PRE-FEASIBILITY REPORT

Submission

To

Ministry of Environment & Forests & Climate Change,

New Delhi

By

AROMA BIOTECH PRIVATE LIMITED

[Enhancement of existing Distillery plant from 60 KLPD to 75 KLPD]

at

Avapadu Village, Nallajerla Mandal,
West Godavari District, Andhra Pradesh

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Chapter 1 : EXECUTIVE SUMMARY

1.1 ABOUT THE PROPOSED PROJECT

Aroma Biotech Private Limited is obtained Environmental Clearances from MOEF New Delhi vide order F.No.J-11011/824/2007-IA-II(I) dated 11th July, 2008 and 3rd June, 2009 for 60 KLPD Distillery plant, 1 KLD Malt Spirit and 2.25 MW Co-generation Power Plant in Avapadu Village, Nallajerla Mandal, West Godavari District, Andhra Pradesh. Total land already in possession of the management is 43.69 acres. Now the company proposed to enhance the Distillery Plant capacity from 60 KLPD to 75 KLPD in the same existing land of 43.69 acres of land by making suitable minor process modifications. The following is the summary of the proposed expansion project.

S.NO.	PARAMETERS	DESCRIPTION
1.	Plant capacity for which Environmental Clearance obtained	Distillery (RS/ENA/Ethanol) – 60 KLPD Malt Spirit – 1 KLD Co-gen power – 2.25 MW
2.	Proposed Enhancement proposal	Distillery (capacity enhancement from 60 KLPD to 75 KLPD (Capacity enhancement will be achieved through suitable minor process modifications)
3.	Total land already in possession	43.69 acres
4.	Project cost for 75 KLPD	Rs 98.0 Crores
5.	Water requirement	
a.	Water requirement for existing plant	The water requirement for 60 KLPD distillery is 1540 cum/day.
b.	Water requirement for the proposed enhancement	Water requirement proposed for 60 KLPD distillery at the time of Environmental Clearance in 2009 is 1540 KLD. However by adopting spent wash recycling to the best possible extent, the net water requirement for 75 KLPD plant will be restricted to 750 KLD. Thereby net saving of 790 KLD of precious water
c.	Source of water	Ground water sources Permission for drawing of water from ground water has already been obtained from Groundwater Department, Government of Andhra Pradesh.
6.	Waste water generation	
a.	Effluent generation from the 60 KLD distillery for which Environmental Clearance obtained	549 KLD

b.	Effluent generation from the enhancement proposal	There will be no additional wastewater generation after the capacity enhancement of distillery plant from 60 KLPD to 75 KLPD.
7.	Effluent treatment for 60 KLPD	The thin slop generated from the distillery will be treated in Multiple Effect Evaporators to concentrate the solids to 30% w/w. Thick slop from MEE and wet cake from Decanter will be sold as cattle feed or taken to Dryer to concentrate to 90% solids.
8.	Effluent treatment for enhancement proposal	There will be no additional effluent generation due to the enhancement of distillery plant. Hence no additional treatment facilities will be required. The existing spent wash treatment system, non process effluent treatment system are adequate for 75 KLPD capacity also.
9.	Steam requirement for 60 KLPD distillery plant	Steam requirement for 60 KLPD distillery plant sourced from 28 TPH Boiler.
10.	Steam requirement (enhancement)	The same 28 TPH boiler will be adequate for 75 KLPD also due to reduction in specific steam consumption.
11.	Air emissions (existing)	Emissions from Boiler are Particulate matter, SO_2 and NOx. Bag filters are provided to 28 TPH Boiler to bring down the particulate matter in the exhaust flue gases to below 100 mg/Nm^3. The exhaust flue gases from the boiler discharged into the atmosphere through a stack of 45 m height for effective dispersion of gases into the atmosphere.
12.	Air emissions (enhancement)	The same 28 TPH Boiler will be adequate for enhancement proposal. Hence no increase in fuel for the boiler and no increase in air emissions from the boiler with 75 KLPD distillery.
13.	Noise levels	No new machinery is proposed for the enhancement. Hence there will be no additional noise sources due to the enhancement proposal. Ambient Noise levels will be within the standards prescribed by MOE&F Notification and its amendments even after proposed enhancement.
14.	Solid waste generation (existing)	DDGS – sold as cattle feed. Ash from the Boiler when biomass is used as fuel will be used as manure.
15.	Solid waste generation (expansion)	Additional DDGS generated (18 TPD) due to the enhancement proposal will be – sold as cattle feed. There will not be any additional storage of DDGS due to the enhancement proposal. Ash from the Boiler when biomass is used as fuel will be used as manure

