

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



# TECHNOLOGICAL DEVELOPMENT TO IMPROVE THE PROFITABILITY OF SUGAR INDUSTRY

Presented By:

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# SUGARCANE HAS FOLLOWING COMPONENTS

## 1. Sugar:

To be sold in the Market

## 2. Bagasse:

Major source of Energy Generation, Electricity, Steam, Co-generation, Hot water and other products

## 3. Molasses:

Ethanol Industry and other products

## 4. Mud:

Bio Composting and Organic Fertilizer

# SUGARCANE

- 1) **Recovery %:** It ranges from 9% to 11% in the Country, varies soil to soil.
  - a) Faisalabad division is lowest in recovery %age.
  - b) Efforts to be made to increase the recovery by 0.5% to 1.0% by cultivation of new high sugar %age varieties.  
1 degree rise in recovery can reduce the sugar cost by rupees 7.
  - c) Reduce the losses (Mud, final molasses, bagasse etc.)
  - d) Reduce cut to crush time / Induction of mechanical harvester.
  - e) It mainly depends on sugarcane supply quality and losses.

# SUGARCANE

## 2) Sugar:

a) Pakistan is the only Country making plantation white sugar in same Plants.

b) No Raw Sugar

Per Capita Consumption = 24.64 kgs sugar

Industrial Consumption = 75%

Household Consumption = 25%

# SUGARCANE

- Country Consumption = Max 5.5–6.0 Million Tons/year
- = Including smuggling etc.
- This Year production = 8 Million Tons
- Surplus = 2 Million Tons
- Consumption 2020-21 = 5.3 Million Tons
- (Economic Survey)
- International Consumption = 21.3 Kg
- / Capita
- International Sugar Rate = 550 Dollar per Ton ( $\pm 20$ )
- Dollar Rate = Rs.200
- Sugar Rate = Rs.100 Plus (By Export)

# SUGARCANE

- Raw Material Cost in Past years = 70% of Total Income
- Now a days = Now it has gone up 90% plus
- Profit Margin = Reduced
- So we have to find other areas for increase in profit.

# IMPROVEMENT IN SUGAR QUALITY

1. Sugar is major source of revenue.
2. Low Colour Sugar (To get the high price of Sugar)
3. Producing Value added products
4. Other Products like 1,2,5 & 10 Kg packing
5. Beverage, Bakery, Industry, Pharmaceutical and Export  
(if Government allows)
6. Organic sugar (A small segment but can get more profit)
7. Last year average sale price of sugar was Rs.93/- per kg.
8. This year it will remain around Rs.85  $\pm$  Rs.2

# IMPROVEMENT IN SUGAR QUALITY

9. Sales Tax is 17% (on Sale Price Rs.84)
10. Sugar cost varies 85 – 90 Rupees, depending upon sugarcane price, recovery % and other expenditures.
11. If selling price will be above 90 Rupees then profit can be achieved.
12. To get the profit and increase it, other areas of income from sugarcane byproducts to be explored.
13. By having modern machinery / equipment methods automation Dcs system
14. Sugarcane is also called Raw Gold as natural Gas.

# SAN ISIDRO SUGAR MILLS & DISTILLERIES

## Organic Sugar:

It is obtained from organic crop which preserve the fertility of the soil without use of synthetic chemical. Its characters are:-

- ❖ Natural flavour
- ❖ Slightly gold colour
- ❖ Without additives
- ❖ More vitamins and minerals
- ❖ Healthy food
- ❖ Certified and Guaranteed
- ❖ Selling price is 700 US\$ / Ton
- ❖ Ethanol make from organic juice is called good taste ethanol and sold as organic ethanol.

# BAGASSE

1. It ranges 30 – 32% on cane, major source of electricity generation and steam for process use by burning it in low / high pressure boilers.
2. Used in paper Industry (Every type of paper)
3. Used for ethanol making
4. To be saved to use for other purposes
5. Steam % cane in Pakistan Sugar Industry varies from 50% plus to 30% plus
6. Surplus electricity / exhaust steam can be used other than Sugar Industry.
7. Now a days, Electricity rate in Pakistan is around Rs.25 per unit which will be further increase.

# BAGASSE

1. Bagasse is the cheapest fuel at the moment.

2. So save maximum bagasse by :-

**a. Through reduction of bagasse moisture**

Reducing 1% moisture (48.5 K Cal/Kg) Bagasse saving will be 66 Tons / day on a plant of 8,000 TCD. Our average moisture in bagasse is around 50% in Pakistan

b. Installation of bagasse dryers (Upto 35% moisture in World)

**c. Increasing Steam to Bagasse Ratio**

If ratio is increased by 1:2 instead of 1:1.8 then saving will be 200 Tons/day at 8,000 TCD (In low pressure Boilers)

## d. Reduction in Steam Consumption (Process House)

- It is a major source of saving and this area to be focused.
- By reduction 1% steam can save 90 Tons of bagasse on 8,000TCD (50 to 49% cane)
- But we can go up to 30% on cane
- Imagine what will be saving
- But it needs investment

# POWER GENERATION

- I. To meet the requirement of Sugar Plant
- II. Surplus power for sale to City Grid up front tariff  
(Suspended for time being, no new contracts)
- III. Surplus power to be used for other Plants in same area.

