PROJECT REPORT FOR EXPANASION OF DISTILLERY

CAPACITY (200 KLPD TO 350 KLPD)

150 KLPD RECTIFIED SPIRIT/FUEL ETHANOL/ ENA PLANT

AT DSM CHEMICALS DHAMPUR

(A UNIT OF THE DHAMPUR SUGAR MILLS LTD)

DHAMPUR, DIST: BIJNOR

UTTAR PRADESH

EXECUTIVE SUMMARY

DSM Chemicals, a unit of the Dhampur Sugar Mills Ltd is located in district Bijnor of Uttar Pradesh. The factory is most ideally located with respect to the availability of raw material, water, skilled and unskilled manpower and infrastructure facilities.

In view of the availability of molasses from sugar plant at Mansurpur and other sugar plants of the group located nearby, it is a suitable location for setting up an ethanol plant to meet the demand of the automobile fuel sector. Blending of Ethanol with petrol is being encouraged by the Indian Government to reduce the country's dependence on high priced imported crude oil.Rectified Spirit internal consumption has also gone up for our expanded capacity of Ethyl Acetate.

Ethanol is manufactured from molasses in three steps. First molasses is fermented to produce fermented wash, followed by distillation of fermented wash to produce rectified spirit and finally rectified spirit is dehydrated into ethanol, using molecular sieve system. Molecular sieve system is better than the conventional distillation system as it consumes less steam as compared to the latter.

A suitable effluent treatment plant has been conceived to reduce BOD level to the acceptable limit. Spent wash will be first treated in a bio-methanation plant, which converts organic matter into useful energy in the form of biogas. Biogas is sent to the Boiler as a Fuel, resulting in saving of bagasse. Spent wash from the bio-methanation plant is proposed to be converted into useful manure by bio-composting.

Total project cost for the proposed ethanol plant is estimated at 10737.00Lacs.The project is planned to be funded partly through commercial loans and partly through the Sugar Development Fund. The cost benefit analysis indicates that the project is commercially viable and offers a favourable debt service coverage ratio.

SECTION 1

BACKGROUND

The Dhampur Sugar Mills Ltd (DSM) started operation in 1933 with a 300 TCD sugar mill located at Dhampur in North India and has a successful track record of about seven decades of efficient operation. During this period it has grown into one of the largest sugar manufacturing groups in India, owning at present five sugar mills in the state of Uttar Pradesh with a combined cane crushing capacity of more than 40,000 TCD.

DSM has diversified into molasses based chemicals, by setting up a distillery and manufacturing facilities for alcohol based chemicals, such as; ethyl acetate. Licensed and Installed Distillery Capacity is 200 KLPD. Distillery is already in production of Rectified Spirit ENA and Fuel Ethanol. Apart from alcohol production DSM presently having a esterification plant producing 140 MT/day Ethyl Acetate.

DSM is now proposing to exapand the Distillery Capacity from **200 KLPD to 350 KLPD,** which will be based on most modern technologies and the state of art features. Project will result in Higher efficiencies, Energy conservation and Zero Effluent Discharge.

The present project report covers salient features of the project; such as market scenario, process of manufacture, raw material and utilities, project implementation schedule and estimated cost of project.

This Project Report involves the additional Infrastructure required to enhance the capacity of distillery from 200 KLPD to 350 KLPD i.e. an additional set up of 150 KLPD Distillery with Effluent Handling System.

SECTION 2

NEED FOR ETHANOL PLANT

India is predominantly an agro based economy. Sugarcane plays a vital role in this agro-based economy by providing sugar, the main sweetener, used in India. The state of Uttar Pradesh is the largest producer of sugarcane in India among all the states and accounts for over 45% of the sugarcane production in the country.

There are three important by- products of the sugar industry:

- **Molasses** which is converted into alcohol, an important raw material for organic chemicals and polymer industry.
- **Bagasse** which is used as a fuel for cogeneration of power and also as a raw material for production of paper.
- **Press Mud** which is used for the effluent treatment to produce biofertiliser.

The sugarcane available in U.P. yields on an average; 10% sugar, 32% bagasse and 4% molasses. Molasses is used for manufacturing industrial alcohol, potable alcohol and other organic chemicals.

There are at present more than 45 distillery units in U.P., of which 80% are in private sector and 20% in the Government / Cooperative sector. Functional, distilleries are about 85% and two are based on non conventional sources of raw material i.e. broken grain and malt.

The Alcohol Distillery industry in U.P., with its link to the sugar industry constitutes a major segment of the state's industrialization. Its contribution to the state revenue is second only to the trade tax realization in the state. This is also the highest contribution by any single industry to the state exchequer. It also provides employment to about 10000 persons in the state, thus leading to overall growth.

With the opening up of the automobile fuel sector for blending with ethanol and favorable export of hydrous ethanol, the alcohol industry is slated for a major expansion to play a vital role in meeting the ever- growing energy requirement of the country. Ethanol blended fuel is set to be made mandatory once again, as part of a long term commitment to the blending programme in keeping with the policy prevailing in countries, such as the USA and Brazil. The main reason for

switching back to ethanol blending is the better properties of ethanol as an oxygenate compared to the conventional oxygenate MTBE. The latter is being phased out globally on the contention that it is carcinogenic. Moreover, ethanol blending is expected to reduce the country's dependence on high priced imported crude oil.

