languages;
- Be equipped to work through all possible modes of communication, such as, emails, surface mail and face-to-face meetings at project site or requiring visits;
- Employ female staff, preferably from the nearby communities, to oversee complaints and issues of the female community members.
- Maintain a log of all grievances, with record of the date and time of the complaint logged and stakeholder information, such as, name, designation and contact details;
- Provide opportunity to the stakeholder to revert with their comments on the proposed plan of action;
- Keep the stakeholder informed of the progress in grievance resolution;
- Obtain stakeholder consent on the mechanism proposed to redress the grievance and document consent; and,
- Maintain confidentiality of the stakeholder, if requested so.

8.6.6 Stages of Grievances

Once a grievance is logged with the PCU, it could acquire the following stages:

Stage 1: it is resolved by the PCU or if not PCU, by the GRC;

Stage 2: If the stakeholders are still not satisfied, they can go through local judicial proceedings.

8.6.7 Awareness

The stakeholders will be informed of the establishment of the PCU, GRC and GFPs through a short and intensive awareness campaign. Under the awareness campaign, the proponent will share:

- Objective, function and the responsibilities of the PCU, GRC and GFPs;
- Means of accessing the PCU and the mechanics of registering a grievance at the PCU,
- GRC and GFPs;
- Operating principles of the PCU, GRC and GFPs; and,
- Contact details.
- Additional awareness campaigns may be organized, if necessary

8.7 COMMUNITY CONCERNS

Project Approval

The community consultations demonstrated that goodwill towards the project proponents indeed exists; approval for project activities by the communities was evident. The consultations were considered a good gesture and appreciated, especially by the men and women. This project will provide employments to the local as well as non local poor community in its construction as well as in operational stages.

Resettlement/ Relocation

The owner of the private land demanded the followings;

- Lucrative Land against land
- Fair Compensation against acquiring land
- Compensation of Land before the commencement of the work

Local Employment

Communities in the project area emphasized that local poor community should be given priority when employing people for various project-related works and activities according to their skills.

Interaction with Local Community

Non-Local work force coming in the project area that will not be aware of the local customs and norms, may result in conflicts with the local community, keeping in mind the sensitive law and order situation and culture of the area.

Impact on Livelihood

The communities also expressed some fear that project construction would disturb their living because of noise and vibration of constructional woks and due to vehicular movement. Another concern of local community is the road blockage and traffic problem in the surrounding areas of proposed project sites during construction.

8.8 LOCAL GOVERNMENT REPRESENTATIVES

The consultations were considered a good gesture and appreciated. They also expressed the jobs and business opportunities for the local community will be increased due to project activities. They also expressed the concern that most of the unskilled and skill jobs should be reserved for the local communities.

SECTION-9

EMERGENCY RESPONSE PLAN & EVACUATION PLAN

9 EMERGENCY RESPONSE PLAN & EVACUATION/EXIT PLAN

9.1 EMERGENCY PREPAREDNESS AND RESPONSE

a. Policy:

It is the policy of project proponent to establish an Emergency Response Program and guidelines for the protection of plant people, equipment damage, environment and community.

b. Purpose:

The objective of the Emergency Preparedness and Response System is to:

1. Recognize and plan for appropriate responses to an emergency so that the safety risks associated with the emergency may be prevented or mitigated.
2. Train and prepare individuals working inside the installation so that they can respond effectively in the following:
   i) Potential Risk Assessment
   ii) Fire detection and Alarm System
   iii) System for Intervention and Actions to control any incident
   iv) Emergency Evacuation Procedure / Drills in order to meet the emergency situations, like Bomb Threatening Message or Terror Act / Threat etc Emergency Response Plan at a Glance:

c. Incident Categories:

Category	Title	Definition & Effect	Causing Incident
1	Minor Incident	Incident, which may involves injury or damage to plant controllable by personnel on the spot	1. Small Fire, 2. Small Hydrocarbon Spill, 3. Process Leakage, 4. Small leakage of Hazardous Chemicals, 5. Minor Gas release (Toxic or Flammable)
2	Serious Incident	Incident, which may involves injury, damage or serious damage to plant beyond resources of personnel on the spot and controllable by	1. Fire, 2. Small explosion with minor knock on effects, 3. Serious Spill containable, 4. Gas Release but controllable.

