DIVERSIFICATION THROUGH BIOFUELS AND BYPRODUCTS IN BIOREFINERY

WEBINAR
ORGANISED BY:
THE SUGAR TECHNOLOGISTS’ ASSOCIATION OF INDIA

Presented By:
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Marketing Head

Council member, STAI
PREAMBLE

Sugar Sector

Major commodity

Country economy

Farmer source of income

Sugar Supply

Sugar Demand

COVID-19

Sugar Market

Farmer Arrear

Owner

Think Outside the Box
During this time of Covid-19 crisis, Sugar & distillery sector never stopped manufacturing because of being essential commodity.

Indian sugar industry is also a major sector to create employment/ financial support to about 10-12 cr. Indians directly or indirectly.

Sugar industry is maintaining it’s sustainability even in this pandemic and financial crisis and supporting Country’s economy.

Key sugar consumers like companies manufacturing beverages, soft drinks, confectioneries, bakeries, hotels etc. are either shut or operating at low capacities. The COVID-19 is expected to hit domestic demand for sugar by up to 2 million tonnes in the current sugar cycle alone.

This will hit the sugar stock drastically.
During this hard time and unpredictable market conditions, it is time for sugar industry to think out of box, to ensure its survival.

Industry can maintain its financial viability through shifting revenue by diversification in to the followings:

- Refined sugar/ Pharmaceutical sugar
- High pressure incidental Co-gen
- Ethanol by Syrup/B heavy combination.
- Ethyl acetate by rectified spirit
- Bio CNG from filter cake
- CO2 from distillery
Bio-refinery: Flowchart

- **Sugar cane**
  - Milling
  - Juice
  - Evaporation
  - Bagasse
  - Cogen+Slop
  - Power Plant
  - Export

- **Ethanol**
  - Ethanol Plant
  - Spent Wash
  - Ethyl Acetate
  - Sale to OMCs
  - CO₂
  - Sale to beverage industry

- **Syrup**
  - Juice Evaporation
  - Syrup

- **B-Molasses**
  - Process House
  - Filter Cake

- **Raw Sugar**
  - Refinery

- **Bio-CNG Plant**
  - Bio-CNG
  - Sale to vendor

- **Spent Wash**
  - Incineration Boiler + Power Plant
  - Power
  - Export
Challenges faced by the Industry
An Overview
There are total 525 operating sugar factories in India, out of this only 276 have Cogeneration facility, only 50 are running for refined sugar & only 177 have distillery plants.
Challenges faced by the Industry

SUGARCANE PRICE VS SUGAR PRICE
The Sugar Industry is facing some major challenges now and some will come into light in the future due to pandemic COVID-19.

These challenges are three fold: Economic, Environmental, Political

These can be further subdivided as shown below:
Challenges faced by the Industry

**Economic: Alarming state of Farmers’ Debt**

- Sugar cane arrears to farmers have crossed Rs 20,000 Cr. in the current marketing year 2018-19 (about Rs 20,159 Cr. as on February 22, 2019) *.

- This is perhaps the most critical factor that bottlenecks and impedes the industry’s growth and sustainability.

*Source: Economic Times*
## Challenges faced by the Industry

### Economic: Surplus Sugar production

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carry over stock</strong></td>
<td>7.53</td>
<td>9.09</td>
<td>7.76</td>
<td>3.97</td>
<td>10.66</td>
<td>14.52</td>
</tr>
<tr>
<td><strong>Sugar Production</strong></td>
<td>28.3</td>
<td>25.12</td>
<td>20.26</td>
<td>32.33</td>
<td>33.16</td>
<td>27.0</td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>--</td>
<td>--</td>
<td>0.45</td>
<td>0.215</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Total available for Consumption</strong></td>
<td>35.83</td>
<td>34.21</td>
<td>28.47</td>
<td>36.52</td>
<td>43.82</td>
<td>41.32</td>
</tr>
<tr>
<td><strong>Sugar consumption</strong></td>
<td>25.65</td>
<td>24.8</td>
<td>24.45</td>
<td>25.4</td>
<td>25.5</td>
<td>24</td>
</tr>
<tr>
<td><strong>Export</strong></td>
<td>1.09</td>
<td>1.65</td>
<td>0.046</td>
<td>0.464</td>
<td>3.8</td>
<td>5</td>
</tr>
<tr>
<td><strong>Closing stock</strong></td>
<td>9.09</td>
<td>7.76</td>
<td>3.97</td>
<td>10.66</td>
<td>14.52</td>
<td>12.52</td>
</tr>
</tbody>
</table>

*Carry over stock will not allow good price of sugar in near future.*

*Source: ISMA*
Economic: Falling selling rates of Cogenerated Power

- Due to surplus electricity, electricity rates for power export to grid have been reduced from 6.5 INR/unit to 4.25 INR/unit.

- This sudden fall in rates again affected the liquidity position of sugar mills as production of cogen power is almost the same as that of its selling rate, providing no net profit.

