PREFEASIBILITY REPORT

For

M/s Harsha Sugars Ltd.,

For

THE EXPANSION OF SUGAR CANE CRUSHING FROM 4500 TCD TO 7500 TCD AND 14 MW COGENERATION UNIT TO 30 MW COGEENRATION, ESTABLISHMENT OF 60 KLPD DISTILLERY ALONG WITH INSTALLATION OF INCINERATION BOILER TO GENERATE 3 MW POWER

at

Sy No 411/1, 411/2, 413/1, 412, 411/3, Savadatti Village, Savadatti Taluk, Belgaum Dist, Karnataka.

PREPARED BY

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1. Executive Summary

M/s Harsha Sugars Ltd., have obtained Consent for establishment for the establishment of 4500 TCD sugar cane crushing, 14 MW cogeneration unit. Now based on the demand, management has decided to expand the project from 4500 TCD to 7500 TCD sugar cane crushing and 14 MW to 30 MW cogeneration unit, 60 KLPD distillery and 3 MW power by the installation of incineration boiler.

Sl.No	Items	Particulars
1	Objective of the Project	**Expansion from 4500 TCD to 7500 TCD sugar cane crushing and 14 MW to 30 MW cogeneration unit, establishment of 60 KLPD distillery and 3 MW power by the installation of incineration boiler.**
2	Promoters	**M/s. Harsha Sugars Ltd**
3	Total Investment , Rs	**Rs 307.32 Crores (Rs. 62.32 Crores for expansion)**
4	Project location	**Sy No 411/1, 411/2, 413/1, 412, 411/3 Savadatti Village, Savadatti Taluk, Belgaum Dist, Karnataka.**
5	Extent of land	**The total land area already available is - 51.3 Acres**
6	Man Power	**470 Nos (200 nos for expansion)**
7	Water demand and Source	**724 KLD during Season 1567 KLD during Off-Season For 60 KLPD distillery: 480 KLD Sources: From Malaprabha River from Renuka Sagar Reservoir**
8	Power supply	**The total power required for the proposed project will be 500 kwh – for construction phase from HESCOM During Season : Power Generation : 30 MW Power Consumption at Co-Gen Unit : 3.0 MW (10% on generation) Power Consumption for Sugar Unit : 5.2 MW (24 units/Ton of Cane) Power Export :21.8MW During Off - Season : Power Generation : 30 MW Power Consumption at Co-Gen Unit : 2.4 MW (8% on generation) Power Consumption for Sugar Unit : 0.5 MW Power Export : 27.1 MW**
9	Co-ordinates of the project site boundary	**15°43'17.97"N 75° 3'31.82"E; 15°43'19.46"N 75° 3'51.61"E; 15°43'6.10"N 75° 3'28.48"E; 15°43'5.99"N 75° 3'45.54"E**

2. Introduction of the Project/ Background Information

2.1 Identification of project and project proponent.

The Harsha Sugars Ltd., is originally incorporated as Private Limited Company on 8th Aug 2014 and subsequently converted into Public Limited Company on 30th Dec 2014 vide ‘Certification of Incorporation Number U15122KA2014PLC075717 issued by ‘Registrar of Companies, Karnataka, under Companies Act 1956. Company obtained business commencement certificate on 28th Jan 2015. The present capacity of the plant is 4500 TCD Sugarcane crushing with 14 MW Power Generation. The plant is under construction.

List of directors of the company:

SI.No	Name	Designation	Address
1	Mrs. Laxmi R Hebbalkar	CMD	27/B, Basava Kunj, Kuvempu Nagar Hindalga, Belgaum District Belgaum, Karnataka, India
2	Mr. Chennaraj B Hattiholi	ED	27/B, Basava Kunj, Kuvempu Nagar Hindalga, Belgaum District Belgaum, Karnataka, India
3	Mr. Robert Monis	Director	No 301, 3rd Floor, Vijayadurga Residency, Matthikeri, 14th Cross, SBM Colony, Opp JP Park, Bangalore, Karnataka India
4	Mr. Mohammed Ali Attar	Director	No 188 C2, Basavanagar, Gokak,District Belgaum, Karnataka

The integrated expansion project comprises of a sugar factory for the manufacture of white plantation sugar using Sugar Cane, thereby making available required bagasse for the Co-gen power plant. The command area of the proposed sugar mill has excellent irrigation facilities from Malaprabha River from Renuka sagar Reservoir, availability and potential for sustained cane supply & biomass materials like cane trash etc. And Bagasse generated during season shall be saved for Off-season operation of Co-Generation Power plant along with purchase Bagasse/Biomass.

The aggregated capital investment for the expansion project has been estimated at Rs.307.32 Crores.

2.2. Brief description of nature of the project.

M/s Harsha Sugars Ltd is located at Sy No 411/1, 411/2, 413/1, 412, 411/3, Savadatti Village, Savadatti Taluk, Belgaum Dist, Karnataka.

The total land area available is - 51.3 Acres. The area is almost flat land hence cutting-filling will be balanced and there will be no/low borrowing from nature.

The area of operation and cane cultivation is mostly irrigated by lifts, wells, and canals, Malaprabha River from Renuka Sagar Reservoir is at a distance of 5 kms from the site. The climate, soil, rains are favorable for sugarcane growth and sugar cane yield.

2.3. Need for the project and its importance to the country and / or region.

The demand for expanding sugar plant of capacity from 4500 TCD to 7500 TCD in Savadatti Village, Savadatti Taluk, Belgaum Dist, Karnataka. has been receiving encouraging support among the farming community due to the following reasons.

- Increase in area under sugar cultivation every year.
- Particularly the farmers are finding difficultly to sell their sugarcane in time.
- The viability of the sugar factory is improved due to cogeneration, which is also a need of the State to have more power to meet the growing power demand in the State.

The proposed factory is situated in the heartland of intensive sugar cane agricultural area. The site is well situated with Malaprabha River from Renuka Sagar Reservoir on the North at a distance of 5 kms.

The promoter felt the need for expansion of a sugar factory and now venturing into this project and also visualized the need to provide employment to the local population and improve the overall economy of the society in the area. After studying the necessity for such a factory and the profitability of the project promoter has decided to expand the sugar factory with Co-generation.

2.4. Demand-Supply

The existing Sugar factories could not crush all available cane from the areas of operation and hence, rest of the sugarcane is being taken to the sugar factories in neighbouring districts of Belgaum. Presently, the cane grown by farmers are diverting to the sugar factories located in neighbouring taluks, in this connection farmers are suffering like delay in disposal, less price, less payment etc., Thus, the farmers are facing problems of disposal of sugarcane in 3-4 seasons. This situation has demanded to need Sugar units at this area.
The demand for electrical power has been increasing at a faster pace after the country's economic development pace speeded up, especially in Karnataka which has been the hub of software services. The effective generation of power has not been meeting the demand and the same trend is expected to continue, especially during the peak hours and summer seasons. Hence, there is good scope for exporting power to the third parties using the state grid through power traders / purchasers.

2.5. Imports vs. Indigenous production

Not Applicable

2.6. Export possibility and Domestic / Export markets.

Not applicable. Will be used for domestic use

2.7. Employment Generation (Direct and Indirect) due to the project.

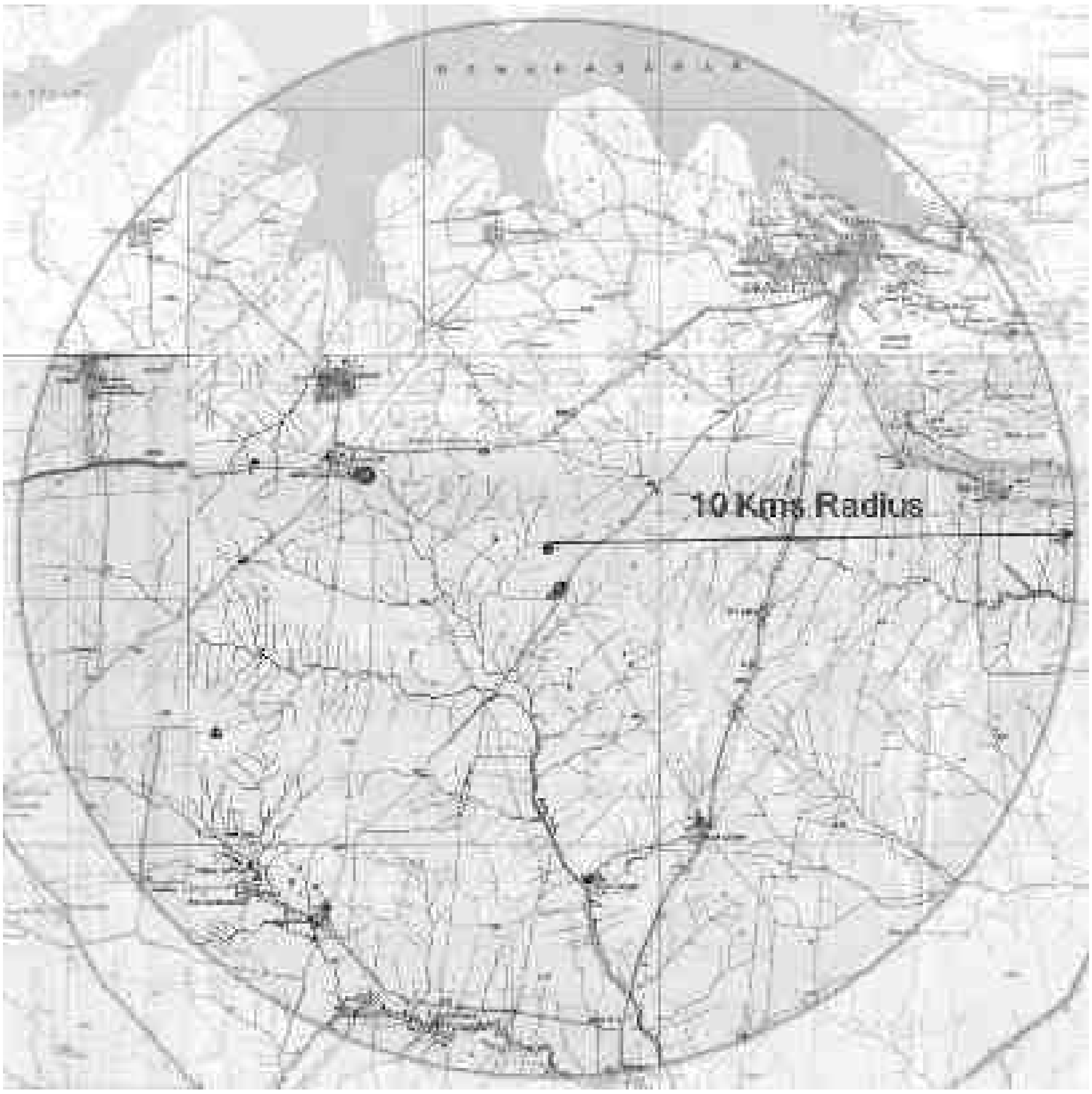
The direct employment will be about 200 no. of persons of all categories in addition to the existing 270 manpower, The Sugar Industry will have lot of Indirect Employment sources like, Raw material, Product and By-product handling contracts, Sugar Cane Cultivation, Harvesting and Transportation, etc.