Chapter – 2 : INTRODUCTION OF THE PROJECT / BACKGROUND INFORMATION

2.1 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

Aroma Biotech Private Limited started to be part of the Agro-Based Industry revolution for renewable and sustainable production of Ethanol as fuel, Industrial usage and marketable byproducts from agricultural crops such as Maize, Sorghum grain, broken rice and starch based cereals.

The Project

Aroma Biotech Private Limited is a 60 KLPD Grain based Distillery plant located at Avapadu village, Nallajerla Mandal, West Godavari District. It is at a distance of about 38 Km from Eluru city.

The present capacity is enhancement from 60 KLPD to 75 KLPD has been planned with existing facilities, adequate for 75 KLPD also. The capacity enhancement project is based on the multi feed stock and multi product with a well proven technology world-wide.

Aroma Biotech Private Limited has procured 43.69 acres of the land. Sufficient area is made available for the Effluent Treatment Facilities as it plans for zero discharge. A good network of internal as well as main approach roads maintained. The unit 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 project of the Ethanol Plant would be undertaken & implemented by the management of Aroma Biotech Private Limited. The promoters are well experienced in Business & have made a thorough study of entire project, planning as well as implementation schedule. The names and designations of the Promoters are as under.

S.No.	NAME	DESIGNATIONS
1.	A. Jaipal Reddy	Managing Director
2.	Hariram Agarwal	Joint Managing Director

3.	Amit Agarwal	Director
4.	Sneha Reddy	Director

2.2 BRIEF DESCRIPTION OF NATURE OF PRODUCT

Generation of Alcohol by fermentation technology

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 naphtha of petroleum crude, is not useful for beverages.

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. 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.

The Potable Alcohol market in India for the year 2007-2008 is as follows with Rs.7000 Crores Industry turnover. The year over year growth rate of the Potable alcohol market is 12-15%

IMFL (Whisky, Rum, Brandy, Gin & Vodka) - 121 million cases per annum

Country Liquor – 195 million cases per annum

Beer (made from Barley and Malt) - 103 million cases per annum

Wine Domestic –365,000 cases per annum

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

(Sugar marketing Year (October / September)			
Item	**2005 / 06**	**2006 / 07**	**2007 / 08**
Total Molasses Production (million tons)	8.55	11.21	12.15
Molasses for :			
Alcohol Production (million tons)	7.45	9.21	10.05
Other Use (feed, other uses & waste) (million tons)	1.10	2.00	2.10
Total Alcohol Production (million liters)	1790	2200	2400
Opening Stocks (million liters)	483	730	1120
Imports (million liters)	0	0	0
Alcohol for :			
Industrial Use (million liters)	619	631	655
Potable liquor (million liters)	747	765	780
Ethanol for Blended Gasoline (million liters)	100	250	550
Other Use (million liters)	77	84	85
Carryover Stocks of Alcohol (million liters)	730	1120	1450

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

India's Ethanol Requirement for 5 Percent Blending with Gasoline

(Figures in million liters)

Item	2006/07	2007/08	2008/09
Molasses production (million tones)	11.21	12.15	12.15
Potential alcohol production	2690	2916	2916
Demand for Industrial use, potable alcohol etc	1477	1515	1550
Ethanol demand for 5% blend in gasoline for the country (figure in parentheses is demand at 10% blend)	682 (1364)	741 (1482)	808 (1616)
Total demand	2159 (2841)	2256 (2997)	2358 (3166)

Source: Industry source

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

1. Gasohol Power complexes from Sugar Cane.
2. Manufacture of Sugar, Alcohol and Power from sugarcane.
3. 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 EXPORT POSSIBILITY

Possibility of export of alcohol is there.

2.6 DOMESTIC / EXPORT MARKETS

The entire product as grain ENA will be used in domestic and also will be exported to other countries.

