PRE- FEASIBILITY REPORT

For

SENTINI BIOPRODUCTS PRIVATE LIMITED UNIT - II
(160 KLPD Molaasses/Grain based Distillery Plant and power plant)
at
Gandepally Village,
Kanchikacherla Mandal,
Krishna District, Andhra Pradesh

PREPARED BY

PEOPLE WHO CARE FOR ENVIRONMENT | SAVE ENVIRONMENT
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1.0 EXECUTIVE SUMMARY

1.1 Introduction

‘Sentini Bioproducts Private Limited Unit - II’ is launched by Sentini GROUP who are associated with the Liquor trade and manufacture for few years in Andhra Pradesh. The proposed integrated project of ‘Sentini Bioproducts Private Limited Unit - II’ is envisaged at Gandepally Village, Kanchikacherla Mandal, Krishna District, Andhra Pradesh. The project would comprise of a 160 KLPD Molasses/Grain based Distillery plant to manufacture Rectified Spirit/ENA/Ethanol/Industrial Alcohol/Potable alcohol/Grain Impure Spirit with Denature spirit with 5 MW captive Power generation.

Ethanol is a clear, colorless liquid with a characteristic, agreeable odor. In dilute aqueous solution, it has a somewhat sweet flavor, but in more concentrated solutions it has a burning taste. Ethanol melts at -114.1°C, boils at 78.5°C, and has a typical density of 0.789 g/ml at 20°C. Ethanol has been made since ancient times by the fermentation of sugars. All the beverage ethanol, and more than half of industrial ethanol, is still made by this process. Simple sugars are the raw materials.

Enzyme from yeast, changes the simple sugars into ethanol and carbon dioxide. Starches from potatoes, corn, wheat, and other plants can also be used in the production of ethanol by fermentation. However, the starches must first be broken down into simple sugars. An enzyme released by germinating barley, diastase, converts starches into sugars. Thus, the germination of barley, called malting, is the first step in brewing beer from starchy plants, such as corn (maize) and wheat.

We feel that Andhra Pradesh is the right place as we plan to utilize all the available agro based raw materials. The proposed project will change the agriculture statistics of the districts with assured returns for the farmers. The proposed project with multi feed stock and multi product utilizes a proven technology world-wide.

As per the government mandate, ethanol is considered a green fuel and its blending with petrol will help reduce India’s heavy dependence on crude oil imports. Blending at the rate of 5% will require 1,050 million litres ethanol annually. But the OMCs (Indian Oil, Bharat Petroleum and Hindustan Petroleum) have procured only 400 million litres since January 2013. Blending in states
like Uttar Pradesh, Haryana, Punjab, Delhi and Karnataka has been taking place at 10% but in several other states like Tamil Nadu, Andhra Pradesh, Maharashtra and Gujarat only 5% has been achieved. At the national level, only 2 to 2.5% blending is happening against a target of 5%.

With a due consideration to all the above facts, the management of ‘Sentini’ has decided to go for a Multi-feed and Multi-Product Ethanol Plant with production capacity of 160 KLPD.

1.2 Project Details

<table>
<thead>
<tr>
<th>NAME OF THE COMPANY</th>
<th>M/s. Sentini Bio Products (P) Limited Unit-II</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADDRESS OF THE COMPANY</td>
<td>Sentini Group of Companies</td>
</tr>
<tr>
<td>REGISTERED OFFICE</td>
<td>Plot No. 1229, Road No. 60, Jubilee Hills, Hyderabad - 500 034</td>
</tr>
<tr>
<td>CORPORATE OFFICE</td>
<td>Sentini Group of Companies</td>
</tr>
<tr>
<td></td>
<td>Plot No. 1229, Road No. 60, Jubilee Hills, Hyderabad - 500 034</td>
</tr>
<tr>
<td>LOCATION OF PROJECT</td>
<td>Gandepally Village</td>
</tr>
<tr>
<td></td>
<td>Kanchikacherla Mandal</td>
</tr>
<tr>
<td></td>
<td>Krishna District, Andhra Pradesh</td>
</tr>
<tr>
<td>Line of Activity</td>
<td>• Manufacture of Rectified Spirit/ENA/Ethanol/Industrial Alcohol/Potable alcohol/Grain Impure Spirit with Denature spirit</td>
</tr>
<tr>
<td></td>
<td>• Captive Power generation</td>
</tr>
<tr>
<td>Capacity Proposed</td>
<td>160 KLPD Rectified Spirit/ENA/Ethanol/Industrial Alcohol/Potable alcohol/Grain Impure Spirit with Denature spirit</td>
</tr>
<tr>
<td></td>
<td>5 MW captive power plant</td>
</tr>
</tbody>
</table>
2.0 INTRODUCTION

2.1 Identification of project and Project Proponent

M/s. Sentini Bio Products Private Limited is existing plant with 125 KLPD Grain based distillery and 4 MW power plant at Gandepally Village, Kanchikacherla Mandal, Krishna District, Andhra Pradesh, the existing plant has procured ample land i.e 100 acres envisaged for establishment of 120 KLPD distillery and 4 MW power plant. Now the same group is proposed another distillery plant with 160 KLPD Molasses/ Grain based distillery plant with cogeneration power plant of 5 MW within the existing plant premises of 100 acres under the name of M/s. Sentini Bio Products Private Limited Unit – II as new unit. This unit would be designed in a versatile fashion by adopting latest CDM (Clean Development mechanism) process techniques as well as with state-of-the art machinery. The project would be formulated in such a fashion and manner so that the utmost care of Safety Norms & Environment Protection shall be taken care of.

The Promoters

The proposed project of the Ethanol Plant would be undertaken & implemented by the management of SBPPL Unit -II. The promoters are well experienced in Business, Management, and Technology and process orchestration and have made a thorough study of entire project, planning as well as implementation schedule.

The names and designations of the Promoters are as under:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name</th>
<th>Designations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>K. Jaya</td>
<td>Managing Director</td>
</tr>
<tr>
<td>2.</td>
<td>T. Seshagiri Rao</td>
<td>Director</td>
</tr>
<tr>
<td>3.</td>
<td>T. Ratna Kumari</td>
<td>Director</td>
</tr>
<tr>
<td>4.</td>
<td>Dr. Padma Movva</td>
<td>Director</td>
</tr>
<tr>
<td>5.</td>
<td>MLN Acharyulu</td>
<td>Director</td>
</tr>
</tbody>
</table>

2.2 Brief Description of nature of Product:

The Bio-energy industry across the world has the potential to make significant contributions to meet the world’s energy needs. In India, Bio-energy can contribute towards achieving the country’s energy security and help reduce the dependence on fossil fuels. Large possibilities exist
for biomass resources, in particular energy crops to penetrate into Power Generation, Transport Markets, Pharmaceutical Markets and Potable alcohol markets.