## Usage of Power / Steam / Hot Water

- a) Sugar Plant (Steam / Electricity)
- b) Ethanol Plant (Steam / Electricity)
- c) Chipboard Plant (Particle Board or Chipboard / Electricity)

# POWER GENERATION

- d) Paper Industry (Steam / Electricity)
- e) Tomato Ketchup (Steam / Electricity)
- f) Juice Concentration (Steam / Electricity)
- g) Milk Industry (Steam / Electricity)
- h) Bio Composting (Electricity)
- i) Sale to City Grid (Not new contracts exists now a days)
- j) Steel Industry (Major consumer of Electricity)
- k) Ghee Industry (Electricity)
- l) Textile Industry (Electricity)

# THE PROFILE OF RECENT BRAZILIAN “GREENFIELDS”



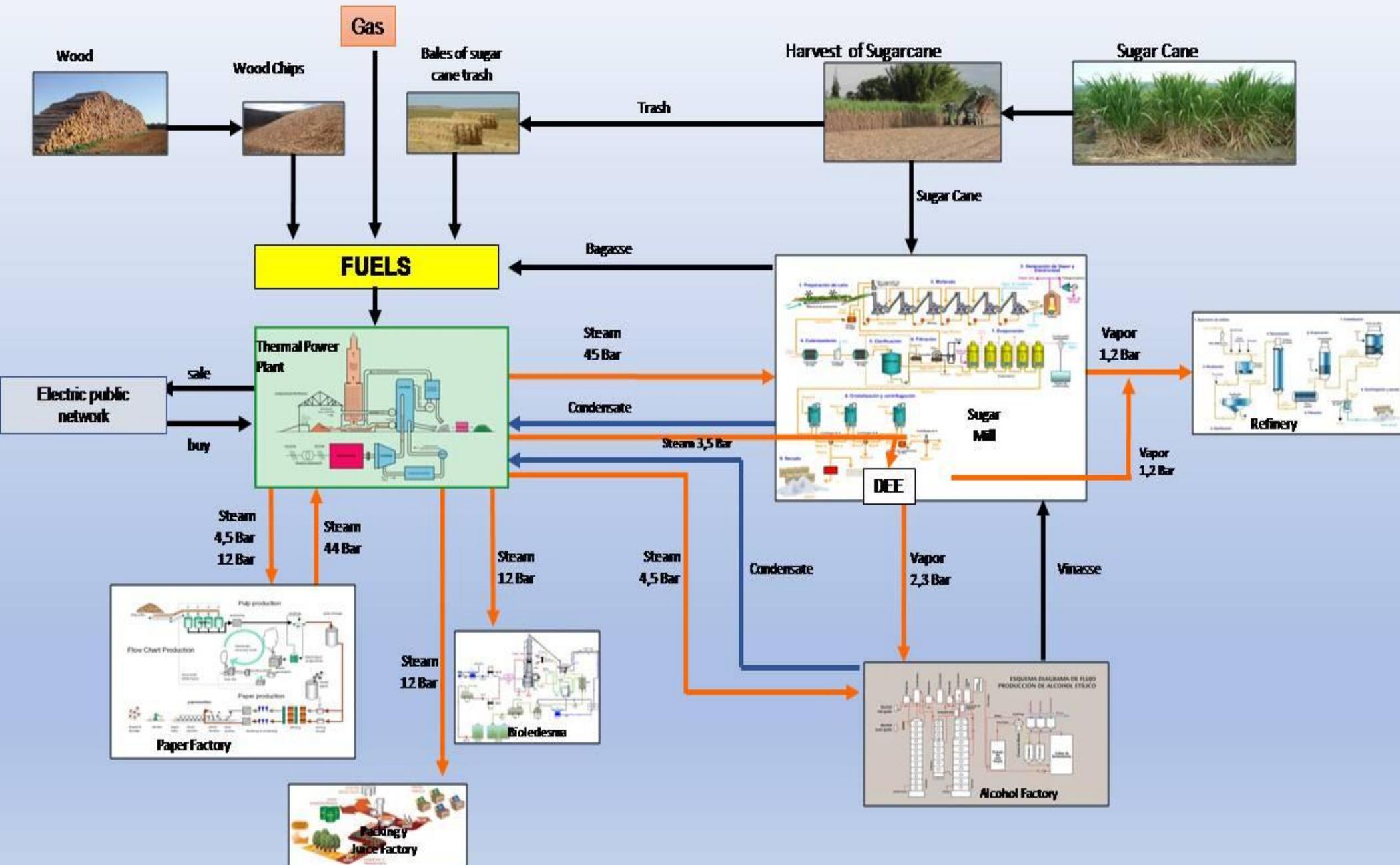
**ODEBRECHT (ETH) ÁGUA EMENDADA MILL (GO)**

**18.000 TCD – 3,6 MM TCC – 1.800.000 L ETHANOL/DAY**

**TOTAL POWER CAPACITY: 71 MW – SURPLUS POWER (BIOELECTRICITY): 50 MW**



# ENERGY INTEGRATION



# REDUCTION IN STEAM CONSUMPTION

Major steps required for curtailing Steam Consumption from 50% to 30%.

1. Energy audits of Plants to be carried out.
2. Installation of Falling Film Evaporators
3. Effective vapour bleeding
4. Flash heat recovery
5. Molasses conditioning and contact heaters
6. Condensate heaters
7. Automatic Condensers
8. Pan Automation and A, B, C Refineries

# REDUCTION IN STEAM CONSUMPTION

9. Effective utilization (reduced) of hot water at centrifugal, pan boiling and vacuum filters.
10. Pan Agitators
11. Variable speed drives (Specially motors more than 50KW)
12. Less power consumption (because all steam turbine at milling will be replaced by electric motors)
13. Power factor improvement
14. Reduction of steam below 35% requires more investment and less reduction.
15. From 50% to 30% can be carried out in 2 to 3 phases (50 to 45, 45 to 38, 38 to 35 and then below 35%)