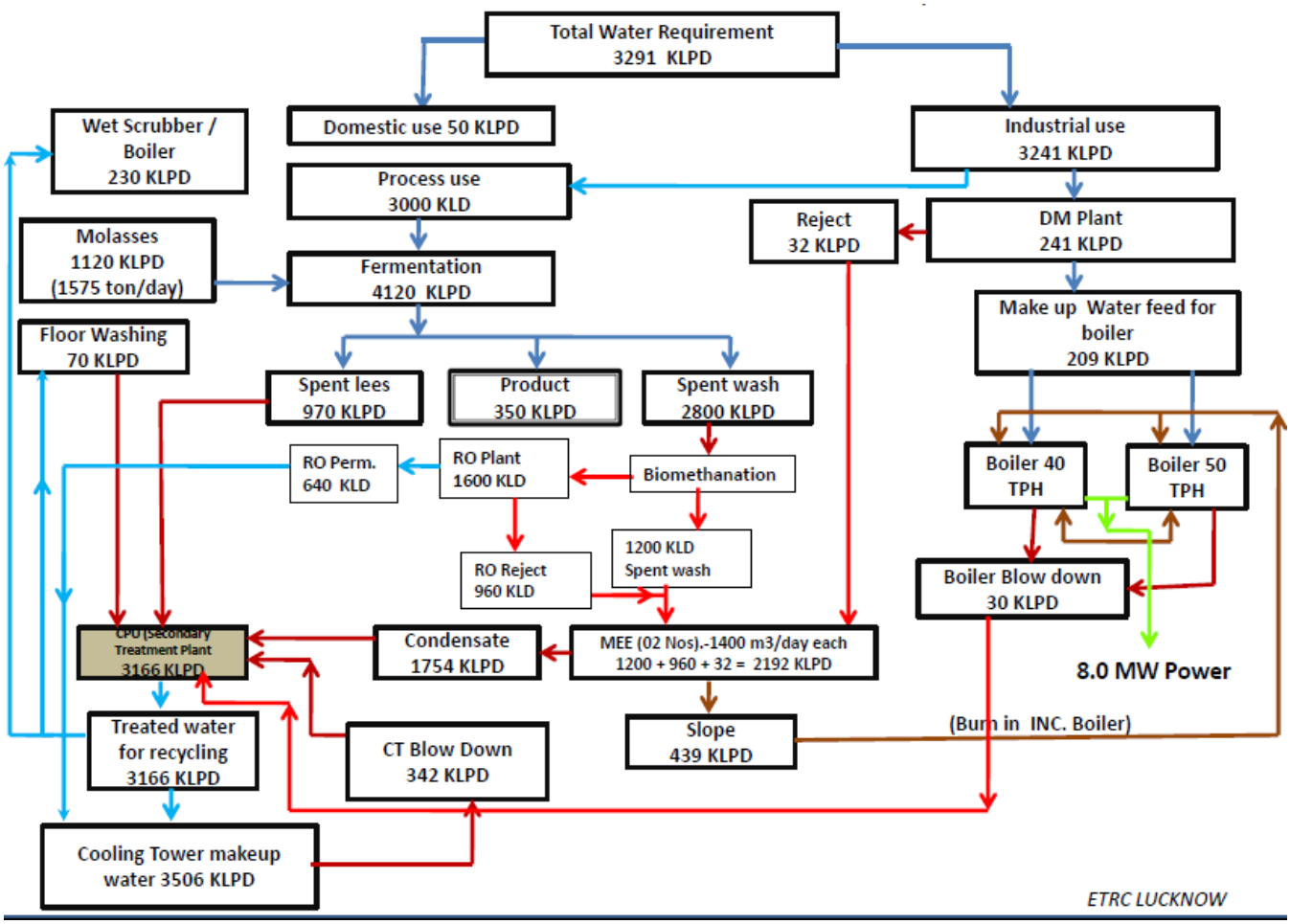
Sugar industry will also benefit, as its profitability will increase by producing a value added product, having an assured market.

This diversification will also strengthen the sugar industry's ability to balance the Sugar and Ethanol production according to the prevailing International prices of sugar and crude oil. This is the kind of model successfully employed by the Brazilian sugar industry.

In the wake of increased ethanol prices world wide, many potential producers of ethanol have been prompted to re-evaluate opportunities in the sector. There is also increased enthusiasm for national fuel ethanol programme designed to reduce vehicle carbon emissions.

SECTION 3

PROCESS DESCRIPTION: DISTILLERY BLOCK DIAGRAM



PROCESS BLOCK DIAGRAM FOR DISTILLERY/ETHANOL PLANT

The process for the manufacture of Ethanol consists of the following steps:

- Fermentation of molasses to produce fermented wash.
- Distillation of fermented wash to produce rectified spirit (RS).
- Distillation of fermented wash to produce Extra Neutral Alcohol (ENA).
- Dehydration of RS to Ethanol, using the molecular sieve system.
- Distillation of fermenter wash to produce Ethyl Acetate

3.1 FERMENTATION:

3.1.1 Molasses: Storage & Handling

Molasses is a by product of the sugar industry and is generally stored in steel tanks. It is pumped to the molasses weighing system located in the plant premises. The weighing system is generally a load cell based system with a counter for measurement of quantity of molasses being processed in a given period of time. After weighment, molasses is pumped to the molasses diluter located alongside the fermenter.

3.1.2 Yeast Propagation:

Molasses is taken into the yeast vessel and sterilized by steam. Yeast seed material is prepared and added to the yeast vessels by inoculating molasses with yeast. The contents of the yeast vessel are then transferred to the yeast activation vessel. The purpose of aeration in the yeast activation is to allow time for the multiplication of the yeast cells.

3.1.3 Fermentation:

The purpose of fermentation is to convert the fermentable sugars into alcohol. During fermentation, sugars are broken down into alcohol and carbon dioxide. Significant heat release takes place during fermentation, however; the fermentation temperature is maintained between 32-34 deg C by recirculation of cooling water through forced circulation heat exchangers.

The fermentation system has a provision for addition of anti foam, nutrients etc. Alcohol concentration of 5% V/V is maintained in the first fermenter, while the same is maintained between 7-8% V/V in the second fermenter, depending upon FS content of molasses. CO2 is collected and is passed through a CO2 scrubber in order to recover any alcohol, escaping with the gas. The alcohol containing the water is returned to the system and mixed with the fermented wash. The CO2 is taken to the CO2 bottling plant.

At the end of the fermentation cycle, wash is received in a wash holding tank, from where it is fed to the distillation section. Yeast growth critically required for

the fermentation process, is maintained under aerobic conditions and the aerated cell mass is transferred to the fermenters.

3.1.4. Distillation of Wash to Rectified Spirit:

The process requires analyser, aldehyde, degasifying and rectifier cum exhaust columns. The analyser, aldehyde and degasifying columns are operated under vacuum, whereas; rectifier cum exhaust column is operated under pressure.

Rectifier column top vapours meet the energy requirement for analyser column. The rectifier column top vapours are condensed in a thermo-siphon reboiler, connected to a flash tank and then flash vapours are injected into the analyser column.

The fermented wash is fed to the degasifying column top. Analyser vapours are condensed and fed to the rectifier column. Final RS is drawn from the top of the rectifier column.

3.1.4. Distillation of Wash to ENA Spirit:

The process requires analyser, aldehyde, degasifying and primary rectifier cum exhaust columns, hydro-extractive distillation column, rectifier column, fusel oil column, refining column. The analyser, aldehyde and degasifying columns, refining columns are operated under vacuum, whereas; rectifier cum exhaust column, fusel oil column and hydroextractive distillation column are operated under pressure.

Rectifier column top vapours meet the energy requirement for analyser column. The rectifier column top vapours are condensed in a thermo-siphon reboiler, connected to a flash tank and then flash vapours are injected into the analyser column. The hydroextractice distillation column top vapour is used for heating refining column and fusel oil column top vapour is used for heating heads cum dealdehyde column.

The fermented wash is fed to the degasifying column top. Analyser vapours are condensed and fed to the rectifier column. Final RS is drawn from the top of the rectifier column. The RS is fed to hydroextractive column for purification. The dilute alcohol from bottom of this column is fed to the Rectifier column where from the top ENA is taken and fed to refining column. The final refined ENA product is taken from refining column bottom.