This proposed project of **M/s. Sentini Bio Products Private Limited Unit – II** aims to be part of the Agro-Based Industry for manufacturing Rectified Spirit/ ENA / Ethanol/Pharma Alcohol/ Industrial Alcohols by using agricultural not for human consumption crops such as Molasses, Maize, Sorghum grain, broken rice and starch based cereals and power generation.

**2.3 Demand – Supply Gap:**

Alcohol has assumed very important place in the Country’s economy. It is a vital raw material for a number of chemicals. It has been a source of a large amount of revenue by way of excise duty levied by the Govt. on alcoholic liquors. It has a potential as fuel in the form of power alcohol for blending with petrol & Diesel. Also, the fermentation alcohol has great demand in countries like Japan, U.S.A., Canada, Sri Lanka etc. as the synthetic alcohol produced by these countries, from naphthta of petroleum crude, is not useful for beverages.

Teething problems in the 5% EBP program are primarily on account of the shortage of ethanol at various locations across the country. Even in states where blending has taken off in full swing, it has been seen that ethanol supply has not been adequate to meet demand. Even supply locations in UP and Uttarakhand where supplies have been satisfactory so far are now facing a severe shortfall of ethanol.

The petroleum industry however looks very committed to the use of ethanol as fuel, as it is expected to benefit the farmers as well as the oil industry in the long run. Ethanol can be produced from Sugar cane, wheat, corn, beet, sweet sorghum etc. Ethanol is one of the best tools to fight vehicular pollution, contains 35% oxygen that helps complete combustion of fuel and thus reduces harmful tailpipe

**Expert Committee on Ethanol Blending**

Indian Government had set up an Expert Group headed by the Executive Director of the Centre for High Technology for examining various options of blending ethanol with petrol at terminals/depots. Considering the logistical and financial advantages, this Group had recommended blending of ethanol with petrol at supply locations (terminals / depots) of oil companies. In view of the above, Government vide the Gazette notification of 3rdSeptember,
2002 No. P-45018/28/2000-C.C had mandated that with effect from 1-1-2003, 5% ethanol-doped petrol will be supplied in following nine States and four contiguous Union Territories of Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh, Pondicherry, Daman & Diu, Goa, Dadra and Nagar Haveli & Chandigarh. This was the beginning of ethanol implementation in 1st phase.

Government of India further announced to implement the Ethanol programme in 2nd phase. This was intended to supply ethanol bended Gasoline across the country effective the year 2006 and in 3rd phase switching over from the existing 5% to 10% blending of ethanol in selected states.

With implementation of the 5% Ethanol-Blended Petrol (EBP) programme throughout the country still a distant dream due to various complications like ethanol shortages, the variable taxation structure of state governments and regulatory restrictions, the petroleum ministry has decided to defer the proposed rollout of mandatory 10% blending of ethanol, which was expected to take place from October, 2008 onwards. Blending at the rate of 5% will require 1,050 million litres ethanol annually. But the OMCs (Indian Oil, Bharat Petroleum and Hindustan Petroleum) have procured only 400 million litres since January 2013. Blending in states like Uttar Pradesh, Haryana, Punjab, Delhi and Karnataka has been taking place at 10% but in several other states like Tamil Nadu, Andhra Pradesh, Maharashtra and Gujarat only 5% has been achieved. At the national level, only 2 to 2.5% blending is happening against a target of 5%.

**Potable Alcohol Market**

Liquors are manufactured in a synthetic way to imitate foreign liquors viz. Whisky, Brandy, Rum and Gin. They are called Indian Made Foreign Liquor (I.M.F.L.). (Different varieties are produced by addition of flavors & are called spiced liquor.) The excise duty on I.M.F.L. is much higher than that on country liquor. Supply of country liquor at low rates is very much needed to keep away the illicit liquor manufacturers & traders. The I.M.F.L. requires alcohol of very high purity and high quality. For this purpose separate distillation plant to redistill and purify Rectified Spirit is necessary. This alcohol is called Extra Neutral Alcohol. It is also useful in cosmetics and perfumes manufacturing.

Extra Neutral Alcohol (ENA) is used as the main raw material in the manufacture of consumption alcohol. There are two varieties of ENA: Molasses based ENA and Grain based ENA. The molasses
based ENA is mainly used to manufacture cheap liquor and Grain based ENA is used for premium brands. In developed nations it has been declared that consumption alcohol should not be manufactured from molasses as it is dangerous for human consumption. But in India there is an acute shortage of Grain ENA and only available raw material for consumption alcohol is molasses ENA so it is been widely used.

India has just topped the fastest-growing list of a popular research report recently; the country also remains the most attractive destination for international alcobev companies despite high duties. It is apparent from the number of new companies who have entered the market since last year, and the number of new brands being introduced across the country. The alcoholic beverage industry is a multi-billion dollar business. The Indian liquor industry is estimated over ₹55,000 Crore and has been growing at around CAGR 7% per annum in the past financial year (FY 2009-14).

In volume terms, the IMFL industry is nearly 310 million cases with country liquor accounting for another 220 million cases. Beer accounts for another 260 million cases. The IMFL market is currently 60% whisky, 17% brandy, 15% rum, and 8% white spirits like vodka and gin. Wine market is said to be about 2.7 million cases.

2.4 Imports V/s Indigenous generation:

India has about 300 distilleries, with a production capacity of about 3.2 billion liters of Rectified spirit (alcohol) 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 liters 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 EBP 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.

### Production & Distribution of Molasses, Alcohol and Ethanol

<table>
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<tr>
<th>Item</th>
<th>2005 / 06</th>
<th>2006 / 07</th>
<th>2007 / 08 (Forecast)</th>
</tr>
</thead>
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<tr>
<td>Total Molasses Production (million tons)</td>
<td>8.55</td>
<td>11.21</td>
<td>12.15</td>
</tr>
<tr>
<td>Molasses for:</td>
<td>7.45</td>
<td>9.21</td>
<td>10.05</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>Alcohol Production (million tons)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Use (feed, other uses &amp; waste) (million tons)</td>
<td>1.10</td>
<td>2.00</td>
<td>2.10</td>
</tr>
<tr>
<td>Total Alcohol Production (million liters)</td>
<td>1790</td>
<td>2200</td>
<td>2400</td>
</tr>
<tr>
<td>Opening Stocks (million liters)</td>
<td>483</td>
<td>730</td>
<td>1120</td>
</tr>
<tr>
<td>Imports (million liters)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Alcohol for:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Use (million liters)</td>
<td>619</td>
<td>631</td>
<td>655</td>
</tr>
<tr>
<td>Potable liquor (million liters)</td>
<td>747</td>
<td>765</td>
<td>780</td>
</tr>
<tr>
<td>Ethanol for Blended Gasoline (million liters)</td>
<td>100</td>
<td>250</td>
<td>550</td>
</tr>
<tr>
<td>Other Use (million liters)</td>
<td>77</td>
<td>84</td>
<td>85</td>
</tr>
<tr>
<td>Carryover Stocks of Alcohol (million liters)</td>
<td>730</td>
<td>1120</td>
<td>1450</td>
</tr>
</tbody>
</table>