# STEAM GENERATION

- ❑ Low Pressure Steam Boilers up to 25 ° Bar

- ❑ High Pressure Boilers

- I. 65 ° Bar

- II. 80 ° Bar

- III. 100 ° Bar

- IV. Above 100 ° Bar (Do not exist in Pakistan)

- ❑ **Low Pressure Boilers:**

1 MW generation consumed 10 – 12 Tons steam

depending upon Power house Turbine and back pressure

steam bagasse ratio 1:2 Tons at 50% moisture

# STEAM GENERATION

- ❑ 1 MW generation from high pressure boiler consumed 4–6 Tons steam for 100 to 65 ° bar pressure boiler and steam bagasse ratio upto 1:2.4 Tons. So roughly we can produce almost more than double Power by installing high pressure boilers.
- ❑ But we have keep in mind the local manufacturing facilities of boilers.
- ❑ World has now gone upto 150 to 250 ° Bar pressure boilers and have steam consumption 3 Tons / MW

# POWER TO CITY GRID

- ❖ Sugar Industry is supplying upto 55MW cheapest electricity (Rs.10-12 per unit) to nearby City Grid. (Ramzan, Ghohki, JDW-II, Layyah, RYK, Hamza and Almoiz-II Sugar Mills)
- ❖ But at the moment, no new electricity sale contract between Wapda and Sugar Industry. Up front tariff have been stopped.
- ❖ It should be started again with new contract. (As already some Mills have done lot of work)
- ❖ PSMA should take up this matter with Government.
- ❖ So now a days, a major source of power consumption is Steal Mill. If it is not supplied to city grid.
- ❖ Can be supplied to Textile within same boundary wall.
- ❖ Other wise NEPRA permission have to be taken for selling of Electricity.

# STEEL INDUSTRY

❖ Power can be used in furnaces to melt scrap to get

❑ Billets



❑ Rolling Mills



❑ Sira



❑ And Other Products

❖ It can consume upto 12-16 MW of electricity even more.

❖ Extra bagasse can also be consumed in off season.

# PAPER MILL / DISTILLERY (Ledesma Plants – Argentina)

Paper Mill fibre length = 1mm to 3mm

✚ NAOH = 50 mg / Lit.

✚ Digestion = 50 mm

✚ Wood chops were also used for special type of papers

✚ Steam condensing turbine in off-season is used only for paper / distillery plant

✚ Duration of Season = 6 Months

✚ Steam pressure for Distillery = 2 -3 Bar

✚ 1<sup>st</sup>& 2<sup>nd</sup> Vapour for Distillery operation

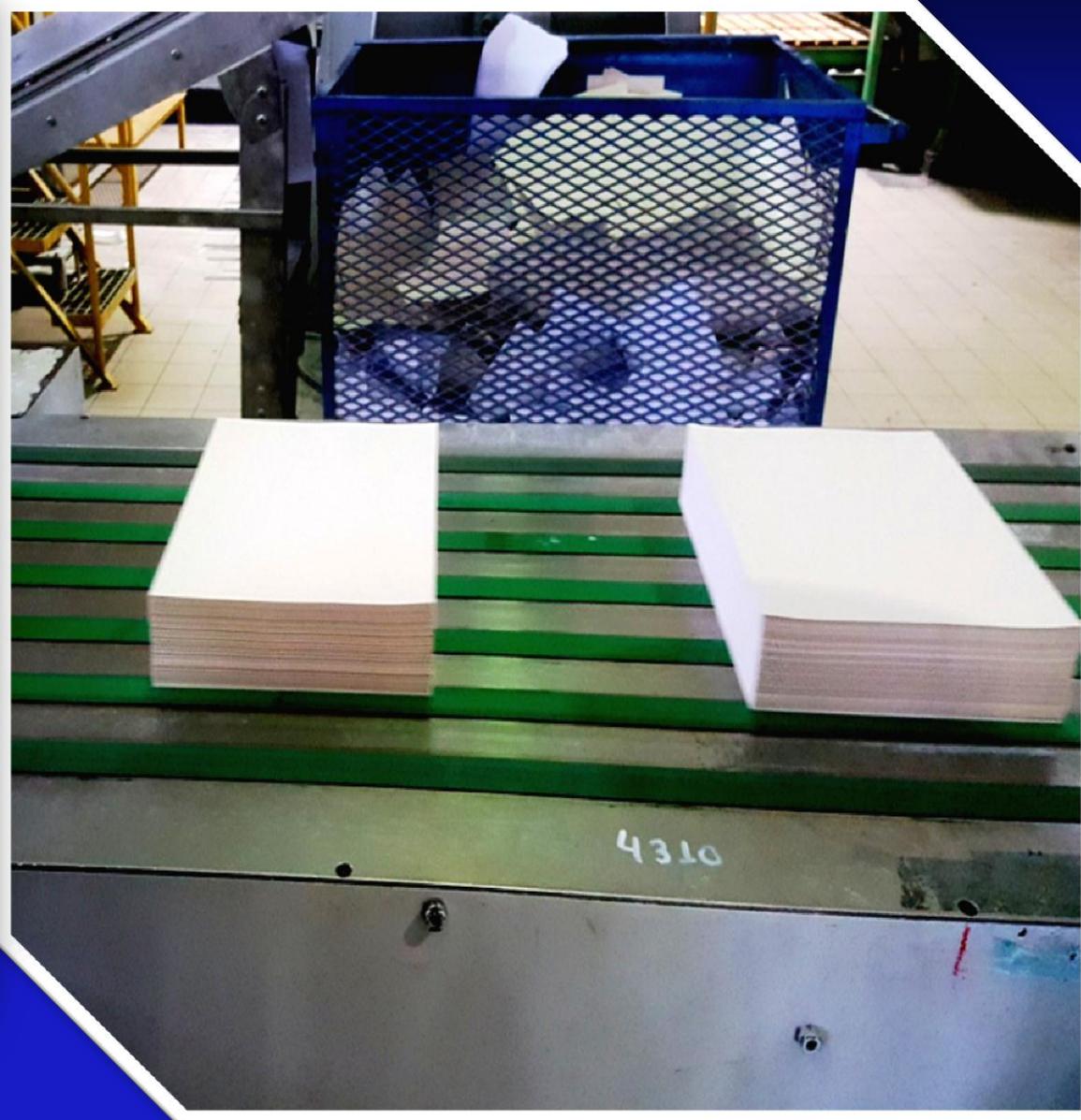
✚ 3<sup>rd</sup> and 4<sup>th</sup> to Sugar Mills