3.2 Ethanol Plant Based on Molecular Sieve

The skid mounted molecular sieve dehydration system is configured as a stand-alone unit and is capable of operating independently from any other process equipment, once properly connected to the utilities.

The unit consists of two beds of desiccant and an evaporator / regeneration column. While one bed is on line, the other is regenerated for an equal period. A computer-controlled control system actuates the required valves operation, switching the flow from one bed to the other in a continuous operation, at the same time constantly monitoring all process, quality and safety parameters.

The feed is pre-heated and fed to the evaporation / regeneration column. The vapours are drawn from the top of the column and are partially condensed. A part of the vapour drawn is superheated and sent to Sieve bed 1, where the vapour is dehydrated, condensed and cooled, and pumped to storage. A portion of the dry vapour is purged to sieve Bed 2, under vacuum, to regenerate the bed in preparation for cycle changeover when bed 2 goes on line.

The regeneration process releases the adsorbed water and ethanol as low strength vapours. These are condensed and recycled with the feed to the evaporation column. A stillage stream (containing not more than 500 ppm ethanol) is obtained from the bottom of the evaporation column.

SECTION 4

PROJECT AT A GLANCE

A) DESIGN BASIS OF THE ETHANOL PROJECT

1.	**Capacity of the plant**	**:**	**150,000 litres per day total Additional Alcohol. (Design Basis)**
2.	**Extra Neutral Alcohol**	**:**	**150,000 litres per day.**
3.	**Anhydrous Alcohol**	**:**	**150,000 litres per day.**
4.	Raw material	:	Cane Molasses with 40 % FS Min.
5.	**Molasses Requirement**	**:**	**650- 680 MT per Day(avg. 675MT/day)**
6.	Water source	:	Ground water after suitable treatment.
7.	Fuel for steam	:	Bagasse – Dhampur Sugar
8.	Electricity source	:	Steam turbine for regular operation

9. Waste water treatment ::

Proposed treatment strategy :

1. During Non Rainy Season :

Spent wash: Bio-methanation followed by Reverse osmosis then MEE and Bio-composting.

Other effluent: Other effluent will be treated in secondary effluent treatment plant and 100 % recycling will be done within the process**.**

2. During Rainy Season :

Spent wash: Bio-methanation followed by Reverse osmosis then MEE and incineration boiler.

Other effluent: Other effluent will be treated in secondary effluent treatment plant and 100 % recycling will be done within the process**.**

4 B) PERFORMANCE PARAMETERS

	Parameters	**Description**
1	Plant capacity	150,000 litres / day
2	Main products	145,000 litres / day of Fuel Grade Ethanol OR Rectified Spirit /ENA 5,000 liters per day Technical Alcohol at 95 % v/v. **OR 150,000 litres / day Anhydrous Alcohol at 99.8 % v/v.** It can produce above products simultaneously in any ratio.
3	Technology	**Cascade continuous fermentation with special yeast strain.** The fermentation is trouble & maintenance free without using recycle of yeast or spent wash, which ensures cleaner & longer fermentation cycle. **8 columns vacuum distillation with hydro extractive distillation.** The distillation is designed to produce any of the products at any ratio and superfine neutral alcohol is produced using hydro extractive distillation.
4	Efficiency & alcohol yield at 45 % w/w Fermentable sugars	1. EFFICIENCY Fermentation efficiency–88-90 % (91% for FS more than 45%) Distillation efficiency – 98.0 % 2. YIELD 265 to 267 litres 96 % v/v alcohol per Ton molasses at 45 % Fermentable Sugars. 251 TO 253litres of 99.8% v/v Alcohol per Ton of molasses at 45 % Fermentable Sugars.

SECTION 5

SPECIFICATIONS – PRODUCT, INPUT AND PROJECT

PRODUCT SPECIFICATIONS

Indian Standard 6613 of 1972, Revised 1984

Specification requirements for ENA (Extra Neutral Alcohol)

1.	Relative density at 15°C	0.81245 - 0.81679
2.	Ethanol content, percent by volume at 15.6 °C	94 – 96
3.	Miscibility with water	Miscible
4.	Alkalinity	Nil
5.	Acidity, as acetic acid, g/100 ml, maximum	0.002 (20 p.p.m)
6.	Residue on evaporation, g/100 ml, maximum	0.002 (20 p.p.m)
7.	Aldehydes, as acetaldehyde, g/100 ml, maximum	0.004 (40 p.p.m)
8.	Esters, as ethyl acetate, g/100 ml, maximum	0.01 (100 p.p.m)
9.	Copper, as Cu, g/100 ml, maximum	0.0002 (2 p.p.m)
10.	Lead, as Pb, g/100 ml, maximum	Nil
11.	Methyl alcohol:	To satisfy test
12.	Isopropyl alcohol, acetone and other ketones	To satisfy test
13.	Furfural	To satisfy test
14.	Permanganate decolonization time, minimum, minutes	30

Indian Standard 323 of 1959

Specifications requirements for Rectified Spirit

Grade 1 (Potable) and Grade 2 (Industrial)

		Grade 1	Grade 2	Test method (Refer to appendix)
1.	Specific gravity at 15.6°C, maximum:	0.8171	0.8171	B
2.	Ethanol content:			
	(a) Percent by volume at 15.6°C, minimum:	94.68	94.68	C
	(b) Degrees overproof, minimum:	66	66	C
3.	Miscibility with water:	Miscible	Miscible	D
4.	Alkalinity:	Nil	Nil	E
5.	Acidity, as acetic acid, percent by weight, maximum:	0.002 (20 ppm)	0.01 (100 ppm)	E
6.	Residue on evaporation, percent by weight, maximum:	0.005 (50 ppm)	0.01 (100 ppm)	F
7.	Aldehydes, as acetaldehyde, g/100 ml, maximum:	0.006 (60 ppm)	0.10 (1000 ppm)	G
8.	Esters, as ethyl acetate, g/100 ml, maximum:	0.02 (200 ppm)	-	H
9.	Copper, as Cu, g/100 ml, maximum:	0.0004 (4 ppm)	-	J
10.	Lead, as Pb, g/100 ml, maximum:	0.0001 (1 ppm)	-	K
11.	Methyl alcohol:	To satisfy test.	-	L
12.	Fusel oil:	To satisfy test.	-	M
13.	Furfural:	To satisfy test.	-	N

****Please note: The figures in parentheses for parts per million (ppm) do not appear in the original standard, but have been added here to facilitate comparison with standards of other countrie