Category	Title	Definition & Effect	Causing Incident
		Emergency Response Team	
3	Major Incident	Incident involving injury, death or major damage to plant or environment beyond resources of Site Emergency Response Team and external Aid required.	1. Major Fire, 2. Major Explosion, 3. Major Spill, 4. Major Gas Release 5. Major or multiple injuries or illness.
4	Disaster	Escalating incident involving large-scale injury, death or damage, beyond the resources of External and Internal Emergency Services and threatening civilian population.	1. Toxic Gas Cloud, 2. Flammable Gas Cloud, 3. Disastrous Fires and Explosion

9.2 EMERGENCY EVACUATION PLAN

a. Objective:

The purpose of this procedure is to facilitate and to organize individual's actions during workplace emergencies and get working people of power plant out of danger quickly and efficiently. A disorderly evacuation under emergency condition can lead to confusion, injury and property damage.

b. Possible Situations:

A wide variety of emergencies both man-made and natural may require a workplace to be evacuated. These emergencies include but are not limited to fires, bomb threats, toxic material releases etc.

c. Responsibilities:

1. Observer or First on Scene

- Activate alarm from local panel to inform CCR if it is not activated or Inform CCR by radio, telephone 111or 222, by paging system, then call. If cannot do all above, shout loudly to alert the colleagues.

- Try to understand the type of emergency and communicate to CCR as detailed as possible.
- Location, extent and type of Fire / Accident / Incident
- If it is safe to fix the problem, try to fix it without putting anyone at Risk.
- When relieved by emergency response team, proceed to assembly area.

2. On Duty CRE

- Respond to the alarm / call.
- Arrange available emergency response team
- Arrange fire tender to the scene
- Arrange to sound emergency siren
- Inform Doctor and arrange ambulance
- Inform emergency team leader and fire chief.
- Inform Safety and Security Team Leaders.
- Inform to the security gates and Reception, and will request to stop the entrance of contractors/visitors. Also brief the security for Fire tender and ambulance and for plant entry sheets.
- Start Ground activities.

  Note: CRE will coordinate the ground activities till emergency team leader comes. If due to operational activities or manpower shortage it is difficult for CRE to go out, he will nominate any area engineer to coordinate the ground activities.

3. Emergency Response Team

- Proceed to scene of incident.
- Select a leader and act under the instructions of leader till Fire chief arrival.
- Communicate on Radio.
- Give necessary assistance e.g. Evacuation, first aid etc.
- Report to Emergency Team Leader when incident is under control.

4. Fire Chief

- Communicate using the radio.
- Appoint himself as External Aid Service Coordinator/ Mutual Aid Coordinator.

- Assist with the follow up services as required.
- Do liaison with Incident Controller/ Emergency Main Controller and provide any specific advice or technical expertise as may be required.
- Ensure 24 hrs coverage of the control center during an Extended Emergency.

5. Emergency Team Leader

- Proceed to scene of incident.
- Communicate by using radio.
- Emergency Team Leader or his designee will announce the category of the incident if it is 1 or higher.
- Appoint himself as Incident Controller.
- Inform other team leaders and Plant Manager.
- Guide Fire Chief for positioning Emergency Services / Fire Fighting.
- Nominate a person for head count.
- Coordinate Emergency response team.
- Help in Search and Rescue.
- Do identification of casualties.
- When Incident scene is in secure position, announce EMERGENCY OVER or "ALL CLEAR".
- Plant if previously shutdown due to emergency shall be started as per standard procedure recommended by OEM.
- Assist with investigation.

6. Plant Manager

- Proceed to emergency control center (CCR or nominated control center).
- Communicate by using radio.
- Declare himself as Emergency Main Controller.
- Alert mutual aid partners.
- Check call out response.
- Support the on scene response.
- Brief the security services.