Source: FAS/New Delhi estimates based on information from industry sources

All nations across the world are concerned about the rate of increase in the global warming. India through its large sugarcane industry can play a pro-active role in mitigating the same. The recent awareness of the advantages of using green fuel for generation of power and use of gasohol to reduce automobile emissions have led to setting up of a number of co-generation plants in various sugar mills and the Government of India is taking steps to encourage manufacture of Ethanol for the purpose of doping motor fuel to reduce air pollution. The Indian sugar industry can therefore, make an intelligent use of this opportunity for its sustainable growth. It is observed that this can be possible through change in its present product mix. The various likely options are the setting up of

- Gasohol Power complexes from Sugar Cane.
- Manufacture of Sugar, Alcohol and Power from sugarcane.
- Sugar, Power and Alco chemical complexes.

As on date there are no Ethanol - Power complexes existing in the country or probably elsewhere and setting up of these will require large initial investments. Similarly, there are very few sugar mills in the country at present which are co-generating power and producing downstream chemicals from alcohol due to poor economy of scales. With steps being taken to rapidly modernize the Indian sugar industry, it is now possible to save large quantities of bagasse for use as fuel to produce power. Similarly, with the decision to encourage mixing gasoline with ethanol as an oxygenate the demand for ethanol is expected to rise rapidly.
2.5 Employment generation (Direct & Indirect):

The man power required for the industry is 150.
3.0 PROJECT DESCRIPTION

3.1 Type of the Project
The proposed Project mainly involves fermentation of Starch containing Molasses/Grains for producing Rectified Spirit/ENA/Ethanol/ Industrial Alcohol/Potable alcohol/Grain Impure Spirit with Denature spirit.

3.2 Location of Project
The proposed Distillery Unit is located at Gandepally Village, Kanchikacherla Mandal, Krishna District in Andhra Pradesh.

3.3 Details of the Alternate sites
No Alternate sites have been examined.

3.4 Size or Magnitude of Operation
M/s. Sentini Bio Products (P) Limited Unit-II has decided to go for a Multi-feed and Multi-Product Ethanol Plant with production capacity of 160 KLD as Rectified Spirit/ENA/Ethanol/ Industrial Alcohol/Potable alcohol/Grain Impure Spirit with Denature spirit and 5 MW captive Power plant.

Products & By-Products
The different products and By-Products considered for manufacture are as under

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Product</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rectified Spirit/ENA/Ethanol/ Industrial Alcohol/Potable alcohol/Grain Impure Spirit with Denature spirit</td>
</tr>
<tr>
<td>2.</td>
<td>Power</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of By-Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>DWGS/ (Distilleries Wet Grain with Solubles) / DDGS (Distilleries Dry Grain with Solubles)</td>
</tr>
<tr>
<td>2.</td>
<td>Yeast Sludge</td>
</tr>
<tr>
<td>2.</td>
<td>CO₂ Recovery from Fermentation Process</td>
</tr>
</tbody>
</table>
3.5 Manufacturing Process details

3.5.1 With Molasses

Production of Rectified spirit /ENA/ Ethanol is mainly carried under the following Steps:

i. Molasses Fermentation

ii. Distillation (includes "Wash to ENA" mode and "Wash to RS" mode)

iii. Molecular Sieve Dehydration (MSDH) for Ethanol

**MOLASSES FERMENTATION**

In Hi-Ferm Fermentation process for molasses based operation, culture yeast will be used. Hi-Ferm Fermentation is Fermentation system which offers running the process in fed batch mode in order to cater to variations in Molasses Quality in terms of Fermentable Sugars, TRS, etc. Hi-Ferm Fermentation Plant will have following sections:

- Molasses Handling and Distribution:
  
  Screened molasses from Day Molasses Tank will be fed to molasses receiving tank and molasses will be weighed. Weighed molasses will be distributed to cell mass propagation, Fermentation and yeast activation section.

- Yeast Propagation:
  
  Culture yeast will be grown in laboratory during plant start-up. Yeast propagation section comprises molasses diluter and hygienically engineered yeast vessels equipped with heating, cooling and air sparging facility.

- Pre Fermentation:
  
  In Pre-Fermenter vessel, molasses, process water, nutrients and additive will be added for activation/growth of cell mass. Filtered air will be sparged as required for repairing of cell membranes and other cell components. Activated cell mass will be transferred to Fermenter to maintain desired cell mass concentration in Fermenter.

  Dilute molasses media will be prepared in yeast vessel by recirculating media through molasses diluter. Laboratory propagated cell mass will be scaled up in series of yeast vessels. Sterile air will be sparged in pasteurized and cooled dilute molasses medium for optimum growth of yeast. Temperature will be maintained by recirculation cooling water through jacket of yeast vessels. Cell mass from Yeast vessel will be transferred to yeast activation vessel to build up cell mass required for Fermentation by cell mass transfer pump.
• Fermentation:
The Fermentation process will be engineered to operate in Fed-batch mode (Controlled batch) depending upon varying qualities of molasses. The purpose of Fermentation is to convert the fermentable sugars into alcohol. During Fermentation, sugars will be broken down into alcohol and carbon di-oxide. Significant heat release takes place during Fermentation. The fermenter temperature will be maintained by forced recirculation flow through plate heat exchangers. A provision will be given for spent wash recycle to Fermentation depending on solids concentration in fermented wash and molasses composition.

DISTILLATION

Distillation – “Wash to ENA” Mode

Following Columns will be under operation
a) Analyser Column
b) Degasifying Column
c) Pre-Rectifier Column
d) Extractive Distillation Column
e) Rectifier cum Exhaust Column
f) Recovery Column
g) Simmering Column

Steam Consumption: 3.2 kg/lit of Total Spirit

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 Thermo-syphon reboiler. Vapors of Degasifying Column will be condensed and taken to Recovery Feed Tank. Analyser vapors will be condensed in Analyser Condensers and will be taken to Pre-Rectifier Feed Tank. Analyser Condensate will be concentrated in Pre-Rectifier Column, which operates under pressure. Condensing steam provides energy to Pre-Rectifier Column through a vertical Thermo-syphon reboiler. A Technical Alcohol cut of about 1-2% of Total Spirit will be taken from the Pre-Rectifier column.