2.7 EMPLOYMENT GENERATION (DIRECT & INDIRECT)

There will be no additional man power requirement due to enhancement of Distillery plant.

Chapter 3 : PROJECT DESCRIPTION

3.1 TYPE OF THE PROJECT

The proposed Project mainly involves

⇒ Production of Rectified Spirit / ENA / Ethanol using Grains as raw material

3.2 LOCATION OF THE PROJECT

Aroma Biotech Private Limited is located at Avapadu Village, Nallajerla Mandal, West Godavari District, Andhra Pradesh. Now the company has proposed to enhance the capacity marginally. The proposed enhancement will be taken up in the existing plant premises only without any additional machinery and by making suitable process changes.

3.3 DETAILS OF THE ALTERNATE SITES

No Alternate sites have been examined as the present proposal for enhancement of capacity from 60 to 75 KLPD, as proposed enhancement will be taken up in the existing plant premises only.

3.4 SIZE OR MAGNITUDE OF OPERATION

The proposal is for enhancement of distillery plant capacity (RS/ENA/Ethanol from 60 KLPD to 75 KLPD by making suitable minor process modifications.

3.5 PROCESS DETAILS

3.5.1 MANUFACTURING PROCESS

Milling Section

Milling is required to reduce the particle size of raw material. The milling section of the plant has the necessary equipment for cleaning of raw materials and screening the final floor so as to get the desired particle size.

The raw material is first milled to form floor in the milling section. The lower particle size increases the total surface area per unit weight and makes the starch accessible to

gelatanisation during slurry preparation. The slurry of the milled raw material is prepared in water and this slurry is then sent for liquefaction. In this mill 20 to 30 % oversize particles will be recycled for second milling. The milling also will be provided with proper de-stoner and magnetic separators.

LIQUIFICATION SECTION

Liquefaction initiates the conversion of starch into simple molecules of dextrin. It is divided into three sub processes.

a. **PRE LIQUEFACTION :** This involves partial liquefaction of starch, in presence of enzyme, at a temperature well below the gelatinization temperature.
b. **JET COOKING :** This step involves the cooking of starch slurry with live steam so as to instantaneously raise it's temperature. This gelatinises and opens up starch molecules, thus making it accessible to enzyme action. Jet cooking also sterilizes the slurry.
c. **POST LIQUEFACTION:** The jet cooked slurry is again held at high temperature in presence of enzyme to complete the process of liquefaction.

SACCHARIFICATION:

Saccharification is the formation of sugars. Here, it is done enzymatic ally by breakdown of dextrin. Here the dextrin is acted upon by a second enzyme for further breakdown and release of sugars.

FERMENTATION:

The batch fermentation proposed is the latest and proven technology as compared to the old batch fermentation technology. It has many advantages like continuity of operation, higher efficiency and ease of operation. Most modern ethanol production plants adopt this continuous fermentation technology. Considering all the above advantages, we have proposed to adopt the efficient fermentation in the distillery.

The fermentation process employs a special yeast culture, which can withstand variations in the molasses quality, temperature and other shock loads. Fermentation plant consists of five to six numbers fermenter tanks connected in series with all the accessories like plate heat exchangers for cooling, sparges, broth mixers and air blowers etc.

The yeast is immobilized using special media and it remains in the fermentation plant throughout and hence it gives a tremendous advantage in maintaining the yeast population and in combating the bacterial infection. The technology is called continuous mixed bed fermentation (CMB) and which is the latest technology available in the industry at present.

Saccharified slurry from Saccharification section is pumped into Fermenter and is diluted to appropriate sugar concentration by adding water. It is, then inoculated with required quantity of suitable yeast. The assailable nitrogen is added in the medium in the form of urea and dap. Temperature in the Fermenter is maintained with the help of plate heat exchanger.

The fermented mash is reticulated continuously through PHE. Recirculation also helps in proper mixing of fermented mash. The rate of fermentation reaction gradually increases and after 50 to 55 hours, fermentation completes. After completion of reaction the fermented mash is delivered to mash holding tank. The fermented mash collected in the Clarified Wash Tank is then pumped to Mash or Primary column for distillation.

A closed loop cooling tower system with an induced draft-cooling tower with circulation pumps is also provided to ensure higher cooling efficiency and to minimize water wastages.