- Maintain regular contacts with all the team involved in controlling the incident.
- Liaise with local authorities.
- After examining the emergency, he will declare the shift people evacuation.
- When incident is secure, announce "ALL CLEAR".
- Commence investigation of the incident.

7. **Doctor**
   - Respond to call out.
   - Carry out specified task and report to assembly area.
8. **All Site Personnel (Except shift people)**
   - Make safe exit and report to assembly area
   - Assist as required.
   - If required, after head count, will be evacuated to safe place.

   Note: People before leaving will make sure their work area is in safe condition and equipment they were using is in safe position.

9. **All people** are responsible for the contractor people working in their area to guide them to the assembly area.

   The person receiving visitors to the site will be responsible for the visitor's health and safety.

10. **All shift personnel** will report in CCR for head count. They will remain on duty to continue operation of plant or shut down activities as required unless main emergency controller (Plant Manager) asks them to evacuate.
11. **All Contractors:** Contractor workers will be made aware of Emergency Response Plan prior to commencing the work. Prior to leave the site they will ensure that their work area is in safe position. On emergency call they will report in assembly area.
12. **Roll Call at Assembly:** To ensure that all personnel are accounted for and searches mounted for any missing persons, a head count after any evacuation, must be carried out.
13. **Responsibility of Plant Security System:**
    - Security Team Leader shall pass necessary information to Security Supervisor.

- Security Supervisor or his designee will collect the plant entry sheets in case of emergency and submit at assembly area.
- Small gate near admin building can be opened in case of emergency. For this purpose key should be kept on reception.
- Security Guards should not block the people, in case of emergency exit from the plant.
- Security Guards should not block the entrance of fire tender and/or ambulance and its crew and the persons permitted by the Incident Controller having **RED BADGE**.
- Information should be given to security gates about the emergency situation and ALL Clear announcement.
- Security Guards should not leave the gate without the permission of Security Team Leader or his designee.

14. **Annual Drill:** An annual drill will be conducted to test the emergency program and its record will be kept with Emergency Response Team for at least one year.

9.2.1 Evacuation of Persons with Disabilities

After an evacuation call the disable people must be evacuated immediately and plant ERT team is responsible for whole coordination. The following guidelines should be considered when assisting people with disabilities during an evacuation. ERT team must be familiar with following guidelines;

- FIRST, communicate the nature of the emergency to the person.
- SECOND, ask the person how he would like to be assisted.
- THIRD, evacuate mobility aids with the person, if possible (i.e., crutches, wheelchairs).
- VISUAL IMPAIRMENTS: Describe the nature of the emergency and offer to guide him to the nearest emergency exit. Have the person take your elbow and escort him, advising of any obstacles such as stairs, narrow passageways or overhanging objects. When you have reached safety, orient the person to where he is and ask if further assistance is needed.
- HEARING IMPAIRMENTS: Some buildings are not equipped with flashing light alarms, and persons with impaired hearing may not perceive that an emergency exists. Communicate with the person by writing a note or through simple hand gestures.

- PERSONS USING WHEELCHAIRS: Ask the person what method of assistance he prefers. Some people have minimal ability to move, and lifting them may be dangerous. Some people who use wheelchairs have respiratory complications and should be immediately escorted out of buildings that contain irritating smoke or fumes. If the person wants to be moved in his wheelchair, keep the following considerations in mind:

  1. Ask if he wants to move forward or backward down stairs.
  2. Wheelchairs have many movable or weak parts so while moving the wheel chairs, a proper care must be taken. Some people have no upper trunk or neck strength.
  3. For a person using wheelchair may be moved through Ambulance in emergency or in case of plant evacuation.

9.2.2 Evacuation in Case of Adverse Weather Condition

A. In the event of an adverse weather emergency or flood emergency on plant, the plant manager or CEO, or their designee, will initiate the appropriate announcements concerning the emergency flood warning or hurricane warning and the instructions for preparation and/or evacuation when and if necessary.