ANHYDROUS ALCOHOL SPECIFICATIONS FOR FUEL USE

Fuel Ethanol Specifications: IS 15464: 2004

Absolute (Anhydrous) Alcohol	**Special Grade**	**Test Method**
Relative Density @ 15.6/15.6 ^{o}C, Max.	0.7961	A
Ethanol content @ 15.6 ^{o}C, vol %, v/v Min. (excluding denaturant)	99.6	B
Miscibility with water	Miscible	C
Alkalinity	Nil	D
Acidity (CH3COOH), mg/l, Max.	30	D
Residue on evaporation, wt%, Max.	0.005	E
Aldehydes, as (CH3CHO), mg/l, Max.	60	F
Copper, mg/kg, Max	0.1	G
Conductivity, micro S/m, Max.	300	H
Methyl alcohol, mg/l, Max.	300	J
Appearance	Clear & Bright	Visual

SPECIFICATIONS OF INPUTS

1. MOLASSES

Molasses should be free from caramalisation products and known inhibitory elements of yeast metabolism i.e. lead, Arsenic polyelectrolytes etc. or micro organisms producing side products. Such available molasses will have :-

(a)	Fermentable sugars	:	Min 40% (w/w)
(b)	F/N Ratio	:	Min 0.9 ***
(c)	Sulphated ash	:	Max 15 % (w/w)
(d)	Volatile Acids	:	Normal - 5000 to 8,000 ppm
(e)	Bacterial content	:	Max. 10 cfu/gm
(f)	Caramel content	:	Max 0.3 Absorbance at 375 nm.

*** : Ratio of Fermentable sugars to Non-Fermentable sugars.

2. PROCESS WATER / SEALING / CLEANING / TESTING WATER

Process water should be filtered and shall not contain any E. COLI or COLIFORM bacteria with total germs count being limited to 60 Nos / ml. The chloride content shall be less than 25 ppm.

3 COOLING WATER FOR CIRCULATION

Cooling water at a temperature of 30 Deg. C max. with a total hardness of 5 ppm maximum & Total Dissolved solids of 30 ppm max.

4 SULPHURIC ACID

Concentrated, Commercial Grade, Composition as below value in % W/W

(a)	Sulphuric Acid	: 98	MIN
(b)	Lead	: 0.001	MAX
(c)	Arsenic	: 0.0001	MAX
(d)	Iron	: 0.03	MAX
(e)	Moisture	: 2	MAX

5 UREA

In the form of prills or pellets with total Nitrogen not less than 46% W/W.

6 DIAMMONIUM PHOSPHATE (D A P)

In the form of granules. Composition as below. Values in % w/w

(a)	P205	: 50	MIN
(b)	Nitrogen	: 20	MIN
(c)	Arsenic	: 0.0001	MAX.
(d)	Iron	: 0.01	MAX.
(e)	Lead	: 0.001	MAX

7 ANTIFOAM

Turkey red oil. Composition as below, Value in % w/w

(a)	Degree of sulphation	: 6	MIN
(b)	Total alkali (KOH)	: 3	MAX.
(c)	Total fatty matter	: 60	MIN
(d)	Total Ash	: 8	MIN
(e)	pH	: 6.5 - 7.5	

8 STEAM FOR PASTEURISATION

Dry, saturated should be provided at the inlet of steam header in fermentation plant. and the pressure required shall be 1.5 kg/cm2 (g) at the steam header.

9 STEAM FOR DISTILLATION

Dry, saturated should be provided at the inlet of steam header in Distillation plant and the pressure required shall be 3.0 kg/cm2 (g) at steam header. The max variation in the steam pressure shall not be more than +/- 0.1 kg/cm2.

PROJECT SPECIFICATIONS

The turnkey ethanol project will be designed and constructed in strict compliance with the international standards and brands of equipment.

Design codes:

The following are the design standards used for the equipment for design.

1. Pressure Vessels and distillation columns as per ASME
2. Storage tanks as per API
3. Heat Exchangers as per TEMA
4. Piping and valve as per DIN/JIS
5. Instruments as per ISA.

SECTION 6
PLANT AND MACHINERY LIST
(EQUIPMENT LIST IN ABCD FORMAT)

APPENDIX- A (RECTIFIED SPIRIT SECTION)

Sr. No.	Technical Data	Analyser Column	Degasser Column	Rectifier Column -I	Heads Conc. Column
1	Total height of Column (m) (Dish end to Dish end)	16.500	5.200	16.750	10.700
2	Outer Diameter of Column (mm)	3712	2200	3212	2480
3	Inner Diameter of Column (mm)	3700	2190	3200	2470
4	Material Of Construction	SS 304	SS 304	SS304	SS 304
5	Thickness (mm)	6	5	6	5
6	Total No. Of Plates	20	6	60	45
7	Plate Spacing (mm)	750	4	250	200
8	Design Details of Trays	Tunnel	Tunnel	Bubble Cap	Bubble Cap
9	Material Balance	NA	NA	NA	
10	Location & Design of Feed Plate	NA	NA	21/23	15/16/17
11	Capacity Of Column in terms of Litres of				
11.a	Feed (m^3/hr)	90.15 m^3/hr	91.85 m^3/hr	12.05 m^3/hr	3.15 m^3/hr
11.b	Output (m^3/hr)	m^3/hr	91.85 m^3/hr	6.04 m^3/hr	3.15 m^3/hr
12	Percentage of alcohol in Feed and Output				
12. a	Feed % V/V	7.0 % V/V	7.0 % V/V	45 % v/v	94 % AND 55 % AL
12. b	Output % V/V	45 % V/ V	55 % V/V	96 % V/V	95 %
13	Base and Top Pressure of column (Bar)	0.6/0.45	0.45/0.42	2.5/1.8	0.385/0.29

14	Pressure Drop across Tray mm WC	65	65	40	40
15	Vapour velocity (Superficial Velocity) m/sec	Proprietary Item	Proprietary Item	Proprietary Item	Proprietary Item
16	% Of Alcohol in reflux, reflux ratio	N.A.	NA	95-96 % V/V	94-95 % V/V
17	Efficiency	98.5 %	98.5 %	98.5 %	NA

(EXTRA NEUTRAL ALCOHOL SECTION)

Sr. No	**Technical Data**	**Hydro Extractive Column**	**Fusel Oil Column**	**Refining Column**
1	Total height of Column (m) (Dish end to Dish end)	13.5	11.500	11.500
2	Outer Diameter of Column (mm)	2330	1200	1088
3	Inner Diameter of Column (mm)	2320	1190	1080
4	Material Of Construction	SS304	SS 304	Copper
5	Thickness (mm)	5	4	4
6	Total No. Of Plates	45	50	50
7	Plate Spacing (mm)	250	200	200
8	Design Details of Trays	Bubble Cap	Bubble Cap	Bubble Cap
9	Material Balance			
10	Location & Design of Feed Plate	17/29	21/23,25/27	31/31
11	Capacity Of Column in terms of Liters			
11. a	Feed (m^3/hr)	26.823 m^3/hr	0.175 m^3/hr	6.05 m^3/hr
11. b	Output (m^3/hr)	26.823 m^3/hr	0.175 m^3/hr	6.05 m^3/hr
12	Percentage of alcohol in Feed and Output			
12. a	Feed % V/V	95 %	------	95 %
12. b	Output % V/V	96 %	94 %	96 %