Concentrated alcohol draw from Pre-Rectifier Column will be fed to Extractive Distillation Column for purification. Dilution water in the ratio of 1:9 will be added in this column for concentrating higher alcohol at the top. Top of this Column will be 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 Thermosyphon Reboiler. Technical Alcohol cut will be 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 will be fed to Recovery Column for concentration. A Technical Alcohol cut will be taken out from the top of this column. Simmering Column will be operated under high reflux for better separation of methanol and di-acetyl. Final ENA product draw will be taken from the bottom of this column.

Distillation – “Wash to RS” Mode

Following Columns will be under operation:

- a) Analyser Column
- b) Degasifying Column
- c) Recovery Column
- d) Rectifier cum Exhaust Column

Steam Consumption: 2.2 kg/lit of Total Spirit

Pre-heated Fermented wash will be fed to Degasifying Column. Fermented wash will be stripped off alcohol by ascending vapors in Analyser Column. Vapors of Degasifying Column will be condensed and appropriate TA cut will be taken out from this Column. The DG Condensate will be fed to Recovery Column. Analyser vapors will be condensed in Analyser Condensers and taken to Rectifier Feed Tank (which acts as Pre-Rectifier Column Feed Tank in Wash to ENA mode). Rectifier Column, which operates under pressure, concentrates the condensate of Analyser Column to 95% v/v concentration. Fusel Oil Draws will be taken from appropriate trays and fed to Recovery Column. Recovery Column concentrates the fusel oil streams. A suitable Impure Spirit cut will be taken out from this Column. Rectified Spirit draw of 95% v/v will be taken out from the upper trays of Rectifier Column and taken to storage after passing it through a cooler.

Heat Integration and Energy Input Points

- Condensing steam through a vertical Thermosyphon Reboiler provides energy to Rectifier cum Exhaust Column.
- Rectifier cum Exhaust Column meets the energy requirement of Analyser 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 (MSDH) FOR ETHANOL

The process drives the rectified spirit feed from rectifier column through a bed of desiccant beads. Twin beds will be provided to allow for bead regeneration in continues operation. One bed will be in dehydration mode while the other is regenerating. Depending on feed and product specifications, dehydration-regeneration exchange takes place approximately every few minutes. As the regeneration process releases adsorbed water together with contained ethanol, it is recycled back to the vaporizing column for reprocessing. The feed will be pumped to vaporizing column, overhead vapor of which is superheated to required operating temperature and circulated to sieve bed 1 assumed in the description to be in dehydration mode. After passing through the desiccant, the vapor will be condensed, cooled and sent to product storage. A small portion of the product vapor will be sent, under high vacuum, through bed 2, in regeneration mode, to prepare the desiccant for cycle changeover when bed 2 goes online. The regeneration operation forces release of moisture from the desiccant, making the bed 2 ready for next cycle. The recovered low concentration vapors will be condensed and recycled back to the vaporizing column. The stream (lees) from the bottom of the vaporizing column, containing a maximum of 2000 PPM of ethanol, will be pumped to battery limits.

CARBON DIOXIDE RECOVERY SYSTEM (BY PRODUCT)

CO$_2$ gas will pass through scrubbing tower, where the gas will be scrubbed with water. From the scrubber after washing the gas will pass through air compressor and then the gas will pass through a tower containing sodium dichromate to eliminate the impurities, if any and then to drying arrangement with sulphuric acid. Subsequently it will pass through a tower containing coke coated with washing soda to eliminate odour. The scrubber blowdown will be recycled into the fermenters.
After the scrubber, the pressurized CO$_2$ will be liquefied and stored in the storage container which will be disposed through tankers to the soft drink manufacturing units. Total CO$_2$ production will be 121.6 T/day.

Process flow diagram of molasses based distillery:

3.5.2 with Grains

The distillation plant will be designed to produce either Rectified Spirit (RS) or potable quality super fine Extra Neutral Alcohol (ENA) or Ethanol (fuel ethanol or Anhydrous Alcohol (AA) or Industrial Alcohol. The Project will have a capacity of 160 KLPD Production of RS + IS with integrated units of ENA and AA. Integrated distillation unit provides flexibility to produce either of the products depending on the market demand. The main process sections are explained below.

Grain Handling

The incoming corn grains are inspected upon receipt. Inspection is carried out to determine the bushel weight, moisture content, mold infestation and general appearance. The accepted quality corn grain is unloaded into silos for general appearance the accepted quality corn grain is unloaded into silos for storage before milling. The stored grain is weighed to determine the incoming quantity. Grain is lifted and unloaded by bucket elevator into grain silos. Grain from hopper is transferred continuously to feed bin of intermediate bucket elevator. This bucket elevator lifts the grains and feeds to vibratory pre-cleaner.
The Pre-cleaner removes light impurities like Straws, Stem and fine dust. Grain from vibrator will be fed by gravity to magnetic separator to remove iron particles. From magnetic separator the grain will be fed by gravity to de-stoner. This machine removes heavier particles like stones and supplies almost stone free grains. From de-stoner the grain will be fed by gravity to hammer mill. Grains will be stored in silos only.

The complete reaction of conversion of starch into ethanol can be represented as follows:

\[
H(C_6H_{10}O_5)_n OH \xrightarrow{\text{amylolytic enzymes}} n C_6H_{12}O_6 \xrightarrow{\text{yeast}} 2n CH_3CH_2OH + 2n CO_2
\]

Milling

The milled flour from hammer mill will be fed by bucket elevator to a vibratory sifter from a small hopper. The vent losses are minimized by a bag filter on vent lines. Flour will be unloaded from hopper to vibratory sifter through rotary valve. The sifter classifies flour into fine and course. The coarse particles are recycled by gravity to mill through duct. A specially designed mill facilitates air escaping through Aspiration Section. Front opening of Hammer Mill facilitates easy change of Screen & Hammers. Versatility of this Mill is that it can be used for grinding of all types of grains like Maize, Sorghum, non-consumable Broken Rice & Millets. The Flour coming from mill of desired size of particles will be conveyed through Screw Conveyor and Bucket Elevator and is Stored in Flour Storage Silo with avg. Bulk Density of 0.5/0.6Gm./Cc. The Capacity of Silo is around Four Hours production of Hammer Mill. The flour bins will be mounted on load cell for Weighment. Once the flour bin is full, the actuated diversion valve stops feeding and diverts feed to other bin, which will be empty. At a time one bin will be getting filled and other bin will be feeding to further section. The flour from either of bin will be fed to next section, i.e., liquefaction section through a screw conveyor, which works through loss in weight feeder.