B. In the event of a major weather emergency or disaster, the Safety team leader will coordinate with the local or state authorities and plant people.

C. Any personnel who discovers an emergency weather condition or problems like flood due to severe weather or facilities damage, should follow these procedures:

  1. Stay out of the area. Do not enter until electrical power has been turned off.
  2. There is an extreme danger of electrical shock if the water has contacted any electrical devices. Post people at all entrances to the flooded area to prevent entry by unauthorized personnel.
  3. ERT team personnel will be responsible for pumping water out of the area.
  4. Identify a temporary shelter to house water-soaked materials.

9.2.3 Fire Response Program

a. Purpose:

To provide for safety against potential fires and minimize the risks of damage or injury to personnel or equipment in the event of a fire at project facility.

b. Classifications of Fire:

FIRE CLASSIFICATION	
Fire Classification	**Description**
A	Solid combustible materials that are not metals like, Paper, wood, cloth, etc. where quenching by water or insulating by dry chemical is effective. (Class-A fires generally leave an Ash)
B	Any non-metal in a liquid state, on fire. This classification also includes flammable gases like, gasoline, oil, grease , acetone etc (Class-B fires generally involve materials that Boil or Bubble)
C	Live electrical equipment where the non-conductivity of extinguish ant is vital.
D	Material used in laboratories like, potassium, sodium, aluminum, magnesium. It takes special extinguishing agents (Metal-X, foam) to fight such a fire.

c. Responsibilities

The responsibilities of observer or First on Scene, CRE, ERT, Fire Chief, Emergency Team Leader, Plant Manager, Doctor. The responsibilities of other areas are as follows,

1. Observer or First on Scene

See section 8.1(a) for Observer or First on Scene responsibilities. Other responsibilities are,

In case of Minor Fire:

Minor fire is one that can be extinguished with portable extinguisher.

- Inform CCR.
- Extinguish the fire by using suitable extinguisher.

In-case of Major Fire:

Major fire is one that cannot be extinguished with portable extinguishers alone.

- Inform CCR.
- Check Automatic fire system operated or not, if not operate it.

2. On Duty BOP Engineer

- In case of fire he must arrange make up water for filtered water basin.
- Check the fire pumps performance.

3. In case of HFO or HSD Tanks Fire

- Foam Area Alarm will receive in CCR.
- CRE will inform Area Engineer, Area Engineer will confirm the Heat detection Alarm for Fuel Tank and Smoke physically. Then intimate to CRE about Fire. With the consent of CRE, Area Engineer will pull the Pull Station either inside the foam shed fire panel or from near the tank. Area Engineer will then confirm the water/Foam flow towards the effected Fuel Tank.
- Start water sprinkling through ground monitor, fire tender or from fire hoses, if required.

Note: Each fire breakout must be reported as per Incident / Accident Reporting Procedure before the end of shift.

4. HVAC:

Operation of the fire alarm in the buildings having HVAC system automatically shuts down the HVAC and ventilation fans, in order to clear the smoke when the main fire outbreak is extinguished, the ventilation fans may be started. The switches of these fans MUST NOT ARE OPERATED except on the instructions of the Incident Controller or CRE.

Fire in Community:

Following sequence of events will be observed during any emergency,

- Inform CCR.
- A small fire can be extinguished with the dry chemical Fire extinguisher available in houses.
- Fire response team will handle the situation with Fire tender if required.
- Fire tender make up can be done from nearest Fire hydrants.
- Orderly evacuation of the building.
- Head count at designated assembly point.
- Search and Rescue.
- Identification of casualties.
- Medical Care for injured.

- Security of building, prevent unauthorized entrance.

Note: The community fire water system has five (5) hydrants strategically located. These hydrants have approximately 30-PSI water pressure.