ADVANTAGES OF FERMENTATION PROCESS

1. **Starch Fermentation Process:**

- Good ease of operation and easy way daily cleaning / filling required.
- Consistency in plant operation and performance is very high.
- Less operating manpower required.
- The process can also be automated with less cost and great ease.
- Easy to control & trouble shoot, as it is a continuous process.

2. **Culture Yeast usage.**

- No fresh yeast dosage required. Yeast is present in its culture form and hence saving in cost of the yeast.
- Elimination of other yeast related problems like wild yeast and contamination along with the fresh yeast.

- Yeast culturing will also ensure optimum yeast concentration in the fermenters, even when there is some bacterial growth.

3. **Higher Alcohol Concentration in Wash:**

- Less effluent volume and low cost of treatment.
- Reduced steam consumption in Distillation.
- Higher alcohol concentration ensures low bacterial activity in fomenters.

4. **Rugged Process based on culture Yeast Technology:**

- Can handle varying quality raw material.
- Easy to start and stop, as and when required.
- Can take care of fluctuations like temperature and other conditions.
- Good control and handling of bacterial contamination.

5. **Higher alcohol recovery per MT of Grain**
6. **Yeast can withstand a temperature of up to 34 deg C:** The process works at different climatic conditions i.e. at different locations and also in hot seasons without significant drop in performance.
7. **Lesser residence time of fermentation:**

- Lower residence time also help to maintain low bacterial activity.
- Lesser fermentor volumes and lower capital cost.

8. **No agitation is required in fermentors:**

- Low electricity consumption.

9. **Minimum and controlled air sparing is employed for fermenter:**

- Low electricity consumption.

HYDRO-EXTRACTIVE VACUUM DISTILLATION

The vacuum distillation has many advantages over conventional distillation atmospheric distillation plants like lower energy requirement, very good quality alcohol and less scaling of the distillation trays due to sludge. The vacuum distillation produces ethanol of international quality standards and there is a lot of demand of ethanol from the vacuum distillation process.

"The Extra Neutral Alcohol produced from this latest technology will meet most of the international quality standards for ethanol like US Pharmacopoeia, British Pharmacopoeia and

Japanese standards." The vacuum distillation approximately requires 50 % less steam as compared with the conventional old distillation technologies. The vacuum distillation consists of distillation columns with high efficiency column trays, condensers, re-boilers, vacuum pumps and reflux pumps. A closed loop cooling tower system with an induced draft-cooling tower with circulation pumps is also provided to ensure higher cooling efficiency and to minimize water wastages.

In this vacuum distillation ethanol is separated and concentrated using principal of fractional distillation. This is based on difference in boiling points of volatile compounds in mixture. There are six columns in the system Primary column also called Mash column, Rectifier column, Hydro extractive distillation column, Refining column, Dealdehyde Column and Defusel Column

The Primary or Mash column is operated under vacuum and it is heated using the vapours from the Rectifier column, which is operated under a slightly higher pressure. The vacuum operation of the Primary column will help in reducing the overall energy requirement and also improve the product quality.

Due to vacuum operation of the Primary column the scaling of the column trays is minimised and plant can be operated without stoppage for a longer duration as compared with atmospheric plant.

The fermented mash is preheated using a beer heater at the top of the Primary column and followed by a plate heat exchanger and finally delivered to the top of Primary column. The pre heating of mash in two stages recovers energy and saves steam required for the distillation. The mash runs down the Primary column trays from tray to tray, while vapour goes up in the column contacting the mash at each tray. As a result of this contact and boiling, ethanol and other impurities along with some water are stripped in the form of vapours and remaining mash in the form of vinasse (effluent) is disposed off from the bottom of the Primary column for ETP.

When the vapours of ethanol and other volatile compounds reach the top, they are separated out from the top of Primary column and are then condensed in beer heater and other Primary

condensers. The heat is supplied by the Rectifies vapours from the Reboilers provided at the bottom of the Primary column.