3. Project Description

3.1. Type of project including interlinked and interdependent project, if any.

Not applicable

3.2. Location (map showing general location, specific location, and project boundary & project site layout) with coordinates.



Location of the Proposed Project site on Toposheet with 10 Kms radius demarcation (Toposheet No: 48 M/1, 48 M/2, 48 I/13, 48 I/14 Scale: 1:50,000)

Aerial View of the proposed project site

Existing Industry construction photographs

3.3. Details of alternative sites, considered and the basis of selecting the proposed site particularly the environmental considerations gone into should be highlighted.

Not applicable

3.4. Size & magnitude of operation

The industry is under construction stage. As per obtained CFE, the construction of 4500 TCD sugar cane crushing and 14 MW cogeneration unit is in progress. Now the management has decided to expand the same to 7500 TCD and 30 MW co-generation, installation of 60 KLPD distillery + 3 MW from incineration boiler.

3.5. Project description with process details (a schematic diagram/flow chart showing the project layout, components of the project etc) should be given.

Sugar manufacturing process

Sugar cane is the raw material for manufacture of sugar. Juice is extracted from the sugar cane, which is then processed to recover sugar. Bagasse, which is the left out fibre material after extraction of juice from sugar cane, is used as fuel in boiler to produce steam. Steam is used for generation of electric power and exhaust steam is used for evaporation of water in the juice.

The flow diagram of sugar manufacturing process is given in figure below. A brief description of the process is given below.

Crushing of Sugar cane

Sugar cane is harvested and dresses in the fields and then supplied to factories through lorries, tractor-trailers or bullock carts. Crushing takes place mainly in two stages; first preparation and then milling. Preparation is done in leveller, cutter and fibrizer. The prepared cane is then crushed by passing through mills. Hot water is added in the course of crushing as imbibition water for better extraction of juice from sugar cane. After crushing, the bagasse is sent to boiler as fuel and juice is sent for purification & recovery of sugar.

Juice Clarification

The weighed quantity of juice is primarily heated to 70-75^{o}C in juice heaters and then treated with sulphur and lime. Then the treated juice is again heated to 100- 102^{0} C in another set of juice heaters. The hot juice is sent to clarifier. Clarified juice is decanted out and sent for evaporation in a set of multiple effect evaporate bodies. The juice of 15^{o} Brix is concentrated in the evaporators to syrup of 60^{o} Brix.

Crystallization

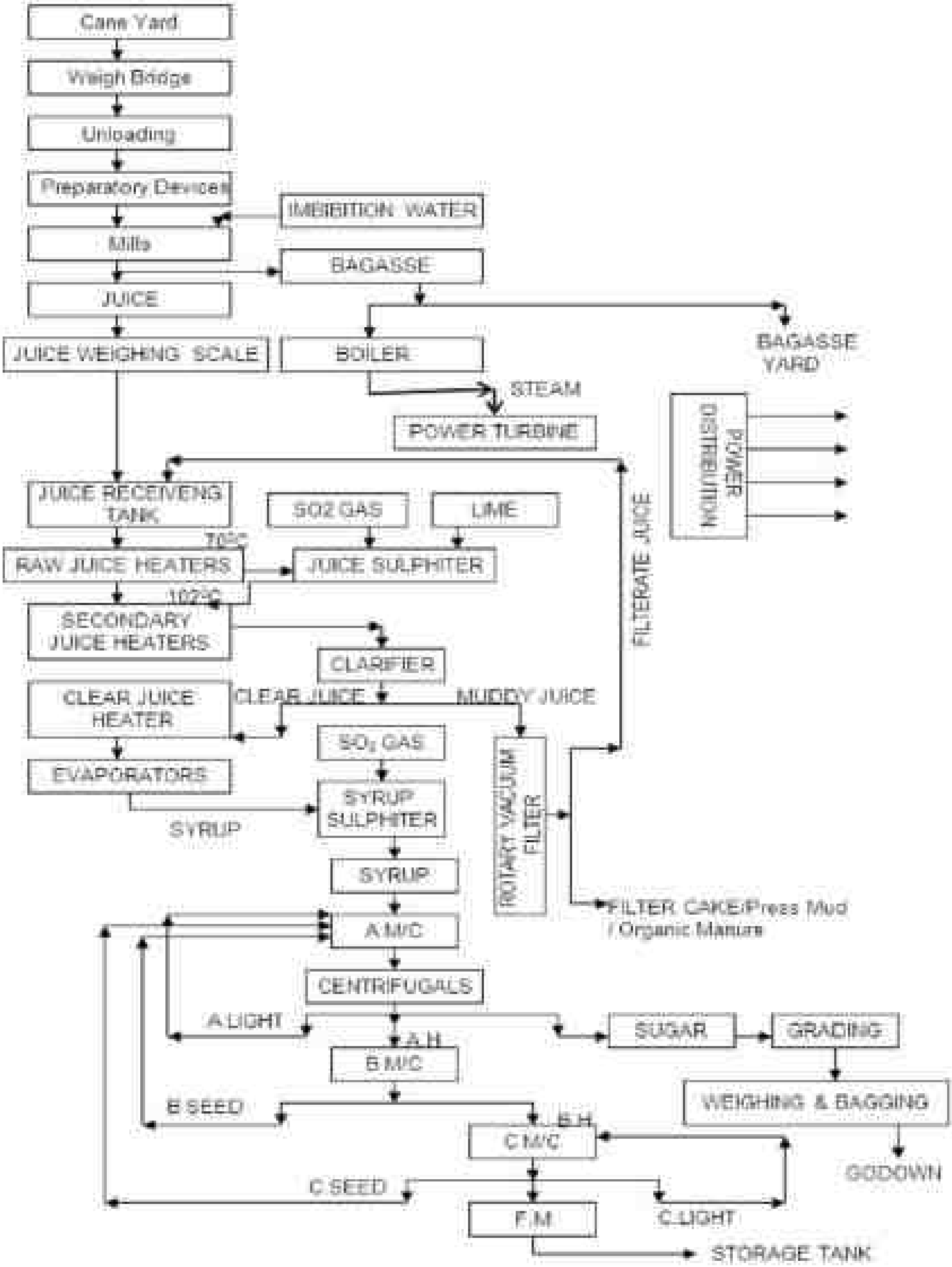
The syrup is sent to pan floor for further concentration in vacuum pans. The syrup collected in supply tanks is taken to pans for boiling where the syrup concentrates and attains super saturation stage. In such a condition sugar grains are formed in the syrup. The syrup mass with sugar particles is called massecuite. The massecuite is dropped in crystallizers and cooled to complete the crystallization.

Curing or Centrifuging

Massecuite is taken into the high speed centrifugal machine. Sugar crystals are separated from mother liquor and sent to driers. Non crystallisable matter from the massecuite called molasses, is drained out from the centrifuge. The molasses is weighed and sent to storage tank.

Drying, Grading and Bagging

Sugar is dried in the vibrating hopper and graded by passing through standard sieves. The graded sugar is bagged, weighed for 50/100 Kgs net, stitched, numbered and stacked in sugar godown.



Process Flow diagram of Sugar industry

Operation data of the plant after expansion			
Sr No	**Description**	**Unit**	**Qty**
1	Crushing capacity	TPD	7500
2	Crushing rate (hourly crushing)	TPH	340
3	Duration of crushing season	Days	180
4	Duration of Cogen during off season	Days	60
5	Sugar % cane (recovery)	%	11
6	Bagasse % cane	%	30
7	Molasses % cane	%	4

8	Press mud % cane	%	4
9	Bagasse required for juice filtration and handling losses % on cane	%	1
10	Bagasse saving % on cane	%	8
11	Net Bagasse available for steam generation	%	21
12	Steam working pressure	Kg/cm2	110
13	Steam Temperature	°C	525 ±10^0 C