9.3 FIRE / EMERGENCY SYSTEM INSPECTION, TESTING AND MAINTENANCE PLAN

a. Purpose:

This document establishes the minimum requirements for the periodic inspection, testing, and maintenance of fire protection systems

b. Scope:

The purpose of this document is to ensure healthiness and to provide requirements that ensure a reasonable degree of protection for life and property from fire through minimum inspection, testing, and maintenance methods for fire protection systems.

c. Fire System Testing and Preventive Maintenance Plan:

Item	Activity	Responsible	Frequency
Sprinklers	1. Inspection for corrosion, paint, physical damage 2. Replace faulty one.	Maintenance	Annually
	1. Nozzle discharge pattern and direction. 2. Automatic & Manual system test. 3. Record the response Time.	ERT, Operation	Annually
Alarm Devices	Inspection for physical damage and calibration.	I&E	Annually
	1. Testing the water flow alarms 2. Pressure switches signals	I&E, ERT, Operation	Quarterly
Gauges	1. Calibration	I&E	5 yearly or when required

Item	Activity	Responsible	Frequency
Strainers, Filters	Inspection & Cleaning	Maintenance	Annually
Monitor Nozzles	Lubrication	Maintenance	Annually
	Test	ERT, Operation	Monthly
Fire Hoses	Test	ERT, Operation	Monthly
Hydrants	Test	ERT, Operation	Annually
	Lubrication	Maintenance	Annually
Fire Pump	Auto Cut In Test for 30 minutes.	Operation	Weekly
	Preventive Maintenance	Maintenance	
Foam System	1. Foam Sample 2. Foam Concentration Testing 3. System Testing 4. Manual Actuation devices Test	ERT, Operation	Annually Annually Quarterly Annually
Deluge Valves	Full Flow Test	ERT, Operation	Annually but not exceed from 3 years.
	Preventive Maintenance	Maintenance	Annually
Foam Chambers at Fuel oil Tanks	Cleaning	Maintenance	Annually
Valves	Lubrication of outside screw and Yoke.	Maintenance	Annually
Check Valves	Internal Inspection	Maintenance	5 yearly

Item	Activity	Responsible	Frequency
Heat & Smoke detectors	Preventive Maintenance	I&E	Annually
Cl_2 leak detectors	PM and Testing	I&E	Annually
CO_2 cylinders for CCR	Weight & Inspection	ERT, Operations	Annually
Fire Protection System Log	Readings as per standard sheet (attached)	Operation	Quarterly
Pull Stations	Preventive Maintenance	I&E	Annually

d. Fire / Emergency System Audits and Follow up:

Item	Activity	Responsible	Frequency
Fire Extinguishers	Inspection & Follow up	Safety Committee	Monthly
Fire Cabinets	Inspection & Follow up	Safety Committee	Monthly
Emergency Shower/ Eye wash	Inspection	Safety Committee	Monthly
Exit Light	Inspection	Safety Committee	Monthly
SCBA	Inspection & Follow up	ERT	Monthly
Plant Paging System	Audit, Inspection & Follow up.	ERT	Monthly
Fire Alarm Panels	Audit and Follow up for any standing Alarm	ERT	Monthly
Fire Tender	Check List & Maintaining	ERT	Weekly
Fire House Stock for Fire Extinguishers and	Check List and Maintaining	ERT	Monthly or when required.

Item	Activity	Responsible	Frequency
SCBA			
Exit Light Audit	Inspection	Safety Committee	Monthly
Cl2 Cylinder Repair kit	Inspection	ERT	Monthly

9.4 CHEMICAL SPILL / RELEASE RESPONSE PROGRAM

a) Purpose:

- Although every effort is made at site to prevent spills of potentially hazardous chemicals or fuels in the workplace, accidents resulting from the release of chemicals can occur. This procedure is provided to mitigate the effects of spills of potentially hazardous chemicals in workplace.

b) Minor Spill:

- A spill of solid or liquid materials which involves the release of a type or quantity of a chemical which does not pose an immediate risk to health and does not involve chemical contamination to the body

c) Major Spill / Release:

- A spill of solid or liquid materials which involves:
- Release of a type or quantity of a chemical that poses an immediate risk to health
- An uncontrolled fire or explosion

d) Major Spill Release:

- Heavy Chlorine Leak
- A major Oil leak where there is a contamination of the drains or outbreak of fire or explosion.
- A Hazardous Chemical Leak that is thought to be a hazard to personnel.

e) Response Program:

1. **In case of Minor Oil Leakage or Hazardous Material:**
   - Inform CCR.
   - Locate the source of the spill, and stop the spill.
   - Close secondary containment drain valve.
   - Remove ignition sources and unplug nearby electrical equipment.

