PRE-FEASIBILITY REPORT

ESTABLISHMENT OF 2*1800 TCD SUGARCANE MILLING PLANT FOR 2*120 KLPD DISTILLERY TO PRODUCE 225 KLPD ETHANOL BASED ON SUGARCANE JUICE WITH SLOP FIRED BOILER TO ACHIEVE ZERO LIQUID DISCHARGE AND 2*6 MW TURBO GENERATOR SET AT VILLAGE HOLKUNDA, TEHSIL AND DISTRICT KALABURAGI (GULBARGA), KARNATAKA, BY M/S. KING RUDRA SUGARS LIMITED

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1. EXECUTIVE SUMMARY

- M/s. King Rudra Sugars Limited is situated at Village Holkunda, Tehsil and District Gulbarga (Kalaburagi) of Karnataka State, and registered under the Companies Act, 1956 on May 31, 2013 vide registration Number U15531KA2013PLC069422.
- KRSL has its registered office at #1124/17A, Opp. V. G. Women’s College, Aiwan-E-Shahi, Kalaburagi Karnataka-585102.
- This proposal is for Establishment of 2*1800 TCD sugarcane milling plant for 2*120 KLPD distillery to produce 225 KLPD ethanol based on sugarcane juice with slop fired boiler to achieve zero liquid discharge and 2*6 MW turbo generator set. The proposed project is listed as activity 5(g) in the schedule attached to the EIA notification 2006 (As amended from time to time) and seek prior environment clearance from the Expert Appraisal Committee of MoEF&CC under Category A.
- The implementation of the project will be done in two phases. In Phase-I 1*1800 TCD milling tandem to extract sugarcane juice for 120 KLPD distillery to produce 112.5 KLPD ethanol with slop fired boiler to achieve zero liquid discharge and 6 MW turbo generator set. Some value added products such as Sugar, Sugar Syrup (Golden Syrup) and CO₂ Gas will be manufactured by the industry based on demand supply gap.
- In phase-II, the project will be repeated as per the phase-I based on techno-economic viability and the availability of sugarcane from the command area.
- The industry proposes to be the part of Ethanol Blending Programme of Government of India and will be contributing the entire amount of ethanol produced in the EBP.
- The salient features of the Phase-I are as under:
  a. The fresh water requirement of the industry will be 950 KLD. Which will be sourced from the Dug well of the industry located 4 km away from the industry. The water will be pumped to the industry in a closed pipeline. The permission for lifting the groundwater from industrial use will be obtained from the concerned authority.
  b. The quantity of effluent i.e. spentwash generated will be 1044 KLD which will be concentrated to 75 KLD (60% Solids) in the proposed MEE along with CPU Reject of 250 KLD and CIP washings of 200 KLD. The steam condensates from MEE (982 KLD) will be treated in Condensate Polishing Unit (CPU) and the treated MEE condensates will be recycled as a process water in the fermenter section.
  c. The concentrated spentwash of 75 KLD will be used as a fuel along with bagasse into 60 TPH Boilers to fulfill the steam and power requirement of the industry.
  d. 6 MW extraction cum condensing type TG set will be installed to produce power to fulfill energy demands. All the power produced will be consumed captively.
  e. Stack height of 75 m and Electrostatic Precipitator as Air Pollution Control equipment will be provided to control the Particulate matter.
  f. CO₂ scrubber will be provided to recover CO₂ emitted from the fermentation process, which will be a value added product to the industry.
  g. The quantity of press mud generated will be 54 MT/day, which shall be used as a filler material to mix with potash rich ash of 19.96 MT/day generated from the slop fired boiler, and sold as a potash rich manure to the farmers.
- There are no reserved forests, Wild life Sanctuaries, Heritages etc within 10 Km radius of the factory site.
- Total Plot area of the plant is 177599 Sq.m, out of which 58610 sq.m (5.861 Hectares) of land will be reserved for green belt development, built up area is 45000 sq.m., 28000 sq.m of area is under parking and internal roads, 7500 sq.m. is for pollution control equipment.
- As per the CPCB guidelines min 33% of the total plot area should be under green belt and accordingly industry has reserved 58610 sq.m (5.861 Hectares) of land for the development of greenbelt, and accordingly there should be minimum 8800 no. of trees which will be planted within 2 years.
- Cost of the project is 300 Crore rupees, EMP cost is estimated as Rs. 50 Crore, recurring expenditures per annum is around Rs. 5 Crore and 1.5 % of the total project cost (Ref: Office Memorandum Dated 1st May 2018 F. No- 22-65/2017-IA.III) will be spent on Corporate Social Responsibilities (CSR) over a period of 5 years.
- Rainwater harvesting and solar energy recovery shall be implemented along with the project commencement.
- Proposed project will help to increase the socio-economic status of the local people. This industry will provide RS/Ethanol which will earn & save foreign exchange in blending in petrol.
- Project will create direct employment opportunities to 150 people and indirect employment opportunities to around 100 people in the surrounding region.
2. INTRODUCTION OF THE PROJECT / BACKGROUND INFORMATION

2.1. Introduction

King Rudra Sugars Limited., (KRSL) is situated at Holkunda, Tehsil & District - Kalaburagi (Gulbarga), Karnataka, registered under the Companies Act, 1956 on May 31, 2013 vide registration Number U15531KA2013PLC069422.

KRSL proposes to establish 2* 1800 TCD cane milling plant for 2*120 KLPD Ethanol plant based on sugarcane juice with Slop fired Boiler to achieve zero liquid discharge and 2*6 MW turbo generator set. The establishment of the plant will be carried out in two phases. In Phase-I 1800 TCD cane milling plant and 120 KLPD Distillery along with 1*60 TPH slop fired boiler to achieve zero liquid discharge and 1*6 MW TG Set for captive power generation will be installed. In Phase-II the plant will be replicated as per the configurations in Phase-I based on the techno-economic viability and the availability of sugarcane in the command area. The industry will supply the entire Ethanol produced for blending in Petrol (Ethanol Blending Programme)

Further, in next phase, KRSL is also planning to start separate value added fast moving consumer goods (FMCG products)such as sugar, sugarcane juice powder, bottling of sugarcane juice, Golden Syrup & CO2 gas extraction plant.