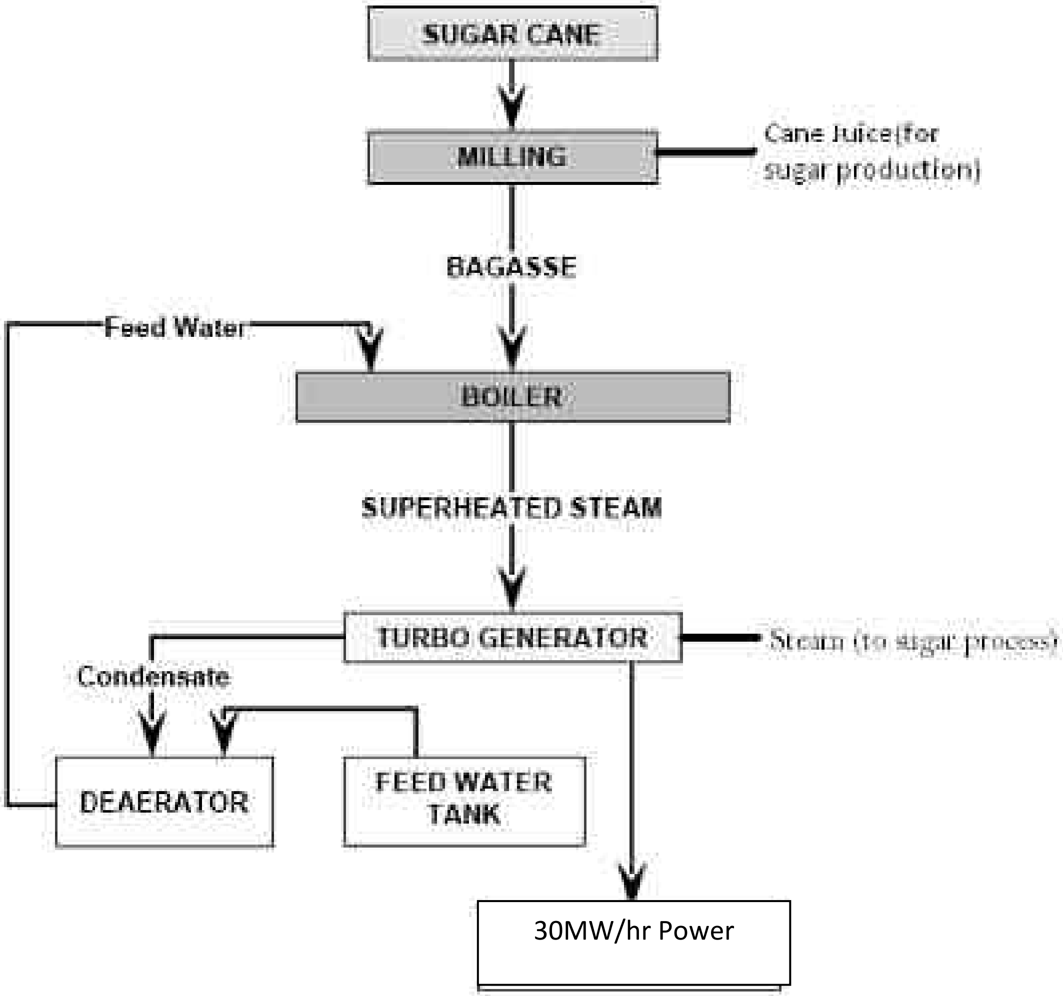
Crushing season operation

1	Sugar process steam requirement	TPH	14.0
2	Net Bagasse available for steam generation	TPH	98.0
3	Steam required	TPH	190
4	Total steam inlet to Turbine	TPH	186.0
5	Bagasse required	TPH	49.95
6	Bagasse saving	TPH	52.36
7	**Total Power Gen.**	MW	30.0
+	Power consumption (captive power) a) Sugar plant and auxiliaries b) Cogen plant and auxiliaries	**MW** MW MW	**8.2** 5.2 3.0
8	Power Exportable	**MW**	**21.8**
9	Duration of crushing season	Days	180
10	Avg. Cane crushed per annum	Lakh MT	13.5
11	Sugar Production /annum	Tonn	148500
12	Power /annum (season only)	MW	142560
13	Molasses Production / annum	MT	54000
14	Press mud sale / annum	MT	54000

Description of operating Scheme:

a)	The plant operating schemes envisages additional milling tandem of Dia 36” X 72” X 4 Nos with TRPF. These are capable of sugar cane crushing @ 7500 TCD
b)	Juice clarification, Sulphitation, Evaporation, Boiling & Centrifugal equipments have been considered on the basis of peak crushing with 10 – 11.5% recovery.
c)	During the conversion process from juice to sugar, molasses will be produced as a byproduct at the rate of 4% on cane which will sold to the Distilleries. At the same time during clarification of juice the filter cake (press mud) will be generated at the rate of 4% on cane and this will be sold to the cultivators as manure.
d)	The end product white crystal sugar is produced at the rate of 11% on cane. White crystal sugar will be bagged & stored in the go downs (temporary storage) & depending upon the market situation it can be sold out.
	The byproduct bagasse will be generated at the rate of 30% on cane & it will be utilized for generating steam as well as power to meet the process requirement which is known as Cogeneration.
e)	The cogen scheme envisages one 140 TPH capacity boiler with the outlet steam parameters of 110 kg/cm2 & 525^o C. with the feed water inlet temperature of 110^o C. It also envisages One TG sets having capacity of 30 MW extraction cum Back pressure TG set, considering the peak crushing capacity of 340TCH. The Cogen plant will be designed with all the auxiliaries for the boiler. TG set with all the auxiliary plants & systems like the fuel & ash handling system, cooling water system, feed water system, raw water system, DM water system, instrument air system & electrical systems.
f)	The new cogen turbine will be back pressure cum condensing type at 2.5 ata for

	meeting the entire 2 ata process steam requirement of the sugar factory & an PRD for at 9 ata for meeting the entire 8 ata steam requirement of the sugar factory.
Operation of the Plant During Crushing Season:	
a)	The entire steam generated in the boiler is fed to extraction cum back pressure TG set.
b)	With the above given steam input & extractions from the turbine, the cogen TG generates 30.00MW, at the generator terminals. Part of the generated power is used for meeting power requirement of the auxiliaries of the cogen plant & the power requirement of the sugar factory.
c)	As discussed, only the exhaust steam condensate from the sugar factory process is planned to be used as the feed water for the boiler. The cycle make up water for the operation of cogen plant will be DM water.
Fuel Availability	
	• In the proposed cogeneration plant, it is suggested to procure bagasse fired boiler. In future if factory propose to use biomass fuel then combination of fuel like cane trash & agro waste can be used. If it is possible to collect cane trash of at least 50 % of total trash production in the field it gives substantial reduction in Bagasse consumption. • Agriculture waste is also available in the nearby area, like fire wood, rice husk, jaggery Bagasse etc.
	Stack Details: Chimney of 85 mts height for the 140 TPH boiler already exists



Process flowchart of Cogeneration process

DISTILLERY SECTION

Process description

Ethanol production mainly involves three main processes:

1. Fermentation
2. Primary Distillation for production of Rectified Spirit. (R.S.)/E.N.A.

Molasses Storage and Handling:

Molasses is generally stored in Steel tanks. It is proposed to install Molasses storage capacity (4 X 5000 MT). Molasses is then pumped to the Molasses receiving tank in the fermentation section.

Fermentation

Fermentation is a critical step in a distillery plant. It is here that yeast converts sugar present in molasses into ethanol. Fermentation practices vary depending upon the raw material, ambient temperatures and end product requirement. The Fermentations consists of following steps:

a. Molasses weighing.
b. Yeast propagation and Pre Fermentation
c. Fermentation

A Load cell based system is to be provided for weighing of molasses with provision for totalizing molasses consumed in a day. This weighed molasses is distributed to yeast propagation section, pre-fermentation and fermentation section.

Yeast Propagation:

Yeast propagation section comprises of three culture vessels, Pasteurization and cooling facility. During fermentation start up, yeast is grown in yeast propagation section. The grown yeast is transferred to pre-fermentation stage (Yeast activation vessel).

Fermentation of Molasses for Production of Alcohol Cane molasses by itself will not ferment on its own without dilution, as the sugars and salts exert a very high osmotic pressure. It is therefore necessary to dilute the molasses to below about 25° Brix. Above this point the yeast will not start fermenting rapidly, contamination may develop before the yeast had a chance to get established, as molasses is laden with contaminating bacteria.

Typically, molasses is diluted and allowed to ferment using yeast. The yeast converts sugars into alcohol under anaerobic conditions, while it multiplies itself under aerobic conditions. Fermentation is carried out under controlled conditions such as temperature, pH, yeast cell concentration, sugar concentration, and solid's concentration in the fermenter. These conditions are maintained in the fermenter so as to maximize efficiencies and obtain higher yields and productivity. However, there are many factors that affect fermentation. These are:

- Molasses composition.
- Water Quality.
- F/N ratio of molasses.
- Bacterial count, Volatile acidity or other key influencers during fermentation process.

The fermentation efficiency generally is in the range of 88-90% provided all the factors influencing the fermentation process are under control.

During the last decade, interesting developments have taken place in the field of technology of fermentation of alcohol, which promise high yield of alcohol, better efficiencies, economy in steam consumption and better quality of spirit produced.

Process

Raw molasses from the storage tank is pumped to the molasses weighing system where exact weighing of molasses going into the fermentation system is achieved. Weighed molasses is then pumped to a static molasses dilutors attached to each fermenter where it is mixed with water / fermentation wash so as to achieve proper concentration of fermentable sugars in the dilute molasses. Typically, this is a four fermenter system. Process water is also added to first one or two fermenters. The fermenters are agitated using agitators and recirculation pumps.

Process water is used to scrub the total outgoing carbon dioxide so as to recover the alcohol vapours in CO_2. This water is then led to wash holding tank. Nutrients & sulfuric acid etc., are fed to the first fermenter by metering or dosing pumps. In this manner by controlling parameters like molasses and water flows, pH, Nutrient and temperature, alcohol concentration between 5.5 and 8.5% v/v is maintained in first and last fermenter respectively. Temperature of the individual fermenters is maintained in the desired range of 34 to 36ºC by re-circulating the fermenting wash through the individual plate heat exchangers. A separate cooling tower and pump is used for recirculation of cooling water for maintaining fermenter temperature.

The fermented wash with 9-10 % v/v alcohol is then fed into the degasifying column top for distillation.

Average fermentation time is about 22-24 hrs. Advantages of this system are that it quality of spirit. Power requirement is lower as compared to the process with yeast recycling.

CO_2 recovery from fermentation section

CO_2 Recovery Plant takes CO_2 gas from the fermentation process passes through a series of purification processes namely - a stainless steel CO_2 foam trap to separate the gas, a deodorizer. At the same time, CO_2 with a very high degree of purity is indispensable for the production process in a modern brewery. With CO_2 recovery plants efficient carbon dioxide treatment: maximum purity with lowest O_2 content and maximum yield will be achieved.