- Establish exhaust ventilation. Vent vapours to outside of building.
- Choose appropriate PPE (goggles, face shields, gloves, clothing, etc).
- Make arrangement to collect or dispose off the spilled hazardous substance safely and properly as per procedure contained in section-16 "Hazardous Substances Handling Procedure".
- In case of Major Fire, follow "Fire Response Program" along with " Emergency Evacuation Plan"

2. **In case of Major Oil Leakage or Hazardous Material:**
   - Inform CCR
   - CRE will inform to other plant people and worker in shift
   - Isolate the area
   - Close secondary containment drain valve
   - Remove ignition sources and unplug nearby electrical equipment
   - Establish Exhaust vapour source, if possible
   - Choose appropriate PPE
   - Make arrangement to collect or dispose off the spilled hazardous substance safely and properly as per procedure contained in section-16 "Hazardous Substances Handling Procedure".
3. **Spills involving Injured People:**

   If a spill involves personal injury, follow the procedures appropriate to the type of spill above and, concurrently;
   - Move the victim from the immediate area of the spill (if this can be done without further injury to the victim or emergency response people).
   - Locate the nearest emergency eyewash or safety shower.
   - Remove any contaminated clothing from the victim and flush all areas of the body contacted by chemicals with high volumes of water for at least 15 minutes.
4. **In case of Chlorine Gas release**

   A leak on a Chlorine cylinder would require a kit designed for this purpose. The team will have to be trained in its use and practice occasionally to be proficient with this equipment. If the cylinder has a liquid leak the leak can be rolled up to minimize the cloud escaping. Depending on wind conditions, a shelter in place may have to be called for the community until the cylinder has depressurised.

The team should wear the SPPE if an attempt is made to apply the cylinder kit. If the decision to lessen the cloud with water fog sprays, the spray must be put on the gas cloud, NOT on the cylinder or directly on the leak.

Following sequence of event will be observed during any emergency,

- Inform CCR.
- CRE will inform to Emergency Response Team, other plant people and Lal Pir people in shift.
- In case of leakage in Chlorine cylinder room, open fire water sprinklers.
- Fire response team will fix the problem by using Cl2 leak fixing kit available in Cl2 rooms of both units.
- Incident Controller will announce if evacuation is required. (Follow Emergency Evacuation Plan)

SECTION -10
CONCLUSION AND RECOMMENDATIONS

10 CONCLUSION AND RECOMMENDATIONS

The project embarks upon the installation of 49.8 MW cogeneration Bagasse based power project. On the basis of this IEE Report it is concluded that:

1- There are no sensitive elements/segments of environment around the project site.

2- The project has inbuilt efficient, state of the art and reliable mechanisms to control all type of pollutants like PM, gaseous emissions and noise in compliance levels well within the PEQS limits of the Pakistan.

3- The project shall not increase the load on the ground water table as the existing water resources will be utilized for the new project activity.

4- EMP and EMtP as recommended in this IEE Report are to be put in place during the entire operation of the project.

5- Quarterly monitoring of all out environmental pollution sources by a third party also certifies that the project will run in accordance with legal requirements.

6- The regular environmental monitoring for the existing plant ensures the environmental soundness of the project.

7- The use of bagasse as main fuel for the operation of the power plant will displace fossil-fuel based electricity generation.

8- EMP and EMtP, as recommended in this IEE Report, are to be implemented during construction and operation phases. This will manage all type of pollutants.