The integrated project comprises of a 2*1800 TCD cane milling plant with 2*120 KLPD Distillery for the manufacture of high quality Ethanol, thereby making available required bagasse and slop for the power plant. The proposed power plant envisages utilizing the slop and bagasse available in the command area as alternative fuel for power generation. The command area of the proposed project has adequate irrigation facilities, potential for sustained cane supply to the mill and bagasse availability.

The command area of the proposed factory is expected to fall mainly in command area of Kalaburagi, Aland, Chittapur, Chincholi & Sedam Talukas in Kalaburagi district. The promoters have extensively and carefully analyzed the present and future scenario of Ethanol. They have studied carefully the present irrigation facilities and surplus cane availability in the command area and additional cane availability.

Salient features of the proposed project are given in Table below.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Item</th>
<th>Quantity</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Phase-I</td>
<td>Phase-II</td>
</tr>
<tr>
<td>1</td>
<td>Number of working</td>
<td>180</td>
<td>Days</td>
</tr>
<tr>
<td>2</td>
<td>Crushing rate</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>Annual installed crushing capacity</td>
<td>324000</td>
<td>324000</td>
</tr>
<tr>
<td>6</td>
<td>Total Ethanol recovery, % cane</td>
<td>68%</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Total Ethanol production</td>
<td>20250</td>
<td>20250</td>
</tr>
<tr>
<td>8</td>
<td>Total slop production</td>
<td>13500</td>
<td>13500</td>
</tr>
<tr>
<td>9</td>
<td>Annual Press mud production</td>
<td>9720</td>
<td>9720</td>
</tr>
</tbody>
</table>
2.1.1. Project Proponent

Shivaraj R Patil: (Promoter Chairman & MD) is an Agriculturist, Industrialist and a Social Worker. A Post Graduate from Gulbarga University has an overall Industry experience of 40+ years. He was first to establish a Transformer manufacturing and servicing unit in Hyderabad- Karnataka Region; and an Excise contractor for over a 10+ years. He has received many coveted Awards and Certificates for achieving Excellence in manufacturing and services. He has widely travelled the World and India to understand the Best Practices in Industry and Agriculture. The management of M/s. King Rudra Sugars Limited is presently under the dynamic leadership of Shri. Shivaraj R Patil: as the Chairman and Managing Director.

The details of the organizational structure of the industry are given in Table below.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mr. Shivaraj Rudrashetty Patil</td>
<td>Chairman &amp; Managing Director</td>
</tr>
<tr>
<td>2</td>
<td>Mr. Naren Shivaraj Patil</td>
<td>Director &amp; Project Engineer</td>
</tr>
<tr>
<td>3</td>
<td>Dr. Arvind Ishwarappa Moldi</td>
<td>Dentist and an Investment Banker</td>
</tr>
<tr>
<td>4</td>
<td>Mrs. Sharada Shivaraj Patil</td>
<td>Director Administration</td>
</tr>
</tbody>
</table>

2.1.2. Project Consultants

To seek prior environmental clearance for the establishment of 2*1800 TCD sugarcane milling plant for 2*120 KLPD distillery to produce 225 KLPD ethanol based on sugarcane juice with slop fired boiler to achieve zero liquid discharge and 2*6 MW turbo generator set, KRSL has appointed Dr. Subbarao’s Environment Center (SEC), Sangli, Maharashtra (formerly known as Water and Wastewater research center). SEC is a QCI-NABET accredited consulting organization, for conducting EIA studies, encompassing baseline scenario with respect to different components of environment viz. air, noise, water, land, biological and socio-economic etc. SEC is serving for more than 45 years in the field of Environmental Services. The company was established by an entrepreneur Dr. B. Subbarao in the year 1972.

2.2. Nature of the project

KRSL have proposed to establish a new sugarcane juice based 2*120 KLPD distillery to produce Ethanol. Sugarcane Juice from the milling plant is used to produce Rectified Spirit/Ethanol. The industry proposes to be the part of the Ethanol Blending Program started by the Government of India and will be selling entire amount of Ethanol for blending in petrol. The main raw material for the proposed distillery is Sugarcane juice. The project placed under item no 5 (g)- Distillery, Category A as per the EIA Notification 2006 (as amended from time to time) and will be appraised by Expert Appraisal Committee at the Central level.

2.3. Need for the project

The sugar industry is one of the major agro-based manufacturer industries. India being the largest Sugarcane producer country after Brazil, it is inevitable and unavoidable for India to grow as the largest sugar and allied products manufacturing country. The major shareholder of this sector is the farmer, producer of raw material sugarcane and it is estimated that around 45 millions of people in India are sugarcane growers. Sugarcane Potential, agro-climatic conditions and the cost of conversion and
overheads etc. are the major deciding factors for fixing the crushing capacity of a sugar plant. As there is excess cane available in the command area, industry shall have to make arrangement for the timely crushing of sugarcane of not only its shareholders but also entire farmer’s community in the command area. Incidentally, the economic viability would also improve not only by producing ethanol more but also to generate power which can be exported to the state grid and additional money can be distributed to farmers as cane price. Besides the direct benefit, the establishment would help to crush sugarcane in time so that the high recovery due to timely crushing would further improve the economy of the farmers. Apart from this, the establishment of such institutions brings employment and other developmental opportunities for the entire region.