In several steps the carbon dioxide gas is purified thoroughly, so that it complies even with the strict demands of the brewing industry. From the fermentation tanks the CO_2 is first led to the foam separator. In this stage, the foam entrained from the fermentation tanks is separated. Through low-pressure gas storage balloon the gas flows into the gas scrubber, where it is cleaned by counter flow of water. In the gas scrubber water-soluble impurities and aerosols are absorbed from the carbon dioxide.

Distillation

The next stage in the production of alcohol is to separate alcohol from fermented wash and to concentrate it to 96% alcohol called rectified spirit (RS)/Extra neutral alcohol (ENA). Rectified spirit is industrial alcohol and ENA is more purified and is used for potable purpose especially for manufacturing IMFL (Indian made foreign liquor).

Distillation is separation of one liquid from other liquids taking advantage of their difference in rate of vaporization. This is achieved in alcohol distillation using seven columns. The columns are same for RS & ENA preparation. RS requires 5 columns whereas ENA uses all seven columns. These are described below:

(A) Wash to RS Mode

Following columns will be under operation

1. Analyzer Column
2. Degasifying Column
3. ED column
4. Rectifier cum Exhaust Column
5. Recovery Column

Pre-heated fermented wash will be fed to Degasifying column. Fermented wash is stripped off alcohol by ascending vapors in Analyser column. Rectifier vapors provide energy to Analyser column through a Thermosyphon re-boiler. Vapors of Degasifying column are condensed and taken to Recovery Feed Tank. Analyser vapors are condensed in the Falling Film Evaporators in the Integrated Evaporation Section. The condensed Analyser vapors are fed to ED column. Dilution water is added in this column for concentrating higher alcohol at the top. Top of this column is condensed in its condensers and fed to recovery feed tank while bottoms are fed to Rectifier cum Exhaust Column for concentration.

Rectifier column, which operates under pressure, concentrates it. Condensing steam provides energy to Purifier and Rectifier column through a vertical Thermosyphon reboiler. Fusel Oil Draws are taken from appropriate trays and fed to Recovery Column. Recovery Column concentrates the fusel oil streams and Degasifying condensate to 95% v/v concentration. An impure spirit cut is taken out from the top of the recovery column & rectifier column. Rectified Spirit draw of 95% to 96.1% v/v is taken out depending upon the end customer's requirement from the upper trays of Rectifier Column.

Rectifier cum Exhaust Column meets the energy requirement of Analyser cum Degasifying Column. Flashing the steam condensate will provide energy to Recovery column or separate team will be provided to meet energy requirement.

Generally the distillation efficiency is around 98.5%

(B) Wash to ENA Mode

Following Columns will be under operation

1. Analyser Column
2. Degasifying Column
3. Pre-Rectifier cum Exhaust Column

4. Extractive Distillation Column
5. Rectifier cum Exhaust Column
6. Recovery Column
7. Simmering Column

Pre-heated fermented wash will be fed to Degasifying column. Fermented wash is stripped off alcohol by ascending vapors in Analyzer column. Rectifier vapors provide energy to Analyzer column through a Thermosyphon re-boiler. Vapors of Degasifying column are condensed and taken to Recovery Feed Tank. Analyzer vapors are condensed in the Falling Film Evaporators in the Integrated Evaporation Section. The condensed Analyser vapors are taken to Pre-Rectifier Feed Tank. Analyzer Condensate is concentrated in Pre-Rectifier column, which operates under pressure. Condensing steam provides energy to pre-rectifier column through a vertical Thermosyphonre boiler.

A Technical Alcohol cut of about 1-2% of total spirit is taken from the Pre-Rectifier column. Concentrated alcohol drawn from Pre-Rectifier column is fed to Extractive distillation column for purification. Dilution water in the ratio of 1:9 is added in this column for concentrating higher alcohol at the top. Top of this column is condensed in its condensers and fed to recovery feed tank while bottoms are fed to Rectifier cum Exhaust Column for concentration. Rectifier Column operates under pressure and condensing steam provides energy to this column through a vertical Thermosyphonre boiler.

Technical Alcohol cut is taken out from the top of this column while ENA draw is taken out from appropriate upper trays and fed to Simmering Column after cooling. Fusel Oil build up is avoided by taking fusel oil draws from appropriate trays. These fusel oils along with the condensate of Degasifying & Extractive Distillation columns are fed to recovery column for concentration. A technical alcohol cut is taken out from the top of this column.

Simmering Column is operated under high reflux for better separation of methanol and di-acetyls. Final ENA product draw is taken from the bottom of this column.

Condensing steam through a vertical Thermosyphon re-boiler provides energy to Rectifier cum Exhaust Column. Rectifier cum Exhaust Column meets the energy requirement of Analyzer cum Degasifying Column. Supplying steam to Reboiler of the Pre Rectifier column provides energy to Pre- Rectifier Column.

Vapours of Pre-Rectifier Column meet the energy requirement of Extractive Distillation Column and Simmering column. Flashing the steam condensate will provide energy to Recovery column.

Molecular Sieve Dehydration

As ethyl alcohol and water form an azeotrope (constant boiling mixture) at 97.1% v/v it is not possible to concentrate the ethanol above azeotropic composition by normal distillation procedures.

To concentrate the ethanol to above azeotropic strength, the operating pressure of the system has to be changed so that azeotrope is shifted favorably to the desired concentration. But this procedure is only of theoretical interest and no plants have worked with this system.

Another procedure to overcome the azeotrope problem is to introduce a third component such as benzene or cyclohexane. Water to be separated forms a ternaryazeotrope with benzene and alcohol and comes out as top product and pure ethanol is obtained as bottom product some more columns are used to separate the benzene and to recycle. This process is used till two decades back in India.

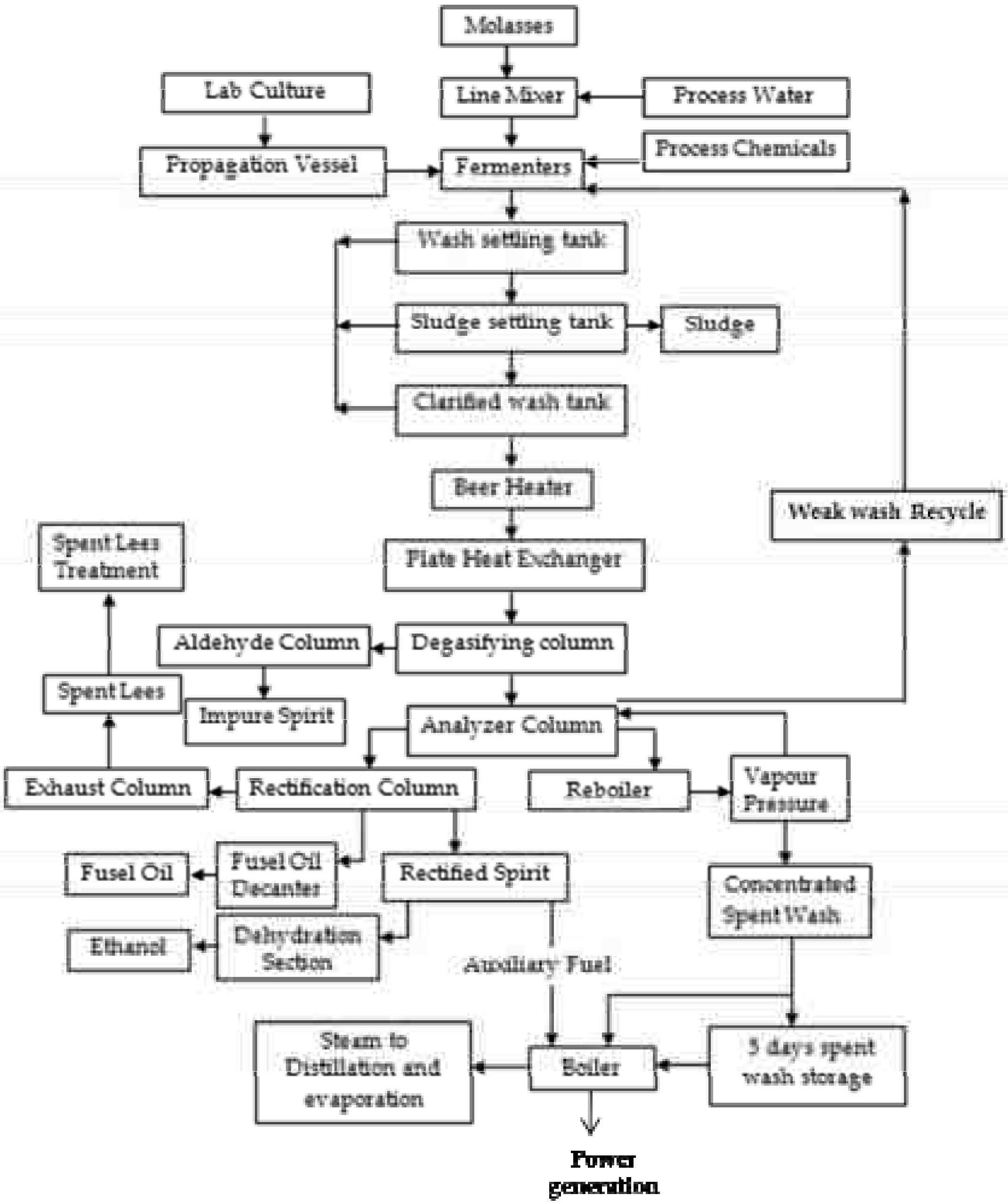
The water removal or dehydrogenation by molecular sieve technology is the latest and almost all the ethanol plants use this technology. Molecular sieves have a very porous structure and a component with a particular molecular size can only pass through it. In ethanol purification, water molecules are adsorbed inside the molecular sieve and pure ethanol comes out. Once the sieve is saturated with water, it is regenerated by changing the pressure. The regenerated sieve is again used for separation of water. Generally two sieve beds are used – one will be under regeneration and the second one will be under absorption.