The purpose of milling will be to break up the grains to the required particle size in order to facilitate subsequent penetration of water in the cooking process. The milling section of the plant has the necessary equipment for cleaning of the raw materials and screening the milled flour so as to get the desired particle size. The raw material will be first milled to form flour in the milling section. The reduced particle size makes the starch accessible to gelatinization during cooking.
The size distribution test or "sieve analysis" of the meal is done regularly in order to ascertain the mill setting and particle size distribution. The slurry of the milled raw material will be prepared in water and this slurry will be then sent for liquefaction.

**Liquefaction**

In liquefaction process, starch will be hydrolyzed to dextrins. The Liquefaction will be carried out in Single Liquefaction Tank. Feedstock Flour will be transferred to Pre-masher and mixed with Recycle Streams, thin stillage and liquefying enzyme. Slurry from Pre-masher will be taken to Liquefaction tank where temperature will be maintained by injection of direct steam through steam sparger / 17ducator. Necessary retention time will be maintained in the Liquefaction Tank. Slurry pH will be maintained by supplying dilute caustic solution. Contents in Slurry Tank will be kept in suspension by Agitation. The Liquefied Slurry will be then cooled in Slurry Cooler using cooling water supply and transferred to Pre-fermentation and Fermentation section.

**Saccharification and instantaneous Fermentation**

A part of the Liquefied Slurry will be taken to Prefermenter, where a part of Saccharifying Enzyme will be added to convert the Liquefied Slurry to glucose. Active Dry Yeast, nutrients and saccharifying enzyme will be added to Yeast Slurry Tank to prepare the Yeast slurry. Yeast slurry will be transferred to Pre-fermenter. Filtered Process Air from Air blower will be sparged at rated quantity to Prefermenter for yeast growth. Carbon di-oxide generated along with the process air will be scrubbed and will be compressed in cylinders. The heat generated due to exothermic reaction during growth and ethanol formation will be removed through Pre-fermenter Cooler and the temperature of fermented mash will be maintained in Pre-fermenter. The Activated cell mass will be then transferred to Fermenter. One Pre-fermenter will be provided in the Fermentation section.

Balance Liquefied Slurry will be taken to the Fermenter. Activated cell mass from Pre-fermenter and rest of the Saccharifying Enzyme will be added to the Fermenter, typically in two stages. The heat generated due to exothermic reaction during ethanol formation is removed through Fermenter Cooler and the temperature of the fermented mash will be maintained in the Fermenter. CO₂ produced during the process will be fed to CO₂ scrubber and collected washed purified and compressed in cylinders and will be sold to beverages industries.

\[
\text{C}_6\text{H}_{12}\text{O}_6 \xrightarrow{\text{Enzymes}} 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 + \text{energy}
\]

\[(\text{ZymaseComplex}) (\text{Ethyl alcohol})\]
Distillation (Production of RS/ENA)

The distillation system comprises seven columns namely Analyzer, Degasifying column, Prerectifier Column, Extractive distillation Column, Rectifier Column, Simmering Column & Recovery column. The Recovery Column will be used for concentrating & removal of Fusel Oil & impurities. After separation of impurities the recovered alcohol will be recycled back to the prerectifier column system.

Ethanol will be separated and concentrated using principles of fractional distillation this is based on difference in boiling points of volatile compounds on mixture. Heat energy from columns operating under high pressure will be utilized for columns operating under low pressure to optimize the operation for energy consumption. Multi Pressure distillation system which ensures steam economy (practically 50% reduction in Steam consumption as compared to conventional atmospheric distillation system).

The next stage in the manufacture of alcohol is to separate alcohol from fermented wash and to concentrate it to 95% alcohol called as rectified spirit, for this purpose method of distillation is employed. The fermentation mash containing Alcohol, non-fermentable solids and water is supplied to Distillation to separate the alcohol and other impurities, as a continuous flow. The Distillation system will be designed suitably for production of either Rectified spirit (RS) / premium quality extra neutral alcohol (ENA) / Fuel ethanol (Anhydrous alcohol). The system details are as below:

The system consists of 7 main columns, namely;

1. Degassifier Column
2. Analyser Column
3. Prerectifier Column
4. Extractive distillation Column
5. Rectification Column
6. Simmering Column
7. Recovery Column

During Wash to RS mode of operation, only four columns namely Degassifier column, Analyser column, Rectification column and Recovery column will be under operation. During Wash to ENA mode of operations, all the seven columns will be under operation. The distillation column consist
number of bubble cap plates where wash will be boiled and alcoholic vapors are separated and concentrated on each plate stage by stage. Wash will be fed to Degassifier Column to remove CO₂ gas present in wash. Alcohol will be stripped off water in Analyzer column. The top vapours from analyzer column and Degasifying section will be fed to Calendria 1 in integrated evaporation section as heat source for concentrating thin slop. Analyzer condensate from Condensers will be fed to pre-rectifier column as feed and steam will be supplied as heat source. Pre-rectifier removes most of the fusel oils. Top of the Pre-rectifier column will be fed to Reboiler of Extractive distillation and simmering Column and draw of the distillate from pre-rectifier column will be fed to extractive distillation column after dilution where DM water will be used as dilution water and remaining distillate returns back as reflux. In extractive distillation column most of the high boiling and low boilers impurities are separated from ethanol by volatility inversion in presence of water. The bottom ethanol water mixture will be preheated by steam condensate and spent lees from rectifier bottom and fed to rectifier column. Top vapours of Rectifier column will be fed to Analyzer Reboiler as a heat source. In rectifier column rectified spirit draw will be taken out from top trays and fed to simmering column where mainly methanol impurities along with esters are separated. Pure ENA is obtained at bottom of simmering column, which will be cooled and stored. The impure spirit from top of Degasifying column, extractive distillation column, rectifier column and simmering column are fed to Recovery Column. The final impure spirit cut will be taken out from Recovery column. The alcohol containing fusel oil from pre-rectifier and rectifier column will be fed to fusel oil decanters. Fusel oil being immiscible with water collects at the top and will be decanted through a funnel and sent to storage. The rectifier column, recovery column and prerectifier column get heat from steam at 3.5 bar (g).

Rectification column and pre-rectifier column works under positive pressure. The top vapours from rectifier column will be condensed in analyzer column for giving heat to analyzer re-boiler. Most of the other columns work under vacuum. The Distillation process is operated through PLC.

**PRODUCTION OF ALCOHOL**

Rectified Spirit containing at least 95% v/v alcohol will be pumped from RS collection tank to dehydration section. Rectified spirit will be preheated in Feed preheater 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 will be
supplied to the Evaporator Column through Evaporator Column Reboiler with steam condensing on shell side. The steam condensate can be recycled back to the boiler.

Overhead feed alcohol vapors from the Evaporator Column will be then passed through Superheater where alcohol vapors are superheated. Energy for superheating will be supplied by steam condensation on shell side of the Superheater.