India is the fourth largest producer of ethanol in the world and the second largest in Asia. Most of the Indian distilleries use sugarcane molasses as raw material. The demand for potable alcohol has been ever increasing with the more liberal attitude, rising middle class and less taboo/stigma in Indian society. With the advent of ethanol blending with petrol/motor fuel, the requirement of ethanol/industrial alcohol has increased manifold in the country to the extent that in case 5% blending, if made mandatory all over the country, the sugar factory molasses available in the country shall not prove to be adequate for meeting the total requirement of ethanol including its use for potable liquors and other industrial uses. However, the notification no.G.S.R.705(E) dated 27th October, 2004, Ministry of Petroleum and Natural Gas, Government of India, mandates that 5% ethanol-blended petrol (E5), conforming to Bureau of Indian Standards specifications which may grow to 20%. The sugarcane farmers in the region and state will be directly benefitted by assuring stability of the sugar industries, reasonable return for the molasses and then passing a significant part of the same to the farmers. Fuel ethanol is able to save valuable foreign exchange on import of fossil fuel. Apart from its use for beverage, medicinal, pharmaceutical and flavoring, alcohol constitutes the feedstock for large number of organic chemicals, which are used in manufacturing a wide variety of intermediates, drugs, rubber, pesticides, solvents etc.

2.4. Demand-Supply gap

There are three main uses of ethanol in India. Of the total available ethanol, the maximum about 45 percent is used to produce potable liquor, about 40 percent is used in the alcohol-based chemical industry (as a solvent in synthesis of other organic chemicals) and the rest is used for blending with petrol and other purposes. The demand for ethanol has been continually increasing on account of the growth of user industries and use of ethanol as a fuel in the country. However, the production and availability of ethanol has largely lagged behind. India is the fourth largest producer of ethanol in the world after Brazil, the United States of America (USA) and China, producing approximately 2000 million litres of ethanol, mainly by fermentation of sugarcane molasses. However, the amount of ethanol currently produced in India is not sufficient to meet domestic demand. In the year 2008-09, there was a huge unmet demand from the industrial sector, which was met by imports. Moreover, the current government policy of blending ethanol in petrol has targeted a demand of around 266 crore litres and would go further ahead in coming years. Currently only 120 crore is blended. This has created a demand of 150 crore litres which would be a prime target of the industry.

2.5. Imports vs. Indigenous products

India has more than 300 distilleries, with a production capacity of about 3.2 billion litres of rectified spirit per year, almost all of which is produced from sugar molasses, and not from sugar juice, food grains or
other cellulose feed stocks. The government’s ethanol policy has led to over 110 distilleries modifying their plants to include ethanol production with the total ethanol production capacity of 1.3 billion litres per year. The current ethanol production capacity is enough to meet the estimated ethanol demand for the five percent blending ratio with gasoline. However, for a ten percent ethanol blending program, current ethanol production capacities will need to be enhanced by expanding the number and capacities of molasses-based ethanol plants and by setting up sugarcane juice-based ethanol production units. The import of ethanol is reduced to great extent due to adequate indigenous production of the same..

2.6. Export possibility

Alcohol produced is mainly utilized in blending with petrol (additives).

2.7. Domestic / Export markets

Domestic markets are found to be more suitable, by the observations made over the years. Convenience and profitability are always preferred by the management of KRSL.

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

The skilled manpower required for operation of distillery will be easily available from Kalaburagi. KRSL will require 150 people for proposed project. It is most essential for KRSL to define the organization structure for the proposed project. KRSL is in a process of appointing required manpower and has already appointed key top management positions for the purpose. It is most essential that the experienced and well-qualified manpower is employed right from the project development / implementation period, through advertisement or through head hunting exercise, particularly for the top and key positions. Manpower training and skill up-gradation must become an integral part of the HRD policy.

KRSL is also initiating establishing an Industrial Training Institute (ITI), in collaboration with German Institutions & support from German Consulate in India, on the periphery of the proposed project site/campus. This shall give a continuous flow of skilled required operational level manpower and also pass out lot of skilled manpower to local ancillary & other SSIs in the District.

KRSL is signing MoU with local Gulbarga University, Gulbarga; Central University of Karnataka and other top Engineering Institutions in the State for Graduates, both in Engineering & Management streams.
3. PROJECT DESCRIPTION

3.1. Type of the project

The proposed new project involves fermentation of sugarcane juice for producing rectified spirit / Ethanol. Raw materials such as sugarcane will be sourced from nearby farms, and others will be purchased from open market. Further, it is an establishment project of 2*120 KLPD distillery to produce RS/ethanol based on sugarcane juice as a raw material, so sugarcane crushing contributes to Bagasse and slop as a by-product. Hence, utilize this by-product for power generation purpose.

3.2. Location with coordinates

There are no sensitive, historical, forest reserves and wildlife sanctuaries etc within 10 Km radius of the factory site. The location is at Holkunda, Tehsil & District: Kalaburagi (Gulbarga), Karnataka State, at longitude 76°58'6.79"E and latitude 17°30'39.37"N. The MSL is 490 meters. The site is surrounded by the sugar cane growing area so that there is less transportation of raw material and lower loss of recoverable sugar.

- The Project Site is conveniently located for development of the Project.
  - 25 km away from Kalaburagi, which is a District place
- Environmental Setting:

<table>
<thead>
<tr>
<th>Location</th>
<th>Latitude: 17°30'39.37&quot;N</th>
</tr>
</thead>
<tbody>
<tr>
<td>longitude: 76°58'6.79&quot;E</td>
<td></td>
</tr>
<tr>
<td>Nearest Village:</td>
<td>Holkunda</td>
</tr>
<tr>
<td>Nearest town / City:</td>
<td>Kalaburagi</td>
</tr>
<tr>
<td>Nearest National Highway:</td>
<td>NH 218 (Hubballi to Vijapura):</td>
</tr>
<tr>
<td>Nearest Railway Station:</td>
<td>a. Kalaburagi</td>
</tr>
<tr>
<td></td>
<td>b. Mahagaon</td>
</tr>
<tr>
<td>Nearest Airport:</td>
<td>Solapur</td>
</tr>
<tr>
<td>Nearest Water Body:</td>
<td>Bennethora Reservoir</td>
</tr>
<tr>
<td>Seismicity:</td>
<td>Seismic Zone III</td>
</tr>
</tbody>
</table>
Figure 1 Location Map
Figure 2 Toposheet
Figure 3 Contour map of the project site
The available land is 17.76 Ha out of which 5.86 Ha of land is reserved for development of Green Belt.