Rectified Spirit containing at least 94% v/v alcohol is pumped from RS collection tank to dehydration section. Rectified spirit is preheated in Feed pre-heater with the help of product vapors and then fed to top tray of Evaporator Column. The objective of the Evaporator Column is to evaporate rectified spirit. The Evaporator Column operates under pressure. Energy is supplied to the Evaporator Column through Evaporator Column Re-boiler with steam condensing on shell side. The steam condensate can be recycled back to the boiler.

Overhead feed alcohol vapors from the Evaporator Column are then passed through Super-heater where alcohol vapors are superheated. Energy for superheating is supplied by steam condensation on shell side of the Super-heater. Super heated hydrous alcohol vapors are sent to twin Adsorbent beds. The twin Adsorbent beds operate in cyclic manner. Twin beds are provided to allow for bed regeneration in continuous operation. While one bed is in dehydration mode, the other is in regeneration mode. Depending on feed and product specifications, dehydration regeneration exchange takes place approximately every few minutes. The feed alcohol vapors are passed through the bed under dehydration mode. The Adsorbent bed will absorb moisture present in feed vapors and dehydrated product alcohol vapors are obtained from bottom of the bed. The product alcohol vapors are then passed through Regeneration Pre-heater and Feed Pre-heater for heat recovery. The product alcohol vapors are then passed through Product Condenser where product vapors are condensed with the help of cooling water. Condensed product alcohol is collected in product receiver. The product alcohol from Product Receiver is pumped to Product Cooler where it is cooled with the help of cooling water and then sent for storage.

During regeneration mode, vacuum is applied to the bed under regeneration. A small amount of product alcohol vapors are purged through the bed in regeneration mode under high vacuum, to prepare the desiccant for cycle changeover when this bed goes online. The purged alcohol vapors act as carrier for removal of moisture from the bed. These alcohol vapors along with moisture are obtained from the top of bed. These alcohol-water vapors (regeneration stream) are condensed in Regeneration Condenser, which is attached to Vacuum Eductor. Vacuum is pulled in the system with the help of Vacuum Eductor. Regeneration stream is used as motive fluid for Vacuum Eductor. There generation stream coming from the Regeneration Condenser is pumped, preheated in Regeneration Pre-heater and fed to the Evaporator Column for recovery of alcohol.

Moisture present in feed alcohol is removed from the bottom of the Evaporator Column in the form of spent lees containing less than 500 ppm of ethanol. After one cycle is over, the beds are interchanged, that is, the bed on dehydration mode will be switched over to regeneration mode and the bed on regeneration mode will be switched over to dehydration mode, with the help of automation system.



Process flow diagram - Distillery section

Spent wash Treatment and power generation- using incineration boiler:

Incineration

The spent wash which is generated after recovery of alcohol from the distillery is a highly pollutant liquid which will cause great pollution to receiving body like land or water. Hence this needs to be taken care. The latest technology developed to achieve the zero discharge is spent wash incineration boiler. This is a specially designed boiler which will burn the concentrated spent wash along with the bagasse/agro based fuel as supporting fuel. The ratio of this spent wash to bagasse/agro based fuel is 70: 30.

In this specially designed boiler after burning the spent wash we can generate the steam which is required to run the distillery. The calorific value of the concentrated spent wash will be in the range of 1600- 1800 K Cal. Hence this special technology helps us in achieving zero discharge of spent wash. The air pollution causing from this boiler is also very minimum and ESP can be used as air pollution control equipment to achieve SPM <100µgm/Nm^3. The ash collected from the ESP will be utilized as manure.

This technology helps us in generating steam, power and most important is achieving zero discharge of spent wash.

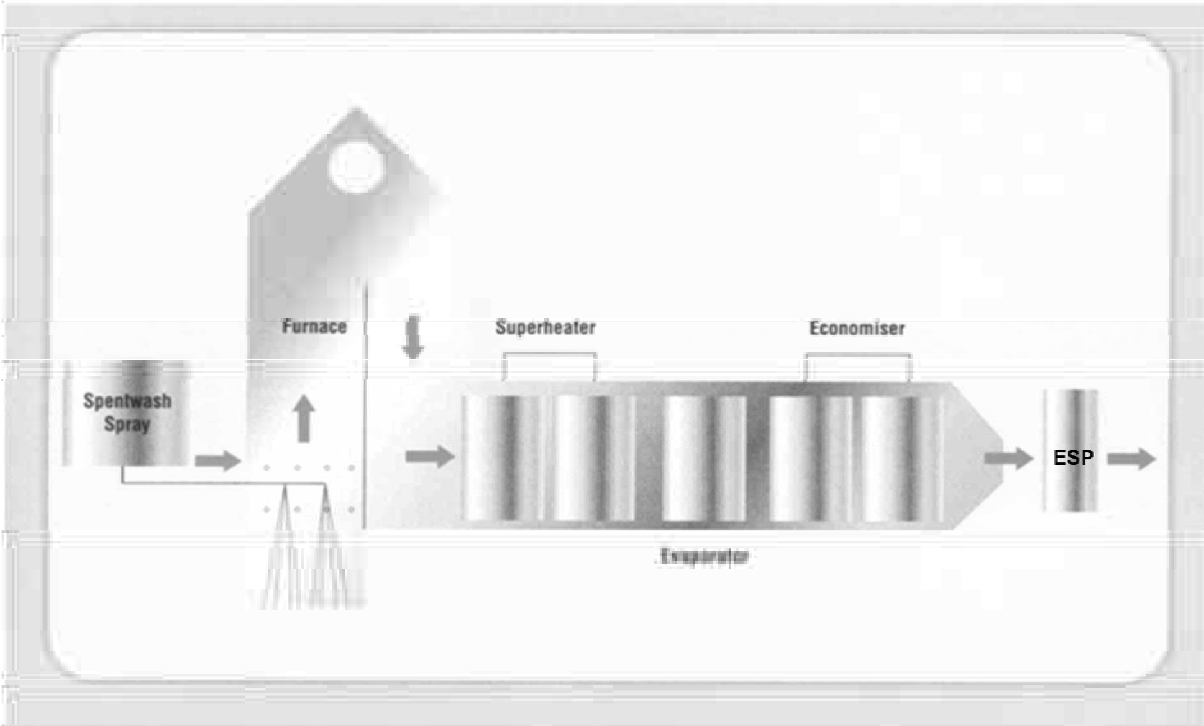
Salient Features of 22 Incineration boiler

Proposed 22 TPH Boiler features

Capacity	Pressure	Temperature	Qty	Type
22 TPH	45 kg/cm^2	390 ^{0}C	1	70 % concentrated Spent wash and 30 % bagasse/ agrobased fuel fired CFBC boiler

- The construction of the boiler is such that the fouling potential is minimized through multi- pass design.
- The boiler is designed such that it is easily maintainable.
- The convective section of the boiler (consisting of Economiser, Superheater and Evaporator) are of vertical tubes.
- A Steam Coil Air Preheater is provided to preheat combustion air. This is required to maintain the bed from quenching.
- Deep Fluidised bed construction to improve combustion efficiency.
- Fluidised bed combustor ensures complete combustion.
- Special On-line cleaning devices are provided.

The boiler will need off-line cleaning once in 30 days of operation. The cleaning will include the water wall, super-heater, evaporator and economiser section. The total time required will be 2-3 days. The cleaning frequency and duration is an estimated one, and will be decided based on the actual operating parameters condition.



Typical Boiler Schematic

3.6. Raw material required along with estimated quantity, likely source, marketing area of final products, mode of transport of raw material and finished products.

Raw Material and Product (For Sugar Plant and cogeneration plant)

Sl. No.	Particulars	Quantity
1	Sugar cane (T/d)	7500
2	Bagasse as fuel at 100%(T/d)	1098
3	Sulphur (T per month)	150
4	Lime (T per month)	480
5	Caustic Soda flakes (T/month)	4.5
6	Lubricants (KL/month) (Wheel bearing greases, lubricating oils etc.)	15
7	Ortho Phosphoric acid MT/Month	3

Raw material for Incineration Boiler

Fuel	Quantity	Source
Spent wash (concentrated)	144 T/day	Own Distillery unit
Bagasse	50 T/day	Bagasse

3.7. Resource optimization/recycling and reuse envisaged in the project, if any, should be briefly outlined.

The cane sugar factory has unique characteristics for the application of cogeneration technology. The principal advantages lie in the good fuel characteristics of bagasse and in the high uses of low-pressure steam within the plant. In conventional power plants, most of the heat that is obtained by burning fuel is thrown away in the form of low-pressure steam as the steam condenses and heats cooling water. In the sugar factory, the heat in low-pressure steam is used to perform such work as juice heating, evaporation and sugar boiling. During the process steam condenses.

A well-known option for sugar mills to increase their profitability is bagasse cogeneration. at present, bagasse is burnt inefficiently in low-pressure boilers to raise steam. Cogeneration has long been a standard practice in the cane sugar industry. With the application of efficient processing and energy management systems, energy from the bagasse, well above the factory needs, is available and can be exported conveniently in the form of electric power. Application of sugar cogeneration will displace a part of fossil-based electricity generation leading to a more sustainable mix in power generation.