13	Base and Top Pressure of column (Bar)	1.20/1	1.20/1	0.63/0.4
14	Pressure Drop across Tray mm WC	40	40	40
15	Vapour velocity (Superficial Velocity) m/sec	Proprietary Item	Proprietary Item	Proprietary Item
16	% Of Alcohol in reflux, reflux ratio	95-96 % V/V	94-95 % V/V	95-96 % V/V
17	Efficiency	98.5%	98.5 %	NA

Sr.No	**Technical Data**	**Rectifier Cum Exhaust column**
1	Total height of Column (m) (Dish end to Dish end)	19.5
2	Outer Diameter of Column (mm)	2950
3	Inner Diameter of Column (mm)	2940
4	Material Of Construction	Copper
5	Thickness (mm)	5
6	Total No. Of Plates	72
7	Plate Spacing (mm)	250
8	Design Details of Trays	Bubble Cap
9	Material Balance	NA
10	Location & Design of Feed Plate	21/23
11	Capacity Of Column in terms of Litres of	
11.a	Feed (m^3 /hr)	42.83 m^3/hr
11.b	Output (m^3 /hr)	42.83 m^3/hr
12	Percentage of alcohol in Feed and Output	
12. a	Feed % V/V	20 % v/v
12. b	Output % V/V	95 % V/V
13	Base and Top Pressure of column (Bar)	2.5/1.8
14	Pressure Drop across Tray mm WC	40
15	Vapour velocity	Proprietary

	(Superficial Velocity) m/sec	Item
16	% Of Alcohol in reflux, reflux ratio	95-96 % V/V
17	Efficiency	98.0 %

ABSOLUTE ALCOHOL PLANT

Sr. No	Technical Data	Recovery Column
1	Total height of Column (m) (Dish end to Dish end)	8.700
2	Outer Diameter of Column (mm)	2070
3	Inner Diameter of Column (mm)	2060
4	Material Of Construction	SS 304
5	Thickness (mm)	5
6	Total No. Of Plates	35
7	Plate Spacing (mm)	200
8	Design Details of Trays	Sieve Tray
9	Material Balance	NA
10	Location & Design of Feed Plate	26/27
11	Capacity Of Column in terms of Liters of	
11.a	Feed (m^3/hr)	6.65 m^3/hr
11.b	Output (m^3/hr)	6.25 m^3/hr
12	Percentage of alcohol in Feed and Output	
12. a	Feed % V/V	94.68 %
12. b	Output % V/V	99.9 %
13	Base and Top Pressure of column (Bar)	3.0/2.8
14	Pressure Drop across Tray mm WC	40

15	Vapor velocity (Superficial Velocity) m/sec	Proprietary Item
16	% Of Alcohol in reflux, Reflux ratio	99 % V/V
17	Efficiency	98.7 %

APPENDIX- B

Sr. no	Technical Data	Rectifier Vent Condenser	Primary Column Reboiler	Mash Preheater	Degasser Column Condenser I & II	DealdehydeCondeser I &II	Rectifier Vent Condenser	Hydro Extractive Condenser I	Rectifier Column Reboiler
1	Area m^2	40	480	144	40/12	80/12	400/48	40	560
2	Tube Length m	3	3	3	3	3	3	3	3
3	Tube Diameter MM	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4
4	No. Of Tubes	168	2016	604	168/50	336/50	1680/200	168	1882
5	No. Of Pass	4	1	12	4/2	4/2	4/2	4/2	1
6	Tube Side Fluid temp. IN/OUT	32/42	128/105	32/45	32/45	32/40	32/45	32/45	128/128
7	Shell side Fluid Temp. IN/ OUT	92/92	140/128	NA	72/72	50/50	96/96	78/78	140/128

Sr. no	Technical Data	Fusel Oil Vent Condenser I	Refining Column Condenser I & II	Refining Column Reboiler	Main Product Cooler	Technical Alcohol Cooler	Fusel Separator	Fusel Oil Cooler	Mash Preheater Using PHE	Water Preheater PHE
1	Area M^2	32	144/12	200	80	6	NA	5	NA	NA
2	Tube Length m	3	3	3	3	3	NA	3	NA	NA
3	Tube Diameter MM	25.4	25.4	25.4	25.4	25.4	NA	25.4	NA	NA
4	No. Of Tubes	134	604/50	840	336	26	NA	22	NA	NA
5	No. Of Pass	2	4/2	1	1	1	NA	1	NA	NA
6	Tube Side Fluid temp. IN/OUT	32/45	32/40	68/67	32/45	NA	NA	NA	NA	NA
7	Shell side Fluid Temp. IN/ OUT	78/78	57/57	96/68	78/32	NA	NA	NA	NA	NA

ABSOLUTE ALCOHOL PLANT

Sr.no	Technical Data	Mol. Sieve Condenser	Weak Alcohol condenser	Recovery column Reboiler	Superheater	Feed Preheater	Absolute alcohol cooler
1	Area m^2	74	96	64	54	74	80
2	Tube Length m	3	3	3	3	3	3
3	Tube Diameter MM	25.4	25.4	25.4	25.4	25.4	25.4
4	No. Of Tubes	310	404	268	226	310	336
5	No. Of Pass	4	4	1	1	1	1
6	Tube Side Fluid temp. IN/OUT	32/45	32/40	68/67	NA	NA	NA
7	Shell side Fluid Temp. IN/ OUT	78/78	78/78	96/68	NA	NA	NA

PUMPS For Distillation

S.N	Discription	Type	Capacity	Head	Material	Quantity
1	Reflux Pumps	Centrifugal Centrifugal	35 m^3/hr 32 m^3/hr	40 MWC 30 MWC	With SS internals With SS internals	1+1 1+1
2	Spent wash pump	Centrifugal	100 m^3/hr	30 MWC	With SS internals	1+1
3	Spent Lees hot water pumps	Centrifugal	30 m^3/hr	25 MWC	With SS internals	1+1
4	Vacuum pump	Water ring type	--------	---------	With SS internals	1+1
5	Alcohol pumps	Centrifugal	50 m^3/hr	25 MWC	With SS internals	1+1
6	HydroExtractive Transfer pumps	Centrifugal	35 m3/hr	35 MWC	With SS internals	1+1
7	Rectifier reflux pump ENA	Centrifugal	35 m3/hr	40 MWC	With SS internals	1+1
8	HCC Reflux IS Feed Pumps	Centrifugal	10 m3/hr	25 MWC	With SS internals	1+1
9	FO Reflux	Centrifugal	3 m3/hr	35	With SS	1+1

	Transfer Pump			MWC	internals	
10	Air Compressor		---------	---------	----------	1
11	Pump for rect. column	Centrifugal	---------	---------	Flame Proof	1+1
12	Pump for reflux to Recovery column	Centrifugal	---------	---------	Flame Proof	1+1