**3.3. Details of alternate sites**

No alternate site is considered as the site is selected considering the following features:
- The site is well connected by Road.
- Proximity to Raw Material (Sugar Cane).
- Availability of sufficient land.
- Availability of power evacuation facilities.
- The site is near to the perennial source of water from the Bennithora river 5 km from the proposed factory premises

Modern infrastructure support and amenities at par with industry including:
- Efficient transport facilities.
- Environment-friendly zone as the habitation is remote and surrounded by Agricultural activities.

**3.4. Size or magnitude of operation**

The implementation of the project will be done in two phases viz. Phase-I and Phase-II. In Phase-I, the project constitutes the following configuration

**A. Cane Milling Tandem 1800 TCD**

A cane mill of 1800 TCD capacity will be installed for cane preparation and extraction of juice.

**B. Juice Clarification System**

Juice clarification & Evaporation will be installed for clarification of juice from suspended solids. And to get 40% solids syrup, which shall be pumped to Distillery

**C. 120 KLPD Distillery**

The Distillery will mainly operate on juice syrup extracted from the mill. The capacity of the Distillery is 120 KLPD. The Distillery will be integrated with Slop fired Boiler of 60 TPH capacity, which shall meet the steam requirements of the Distillery and for slop concentration. The concentrated slop generated from the Distillery will be mixed with bagasse and used as fuel in the incineration boiler. During crushing season of 180 days, the gross Ethanol generated will be about 20250 KL

The Distillery shall be equipped with Ethanol & Slop concentration plant. This plant helps in concentration of Ethanol and slop. The concentrated Ethanol is directly sold to buyers, whereas the concentrated slop is mixed with bagasse and used in the Boiler as fuel.

**D. Power plant**

The power plant of 6 MW capacity will mainly operate on slop generated from Distillery.

It will employ a slop fired boiler of pressure and temperature configuration of 60 TPH (45 kg/Sq.cm and 400 deg. C) capacity and 6 MW extraction cum condensing TG set, as well as ESP for emission control and DCS control system for efficient operation. All steam and power requirements of the Distillery & Power plant auxiliaries and colony will be met internally from the power plant. The Power generated from slop will be consumed captively.

The policy for ethanol distillery plants, both at the Central Government and at the State, Government of Karnataka are quite conducive. The Centre has provided several financial incentives in terms of capital grants and interest subsidy for Ethanol Blending Program (EBP), till date and the same are likely to
continue. The proposed project will be eligible for these incentives as well as other incentives like accelerated depreciation, income tax benefits, reduced import duties for renewable energy projects. Indian Renewable Energy Development Agency (IREDA) Ltd., the lending arm of MNRE, also provides term loan for these projects at soft terms.

In phase-II, the project will be repeated as per the phase-I based on techno-economic viability and the availability of sugarcane from the command area.

The details of the size of magnitude of operation of the proposed project are tabulated in table below.

**Table 3 Capacity after the Proposed Establishment**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Item</th>
<th>Quantity</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phase-I</td>
<td>Phase-II</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Sugarcane Crushing rate</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>2.</td>
<td>Slop production</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>3.</td>
<td>Press mud production</td>
<td>54</td>
<td>54</td>
</tr>
<tr>
<td>4.</td>
<td>Ethanol</td>
<td>112.5</td>
<td>112.5</td>
</tr>
<tr>
<td>5.</td>
<td>Cogeneration Power</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>6.</td>
<td>Other value added products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Sugar</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>b.</td>
<td>Golden Syrup</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>c.</td>
<td>CO₂ Gas</td>
<td>87</td>
<td>87</td>
</tr>
</tbody>
</table>

3.5. Manufacturing process details

KRSL intends to establish 2*120 KLPD Distillery based on sugarcane juice as a raw material to produce 225 KLPD ethanol.

3.5.1. Manufacturing process of ethanol from sugarcane juice

Sugarcane is directly taken as per the availability of the cane area, which is being transported through trucks, or bullock carts, which is then weighed for records and then cut into specified sizes. These sizes are treated with lukewarm water treatment so as to give maximum outputs with lower contamination. The cane is further crushed in the mill in four phases in order to extract more juice percentage say about 95%. After the extraction of juice from sugarcane it shall be sent to Juice clarification & Evaporation system for clarification of juice from suspended solids and to get 40% solids syrup, which shall be pumped to Distillery.

3.5.2. Feed preparation and weighing

Sugarcane Syrup/ Juice stored in a storage tank is first weighed in a tank with load cells so that accurate quantity can be fed to the fermentation section. The weighed molasses then transferred from tank to the dilutor in fermentation section where it is diluted with water and fed to the fermenter.