3.8. Availability of water its source, Energy/power requirement and sources should be given.

Water Requirement

Water requirement and waste water generation- during season

	Water requirement		**Waste water generation**	
Process and washing	3753	KLD	371	KLD
Cooling	510	KLD	360	KLD
Boiler	154	KLD	46	KLD
Others	64	KLD	64	KLD
Domestic	150	KLD	135	KLD
	4630	**KLD**	**976**	**KLD**
Fresh water	724	KLD		
Condensate usage	3907	KLD		
Excess Condensate	218	KLD		
Effluent to ETP	**841**	**KLD**		
ETP capacity to be provided	**1000**	**KLD**		
Septic tank and soak pit capacity	150	KLD		

Water requirement and waste water generation- during off-season

	Water requirement		**Waste water generation**	
Cooling	1275	KLD	765	KLD
Boiler	139	KLD	42	KLD
Others	34	KLD	34	KLD
Domestic	120	KLD	96	KLD
Total	1567	KLD	936	KLD
Effluent to ETP	840	KLD		

For Distillery

Resource Requirement

Sl. No.	Description	Water Quantity m^3/day
1.	Process	397
2.	DM plant	180
3.	Cooling Tower	360
4.	Domestic	6
5.	For washing	8
	Total	951

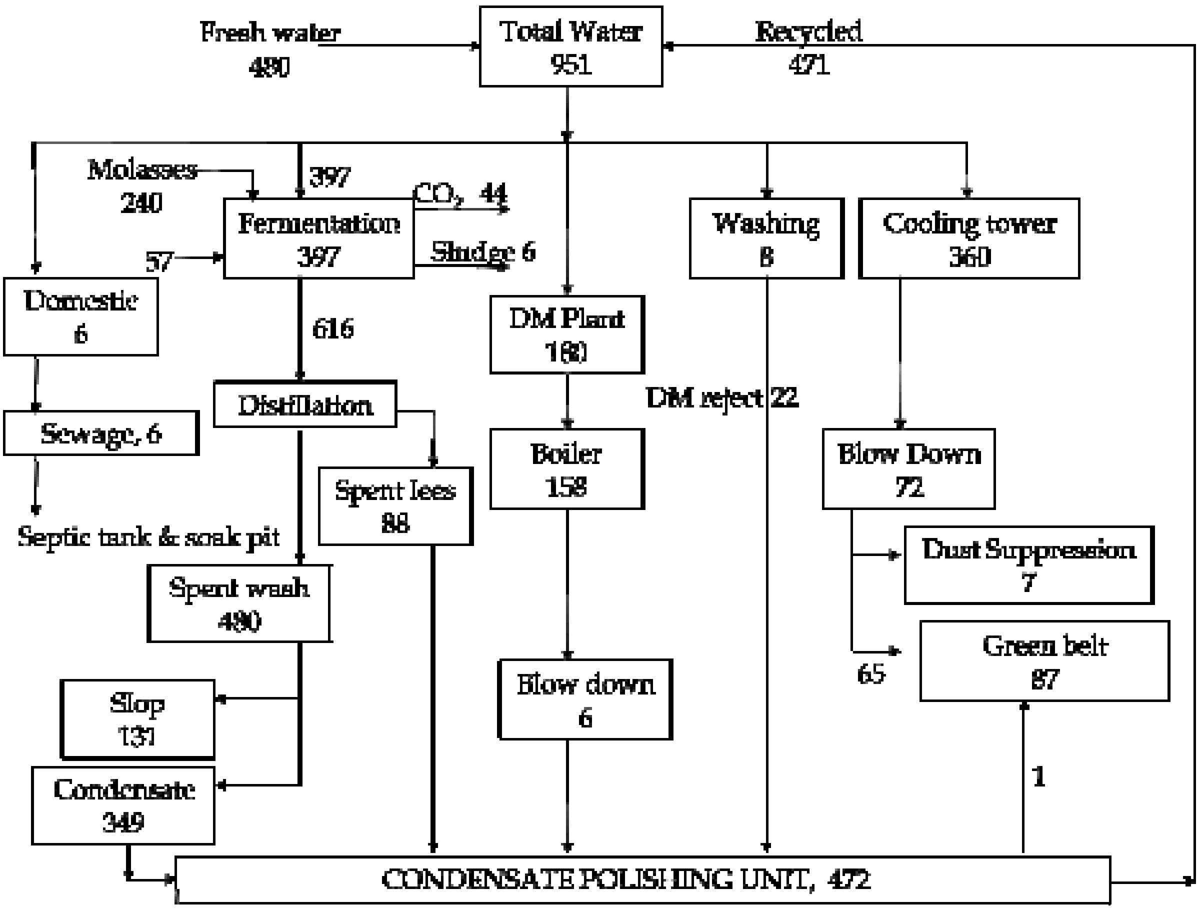
Total fresh water requirement	480	KLD
Spent lees	88	KLD
Spent wash	480	KLD
Concentrated spent wash	131	KLD
Condensate	349	KLD
Cooling tower blowdown	72	KLD
Boiler Blowdown	6	KLD
To Condensate polishing unit	472	KLD
Recycled to the process	471	KLD
Treated water available for gardening	87	KLD
Water utilised for dust suppression and ash quenching	7	KLD

All units in TPD

Hence, total water requirement for the industry is 951 KLD out of which 471KLD will be from the utilisation of treated Condensate water. Maximum fresh water requirement is 480KLD, met from Malaprabha River from Renuka Sagar Reservoir

Spent wash will be stored in the impervious storage tank and will be concentrated and used as fuel in the slop fired boiler.

Spentlees along with condensate, boiler blow down, cooling tower blow down and washing will be treated in the CPU of 600 KLD capacity and recycled back in the process.



Water balance chart

All units in TPD

Power Requirement

The power requirement will be met through co-generation unit. DG sets are also provided as a backup. The total power required for the proposed project will be 500 kwh – for construction phase from existing Co-generation unit or from HESCOM

During Season :
Power Generation : 30 MW
Power Consumption at Co-Gen Unit : 3.0 MW (10% on generation)
Power Consumption for Sugar Unit : 5.2 MW (24 units/Ton of Cane)
Power Export : 21.8 MW

During Off - Season :
Power Generation : 30 MW
Power Consumption at Co-Gen Unit : 2.4 MW (8% on generation)
Power Consumption for Sugar Unit : 0.5 MW
Power Export : 27.1MW

3.9. Quantity of wastes to be generated (liquid and solid) and scheme for their Management/disposal.

Please refer 3.8 for the quantity of effluent generated.
ETP of 1000 KLD will be provided

Treatment Scheme:

The combined effluent from the factory shall flow through Main gutter to ETP. The effluent is passed through Bar screen, Oil separator, neutralizer, equalization tank, primary settling tank, UASB Reactor, Aeration tanks, Secondary Clarifiers and Polishing Pond and then let out as treated effluent for use in gardening and irrigation. The Sludge collected at Secondary clarifiers is recycled to aeration tank and / or to sludge drying bed. Cleaning day waste water, which is highly alkaline, is collected in cleaning day sump separately and then gradually added to regular treatment. An additional oil separator is provided at Mill house of the sugar plant to remove the oil and fibres. Excess Hot water generated from sugar plant is collected & cooled in cooling tower in two stages and partly recycled back in process and partly used for irrigation.

Sludge generated from primary settling tank to separate sludge drying beds. The drainage from sludge drying bed is taken back to equalization tank for treatment.

Detailed description along with calculation of each units are enclosed as Annexure.

Distillery section: Spentlees generated from distillery section will be subjected to recirculation after neutralization and spent wash generated will be treated in the incineration boiler (details explained earlier). Excess spent wash will be mixed with required amount of pressmud and boiler ash in the compost yard

Solid waste generated from different operations

Sl. No.	Solid waste	Method of collection	Mode of disposal
1	Boiler- Bottom Ash	Mechanical conveyor into common silo for further disposal	Ash collected from Ash Silo is disposed to farmers and also sold to Brick manufacturers
2	Boiler fly ash		
3	Lime Grit	Mechanical screw conveyor	Collected in Trailers used for land filling
4	Press mud	Mechanical conveyor	Disposed to Farmers to use as manure
5	Sludge from ETP	Sludge drying beds	Sludge collected from ETP is used as manure for plantations inside the Factory
6	Used oil from DG sets	Stored in leak proof sealed barrels	Usually the oil is very less, Used as lubricants for Conveyor chains and sprockets within the industry to avoid use of fresh oil.
7	Waste oil residue from ETP		

- Domestic Solid waste (Garbage/ Trash/ garden litters) will be stored in Garbage collection pits and disposed to nearby municipality
- Used Oil generated from the industry will be collected and stored in barrels/drums and used for lubrication of chains and sprockets within the Industry. If, excess the same shall be disposed to the Karnataka State Pollution Control Board approved waste oil reprocessors/dealers.

- Any other solid waste generated from the facility will be disposed off by using proper disposal mechanism.

3.10. Schematic representations of the feasibility drawing which give information of EIA purpose

As per EIA notification, 2006 and further amendments the proposal is 5(g)- 60 KLPD distillery 5 (j)- 7500 TCD sugar cane crushing, 1 (d)- 30 MW cogeneration unit based on biomass (such as bagasse)

4. Site Analysis

4.1. Connectivity

M/s Harsha Sugars Ltd propose to expand sugar complex consisting of sugar plant of capacity from 4500 TCD to 5000 TCD, co-generation plant from 14 MW to 30 MW capacity. The proposed project is located at Sy No 411/1, 411/2, 413/1, 412, 411/3, Savadatti Village, Savadatti Taluk, Belgaum Dist, Karnataka.

The proposed expansion project is to be developed on existing Factory site of about 51.3 acres is already available. This is flat land whereby cutting-filling will be balanced and there will be no/low borrowing from nature.

Within 10 km influence zone, there is no tropical forest, biosphere reserve, national park, wild life sanctuary and coral formation reserve. The Malaprabha River from Renuka sagar Reservoir is at a distance of 5 kms away from the proposed project site and the state highway (SH-30) is at a distance of 1.85 kms to the project site.

The Project site is well accessed by SH – 30, The nearest airport is situated at 39.43 kms from the factory at Hubli.The nearest township with residential areas is at Karikatti- at 3.45 kms away from the plant.

Malaprabha River from Renuka sagar Reservoir flows at a distance 5 Kms away from the project site.