Two reboilers are provided at the bottom of the Primary column to facilitate the heat transfer from Rectifier column vapour to Primary column. The vapours from Primary top condensed in the above condensers are collected and fed to the Hydro extractive distillation column for purification. The ethanol streams from other columns are also diluted with soft water and are fed to Hydro extractive distillation column via a feed preheater (plate heat exchanger). A Reboiler is installed at the bottom of the Hydro extractive distillation column. Impurities such as Aldehydes and Fusel oil are removed from the top of the Hydro extractive distillation column and are fed to Fusel oil concentration column, while dilute ethanol along with fewer impurities, are taken from the bottom of the Hydro extractive distillation column and fed to Rectifier column middle. Steam is fed to Hydro extractive distillation column through Reboiler.

A Reboiler is installed at the bottom of the Rectifier column, which heats the process liquid i.e. alcohol and water received from the Hydro extractive distillation column, indirectly with the help of steam. In the Rectifier column, the ethanol is concentrated to 96 % by refluxing the Rectifier reflux liquid. Extra neutral ethanol (ENA) is tapped from the top of Rectifier column, which is directly sent to Refining column for removal of other low boiling impurities. While the bottom product of the Rectifier column called spent lees is drained off. The higher alcohols also called light and heavy fusel oils are removed from the middle portion of the Rectifier column so that they are mixed with Extra Neutral Alcohol.

Light and Heavy fusel oil from Rectifier column and top cut from Hydro extractive distillation column plus ester cut from Hydro extractive distillation column is fed to Fusel oil concentration column.

The steam is delivered from the bottom of the Defusel Column to allow the desired separation. Fusel oil consisting of higher alcohols viz. amyl alcohol, iso amyl alcohol, n-propenol etc. are concentrated near middle portion of Fusel oil concentration column and can be removed and separated in the Fusel Oil Decanter in sufficient higher concentration. While the bottom product called spent lees is drained off.

The top product from the Defusel Column is cooled in the cooler and sent to storage as Technical Alcohol. The Refining column is fed with the ENA from the Rectifier column, which is boiled off in the Refining column to remove the low boiling impurities like methanol and mercaptants.

Extra Neutral Alcohol (ENA) is tapped from the bottom of the Refining column, which is cooled upto 30 ^{0}C, by passing through ENA cooler.

The impure ethanol, which contains many impurities, is drawn from the top of the Refining column and cooled in the cooler and sent to storage as Technical Alcohol. Alternatively diluting with soft water in Dealdehyde Column as and when required can further purify some of these Technical Alcohol streams.

Both fermentation and distillation are operated with PLC computer controls system. This will help in maintaining the parameters consistent and without any fluctuations. Most modern distillery plants use computer system for controlling their parameters.

Advantages of Distillation Process

1. Vacuum Multipressure Distillation:

- Multipressure operation results in to good overall energy savings over a longer period.
- Vacuum operation (low temperature) of Mash column ensures minimum scale formation of the trays / other column internals and hence very low cleaning frequency of Mash column is required.
- Lower temperature operation also ensures good quality alcohol, due to less pyrolysis impurity formation in Mash column.
- Much better stripping (separation) of low boiling impurities takes place under vacuum conditions.

2. Simple ENA distillation scheme:

- The distillation scheme consists of optimum number of distillation columns and their configurations, allowing lower capital cost.
- The scheme of distillation is very simple and allows easy operation.
- The simple distillation scheme allows for a cost effective level of automation using PLC system.

- The overall electricity requirement is also low, as compared to other complicated multipressure distillations.

3. Effective separation of Impurities and alcohol quality:

- Better quality ENA, as both low boiling and higher boiling impurities are separated effectively in dedicated columns.
- Vacuum conditions also help in separation of many impurities.
- The alcohol produced is of Neutral taste and character, with a Potassium Permanganate Test Time of around 30 to 35 minutes as BP 1993 method.
- The number of trays and tray spacing in each column are designed, for handling different quality fermented wash.
- The same distillation scheme can be easily made flexible to produce different quality products depending on the requirement.

4. Higher Distillation efficiencies:

- The distillation trays are of Bubble Cap construction, designed using vast experience, resulting in to good tray efficiencies at varying conditions.
- The turndown of the distillation plant is as high as 40 to 50 %, which allows the operation at 40 to 50 % capacity, without any significant change in the efficiency and steam consumption.
- Mash column losses are quite low due to, less scaling, at lower temperature operation.
- The alcohol vapors, after vacuum system is scrubbed to recover maximum alcohol.