3.5.3. Yeast propagation and fermentation

The Yeast from Slant is transferred to Shaker Flasks and grown to the required volume. This “genetically marked” yeast strain is then further propagated, under aseptic conditions, in yeast culture vessel. These vessels are equipped with educators which are designed to achieve enhanced efficiencies through better sugar / yeast contact by shearing and mixing, efficient oxygen transfer etc. The ready yeast “seed” is then
transferred from culture vessel to fermenter. The Sugarcane juice/syrup is diluted by process water. The glucose in the feed media gets converted to ethanol, in each of the four fermenters operating in batch mode. A Plate Heat Exchanger (PHE) and a circulation pump are provided to each fermenter, which will continuously re-circulate the fermenting wash through PHE for maintaining the fermenters at 30°C. The nutrients, biocide, acid and anti-foam agents are fed to the fermenters as per process requirement. The CO₂ liberated during fermentation is sent to CO₂ scrubber for recovery of ethanol otherwise being lost in vent. The fermented wash is then sent to the clarification tank equipped with lamella separator. The settled sludge is then sent to sludge washing tank for recovery of alcohol.

3.5.4. Multipressure Distillation (RS)

The fermented wash is fed to CO₂ stripper column to remove CO₂ gas present in wash. Alcohol is stripped off water in stripper column. The top vapours [alcohol + water] are fed to Beer Heater & Condenser. Distillate from Beer Heater & Condenser is pre-heated by steam condensate and spent leese before being fed to rectifier column. In rectifier column RS is taken out from top tray. The impure spirit from top of CO₂ stripper column, rectifier column, is fed to fusel oil column. The final impure spirit cut is taken out from the fusel oil column and partly alcohol is recycled to rectifier column. The alcohol containing fusel oil from rectifier column is fed to fusel oil column. Rectification column works under pressure. The CO₂ stripper, stripping column, works under vacuum and fusel oil column works under atmospheric condition. The top vapours from rectifier column are condensed in Stripper Reboiler. The alcohol water vapours from stripping column are partly sent to CO₂ stripper bottom for heating. The Rectifier column and fusel oil column gets heat from steam. The distillation process is operated through PLC.

3.5.5. Dehydration

Rectified Spirit at azeotropic concentration is pumped by feed pump. This pump takes care of the entire backpressure of the system. The pump is of stainless steel material of construction for wetted parts complete with flameproof motor and mechanical seal. The rectified spirit will first pass through feed pre-heater, which will pass through vaporizer cum super heater which will convert the rectified spirit feed to superheated alcohol vapour stream ready to feed to the molecular sieve bottles. The degree of superheat is control via a temperature control loop and the flow rate to the plant is control via flow control loop. The superheated vapours will pass through a sieve bottle, which is already regenerated, and pressurize to working pressure via. Bleed flow from an operating sieve bottle. After the drying cycle the flow will be shifted to the next sieve bottle, which is ready after duly regenerated and pressurize. This sequence minimizes the rate of rise and fall of pressure through the molecular sieve. Thus minimizing the attrition of the sieve beads. The sieve column after completion of drying cycle is evacuated to remove the adsorb water through an evacuation system via a condenser. The mixture of alcohol and water is preheated by anhydrous alcohol vapour in plate heat exchanger before being feed to recovery column, which enriches the stream back to azeotropic composition. The bottom of recovery column gets heat from partly by condensing anhydrous alcohol vapour in plate heat exchanger. The anhydrous alcohol vapours condensed in product cooler. A flow indicator indicates the rate of anhydrous alcohol going to the anhydrous alcohol receivers.
Figure 5 Manufacturing Process flow sheet and Material balance of the Distillery
3.5.6. Brief Note on Value added products

Sugar

Sugar is the generic name for sweet-tasting, soluble carbohydrates, many of which are used in food. The various types of sugar are derived from different sources. Simple sugars are called monosaccharides and include glucose (also known as dextrose), fructose, and galactose. "Table sugar" or "granulated sugar" refers to sucrose, a disaccharide of glucose and fructose. In the body, sucrose is hydrolyzed into fructose and glucose. Sucrose is used in prepared foods (e.g. cookies and cakes), is sometimes added to commercially available beverages, and may be used by people as a sweetener for foods (e.g. toast and cereal) and beverages (e.g. coffee and tea).

Brown and white granulated sugars are 97% to nearly 100% carbohydrates, respectively, with less than 2% water, and no dietary fiber, protein or fat (table). Brown sugar contains a moderate amount of iron (15% of the Reference Daily Intake in a 100 gram amount, see table), but a typical serving of 4 grams (one teaspoon), would provide 15 calories and a negligible amount of iron or any other nutrient. Because brown sugar contains 5–10% molasses reintroduced during processing, its value to some consumers is a richer flavor than white sugar.

Golden Syrup

Golden syrup or light treacle is a thick, amber-coloured form of inverted sugar syrup, made in the process of refining sugar cane or sugar beet juice into sugar, or by treatment of a sugar solution with acid. It is used in a variety of baking recipes and desserts. It has an appearance similar to honey and is often used as a substitute where honey is unavailable or prohibitively expensive.

Refiners return syrup, begins as a high brix, pale sucrose syrup made from white sugar and water designed to loosen the dried molasses found on raw sugar crystals. The sucrose saturated content of the initial "green" syrup impedes sugar crystals from dissolving during the process of washing. The purpose is to mix the green syrup with raw sugar crystals to form a "magma" of 8-10% moisture content at around 60-65 degrees C, that is then washed with water in a centrifuge. After the first washing (often termed affination) the "washed off" molasses combines with the sucrose syrup to generate refiners return syrup, which is generally re-used several times until deemed spent. The spent refiners return syrup is sold off to manufacturers for golden syrup production or is sent to a recovery section of the refinery often called the remelt house or boil-out section. Here it is reheated to crystallize and recover the sucrose it contains and that is returned to the affination stage. The final spent syrup left after the recovery process is sold as treacle (often called refiners molasses in older texts)

The free glucose and fructose present in golden syrups are more water-soluble than the original sucrose. As a result, golden syrups are less likely to crystallize than a pure sucrose syrup. The free fructose content gives the syrup a taste sweeter than that of an equivalent solution of white sugar; when substituting golden syrup for white sugar, about 25% less golden syrup is needed for the same level of sweetness.