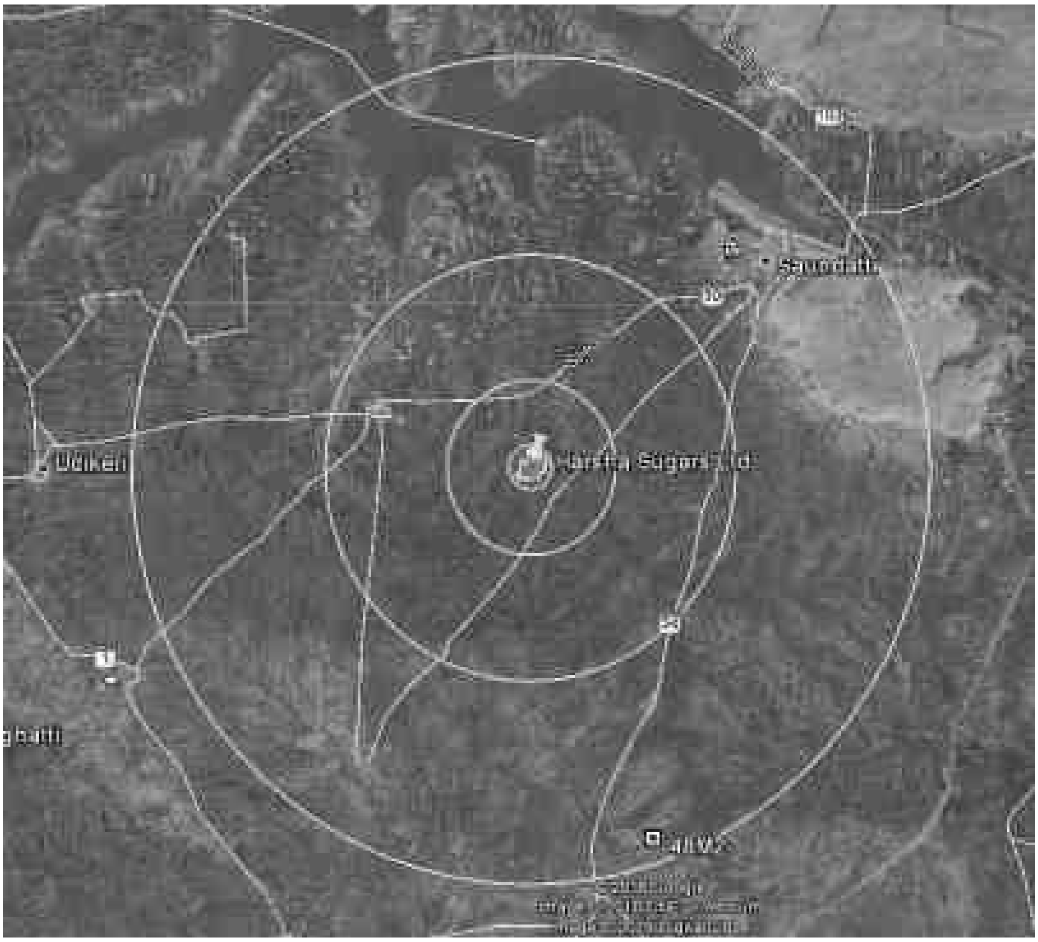
This is one of the units among the several Sugar plants, which have come up in Karnataka State in recent years.

4.2. Land form, land use and land ownership.

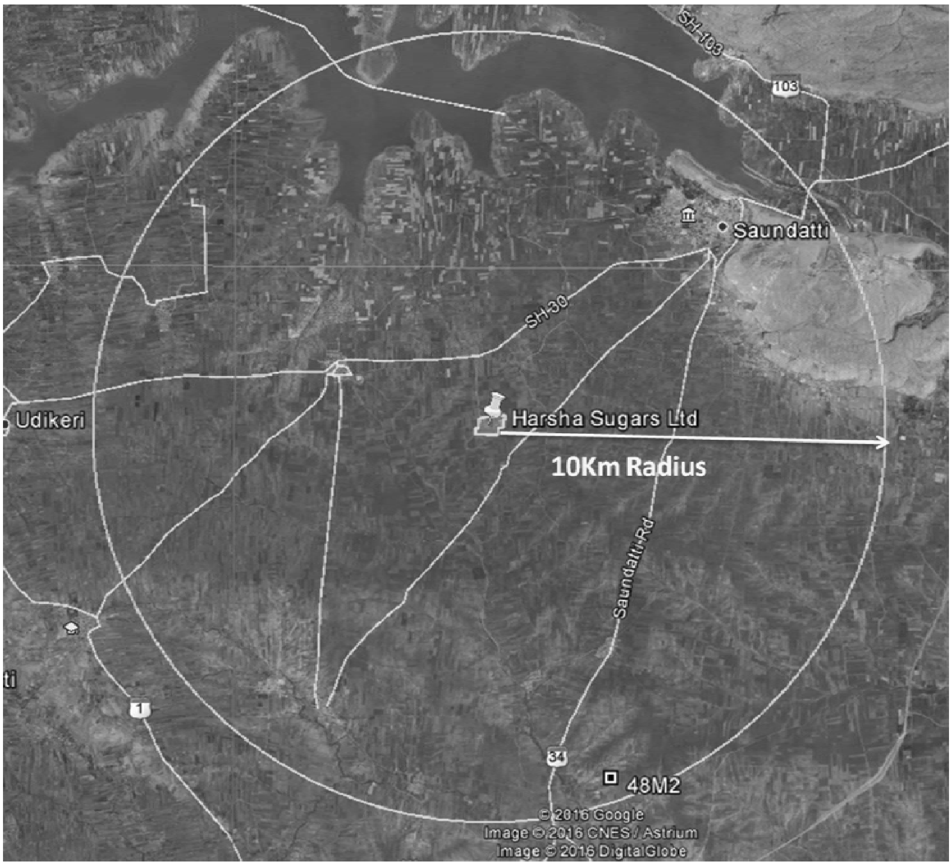
The site is situated at Sy No 411/1, 411/2, 413/1, 412, 411/3, Savadatti Village, Savadatti Taluk, Belgaum Dist, Karnataka.. Total of 51.3 Acres of land in the name of Harsha Sugars Ltd.,

4.3. Topography (along with map)

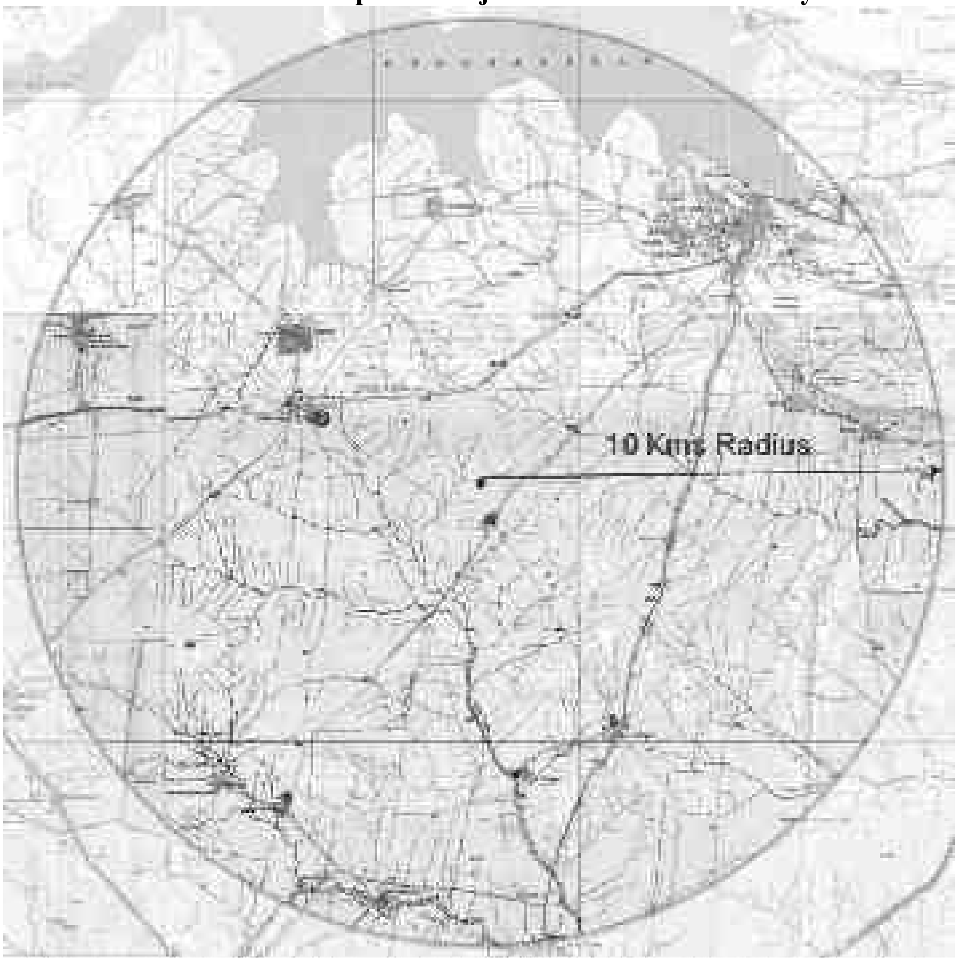
Map of the proposed project site (showing salient features)



Aerial View of the project site (500m, 2km, 5 km, 10km Radius)



Aerial View of the Proposed Project Site with 10 kms study area



Toposheet showing the location of proposed project site within 10 kms radius (Toposheet Nos: 48 M/1, 48 M/2, 48 I/13, 48 I/14)

4.4. Existing land use pattern (agriculture, non agriculture, forest, water bodies (including area under CRZ), shortest distances from the periphery of the project to periphery of the forest, national parks, wild life sanctuary, eco sensitive areas, water bodies (distance from, the HFL of the river)). In case of notified industrial area a copy of the Gazette notification should be given.

Land use pattern of 10 kms study area will be given in the EIA report.