9- The proposed power plant will improve the economic status of the region and also contribute significantly to the overall economic growth of the country, when due to acute shortage of electric power long drawn out load sheddings are salient feature across the entire country. This state of affairs is resulting in huge economic loss to the national exchequer in the form of taxes and duties and drastic decrease in Industrial Productivity resulting in cut of the foreign exchange earnings, joblessness especially among the workers and related socio-economic issues.

Under the light of detailed discussions in IEE Study about likely impacts of the proposed project intervention, it can be safely concluded that the proposed Project would not cause any significant adverse impacts for which detailed IEE is required. On the basis of the facts summarized as above, the project merits for issuing No Objection Certificate/Environmental Approval by the Environmental Protection Agency, Government of Punjab Lahore.

TERMS OF REFERENCES

Listed below are some of the documents, reports and other references consulted during the preparation of this report:

a. Information and data provided by project proponents;

b. Project Pre-feasibility Study Report;

c. Technical Design Data related to the project.

d. Information gathered through discussions with the project related persons of the project proponent;

e. Discussion with concerned government officials;

f. Information collected from the Technical documents of various suppliers of machinery/equipment.

g. Guidelines for Self- Monitoring and Reporting by the Industry (SMART)," Final Report, March 1998, approved by Pakistan Environmental Protection Council (PEPC), August 1999;

h. National Environment Quality Standards for Municipal and Liquid Industrial Effluents, Statutory Notification (S.R.O.), Government of Pakistan, Ministry of Environment, Local Government and Rural Development, S.R.O.549 (1)/2000, Islamabad, the 8th August 2000;

i. National Environment Quality Standards for Ambient Air November 2010;

j. National Environment Quality Standards Noise Levels November 2010;

k. National Environment Quality Standards for Drinking Water November 2010:

l. Pakistan Environmental Protection Act, 1997;

m. The Punjab Environmental Protection (Amendment) Act 2012 covers aspects related to:

- the protection, conservation, rehabilitation and improvement of the environment and the prevention, control of pollution and promotion of sustainable development;
- establishing complete regulatory and monitoring bodies, policies, rules, regulations and national environmental quality standards; and
- to ensure enforcement, the act establishes regulating bodies i.e. Punjab Environmental Protection Council (PEPC) and responsible bodies i.e. Punjab Environmental Protection Agency (Punjab EPA) at Provincial level.

a. Land Use Policies and Environmental Legal Framework including;

b. Environment related Laws in Pakistan and the Province of Punjab;

c. The Pakistan National Conservation Strategy, Environment and Urban Affairs' Division (presently- Ministry of Environment, Urban Affairs and Wild Life), Government of Pakistan, Islamabad;

d. Standard Methods for the Examination of Water and Wastewater, 19th Edition, 1995, Prepared and published jointly by: American Public Health Association, American Water Works Association, Water Environment Federation; Publication office: American Public Health Association, 1015 Fifteenth Street, NW Washington, DC 2005;

e. Government of Pakistan, Pakistan Environmental Protection Agency, Policy and Procedures for Filing, Review and Approval of Environmental Assessment, 2000;

f. The Canal and Drainage Act, 1873;

g. Environmental Assessment Requirements and Environmental Review Procedures of the Asian Development Bank, 1993;

h. Google Earth, Maps.

i. Guidelines for Public Consultations - These guidelines cover:

- Consultation, involvement and participation of Stakeholders
- Techniques for public consultation (principles, levels of involvements, tools, building trust)
- Effective public consultation (planning, stages of EIA where consultation is appropriate)
- Consensus building and dispute resolution.

j. Factories Act, 1934;

k. Applicable International Environmental and Occupational Safety and Health Laws and Regulations;

l. Applicable International Environmental and Occupational Safety and Health Laws and Regulations;

m. Pollution Prevention and Abatement Handbook, The World Bank, 1998;

n. International Finance Corporation's Policy on Energy and Social Sustainability, January 1, 2012;

o. National Resettlement Policy (Draft), Government of Pakistan, March 2002.