✚ 10 Bar for Papers (Vapour 1.2 bar / kg / Distillery)

✚ 50% of paper required in Argentina is made by Sugar Mills.



# LEDESMA PLANTS



**Paper Mill**

# MOLASSES INDUSTRY

- ❖ **Ethanol: Rectified Alcohol (96.4%)**

To be used in Medicine, Solvent, Paint, Ink etc.

Hydrous Alcohol can be used in Automobile upto 75% but heavy changes are required in Engine.

- ❖ **Fuel grade Alcohol (99.9%)** as an automobile fuel, ethanol gel. An hydrous alcohol upto 20% direct mixing in petrol.

- ❖ **Head & Tail 93%** to be used as wood polishing and varnish etc.

- ❖ **Stabilizing Agent:** Low rate of molasses addition in Cement delays concrete settling by 12 – 24 hrs.

# MOLASSES INDUSTRY

- ❖ **Casting Mould:** Molasses makes an excellent glue for Casting Moulds.
- ❖ **Bakers and Brewers:** Sufficient biotin contents required for bakers & brewers yeast. (Fermenter wash remelting plant)
- ❖ **MSG & Lysine:** Molasses is the perfect energy source for complicated technology.
- ❖ **Food Products:** Molasses is used as flavoring & coloring.
- ❖ **Animal Feed:** It is used for animal feed, in silage for nutrients of animals.
- ❖ **Soil Treatment:** Used for treatment of contaminating soil from oil or chemical spillage etc.
- ❖ **Citric Acid:** Moulds used molasses as energy source which returns citric acid.

# ETHANOL

- ❖ **Acetic Acid:** Ethanol is converted into acetic acid (raw material for vinyl acetate, acetic anhydride etc).
- ❖ **Acetaldehyde:** Formed from ethanol and is raw material for acetic acid, crotonaldehyde, pyridine etc.
- ❖ **Ethyl Acetate:** Derivative of ethanol used for paints extraction agents.
- ❖ **Ethylene:** Raw material for PVC, Polyethylene, ethylene oxide etc.
- ❖ **Furfural Alcohol Paint:** Derivative of alcohol used for sand binding resins for foundries.
- ❖ **Bio Ethanol:** Derived from alcohol used as Automobile fuel, pharmaceuticals and chemical etc.
- ❖ CO<sub>2</sub> Gas from fermenters for Beverage (Linked with Ethanol Plant)

# HIGHER VALUE ADDED PRODUCTS FROM SUGARCANE & SUGARCANE MILL

## THE ONE AND ONLY “GREEN” SODIUM BICARBONATE IN THE WORLD

- **Designed Capacity:** 50.000 t/crop
- **Start-up:** march/2004
- **Process and Plant owner:** Raudi Indústria e Comércio
- **Allied Ethanol Mill:** Coopcana – São Carlos do Ivaí – Paraná State – Brazil
- **Plant Manufacturing/Supply:** Dedini

(\*) Source: Valor Econômico, 27/aug/07



**SODIUM BICARBONATE PRODUCTION PLANT – NaHCO<sub>3</sub> – INTEGRATED TO AN ETHANOL MILL**

**USES CO<sub>2</sub> FROM CANE SUGAR TO ETHANOL FERMENTATION PROCESS  
AS A RAW MATERIAL TO PRODUCE NaHCO<sub>3</sub>**

**CARBON CREDITS METHODOLOGY HAS ONU APPROVAL (\*)**

**CARBON CREDITS SOLD UNDER CONTRACT TO ABN AMRO LONDON (\*)**

# HIGHER VALUE ADDED PRODUCTS FROM SUGARCANE & SUGARCANE MILL

New Technologies will be integrated to the Sugarcane Mill towards a Biorefinery, producing higher value added products

Feedstock: Sugarcane Juice, Concentrated Juice, Syrup, Sugar, Bioethanol, Bagasse, Straw

Different kind of fuels and several types of chemical specialties can be produced from the above feedstock, through specific fermentation processes and physical-chemical complementary treatments.