CO$_2$ Recovery Plant

Fermentation gas is high concentration CO$_2$ gas discharged from fermentation system of alcohol, brewery, sugar refinery etc. Generally, fermentation gas contains 90 - 99 % CO$_2$ & impurities of alcohol,
aldehydes, methane, hydrogen, nitrogen, vapour etc., including small amount of NO and oil. The system desorbs alcohol, aldehydes, oil & NO by using methods of washing & hydro dissection and desorbs impurities of water, methane, hydrogen and nitrogen with methods of drying, chilling, heat transferring and rectification in rectifying tower, storing clean CO₂ in tanks for use.

Production Process

- Raw gas from fermenters is fed in to the system from where the gas is taken in foam trap where the foam is removed
- With the help of booster blower, the gas is pushed in to the chain/series of scrubbing systems that comprises of pre water scrubber, Kmn⁴ scrubber with dosing facilities
- In this chain of scrubbers, the CO₂ gas is washed properly using water
- After this, the raw gas gets buffered in a vessel
- From there, it moves towards two stage CO₂ compressor where the gas is compressed up to a desired pressure
- Raw gas goes to the dual tower activated carbon filter for removal of odor
- The raw gas is then enter into the high pressure precooler and from there to dual tower CO₂ dryer
- It also passes through liquefaction system and nox removal tower
- Finally, the liquid goes directly to the storage tank where the gas stores for a particular period of time

Methane Recovery Plant

Methane is a chemical compound with the chemical formula CH₄ (one atom of carbon and four atoms of hydrogen). It is a group-14 hydride and the simplest alkane, and is the main constituent of natural gas. The relative abundance of methane on Earth makes it an attractive fuel, though capturing and storing it poses challenges due to its gaseous state under normal conditions for temperature and pressure.

Natural methane is found both below ground and under the sea floor. When it reaches the surface and the atmosphere, it is known as atmospheric methane. The Earth's atmospheric methane concentration has increased by about 150% since 1750, and it accounts for 20% of the total radioactive forcing from all of the long-lived and globally mixed greenhouse gases.

Liquefied natural gas (LNG) is natural gas (predominantly methane, CH₄) converted into liquid form for ease of storage or transport. Methane has several uses. It is used as a domestic fuel / in central heating systems, in gas cookers, in gas fired power stations. As a chemical feedstock. Methane is converted into synthesis gas; which is an important intermediate for the manufacture of hydrogen, ammonia, methanol, and synthetic hydrocarbon fuels. Methane is used in certain internal combustion engines, and liquefied methane is used as a rocket fuel.
3.6. Raw material required

The following will be the raw material requirement

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Raw Material</th>
<th>Quantity</th>
<th>Source</th>
<th>Mode of Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sugar Cane (TCD)</td>
<td>1800</td>
<td>Nearby Farms</td>
<td>Tractors</td>
</tr>
<tr>
<td>2.</td>
<td>Urea (kg/day)</td>
<td>110</td>
<td>Local Area</td>
<td>Trucks</td>
</tr>
<tr>
<td>3.</td>
<td>Antifoaming Agent (kg/day)</td>
<td>380</td>
<td>Local Area</td>
<td>Trucks</td>
</tr>
<tr>
<td>4.</td>
<td>Diammonium phosphate (DAP) (Kg/day)</td>
<td>80</td>
<td>Local Area</td>
<td>Trucks</td>
</tr>
<tr>
<td>5.</td>
<td>Sulfuric Acid (ltr/day)</td>
<td>30</td>
<td>Local Area</td>
<td>Trucks</td>
</tr>
</tbody>
</table>

3.7. Resource optimization / recycling and reuse

Spent wash generated during the process of distillation will be treated in multiple effective evaporators to concentrate and use in boiler as a fuel. The condensate generated during the process of multiple effective evaporators will be reused in the process consequently decreasing the net water requirement.

3.8. Availability of water

The Total fresh water requirements of the proposed project during Phase-I will be 950 KLD. MEE condensates of 805 KLD will be utilized as process water in the fermentation section, therefore no process water requirement. The water will be sourced from the Dug well of the industry which is 4 kms away from the industry. The water will be pumped from the Dug well to the industry in a closed pipeline. The plan for which is given as Figure-6. The permission to lift the groundwater for industrial use will be taken from the respective authorities.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Quantity (KLD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Boiler</td>
<td>135</td>
</tr>
<tr>
<td>2.</td>
<td>Cooling tower makeup water + Pump Sealing</td>
<td>505</td>
</tr>
<tr>
<td>3.</td>
<td>CIP</td>
<td>200</td>
</tr>
<tr>
<td>4.</td>
<td>Washings</td>
<td>50</td>
</tr>
<tr>
<td>5.</td>
<td>Domestic</td>
<td>20</td>
</tr>
<tr>
<td>6.</td>
<td>Green Belt Development</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>950</strong></td>
</tr>
</tbody>
</table>

3.9. Power and Steam requirement

The company will install 2*60TPH slop and bagasse fired boiler with 2*6 MW TG set for the captive power generation. The Power produced will be consumed captively. 2*500 KVA D.G. Sets will be installed as a stand-by facility.

The detailed flow sheet indicating power and steam requirement at each stage/process for the proposed project is given in Figure-7
Figure 6 Details of Water lifting scheme from Dugwell to the Industry
Figure 7 Steam, power and distillery mass balance
3.10. Fuel Requirement

Slops and Bagasse will be used as fuel in 60 TPH boiler at the rate of 75 TPD and 490 TPD respectively. Diesel will be used as a fuel in the proposed D.G. Set.