TANKS For Distillation

S.N	Discription	Type	Capacity	Material	Quantity
1	Gas Liquid Separator	Cylindrical type	------	SS 304	1
2	Alcohol Continuous Diluter	Static Mixer type	------	SS 304	1
3	Reflux Collectors	Cylindrical type	------	SS 304	9
4	Water & Steam Header	Cylindrical type	------	Carbon Steel	1
5	Over Head water tank	Cylindrical type	40 M^3	MS	1
6	Alcohol Buffer tanks	Cylindrical type	2 M^3	SS 304	2

APPENDEX-C

Sr. NO	Service	Material Of Construction	Service Temperature (^{0}C)
1	Alcohol-Water liquid	MS/SS304	30-80 ^{0}C
2	Alcohol-Water liquid	MS/SS304	80-120 ^{0}C
3	Product Alcohol	SS304 / COPPER	30-80 ^{0}C
4	Cooling Water	MS	32-40 ^{0}C
5	Steam	CS	170-125 ^{0}C
6	Instrument Air	GI/SS 304	32-40 ^{0}C
7	Steam Condensate	CS	80-95 ^{0}C

APPENDIX –D

A	**EXCISE DOCUMENT**	**Quantity**	**Capacity**	**Height (meters)**	**Diameter (meters)**
Sr. NO	**Equipment List**				
1.	Molasses Storage	2	10,000 MT	10.5	30
2.	Molasses Receiving Tank	1	50 M^3	6.5	3.2

3.	Molasses Weighing Tank	1	50 M^3	6.5	3.2
4.	Pre-fermentor	5	30 m^3	6.785	2.5
5.	Fermentor	5	600 m^3	10.95	7.5
6.	Stabilizer Tank	1	300 M^3	7.5	7.1
7.	Buffer Tank	1	300 m^3	7.5	7.2
8.	Settler Tank	1	50 M^3	3.75	4.12
9.	Aldehyde Column Receiver	1	1 M^3	1.5	1
10	Rectification Column Receiver	1	2 M^3	1.8	1.2
11	Fusel oil Decanter	1	1 M^3	1.5	1
12	Fusel Oil Receiver	1	1 M^3	1.5	1
13	Vent Scrubber	1	1 M^3	1.5	1
14	Vent Scrubber Separator	1	0.2 M^3	1	0.6
15	Molasses Diluter	1	1 M^3	1.5	1
16	R.S & ENA Daily Receiver	6	200 M^3	7.5	5.85
17	Ethanol Receiver	3	200 M^3	7.5	5.85
18	Technical Alcohol Tank	1	10 M^3	3.75	3.2
19	Solution Tank	1	1 M^3	1.5	1

A	**EXCISE DOCUMENT**	**Quantity**	**Capacity**	**Height (meters)**	**Diameter (meters)**
20	Fusel Oil Storage Tank	1	30 M^3	3.75	3.2
21	Absolute Alcohol Bulk Storage	2	900 M^3	12.0	9.8
22	R.S. Bulk Tank	3	900 M^3	12.0	9.8
23	E.N.A. Bulk Tank	4	300 M^3	10.0	6.2

SECTION 7

PROJECT IMPLEMENTATION SCHEDULE

Systematic and well planned scheduling is a very important aspect for the implementation of the project. Proper planning and monitoring of the project is essential for the commissioning of the plant within the stipulated time frame and also for preventing substantial financial drain on pre- operative expenses. Considering these factors, a bar chart has been prepared and various activities have been discussed below:

9.1 Site Development:

After land is acquired, site development work will be started. This will include leveling, laying of roads, construction of boundary walls, gates etc. Also activities, such as contour plan of site, soil testing and preparation of plot plan are expected to be carried out during this period. This activity will take about 7 weeks time.

9.2 Process Engineering:

The process engineering will consist of preparation of process flow diagrams, material and energy balance, equipment data sheets, plant layout, P&I diagrams etc. This activity will take about 4 weeks time.

9.3 Detailed Engineering:

Detailed engineering will be started after completion of process engineering. This activity will consist of civil design and Mechanical, Electrical and Instrumentation engineering. Total time required for completion of detailed engineering has been estimated at 8 weeks.

9.4 Procurement:

Procurement activity will be initiated, after data sheets of equipment have been prepared during detailed engineering. Based on data sheets, enquiries will be sent to various suppliers, starting from 4^{th} month. Quotations received from suppliers will be evaluated and orders will be placed. Equipment deliveries are expected to be completed at the end of 8^{th} month.

9.5 Civil Construction:

Civil construction will be started after the release of basic civil drawings in the 4^{th} month and major work will be completed at the end of 4^{th} month.

9.6 Erection:

Erection of equipment will be started in the 8th month, after major equipments have been received at site. Fabrication of equipment will proceed in parallel with the civil construction, so that their installation can also be taken up along with the bought out equipment. After equipment erection; piping and cabling installation will be taken up. Erection activity will be completed at the end of the 7th month.

9.7 Trial Runs:

During trial runs; first, no load and load trials of equipment will be conducted and thereafter trial runs for the complete plant will be started. This activity will take about 1 month time and plant is expected to start production at the end of 8th month, from the starting date of the project.