- Fuel as renewable diesel oil <sup>(1)</sup>
- Jet Fuels <sup>(1)</sup>
- Lubricant oils <sup>(1)</sup>
- Cosmetic products <sup>(1)</sup>
- Aromatics and flavors <sup>(1)</sup>
- Butyl Alcohol <sup>(2)</sup>
- Solvents <sup>(2)</sup>
- Biodegradeable Plastics <sup>(3)</sup>
- Polypropylene <sup>(4)</sup>
- 2<sup>nd</sup> and 3<sup>rd</sup> generation products <sup>(5)</sup>

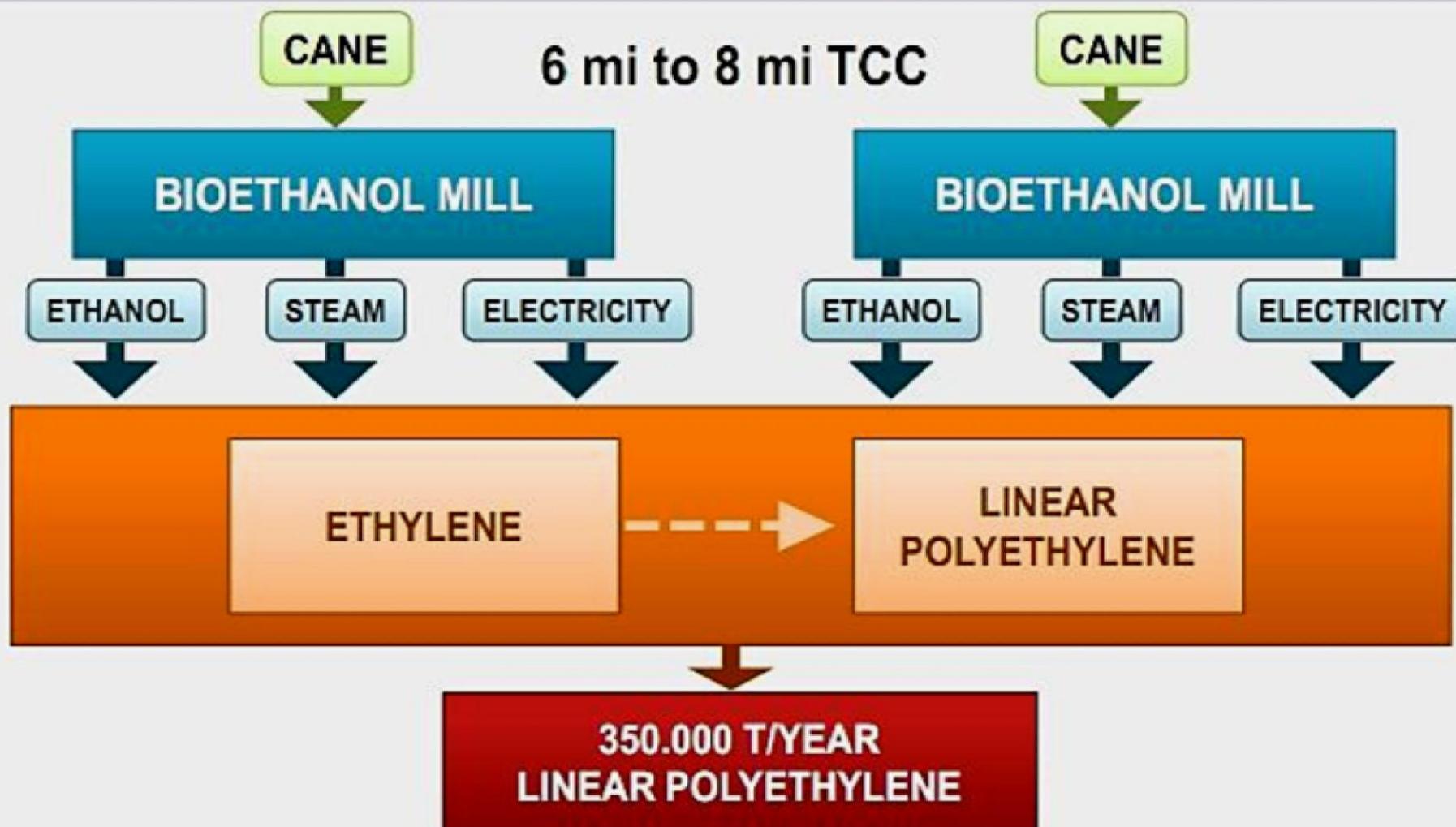
Some companies are in early commercial or in advance stage of development:

<sup>(1)</sup> Amyris, <sup>(2)</sup> Braskem, <sup>(3)</sup> PHB Industrial, <sup>(4)</sup> Rhodia, <sup>(5)</sup> GranBio