The Project site is well accessed by SH – 30, Malaprabha River from Renuka sagar Reservoir flows at a distance 5 Kms away from the project site. The following villages are situated in the study area:

SI. No	Villages	Distance (Km)	Direction
1	Karikatti	3.45	NW
2	Saundatti	6.25	NE
3	Asundi	4.24	NW
4	Kenchalarkop	5.5	NE
5	Shingarkop	5.2	N
6	Betgeri	8.23	SW
7	Sangreshkoppa	7.82	SW
8	Kalle	8.90	SW
9	Hireulligeri	6.14	SE
10	Chikkulligeri	6.10	SE
11	Kabbenur	8.76	SW
12	Sutagatti	8.34	NW
13	Hittangi	8.86	NW
14	Yadravi	6.74	NE
16	Betasur	8.18	NE

4.5. Existing Infrastructure

Within 10 km influence zone, there is no tropical forest, biosphere reserve, national park, wild life sanctuary and coral formation reserve. The Malaprabha River from Renuka sagar Reservoir flows at a distance 5 Kms away from the project site and the state highway (SH-30) is at a distance of 1.85 kms to the project site.

The Project site is well accessed by SH – 30, The nearest airport is situated at 39.43 kms from the factory at Hubli. The nearest township with residential areas is at Karikatti- at 3.45 kms away from the plant.

4.6. Soil Classification

The soils of Belgaum district can broadly be classified into red soils and black soils. These soils vary in depth and texture, depending on the parent rock type, physiographic settings and climatic conditions. By and large, black soils predominates the Deccan Trap terrain and the red soils are found in the southwestern and southeastern part of the district in gneissic terrain. These soils in turn can be grouped into seven categories as given below, out of which the first five cover large tracks of land while the last two are local in nature

1. Shallow black soils: These soils occur in the Deccan trap region and to some extent are also developed in schist, shale and limestone terrains.They are greyish to dark greyish-brown in colour, with clayey texture. These soils have poor to moderate infiltration characteristics.

2 Medium black soils: These soils are predominantly derived from Deccan traps and occupy large parts of the district. They are dark greyish-brown to very dark greyish-brown with clayey texture. These are derived from the weathered products of basalts and limestone and are darker in valleys than in high lands. Their texture varies from loam to clay, with low to moderate infiltration characteristics.

3 Deep to Very deep black soils: These soils occupy large tracts in Deccan trap terrain along the Krishna River and also in the gneissic terrain. These soils are dark greyish-brown to very dark greyish-brown in colour and have clayey texture. These soils occur on plains or lands having gentle slopes. These soils exhibit wide cracks in summers. These are derived from a wide variety of parent rock types, like traps, schists, gneisses and sedimentary rocks. They are generally transported and therefore occur in valleys and depressions. Accumulation of lime, gypsum and soluble salts at varying depths in the soil profile often pose problems. They have poor infiltration characteristics.

4 Mixed red and black soils: These soils occur in the northern parts of the district. They are dark reddish-brown to dark greyish-brown in colour with silty-clay to clayey-loam textures. These soils are derived from gneisses, schists and sedimentary rocks. Red soils having high infiltration characteristics are confined to uplands, whereas, black soils of poor to medium infiltration characteristics occur in valleys and low lands.

5 Red loamy soils: These soils occur as small strips in the valleys adjacent to the Western Ghats. They are generally transported and are loamy to silty-loam in texture. They have moderate to good infiltration characteristics.

6 Lateritic soils: Lateritic soils are red in colour and occur as pockets. They occur at high-levels as insitu in Deccan Trap terrain and at low-levels as transported in Malnad region. They are derived from Deccan traps as well as sedimentary rocks, Dharwarian Schists and peninsular gneisses. These soils have good to moderate infiltration characteristics.

7 Alluvial soils: These soils are developed over the alluvium deposited by the Krishna River and its tributaries. They are very limited in extent and thickness and are local in nature. These soils have good infiltration characteristics and are composed of coarse sand, sandy-loam and loams.

4.7. Climatic and Rainfall data from secondary sources

The climate of the district as a whole can be termed as semi-arid. The variation in the maximum temperature during the year ranges from 270C to 35.70 C and minimum from 13.90C to 20.60 C. The district experiences pleasant winters and hot dry summers. The hot season extends from March to May, during which the daily maximum temperature often shoots up to 35.7 0C.

Agro-climatologically the district can be divided into three zones i.e. high rainfall “Hilly zone”, “Northern transitional zone” and “Northern dry zone” from southwest to northeast respectively. The normal rainfall in the district decreases from more than 1859 mm in Khanapur taluk in the southwest, to less than 491 mm in Raybag taluk towards northeasterly direction. Those areas, that receive less than 750 mm annual rainfall are classified as semi-arid and thus drought prone. Hence, the entire district except, the southwestern part is categorized as semi-arid and drought prone.

Total normal rainy days vary from 90 in Khanapur to 37 in Athani. Eastern and northeastern parts of the district are prone to drought of mild nature.

Although the district as a whole received normal rainfall during the year 2006 on an annual basis; it experienced 24% excess rainfall during monsoon and 53% deficient rainfall during post-monsoon period. The deficiency of rainfall during post-monsoon period was more than 60% in the taluks of Bailhongal, Belgaum, Chikkodi, Gokak, Hukkeri and Khanapur

4.8. Social Infrastructure available

Within 10 km influence zone, there is no tropical forest, biosphere reserve, national park, wild life sanctuary and coral formation reserve. The Malaprabha River from Renuka sagar Reservoir flows at a distance 5 Kms away from the project site and the state highway (SH-30) is at a distance of 1.85 kms to the project site.

The Project site is well accessed by SH – 30, the nearest airport is situated at 39.43 kms from the factory at Hubli. The nearest township with residential areas is at Karikatti- at 3.45 kms away from the plant.

5. Planning

5.1. Planning concept (type of industries, facilities, transportation, etc.,) Town and Country Planning Development authority classification.

The proposed expansion project is to be developed on existing Factory site of about 58 acres 25 Gunta is already available. This is flat land whereby cutting-filling will be balanced and there will be no/low borrowing from nature.

Within 10 km influence zone, there is no tropical forest, biosphere reserve, national park, wild life sanctuary and coral formation reserve. The Malaprabha River from Renuka sagar Reservoir flows at a distance 5 Kms away from the project site and the state highway (SH-30) is at a distance of 1.85 kms to the project site.

The Project site is well accessed by SH – 30, The nearest airport is situated at 39.43 kms from the factory at Hubli.The nearest township with residential areas is at Karikatti- at 3.45 kms away from the plant.

5.2. Population Projection:

As per the provisional 2011 India census, the population of Belgaum is 588,292, and its urban / metropolitan population is 610,189. Males constitute 51% (309,689) of the population and females 49% (300,500). Belgaum has an average literacy rate of 78%, higher than the national average of 65%; of those literate, 54% are males and 46% are females. Eleven percent of the population is under 6 years of age. The local languages spoken in this city are Kannada and Marathi language and official language is Kannada. There are also minority number of Urdu, Konkani speakers. Hindi and English are also understood by the people of the city.

5.3. Land use planning (breakup along with green belt etc.)

Sl No	Land Description	Area (acres)
1	Factory	
	• Raw material storage yard	5:0
	• Sugar Unit	10:0
	• Distillery	5:0
	• Power plant	5:0
	• Admin, repair shop, lab	2:0
	• Internal Road	5:0
2	Landscape, garden	17:0
	Others	2:3
	Total	**51.3**

5.4. Assessment of infrastructure Demand (Physical & Social).

There will not be any negative effect on the living conditions of people. Due to project activities, the surrounding areas are expected to improve by way of socio-economic development due to direct and indirect employment and the project will also lead to supporting utilities by improving business opportunities in the locality.

5.5. Amenities/facilities

Basic amenities and facilities will be provided for all workers working at site.

6. Proposed Infrastructure

Industrial Area (Processing area)

Sl No	Land Description	Area (acres)
1	Factory	
	• Raw material storage yard	5:0
	• Sugar Unit	10:0
	• Distillery	5:0
	• Power plant	5:0
	• Admin, repair shop, lab	2:0
	• Internal Road	5:0
2	Landscape, garden	17:0
	Others	2:3
	Total	**51.3**

6.2. Residential Area (non processing area).

Residential colony for workers will be provided

6.3. Green Belt

33% of total area, 17 Acres will be provided for green belt development. Industry is regularly doing plantation continuously in & around the factory premises.

6.4. Social Infrastructure
Good infrastructure facilities seen around Belgaum district.

6.5. Connectivity Traffic and Transportation Road/Rail/Metro/Water ways etc
The Project site is well accessed by SH – 30, the nearest airport is situated at 39.43 kms from the factory at Hubli. The nearest township with residential areas is at Karikatti- at 3.45 kms away from the plant.

6.6. Drinking Water Management (Source & Supply of water)
Raw water from the Malaprabha River from Renuka Sagar Reservoir flows at a distance 5 Kms away from the project site will be lifted, stored and treated to use for Drinking purpose.

6.7. Sewerage System
Domestic sewage is treated in septic tank and soak pit. Industrial effluent will be treated in the ETP through internal sewer network.

6.8. Industrial Waste Management
Effluent generated will be treated in the ETP of 1000 KLD and treated water will be used within the plant premises garden and irrigation purpose.

6.9. Solid Waste Management
Solid waste generated from the industry include Pressmud sold to farmers to use as manure, Ash from Boiler is sold to mud brick manufacturers & farmers for landfilling. Bagasse generated will be used as fuel in the co-generation boiler.

6.10. Power Requirement & Supply/Source
Power requirement will be met through co-generation

7. Rehabilitation and Resettlement (R&R) Plan

7.1. Policy to be adopted (Central/State) in respect of the project affected persons including home oustees, land oustees, and landless labourers (a brief outline to be given).
Not applicable.

8. Project Schedule & Cost Estimation

8.1. Project Schedule
Expansion of a sugar complex from 4500 TCD to 7500 TCD sugar cane crushing, 14 MW to 30 MW co-generation unit based on biomass (such as bagasse), 60 KLPD distillery + 3 MW power from incineration boiler. Implementation schedule is attached as Annexure

8.2. Cost Estimates
Rs 307.32 Crores as estimated

9. Analysis of proposal (Final recommendation)

9.1. Financial and social benefits with special emphasis on the benefit to the local people including tribal population, if any, in the area

200 nos, the company provides all necessary basic amenities to the workers of the industry.