SECTION 8

ESTIMATED PROJECT COST FOR 150 KLPD DISTILLERY PROJECT

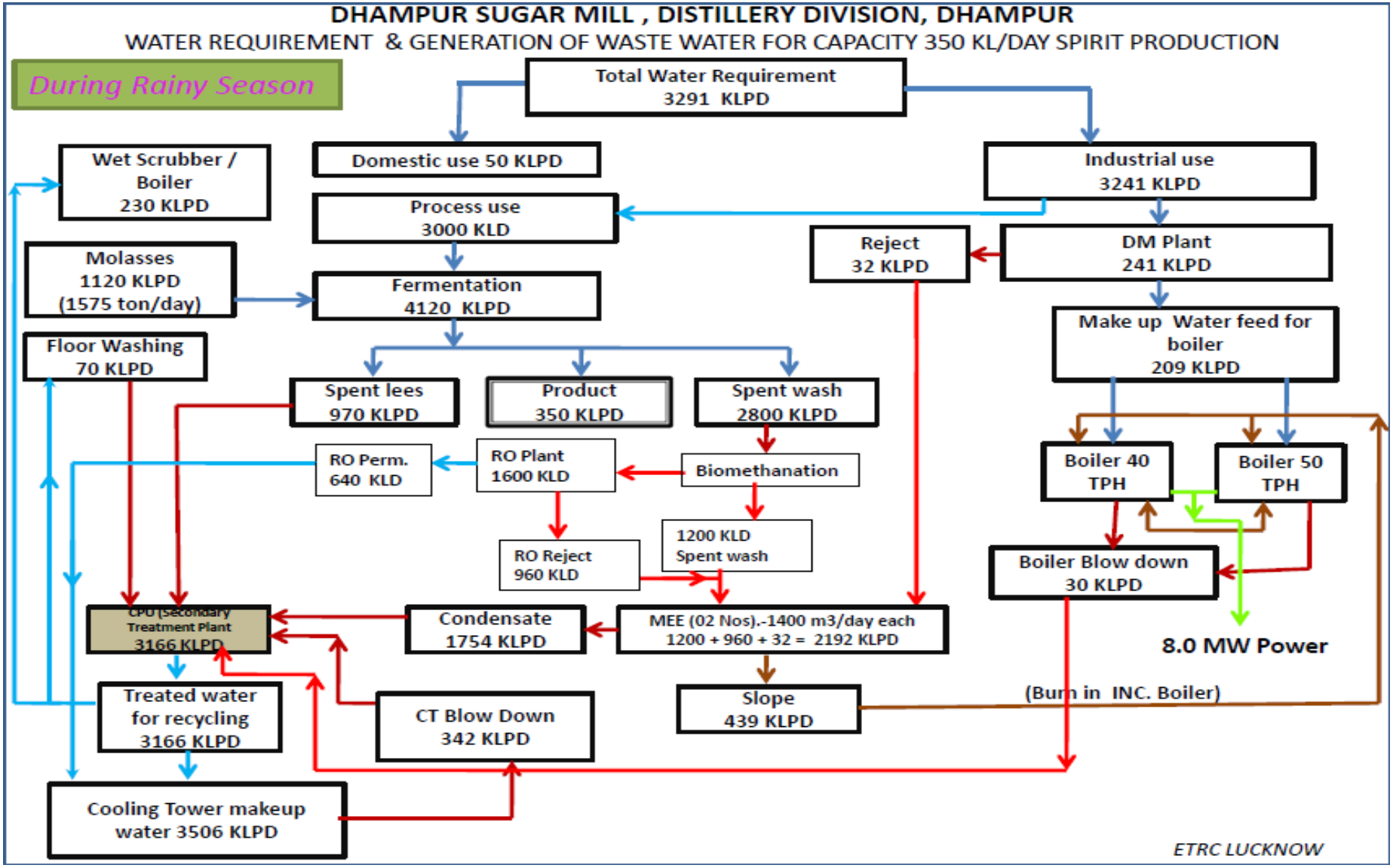
(Rs. In Lacs)

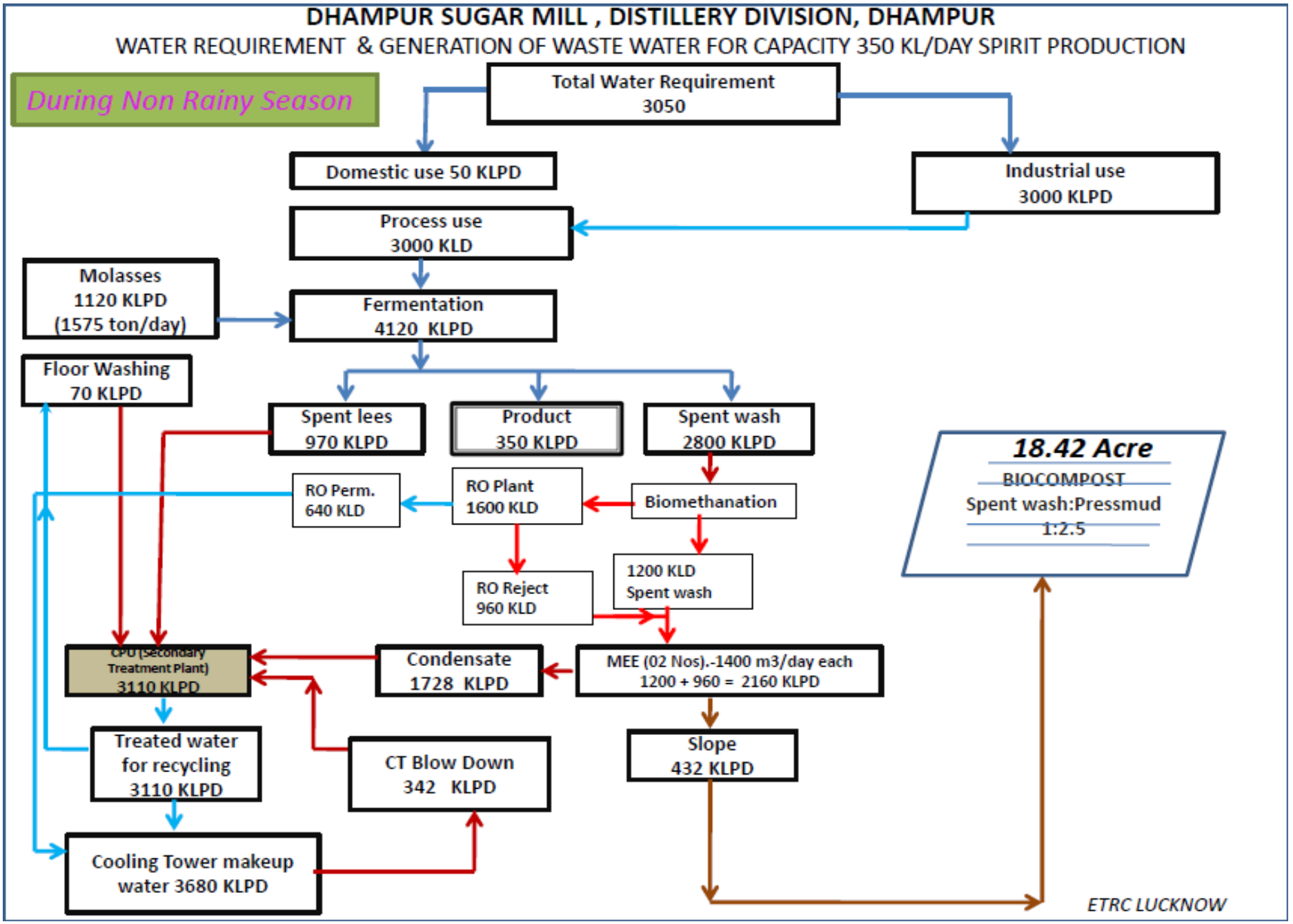
Sr. No.	Description	Estimated Cost	Remarks
1	Land		Available in existing area
2	Main Plant & Machinery		
3	Fermentation and distillation plant suitable to produce 150 KLPD total spirit, based on multi-pressure distillation plant. Molecular sieve based alcohol dehydration plant of 150 KLPD capacity	4700.00	
4	Steam boiler for spent wash concentrate incineration along with bagasses facility suitable for Capacity:40 TPH, Pressure:32 Kg/cm2 with	1100.00	
5	Multi effect Evaporator Capacity : 1400 M3/day	900.00	
6	Bio-digester(600m3/day)&piping network for water reuse and recycle	800.00	
7	Molasses Storage including transfer pumps	175.00	
8	Spirit Storage(RS, ENA, Anhydrous) Including transfer pumps	350.00	
9	Steam boiler for spent wash concentrate incineration along with bagasses facility suitable for Capacity:50 TPH, Pressure:32 Kg/cm2 with	1300.00	