5. Instrument System using DCS (Distributed Control System)

- LC system is a most cost effective instrumentation system for distilling industry.
- It results in to a very high consistency level in terms of alcohol quality, distillation efficiency and energy consumption.
- The distillation operation requires less manpower.
- The DCS system allows easily, changing the operating parameters to produce different quality alcohol as and when required.

MOLECULAR SIEVE TECHNOLOGY FOR ETHANOL

Molecular sieve technology works on the principle of pressure swing adsorption. Here water is removed by adsorbing on surface of `molecular sieves' and then cyclically removing it under different conditions (steaming).

Molecular sieves are nothing but synthetic zeolites typically 3A zeolite. Zeolites are synthetic crystalline Alumino Silicates. This material has strong affinity for water. They adsorb water in cold condition and desorb water when heated. This principle is used to dehydrate ethanol. The crystalline structure of zeolites is complex and gives this material the ability to adsorb or reject material based on molecular sizes. Water molecule can enter the sieve and be adsorbed, but larger alcohol molecule will not be retained and will go through the bed. There can be two to three beds in parallel. Once a particular bed is saturated with water, it is heated with steam so that adsorbed water is desorbed from the bed. Till that time, other bed is used for dehydration.

This type of system is characterized by high capital investment. Low steam consumption and low power consumption as compared to distillation. The only disadvantage of molecular sieves is the high attrition rates of sieves in case of small plants. Hence, typically, some amount of sieve material needs replacement periodically, thereby resulting in higher cost of production in case of small capacity plants. in case of large capacity plants, the molecular sieve is the most optimum both in terms of initial investment and operating cost.

Proposed Modifications:

Capacity enhancement from 60 KLPD to 75 KLPD will be achieved by making only minor process plant modifications. The following modifications will be made to achieve 75 KLPD production.

Proposed Modifications in Liquefaction & Fermentation:

- Liquefaction Process will be carried out at higher DS Flour Slurry.
- Fermentation will be carried out using high tolerant yeast, operating at 12% v/v.

Proposed Modifications in Distillation: Changes in heat integration:

- Extractive Distillation column operation mode will to be changed from 'vacuum' to 'Atmospheric Pressure' & Pre-rectifier column will be operated on vacuum instead of pressure conditions.
- Distillation Pre-rectifier & Extractive column plant integration will be changed to facilitate above changes.

Project cost of the 75 KLPD plant will be Rs. 98.0 Crores.

Following hardware changes have to performed

- ✓ Extractive column overhead condensers to be used for pre-Rectifier column for condensing vapors of Column.
- ✓ Extractive distillation column vapor pipe line modification to drive the simmering column
- ✓ Steam line modification in distillation section.
- ✓ Instrumentation calibration.

Also following changes have to be performed.

- In Liquefaction section – initial liquefaction and final liquefaction tank capacities will increase marginally.
- In fermentation section – Pre-fermenter capacity will increase marginally.
- One additional Decanter Centrifuge will be required in Decantation section.
- Proportionate increase in Civil & Structural Cost.

Environmental Impact due to Coal burning:

No additional steam requirement and the boiler capacity remains 28 TPH only with the present proposal. Hence no additional coal will be required for the present proposal of enhancement of capacity from 60 KLPD to 75 KLPD. The following measures will help in mitigating the environmental impacts due to coal

- Bag filters are installed as particulate emission control system and the outlet dust emission will be less than 100 mg/Nm^3.
- Stack height of 45 m provided for effective dispersion of Sulphur dioxide emissions into the atmosphere.
- Ash storage is in silo only.
- Coal is storing in covered sheds.
- Dust suppression system is provided at coal unloading areas.

- Conveyers are covered with GI sheets to prevent any fugitive dust emission.

STEAM AND BOILER DETAILS

- The steam requirement for 75 KLPD plant will be 28 TPH only.
- During the Environmental clearance for 60 KLPD plant, steam requirement has been presumed as 28 TPH. But after detailed engineering actual steam requirement for 60 KLPD has been arrived as 19.6 TPH. This is resulting in significant loss of steam in condensing and thereby a coal loss of 25 TPD. In order to effectively utilize the steam, it has been proposed to enhance the capacity from 60 KLPD to 75 KLPD with 2.25 MW Co-generation power plant. **This capacity enhancement is achieved without any additional coal, which is environmentally beneficial**. **In order to effectively utilize the coal from the steam balancing point of view it has been proposed to generate 75 KLPD**. Comparison of steam balance with 60 KLPD at the time of EC, 60 KLPD post detailed engineering (actual), with 75 KLPD (Actual) is shown below.