# DRIVER: SYNERGY AND INTEGRATION

## PRODUCTS AND ENERGY INTEGRATION

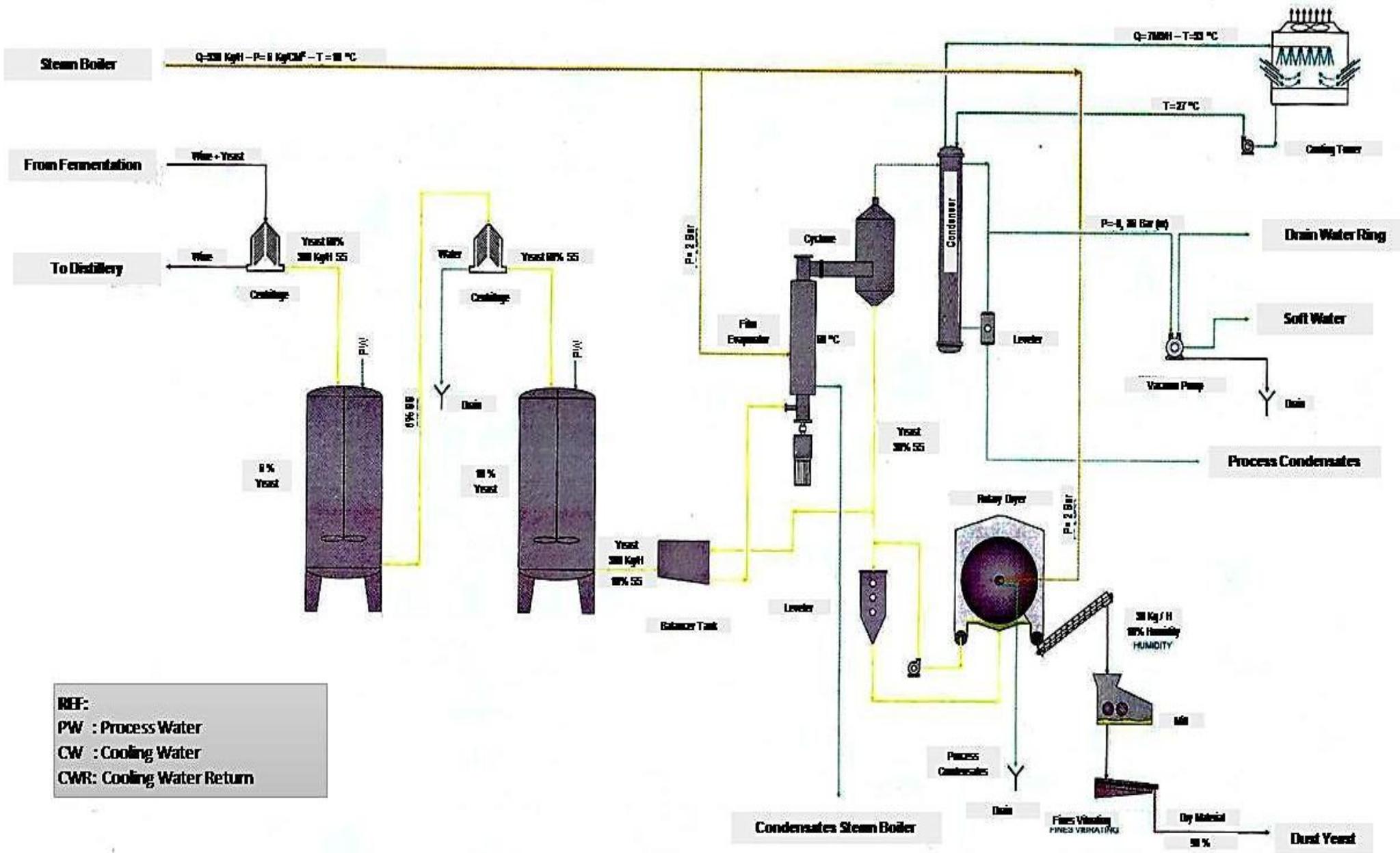
### GREEN PROJECT – DOW/MITSUI - SANTA VITÓRIA PROJECT (MG)



## YEAST RECOVERY / DRYER (Leales Cane Sugar Factory)

- Double centrifugation of the fermented wort.
- Yeast recovered in 1<sup>st</sup> centrifugation stage is diluted upto 6%solid.
- And it is centrifugated again to eliminate the impurities and bacteria.
- Drying system equipments are equalization tank, roller dryer and a mill.
- Production capacity is 30 Kg of 10% of dried vinasse per hr. It can be used for live stock feeding.

# YEAST DRYING PROCESS



REF:  
 PW : Process Water  
 CW : Cooling Water  
 CWR: Cooling Water Return

# BIO COMPOSTING PLANT

## MUD

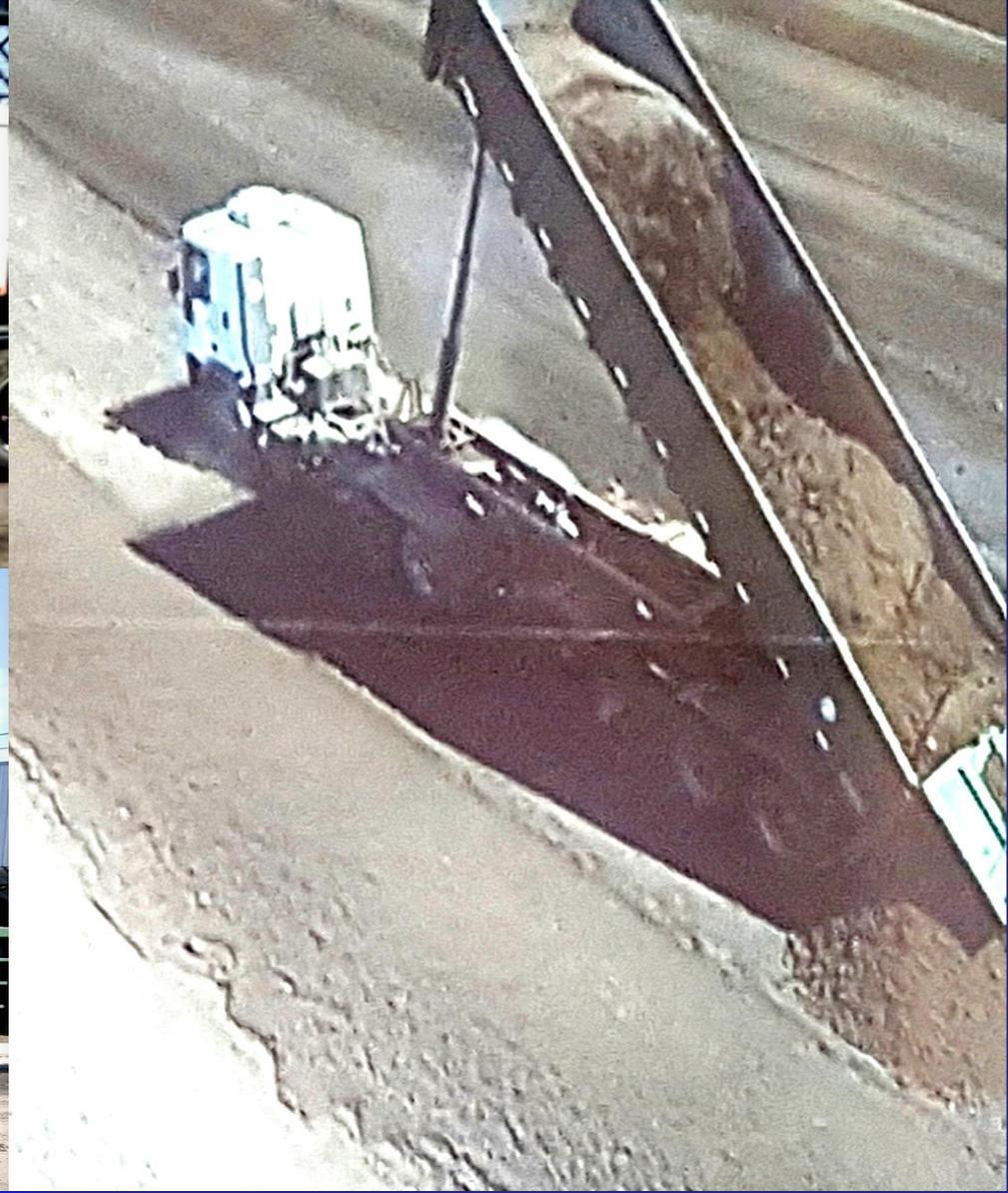
- At present being sold to bricks manufacturers
- To be converted into organic fertilizer by having certain additives
- Filter cake + boiler ash + other solid waste of Mills + Distillery effluent → Bio Compost
- Use of Filter cake for production of Biogas as fuel and cattle feed
- Use as wax production