Superheated hydrous alcohol vapors will be sent to twin Adsorbent Beds. The twin Adsorbent Beds operate in cyclic manner. Twin beds will be provided to allow for bead regeneration in continuous operation. While one bed will be in dehydration mode, the other will be in regeneration mode. Depending on feed and product specifications, dehydration-regeneration exchange takes place approximately every few minutes. The feed alcohol vapors will be 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 will be then passed through Regeneration Preheater and Feed Preheater for heat recovery. The Product alcohol vapors will be then passed through Product Condenser where product vapors will be condensed with the help of cooling water. Condensed product alcohol will be collected in product receiver. The Product alcohol from Product Receiver will be pumped to Product Cooler where it will be cooled with the help of cooling water and then sent for storage.

During regeneration mode, vacuum will be 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 will be pulled in the system with the help of Vacuum Eductor. Regeneration stream will be used as motive fluid for Vacuum Eductor. The regeneration stream coming from the Regeneration Condenser will be pumped, preheated in Regeneration Preheater and fed to the Evaporator Column for recovery of alcohol. Moisture present in feed alcohol will be 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 will be interchanged, that is, the bed on dehydration mode will be switch over to regeneration mode and the bed on regeneration mode will be switch over to dehydration mode, with the help of automation system.

The alcohols both pure and impure is first led into separate receivers, the quantity of alcohol produced is assessed daily in the receivers and it is finally transferred to storage vats in the warehouse. The spirit from storage vats could be issued for de-naturation, or for own consumption, or directly to the tankers of the customer depending upon the type of requisition.

**CO₂ RECOVERY PLANT**

During the biochemical reaction in fermentation section, CO₂ is generated as by product along with ethyl alcohol. This raw CO₂ gas having 99% v/v purity (DB) is taken for purification followed liquefaction.

Initially gas is taken to Foam trap to eliminate liquid particle carried over from fermentation section. Here process water is used to rinse down the foam. Clean gas from Foam trap is then fed to Low pressure organic removal system with the use of booster blower. Organic impurities associated with carbon dioxide gas are scrubbed using high efficiency packing. Main impurities like ethanol, aldehyde, ethyl acetate, are extracted in the scrubbing water through counter current operation of the scrubber. This purified gas is then fed liquid knock out drum for removal of water traces. Purified gas is compressed in two stages reciprocating non lubricated water cooled compressor. This high pressure gas is cooled down to desired temperature in water cooled after cooler. Additional impurity separation step is used to enhance CO₂ gas purity by scrubbing impurities present in traces by use of potable water.

Odour producing hydrocarbons and other sulphur based compounds will be removed in adsorption tower by using activated carbon as a media. De odorized high pressure carbon dioxide gas will be cooled down to remove significant portion of moisture using ammonia as coolant. It will be further dried in molecular sieve dehydration unit. This step is essentially required to avoid ice formation during liquefaction of carbon dioxide. This purified is carbon dioxide gas will be then liquefied by using refrigeration system. Refrigeration system consists of screw compressor, pre cooler, refrigerant condenser and accessories. Liquid CO₂ still contains non condensable gases like nitrogen, oxygen which are removed through venting. Liquid CO₂ stripper is used to avoid high vent CO₂ losses which uses packed tower with reboiler and reflux condenser. Oxygenates of
nitrogen are removed through molecular sieve NOx tower. Purified liquid CO$_2$ of desired quality will be then sent to liquid CO$_2$ storage tank. Liquid storage tank will be equipped with all necessary accessories like pressure safety valves, insulation.

After the scrubber, the pressurized CO$_2$ will be liquefied and stored in the storage container which will be disposed through tankers to the soft drink manufacturing units. Total CO$_2$ production will be 121.6 T/day.

Process flow diagram of grain based distillery:

3.5.3 Raw Materials:
The Industry will use wide range of Agro based raw materials available in different seasons. The Government of India and Andhra Pradesh State Government is encouraging Agro based Industries in production of Ethanol and other related products to benefit farmers, create rural employment for agricultural laborer’s. We have chosen Molasses/Grains depending on the availability. The following will be the raw material requirement.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Raw Material</th>
<th>Source</th>
<th>Quantity (TPD)</th>
<th>Method of Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Molasses</td>
<td>From sugars plants</td>
<td>666</td>
<td>Through covered tankers by Road</td>
</tr>
</tbody>
</table>
1. **Grains**
   (Maize, corn, Sorghum grain, broken rice & other starch based grains, etc.)
   - Local areas: 426
   - Transport: Through covered trucks by Road

2. **Fuel (60 TPH Boiler)**
   - Indian Coal, SECL: 315
     - Rail / Through covered trucks by Road
   - OR
   - Imported, Indonesia / South Africa: 255
     - Sea / Rail / Through covered trucks by Road
   - OR
   - Biomass, Local Areas: 390
     - Through covered trucks by Road

### 3.5.4 Resource Optimization / recycling and reuse:
Spent wash generated during the process of Fermentation, will be treated in Multiple Effective Evaporators to concentrate the solids content up to 30% and concentrated syrup along with wet cake will be dried in Dryer to concentrate the solids content up to 90%. This is known as DDGS. This will be sold as Cattle feed or Poultry feed or to the Fish/ prawn farms.
The condensate generated during the process of Multiple Effective Evaporators and Drying will be reused in the Process thus decreasing the net water requirement.

### 3.5.5 Availability of Water:
Water requirement for the proposed project will be 1600 KLD. Water requirement for the proposed project will be met from Muniyeru River which is at a distance of 1.9 Kms. from the site. Prior permission from the Irrigation Department will be obtained before drawing water. A water storage tank will be proposed on site to ensure adequate water supply. Efforts will be taken to minimize & conserve water. Water harvesting techniques will be used to increase ground water levels.

### 3.5.6 Power Requirement:
The power required for the industry is estimated to be 5 MW. The power requirements will be met using the captive system located on the premises. Change over to APCPDCL connection is proposed to facilitate start-up operations and as a backup option.
3.5.7 Quantity of wastes generation:

With Molasses
As per CPCB recommendations the spent wash quantity will be restricted to a maximum of 8 KL/KL of R.S. for Molasses based distillery by adopting continuous fermentation technology with yeast recycle. The Maximum Spent wash generation from the proposed 160 KLPD Distillery plant will be 1280 KL/day.

With Grains
As per CPCB recommendations the spent wash quantity will be restricted to a maximum of 6 KL/KL of R.S. for Grain based distillery by adopting continuous fermentation technology. The Maximum Spent wash generation from the proposed 160 KLPD Distillery plant will be 960 KL/day.