Process Steam	Earlier proposal 60 KLPD (Pre-Engg.)	Actual Post 60 KLPD (Detailed Engg.)	Actual Post Engg. (75 KLPD)
Cooking & Liquefaction	2.6 TPH	2.1 TPH	2.6 TPH
Multi Pressure Distillation	9.3 TPH	8.4 TPH	9.3 TPH
Multi effect evaporation	4.1 TPH	1.30 TPH	4.1 TPH
DWGS Dryer	7.4 TPH	6.0 TPH	7.4 TPH
Boiler dearation	4.2 TPH	1.8 TPH	4.2 TPH
Total	**27.6 TPH**	**19.60 TPH**	**27.6 TPH**
Boiler size	**28TPH**	**25 TPH**	**28 TPH**
Power Requirement	**2250 kw**	**1875 kw**	**2250 kw**

- Hence no additional coal / Bio-mass will be required for the present proposal enhancement from 60 to 75 KLPD.
- Hence no additional Sulphur dioxide emissions due to the present proposal.
- Hence no increase in stack height due to the present proposal. The stack height calculation is shown below.(which was depicted during the EC amendment for 60 KLPD in 2009)

Coal consumption : 112TPD

Sulphur content in Coal : 0.5% (Max, by mass)

SO_2 emission (Q) : 112x 1000 x (0.5/100) x 2/24

: 46.7 kg/hr.

Stack height (H) : $14(Q)^{0.3}$

: $14(46.7)^{0.3}$

: 44.3

Hence a Stack height of 45 m suggested for 28 TPH Boiler holds good for the present proposal also and the emissions will be discharged into the atmosphere for effective dispersion of pollutants into the atmosphere.

The following is the raw material requirement for 60 KLPD and 70 KLPD distillery unit.

S.NO	RAW MATERIAL	SOURCE	QUANTITY		METHOD OF TRANSPORT
			For 60 KLPD	For 75 KLPD	
1.	Grains (maize, corn, Sorghum grain, broken rice, and starch based grains etc.)	Local areas	160 TPD	200 TPD (Additional grain requirement for additional 15 KLPD plant is 40 TPD)	Through trucks by Road

For Boiler: Existing 28 TPH Boiler will be adequate for 75 KLPD plant also. Hence no additional fuel requirement for the Boiler due to the present proposal. However we are proposing Biomass also as fuel in the Boiler.

3.7 RESOURCE OPTIMIZATION / RECYCLING AND REUSE

All the possible efforts will be to use optimal resources and we will make every possible effort to reuse and recycle of waste.

3.8 WATER REQUIREMENT

Water requirement proposed for 60 KLPD distillery at the time of Environmental clearance in 2009 is 1540 KLD. However by adopting spent wash recycling to the best possible extent, the net water requirement for 75 KLPD plant will be restricted to 750 KLD. Thereby net saving of 790 KLD of precious water. Water drawl permission has already been obtained from SGWB Govt. of Andhra Pradesh

3.9 POWER REQUIREMENT

The power required for the total plant will be sourced from the Co-generation Power plant only.

3.10 WASTEWATER

3.10.1 WASTE WATER GENERATION

There will not be any additional wastewater generation as there is no extra water requirement for the enhancement distillery from 60 KLPD to 75 KLPD. Existing 60 KLPD distillery ETP is adequate for the 75 KLPD capacity also.

3.10.2 WASTE WATER TREATMENT

There will be no additional effluent generation due to the enhancement of distillery from 60 KLPD to 75 KLPD due to further recycling of thin slop. Hence there will be no additional effluent treatment plant is required for enhancement proposal. The existing MEE, Dryer and non process ETP (as the same 28 TPH Boiler is proposed) is adequate for 75 KLPD also. Hence no new ETP systems are envisaged for the present proposal.