# BIO COMPOSTING IN ARGENTINA (INGENIO LA FLORIDA SUGAR MILLS)

## Salient Features:

- 185 Acre fields located 5Km away from La Florida Sugar Factory.
- Plant produces 50,000 Tons / year compost, organic fertilizer which is applied to field.
- Vinasse concentration unit is one of the largest in World
- La Florida Sugar Mills significant efficiency improvement programs of its processes and water and energy.

# INGENIO LA FLORIDA SUGAR MILLS



Bio Composting

# INGENIO LA FLORIDA SUGAR MILLS



Bio Composting

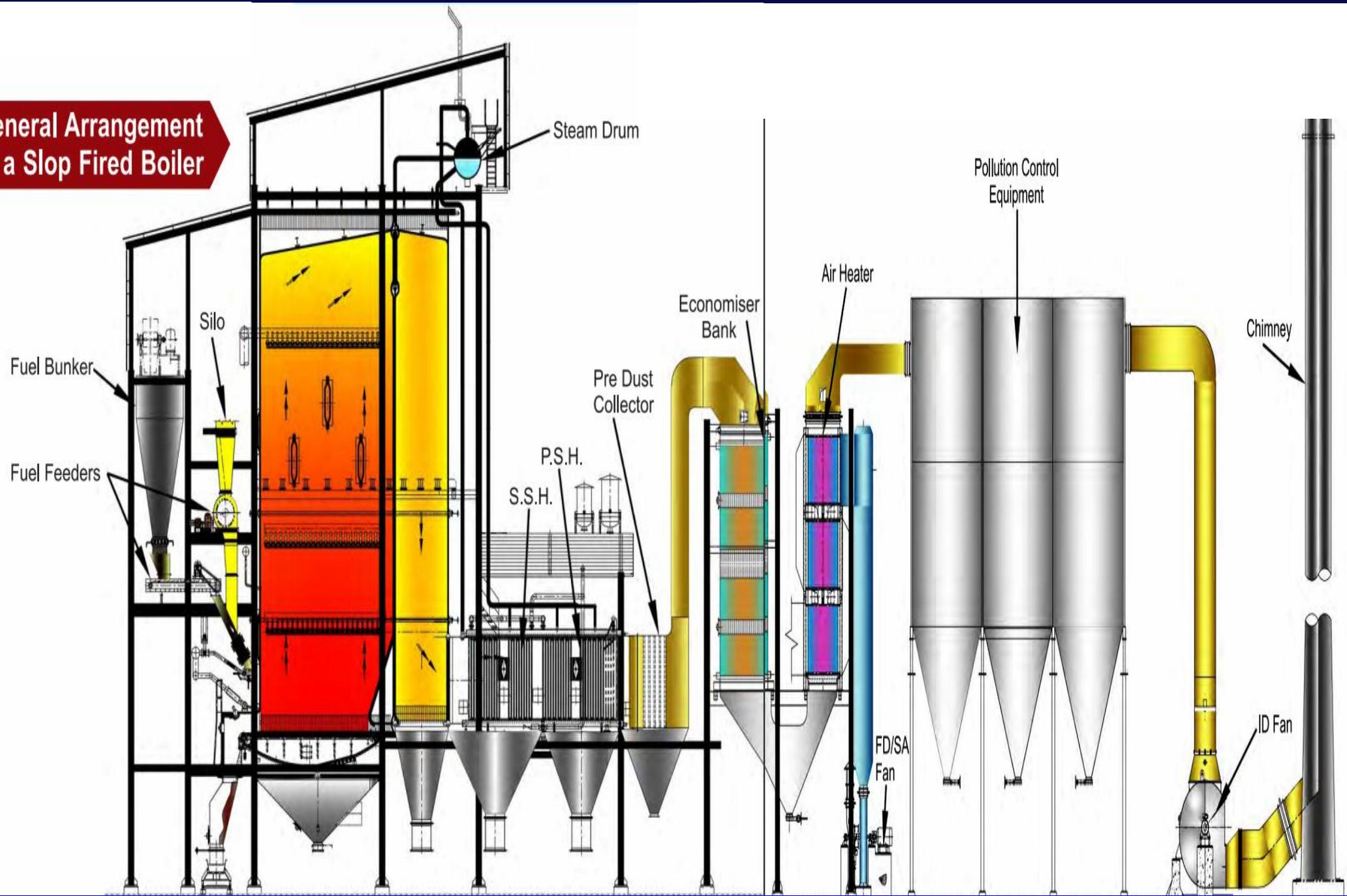
## DISTILLERY WASTE (STILLAGE)