3.5.7.1 Treatment wastewater:

Spent wash Treatment
With Molasses:
The spent wash will be concentrated to 60% solids in Multiple Effect Evaporators and then will be incinerated in exclusive 60 TPH Boiler. This is a ZERO discharge system already approved by Central Pollution Control Board.

Evaporation System
The objective of Evaporation is to concentrate a solution consisting of a volatile solute and a volatile solvent. Evaporation is conducted by vaporizing a portion of the solvent to produce a concentrated solution of thick liquor with 60% solids and 40 % moisture content.
The evaporation system consists of 5 evaporators, which are connected, in series. The spent wash will be pumped from distillation section, which will be fed to the evaporator by using feed pump. Gas Liquid separator (5 Nos.) will be used to separate the vapor and liquid. Both Vapor & Spent wash will be fed to the next evaporation effect so it is called as feed forward effect evaporation. The vapor from last evaporator will be condensed in condenser and transferred to the dryer while the condensate from the evaporators is first utilized for heat recovery. While vacuum pump maintains vacuum in the entire system. Product final thick spent wash with 60% solids will be used in boiler for incineration.
Incineration of Concentrated Spent Wash
The final concentrate from the Evaporators (60% solids w/w) will be incinerated in the Boiler by mixing with bagasse / coal. The condensate from the Evaporation system will be reused in the plant operation. Zero discharge will be implemented as per CREP recommendations

With grains:
Spent wash from mash column bottom is fed to decanter centrifuge after cooling in fermented mash pre-heater. The decanter concentrates the solids present in the spent mash to desired level.

The wet cake is separated in decanter at 25% to 30% solids. This wet cake will be sold directly as cattle feed or mixed with concentrated thin slop for further concentrating in Dryer.

Evaporation Process
The objective of Evaporation is to concentrate a solution consisting of a volatile solute and a volatile solvent. Evaporation is conducted by vaporizing a portion of the solvent to produce a concentrated solution of thick liquor with 30% solids and 70 % moisture content.

The evaporation system consists of Evaporators connected, in series. The spent wash will be pumped from distillation section, which will be fed to the evaporator by using feed pump. Gas Liquid separator (5 Nos.) will be used to separate the vapor and liquid. Both Vapor & Spent wash will be fed to the next evaporation effect so it is called as Feed Forward Effect Evaporation. The vapor from last evaporator will be condensed in condenser and transferred to the dryer while the condensate from the evaporators is first utilized for heat recovery. While vacuum pump maintains vacuum in the entire system. Product final thin slop with 30% solids will be transferred to the drying system where it is further concentrated to 88-90 % solids. The condensate from evaporation will be recycled.

Drying Process
The wet cake from the Decanter and the concentrated syrup with 30% solids from the Evaporator will be dried in a steam tube bundle dryer to produce DDGS with 10% moisture and 90% solids, which will be sold as cattle feed. It is totally a zero discharge process, which is in accordance with the CREP recommendations.

Non-Process Effluent Treatment & Disposal:
The boiler blow down & DM Plant & Softener regeneration water will be treated in a neutralization tank and after treatment it will be mixed with CT Blow down. All these treated
Effluent streams will be stored in a Central Monitoring Basin (CMB). The treated effluent will be used for dust suppression / ash conditioning and onland for irrigation within the premises after ensuring compliance with CPCB /SPCB standards. The scrubbed water from CO₂ Scrubber will be consumed in the Fermentation section. The effluent will be used for greenbelt development within the plant premises after ensuring the compliance with CPCB/SPCB standards.

3.5.8. Solid Waste

The following will be the solid waste generation & disposal.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Solid waste</th>
<th>Quantity (TPD)</th>
<th>Disposal method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Yeast sludge</td>
<td>4.4</td>
<td>Mixed with spent wash and incinerated in the boiler.</td>
</tr>
<tr>
<td>2.</td>
<td>DDGS (with 90% solids)</td>
<td>144</td>
<td>Will be sold as cattle feed / Fish / Prawn feed</td>
</tr>
<tr>
<td>3.</td>
<td>Boiler Ash</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>with 100% biomass</td>
<td>67.5</td>
<td>Ash generated will be given to brick manufacturers.</td>
</tr>
<tr>
<td></td>
<td>when 100% Indian Coal is used</td>
<td>141.7</td>
<td>Ash generated will be given to brick manufacturers / cement plants.</td>
</tr>
<tr>
<td></td>
<td>when 100% Imported Coal is used</td>
<td>25.5</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Sludge from ETP</td>
<td>8</td>
<td>Used as manure</td>
</tr>
</tbody>
</table>
4.0 SITE ANALYSIS

4.1 Connectivity:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>The plant site connected by tar road from NH-9</td>
</tr>
<tr>
<td>Rail</td>
<td>Gangineni railway station – 18 Kms.</td>
</tr>
<tr>
<td>Air</td>
<td>Gannavaram Airport – 52 Kms</td>
</tr>
<tr>
<td>Sea Port</td>
<td>Kakinada Port – 208 Kms.</td>
</tr>
</tbody>
</table>

4.2 Land form, Land use and Land ownership:
The proposed land is for industrial use. It is private land. The total land already acquired by the management.

4.3 Topography: The topography of the land is more or less flat without undulations.

4.4 Existing land use pattern: The existing land is industrial.

4.5 Existing Infrastructure: There is no existing infrastructure at the site.

4.6 Soil classification: The soil at the site is Black soil.

4.7 Climatologically data:
The climate is tropical in Kanchikacherla. In winter there is much more rainfall in Kanchikacherla than in summer. The average annual temperature in Kanchikacherla is 28.6 °C. The average annual rainfall is 938 mm. The driest month is January with 2 mm. Most precipitation falls in July, with an average of 211 mm. The warmest month of the year is May with an average temperature of 34.2 °C. In December, the average temperature is 24.0 °C. It is the lowest average temperature of the whole year. The difference in precipitation between the driest month and the wettest month is 209 mm. The average temperatures vary during the year by 10.2 °C.

4.8 Social Infrastructure Available: The entire social infra-structure available at Kanchikacherla Mandal.
5.0 PLANNING BRIEF

5.1 Planning Concept:
The proposed Project is fermentation type industry in which starch containing raw materials will be fermented for manufacturing Rectified Spirit/ENA/Ethanol/Industrial Alcohol/Potable alcohol/Grain Impure Spirit with Denature spirit.