3.11 SOLID WASTE

Quantity of DDGS generation

For 60 KLPD plant: 72 TPD

For 75 KLPD plant: 90 TPD

Additional DDGS generation due to the present proposal: 18 TPD

The entire DDGS will be used as cattle feed. Hence there will not be any solid waste disposal problem due to the present proposal.

Ash from the Boiler when biomass is used as fuel will be used as manure

Chapter 4 : SITE ANALYSIS

4.1 CONNECTIVITY

Component	Description
Road	The plant site is approached metal road which connects Avapadu and Singrajupalem tar road.
Rail	Unguturu – 7.5 Kms.
Air port	Gannavaram Airport – 78 Kms.
Sea Port	Kakinada – 91 Kms.

4.2 LAND FORM, LAND USE AND LAND OWNERSHIP

The present use of the land is Industrial as Distillery plant is in operation. Now the proposed enhancement will be taken in the existing plant premises only.

4.3 TOPOGRAPHY

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

4.4 EXISTING LAND USE PATTERN

The present use of the land is Industrial

4.5 EXISTING INFRASTRUCTURE

The infrastructure required for operating the distillery plant and co-gen power plant will be provided.

4.6 SOCIAL INFRASTRUCTURE AVAILABLE

The entire social infrastructure available at Eluru district which is at distance of 38 Kms. from the plant site.

Chapter 5 : PLANNING BRIEF

5.1 PLANNING CONCEPT

The present proposal is for enhancement of distillery plant from 60 KLPD to 75 KLPD by making suitable minor process modifications.

5.2 POPULATION PROJECTION

Total population of Nallajerla Mandal is 75031 living in 9,748 Houses, Spread across total 35 villages and 24 panchayats. Males are 23,335 and Females are 22,687.

5.3 LAND USE PLANNING

The present land use is industrial.

5.4 AMENITIES / FACILITIES

Facilities like canteen, rest rooms and recreation facilities provided in the plant premises. No additional facilities are proposed.

Chapter – 6: PROPOSED INFRASTRUCTURE:

6.1 INDUSTRIAL AREA

The present proposal is for enhancement of distillery plant from 60 KLPD to 75 KLPD by making suitable minor process modifications.

6.2 RESIDENTIAL AREA (NON-PROCESSING AREA)

Facilities like canteen, rest room and indoor games facilities will be provided in the plant site.

6.3 GREEN BELT

Total 1/3rd of the total area to be developed with greenbelt within the plant premises.

6.4 SOCIAL INFRASTRUCTURE

Social infrastructure will be developed as per need based in the nearby Villages.

6.5 CONNECTIVITY

Component	Description
Road	The plant site is approached metal road which connects Avapadu and Singrajupalem tar road.
Rail	Unguturu – 7.5 Kms.
Air port	Gannavaram Airport – 78 Kms.
Sea Port	Kakinada – 91 Kms.

6.6 DRINKING WATER MANAGEMENT

Drinking water required for the workers Sourced from bore well.

6.7 SEWERAGE SYSTEM

Domestic wastewater generated to be treated in septic tank followed by soak pit. No additional employment due to enhancement. Hence no additional domestic wastewater generation due to the enhancement proposal.

6.8 INDUSTRIAL WASTE MANAGEMENT

6.8.1 WASTEWATER MANAGEMENT

There will not be any additional wastewater generation as there is no extra water requirement for the enhancement distillery from 60 KLPD to 75 KLPD. Existing 60 KLPD distillery ETP is adequate for the 75 KLPD also.

6.8.2 SOLID WASTE MANAGEMENT

Quantity of DDGS generation

For 60 KLPD plant: 72 TPD

For 75 KLPD plant: 90 TPD

Additional DDGS generation due to the present proposal: 18 TPD

The entire DDGS will be used as cattle feed. Hence there will not be any solid waste disposal problem due to the present proposal.

6.9 POWER REQUIREMENT & SUPPLY / SOURCE

The power required for the plant will be taken from co-gen power plant.

Chapter 7 : REHABILITATION AND RESETTLEMENT (R & R) PLAN

No rehabilitation or resettlement plan is proposed as there are no habitations in the Plant site.

Chapter 8 : PROJECT SCHEDULE & COST ESTIMATES

The project cost for the entire 75 KLPD Distillery plant is Rs 98.0 crores.