3.11. Quantity of waste to be generated

**Table 6 Quantity of waste generated**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Aspect</th>
<th>Pollutant</th>
<th>Quantity</th>
<th>Scheme for Management/ Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Industrial Wastewater</td>
<td>Spentwash</td>
<td>75 KLD*</td>
<td>Spent wash concentration (through MEE) and concentrated Spent wash is burnt in boiler.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>75 KLD**</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Air Emissions</td>
<td>PM$<em>{10}$, PM$</em>{2.5}$, SO$_2$, NO$_x$ and CO$_2$</td>
<td>-</td>
<td>Electrostatic Precipitator (ESP), CO$_2$ Scrubber</td>
</tr>
<tr>
<td>3.</td>
<td>Hazardous Solid Waste</td>
<td>Spent Oil</td>
<td>Negligible</td>
<td>Will be burnt in boiler along with bagasse</td>
</tr>
<tr>
<td>4.</td>
<td>Solid waste</td>
<td>Ash from Boiler (Potash Rich Ash)</td>
<td>19.96 MT/day*</td>
<td>Distributed to Farmers as a Manure/ Sold to Brick Manufacturers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fermenter Sludge</td>
<td>37 MT/day</td>
<td>used as Manure</td>
</tr>
</tbody>
</table>

* - Denotes quantities after implementation of Phase-I

** - Denotes quantities after implementation of Phase-II

3.12. Schematic representation of the feasibility drawing which give information of EIA purpose

2*120 KLPD Sugarcane juice based distillery

Category A 5 (g) (All Molasses/Non Molasses Based distillery)

ToR application (Form I) & Pre-Feasibility study to MOEF &CC
4. SITE ANALYSIS

4.1. Connectivity

The site is conveniently located in many aspects. There are no reserved forests, Wild life Sanctuaries, Heritages etc within 10 Km radius of the factory site. The industry has its own land of 45 Acres having a connecting roads and approachability, which is sufficient for the existing and the proposed expansion. No forest area or displacement of habitation or acquisition of private land is required.

<table>
<thead>
<tr>
<th>Nearest National Highway</th>
<th>NH 218 (Hubballi to Vijapura): Approx 3 Km (North West)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Station</td>
<td>Mahagaon railway station. Approx 5 Km (West)</td>
</tr>
<tr>
<td></td>
<td>Kalaburagi railway Station: Approx 25 Km (South West)</td>
</tr>
<tr>
<td>Nearest Airport</td>
<td>Kalaburagi Airport: Approx 30 Km (South West)</td>
</tr>
<tr>
<td>Nearest Town/City</td>
<td>Gulbarga (Kalaburagi), Approx 25 Km (South West)</td>
</tr>
</tbody>
</table>

4.2. Land Form, Land use and Land ownership

Total land of 177599 sq.m is in possession with management. Land will be used for industrial purpose only. It is roughly plain land with some undulations. NOC from the gram Panchayat of Holkunda is already obtained.

4.3. Topography

It is located in the North Eastern part of Karnataka bordering Maharashtra in the North and Andhra Pradesh in the East, Bijapur District in the West, Yadgir district is in the South, which was recently bifurcated from the existing Gulbarga district. The district is situated on the Deccan Plateau at an altitude of 472 Mtrs above Mean Sea Level. The Study area has a general downward slope from north to south. The Toposheet of the study area is Given in the Chapter 3: Figure 2.

4.4. Existing land use pattern

The existing Land is barren land with no vegetation.

4.5. Existing Infrastructure

Maximum resources like electricity, water supply, road connectivity, availability of raw material etc. are available in the area of the proposed site.

4.6. Soil Classification

There are different types of soil which are available in the Gulbarga district such as light black, reddish and the black cotton soil (BCS) which contains high alumina and carbonates of Ca and Mg. A typical characteristic of the soil is that it swells when wet and dries up with cracks on losing moisture. The predominant soils in the study area is Black cotton soil.

4.7. Climate

The Actual annual rainfall in Kalaburagi District for 2017 was 738.34 mm and that for command area was 757.6 mm. The rainy season ranges between middle of June to October. The climate of Kalaburagi district is generally dry and healthy. In summer, especially in April and May it is too hot; at that time the
temperature lays between 40 degree Celsius and 42 degree Celsius. In winter season, from November to January the temperature is between 15 degree Celsius and 20 degree Celsius.

4.8. Social Infrastructure available

The site has easy access to latest communication and other social infrastructure facilities, including telecommunication, schools and colleges, medical & health facilities, commercial infrastructure, etc. at Kalaburagi, which is a Tehsil / District Headquarters.

5. PLANNING BRIEF

5.1. Planning Concept

The proposed sugarcane juice based distillery will be manufacturing rectified spirit/ Ethanol/ impure spirit viz. fermentation, multi pressure distillation, spent wash evaporation through MEE. Concentrated spent wash will be used as fuel in boiler

5.2. Population Projection

The proposed activity will generate total 150 Nos. of skilled and unskilled employee opportunities. No influx or migration of population is expected as local candidates will be preferred.

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

Total Plot area of the plant is 177599 Sq.m, out of which 58610 sq.m of land will be reserved for green belt development. The other land use of the area is given in table below, and the layout map is included in Chapter 3: Figure 4.

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cane mill</td>
<td>7500</td>
</tr>
<tr>
<td>Syrup Plant, Distillery Boiler and Power House</td>
<td>45000</td>
</tr>
<tr>
<td>Bagasse Yard</td>
<td>2500</td>
</tr>
<tr>
<td>Water Reservoir</td>
<td>500</td>
</tr>
<tr>
<td>Parking</td>
<td>18000</td>
</tr>
<tr>
<td>Internal Roads</td>
<td>10000</td>
</tr>
<tr>
<td>Greenbelt</td>
<td>58610</td>
</tr>
<tr>
<td>ETP/STP</td>
<td>7500</td>
</tr>
<tr>
<td>Vacant Land</td>
<td>27989</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>177599</strong></td>
</tr>
</tbody>
</table>

5.4. Assessment of Infrastructure Demand (Physical and Social)

The basic infrastructure such as roads, electricity, transportation, drinking water facilities, health centres and hospitals, schools, sanitation facilities are available in the vicinity. The proposed project is not going to exert any unbearable load on the available resources.