5.2 Population Projection:
Total population of Kanchikacherla Mandal is 67,662 living in 16,234 Houses, Spread across total 19 villages and 16 panchayats. Males are 33,990 and Females are 33,672

5.3 Land use Planning:
The following is the Land use planning of the area

<table>
<thead>
<tr>
<th>ITEM</th>
<th>EXTENT OF LAND (ACRES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-up area</td>
<td>10.00</td>
</tr>
<tr>
<td>Internal roads</td>
<td>2.00</td>
</tr>
<tr>
<td>ETP</td>
<td>5.00</td>
</tr>
<tr>
<td>Greenbelt</td>
<td>10.00</td>
</tr>
<tr>
<td>Parking area</td>
<td>1.00</td>
</tr>
<tr>
<td>Vacant area &amp; Others</td>
<td>2.58</td>
</tr>
<tr>
<td>Total</td>
<td>30.58</td>
</tr>
</tbody>
</table>

5.4 Amenities / Facilities:
Facilities like canteen, rest rooms and recreation facilities will be provided in the proposed project. No other additional facilities are proposed.
6.0 PROPOSED INFRASTRUCTURE

6.1 Industrial area

The following Plant and machinery will be installed in the Industrial processing area

**List of Plant and Machinery**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Grain Storage Section – Silo</td>
</tr>
<tr>
<td>2.</td>
<td>Grain Handling Section</td>
</tr>
<tr>
<td>4.</td>
<td>Liquefaction Section</td>
</tr>
<tr>
<td>5.</td>
<td>Fermentation Section</td>
</tr>
<tr>
<td>6.</td>
<td>Distillation Section</td>
</tr>
<tr>
<td>7.</td>
<td>Steam Boiler with Accessories</td>
</tr>
<tr>
<td>8.</td>
<td>Steam turbine with Step down transformer &amp; synchronization</td>
</tr>
<tr>
<td>9.</td>
<td>Steam condensers</td>
</tr>
<tr>
<td>10</td>
<td>Air compressor</td>
</tr>
<tr>
<td>11</td>
<td>Storage section (Daily Receiver Section, Bulk Storage tanks)</td>
</tr>
<tr>
<td>12</td>
<td>Centrifugal Machines</td>
</tr>
<tr>
<td>13</td>
<td>CO₂ Recovery Plant (In future)</td>
</tr>
<tr>
<td>14</td>
<td>DDGS Drying section</td>
</tr>
<tr>
<td>15</td>
<td>Multiple Effect Evaporation Section</td>
</tr>
<tr>
<td>16</td>
<td>Raw water treatment plant</td>
</tr>
<tr>
<td>17</td>
<td>R.O. Plant for boiler water</td>
</tr>
<tr>
<td>18</td>
<td>Fire protection equipments for entire plant</td>
</tr>
<tr>
<td>19</td>
<td>Weigh bridge</td>
</tr>
<tr>
<td>20</td>
<td>Water storage tanks</td>
</tr>
<tr>
<td>21</td>
<td>Electricals</td>
</tr>
<tr>
<td>22</td>
<td>Piping works</td>
</tr>
<tr>
<td>23</td>
<td>Lab equipments</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 proposed project.

6.3 Green Belt:

Total 10.0 Acres (33% of total area) of Green belt will be developed in the Plant premises.
6.4 Social Infrastructure:
Social infrastructure will be developed as per need based in the Villages.

6.5 Connectivity:

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</tr>
</tbody>
</table>

6.6 Drinking water management:
Drinking water required for the workers will be met from ground water resources.

6.7 Sewerage system:
Domestic waste water generated will be treated in septic tank followed by soak pit.

6.8 Industrial waste management:

Distillery (with molasses)
Spent wash generated from the distillery will be treated in multiple effect evaporators to concentrate the solids to 60% and then will be sent to a 60 TPH boiler for incineration.

Distillery (with Grains)
Spent wash will be passed through decanter and then the thin slop from Decanter will be dried in Multiple Effect Evaporators (MEE) followed by Dryer up to 90% solids w/w. This solid is known as DDGS. This will be used as cattle feed.

Non-process effluents like DM plant regeneration water & boiler blow down will be neutralized in neutralization tanks and will be mixed with Cooling tower blow down. This treated effluent after ensuring compliance with standards stipulated by SPCB for wastewater for onland for irrigation, will be utilized for ash conditioning and greenbelt development. Sanitary waste water will be treated in septic tank followed by soak pit. Hence there will not be any adverse impact on environment due to the proposed distillery project.
6.9 Solid waste management:

The following will be the solid waste generation & disposal.

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<tr>
<td></td>
<td>with 100% biomass</td>
<td>67.5</td>
<td>Ash generated will be given to brick manufacturers.</td>
</tr>
<tr>
<td></td>
<td>when 100% Indian Coal is used</td>
<td>141.7</td>
<td>Ash generated will be given to brick manufacturers / cement plants.</td>
</tr>
<tr>
<td></td>
<td>when 100% Imported Coal is used</td>
<td>25.5</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Sludge from ETP</td>
<td>8</td>
<td>Used as manure</td>
</tr>
</tbody>
</table>

6.10 Power requirement & Supply / Source:

The portion of power requirements will be met through grid. Balance Power requirement will be met through in house generation through turbine.
7.0 REHABILITATION AND RESETTLEMENT (R & R) PLAN

No rehabilitation or resettlement plan is proposed as there are no habitations in the Plant site.
8.0 PROJECT SCHEDULE & COST ESTIMATES

The total cost of the project has been estimated at Rs. 300.00 Crores. The Project Cost estimates include all expenses to be incurred towards the entire project development including Site Development Expenses, Payments to EPC Contractor, Non EPC Expenses, Pre-Operating Expenses, Start-Up Fuel & Commissioning Expenses, Contingency, and Margin Money for Working Capital and Financing Expenses including Interest during Construction (IDC).
9.0 ANALYSIS OF PROPOSAL (FINAL RECOMMENDATIONS)

With the implementation of the proposed project, the socio-economic status of the local people will improve substantially. The land rates in the area will improve in the nearby areas due to the proposed activity. This will help in upliftment of the social status of the people in the area. Educational institutions will also come-up and will lead to improvement of educational status of the people in the area. Primary health centre will also come-up and the medical facilities will certainly improve due to the proposed project.

EMPLOYMENT POTENTIAL

The man power required for the industry is 150.

OTHER TANGIBLE BENEFITS

The following will be the other benefits to the area due to the proposed project.

- Educational status will improve in the area
- Medical standards will improve due to the proposed project.
- Overall economic up-liftment of socio-economic status of people in the area.
- Ancillary developmental activities like CO$_2$ plant, Cattle feed plants will be created due to the establishment of the proposed unit.

SOCIO-ECONOMIC DEVELOPMENTAL ACTIVITIES

The management is committed to uplift the standards of living of the villagers by undertaking following activities / responsibilities.

- Health & hygiene
- Drinking water
- Education for poor
- Village roads
- Lighting
- Creating harmonious relationships
- Helping locals to conduct sports
- Training to the unskilled manpower