- Stillage is treated in Effluent Treatment Plant (ETP) to produce Biogas for use in Boilers.
- Produced Biogas can also be used in Gas Engine to produce electricity but main problem is higher H<sub>2</sub>S contents in Biogas.
- Stillage is concentrated to burn in Boilers
- Diluted Stillage is used in agriculture land (1:10 ratio)



# VINASSE BURNING IN BOILER

General Arrangement of a Slop Fired Boiler



# VINASSE FIRED BOILERS IN INDIA

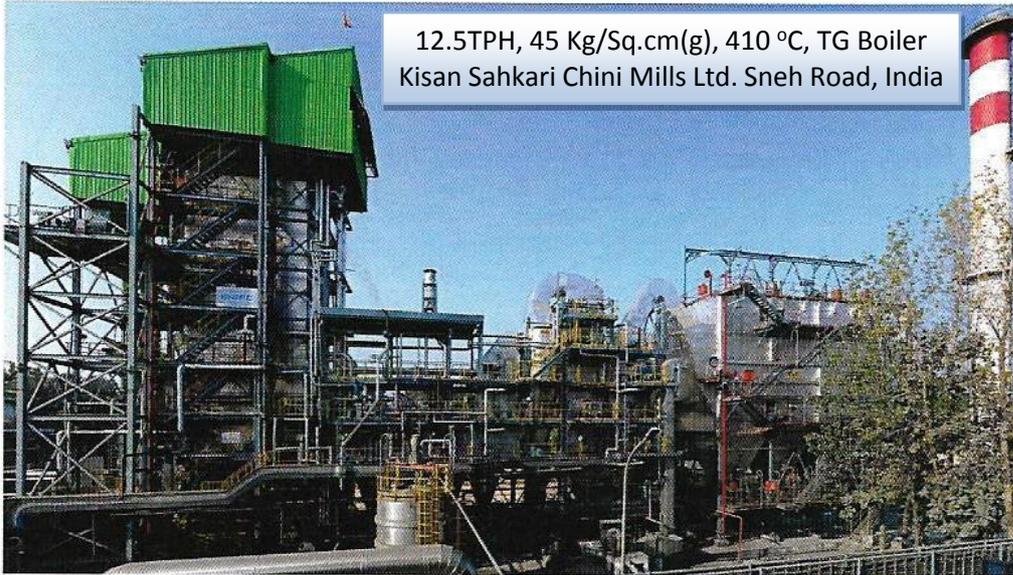
40 TPH, 45 Kg/Sq.cm(g), 400 °C, TG Boiler  
Balrampur Chini Mills Ltd, India



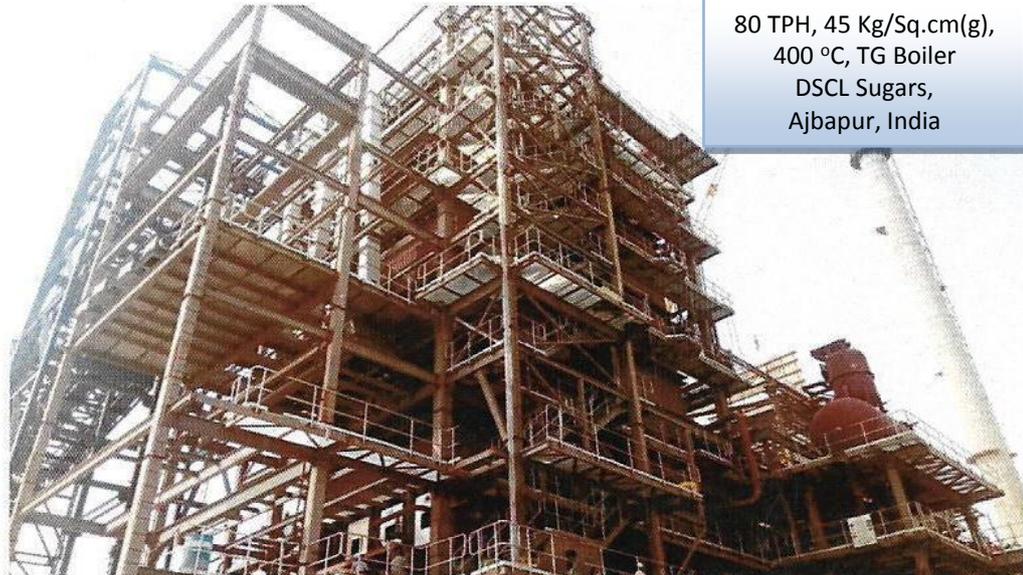
55 TPH, 45 Kg/Sq.cm(g), 400 °C, TG Boiler  
DSSL Sugars, Hariawan, India  
Crossed 120 Days of Continuous operation



12.5TPH, 45 Kg/Sq.cm(g), 410 °C, TG Boiler  
Kisan Sahkari Chini Mills Ltd. Sneh Road, India



80 TPH, 45 Kg/Sq.cm(g),  
400 °C, TG Boiler  
DSSL Sugars,  
Ajapur, India





**Enhanced profitability  
by selling ash as fertiliser**

**THANKS**