	Turbine 8.0 MW		
10	Water supply and treatment Plant: Tubewell, pumps, storage tanks, piping and softening plant of 65 m3/hr capacity	150.00	
11	Wet Scrubber	150.00	
12	Cooling towers for Distillation and Fermentation along with pumps & pipe	150.00	
13	Electricals, comprising of PCC, MCC, Cables, lighting etc	150.00	
14	Automation including control system, panel, hardware and software	100.00	
15	Civil and structural work • Main plant building • Cooling tower basin • Equipment foundations • Boiler sections • Spent wash concentration plant • Boundary wall	700.00	
16	Miscellaneous cost like packing and forwarding, transit insurance, excise duty, sales tax and transportation	500.00	
	Sub Total	11225.00	
(i)	Working Capital margin	652.00	
(ii)	Pre-operative Expenses @2%	224.00	
(iii)	Contingency @ 3%	336.00	
	Total Cost of Project	Rs12437.00 LAKHS (Estimated)	

SECTION – 9

Our treatment strategy and water balance after expansion for 350 KLPD Distillery Unit



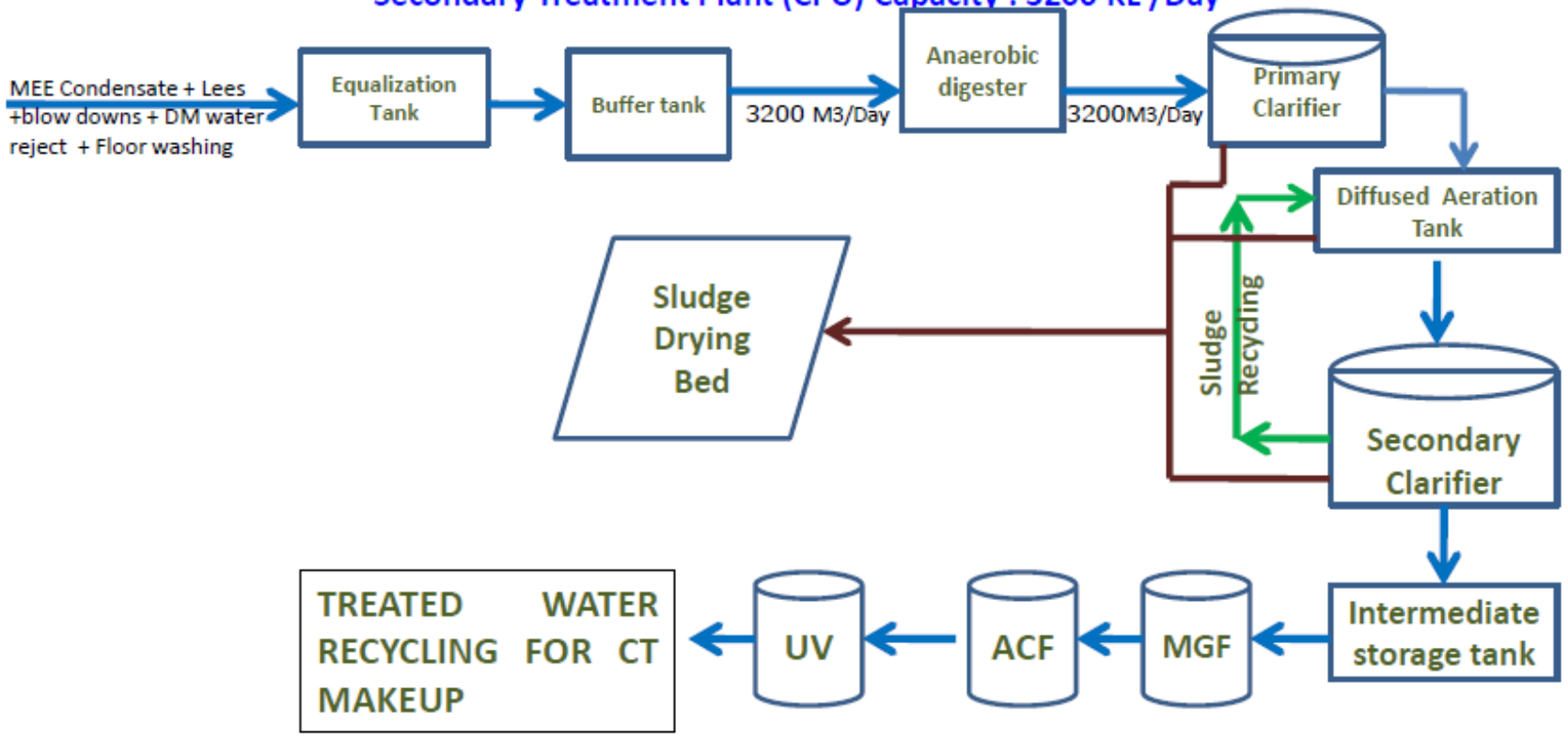

DHAMPUR SUGAR MILL , DISTILLERY DIVISION, DHAMPUR
WATER REQUIREMENT & GENERATION OF WASTE WATER FOR CAPACITY 350 KL/DAY SPIRIT PRODUCTION
During Non Rainy Season
Total Water Requirement 3050
Domestic use 50 KLPD
Industrial use 3000 KLPD
Process use 3000 KLD
Molasses 1120 KLPD (1575 ton/day)
Fermentation 4120 KLPD
Floor Washing 70 KLPD
Spent lees 970 KLPD
Product 350 KLPD
Spent wash 2800 KLPD
18.42 Acre
BIOCOMPOST
Spent wash:Pressmud 1:2.5
RO Perm. 640 KLD
RO Plant 1600 KLD
Biomethanation
RO Reject 960 KLD
1200 KLD Spent wash
CPU (Secondary Treatment Plant) 3110 KLPD
Condensate 1728 KLPD
MEE (02 Nos).-1400 m3/day each 1200 + 960 = 2160 KLPD
Treated water for recycling 3110 KLPD
CT Blow Down 342 KLPD
Slope 432 KLPD
Cooling Tower makeup water 3680 KLPD
ETRC LUCKNOW

DHAMPUR SUGAR MILL , DISTILLERY DIVISION, DHAMPUR

WATER REQUIREMENT & GENERATION OF WASTE WATER FOR CAPACITY 350 KL/DAY SPIRIT PRODUCTION

FLOW DIAGRAM OF WASTE WATER TREATMENT SYSTEM (Other than Spent Wash)

Secondary Treatment Plant (CPU) Capacity : 3200 KL /Day



ETRC LUCKNOW