5.5. Amenities / Facilities

Facilities like canteen, rest rooms, drinking water facilities and recreation facilities will be provided for the proposed project.
6. PROPOSED INFRASTRUCTURE

6.1. Industrial Area

Total area of about 62500 sq.m will be utilized for industrial/processing area to carry out all the industrial activities involved in the proposed project. The major plant & machinery required for the proposed project is as given below

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Instruments/Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cane Milling Tandem</td>
</tr>
<tr>
<td>2.</td>
<td>Juice Clarification System</td>
</tr>
<tr>
<td>3.</td>
<td>Fermentation Section</td>
</tr>
<tr>
<td>4.</td>
<td>Distillation Section</td>
</tr>
<tr>
<td>5.</td>
<td>Steam Condensers</td>
</tr>
<tr>
<td>6.</td>
<td>Air Compressors</td>
</tr>
<tr>
<td>7.</td>
<td>Spentwash/slop fired boiler</td>
</tr>
<tr>
<td>8.</td>
<td>Storage section</td>
</tr>
<tr>
<td>9.</td>
<td>Multiple effect evaporation section</td>
</tr>
<tr>
<td>10.</td>
<td>Raw water treatment plant</td>
</tr>
<tr>
<td>11.</td>
<td>Fire Protection Equipment</td>
</tr>
<tr>
<td>12.</td>
<td>Laboratory instrument</td>
</tr>
<tr>
<td>13.</td>
<td>Condensate polishing unit</td>
</tr>
<tr>
<td>14.</td>
<td>Electrostatic precipitator</td>
</tr>
<tr>
<td>15.</td>
<td>Turbo Generator Set</td>
</tr>
<tr>
<td>16.</td>
<td>D.G. Sets</td>
</tr>
</tbody>
</table>

6.2. Residential Area (Non Processing Area)

Facilities like canteen, rest room and indoor games facilities will be provided in the nearby residential area.

6.3. Green belt

Greenbelt development is undertaken in the area provided separately. According to CPCB guidelines, 1500 trees should be available per hectare of land for Greenbelt development. Total 5.861 Hectares (58610 Sq. m) of land is reserved for greenbelt development; hence there should be minimum 8800 no. of trees which shall be planted within 2 years. The list of the saplings which industry is going to plant in their area is given in table below

<table>
<thead>
<tr>
<th>Sr .No</th>
<th>Name of the plant</th>
<th>Sr .No</th>
<th>Name of the plant</th>
<th>Sr .No</th>
<th>Name of the plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>silver Oak</td>
<td>28</td>
<td>Simarouba</td>
<td>55</td>
<td>Honni</td>
</tr>
<tr>
<td>2</td>
<td>Casuarina</td>
<td>29</td>
<td>Mahogani</td>
<td>56</td>
<td>Sisavi</td>
</tr>
<tr>
<td>3</td>
<td>Cashew nut</td>
<td>30</td>
<td>Aricanut</td>
<td>57</td>
<td>Jakrapa</td>
</tr>
<tr>
<td>4</td>
<td>Coconut</td>
<td>31</td>
<td>Amla</td>
<td>58</td>
<td>Sacred Fig</td>
</tr>
<tr>
<td>5</td>
<td>Almond</td>
<td>32</td>
<td>Tapashi</td>
<td>59</td>
<td>Banyan</td>
</tr>
</tbody>
</table>
6.4. Social Infrastructure

The site has easy access to latest communication and other social infrastructure facilities, including telecommunication, schools and colleges, medical & health facilities, commercial infrastructure, etc. at Kalaburagi, which is a Tehsil / District Headquarter.

6.5. Connectivity

The details of the connectivity of the site are given in Chapter 4 under Section 4.1.

6.6. Drinking Water Management (Source and Supply of water)

Drinking water will be provided after proper treatment. The source of drinking water will be Bennithora River.

6.7. Sewerage System

Domestic waste water generated will be treated by the treatment based on Root zone technology i.e. proposed constructed wetland.

6.8. Industrial Waste Management

Spent wash generated from the distillery will be treated in multiple effect evaporators to concentrate and use as fuel in slop fired boiler along with bagasse.
6.9. Solid Waste Management
Yeast sludge mixed with ETP sludge will be used as manure. Potash rich ash generated in the boiler will be distributed within the farmers as a manure/sold to brick manufacturers.

6.10. Power requirement & Supply / Source
The industry proposed to install 2*60 TPH Slop fired boilers and 2*6 MW TG Sets for captive power generation. The Power produced will be consumed captively. 2*500 KVA D.G. Sets will be installed as a stand-by facility

7. REHABILITATION AND RESETTLEMENT (R&R) PLAN
No rehabilitation or resettlement plan is proposed as proposed plant will be located on the open non-agricultural land.

8. PROJECT SCHEDULE AND COST ESTIMATES
The cost of the proposed project has been estimated at Rs 300 crore, which comprises of land and land development, civil and building, plant and machinery, margin money of working capital. Cost for environment management has been estimated to 50 crore. The estimated time of completion of project will be one and half year after getting Environmental Clearance from the respective authority.

9. ANALYSIS OF PROPOSAL
Proposed project will help to increase the socio-economic status of the local people. Proposed project will provide following benefits,

- This industry will provide RS/Ethanol which will earn & save foreign exchange in blending in petrol.
- Project will create direct & indirect employment opportunities within the surrounding region.
- With the implementation of the proposed project, the socio-economic status of the local people will improve substantially.
- Corporate Social Responsible (CSR) program shall be executed on need base.
10. SITE PHOTOGRAPHS