- However having provision of cogen, keeping local demand of electricity in mind, is always beneficial. Also, it is always profitable to sell electricity than selling bagasse.
Overcoming challenges
Shifting revenue streams by diversification
List of products by sugarcane which can help to generate revenue directly or indirectly

**Sugar**
- Pharma
- Refined
- Flavoured sugar
- Cubes/Candy
- Liquid Sugar
- Khandsari
- Jaggery
- Paper industry
- Cutlery

**Bagasse**
- Electricity
- 2G Ethanol
- Apparel Fabric
- Furfural
- Bio-plastic bottles

**Molasses**
- ENA
- Fuel Ethanol
- Butanol and acetone
- Acetic acid
- Ethyl Acetate
- Glycerol
- Ethylene
- CO2 for beverage industry
- Electricity by Spentwash
- SANITIZER
- Anti biotics

**Filter cake**
- Bio-CNG
- Manure
With rising consciousness towards the premium sugar market there is scope of development of shifting focus towards refined and pharmaceutical quality sugars instead of going for the double sulphitation process.

These products are also higher in their commercial value as shown below and have the scope to rejuvenate the industry.

**Figure 2: Different type of Sugar price and production cost**
## DIFFERENT TYPE OF SUGAR AND USERS

### Users of Plantation White and Refined Sugar
- **Pharma Industry**: For making of Syrups
- **Food Industry**: Making Syrups, Bakery and Confectionery Products, Health Drinks, Sweets, Carbonated and Non-Carbonated Drinks
- **Service Industry**: Hotels and Restaurants, Railway Catering, Hospitals, Airlines

### Users of Pharmaceutical Grade Sugar
- **Pharma Industry**: For making Syrups, Dry Syrups, Tablet Coating, Gripe Water, Suspensions
- **Food Industry**: Health Drinks and Health Food, Powder Drinks, Bakery & Confectionery Products etc.
- **Service Industry**: Hospitals

### Users of Refined Sugar Cubes
- **Service Industry**: Hotels, Restaurants, Catering, Railways, Airlines, Hospitals, Corporate Houses

### Users of Refined Icing Sugar
- **Food Industry**: Bakery & Confectionery

### Users of Coffee Sugar
- **Food Industry**: Coffee & Health drinks
- **Service Industry**: Hotels, Offices, Hospitals, Corporate Houses, Coffee houses like Café, barista etc.

### Users of Flavoured Sugars
- **Service Industry**: Hospitals, Hotels, Restaurants, Catering.
- **Corporate**: Offices & Office canteens.
The **new Bio-fuel policy (EBP)** introduced by the Government in **18th December 2018** was a welcome relief to the ethanol Industry and a radical way for the sugar industry to liquidate its arrears.

However, most of the **existing infrastructure of the industry have to be developed** to take advantage of the policy and its realization shall be over the course of the next few years.

**Present rates of Ethanol produced from different feedstocks:**

<table>
<thead>
<tr>
<th>Raw Material used for Ethanol production</th>
<th>Present Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Molasses</td>
<td>43.75</td>
</tr>
<tr>
<td>B- Heavy Molasses</td>
<td>54.27</td>
</tr>
<tr>
<td>Cane juice</td>
<td>59.48</td>
</tr>
</tbody>
</table>
**Note:**
- Ethanol Blending program is applicable for 20 states and Delhi.
- Excluded states and union territories are as follows:
  - **States:** Arunachal Pradesh, Mizoram, Assam, Nagaland, Jammu and Kashmir, Sikkim, Manipur, Tripura, Meghalaya
  - **Union territories:** Andaman and Nicobar Islands, Chandigarh, Dadar and Nagar Haveli, Daman and Diu, Lakshadweep, Puducherry (Pondicherry)
To get the country’s growth back, PM announced the AATMA NIRBHR Bharat Initiative.

And to support the industry and to promote domestic business Government is maintaining the same ethanol rate as passed in 2019.

Currently, the country is dependent on imports for about 82.1% of its crude oil requirement and this may extend if we do not seek options for crude oil import.

Sugar industry is contributing in EBP and successfully achieved a mark of 7.2% ethanol blending.

To reduce the crude oil requirement and enhance blending upto 10-11% next year, sugar industry can support the economy.
SELF-SUSTAINABLE SYSTEM FOR ETHANOL PLANT

- Distillery Plant
- Fuel Costs
- Steam Costs
- Power Costs
- Effluent treatment Costs
- Incineration boiler
- Vinasse effluent

bioethanol
CO2 Plant

CO2

Fermentation

Molasses

- Used in carbonated beverages
- Used in chemical preparation
- Used as fire extinguisher
- Used as refrigerant, dry ice

Distillery Plant capacity KLPD | CO2 production (TPD)
--- | ---
30 | 12
40 | 16
50 | 20
60 | 24
75 | 30
90 | 36
100 | 40
120 | 48
150 | 60
200 | 80
225 | 90
250 | 100
300 | 120
OTHER USES OF bioethanol

- **Rectified Spirit (RS)**
  - Production of organic chemicals

- **Extra Neutral Spirit (ENA)**
  - Production of IMFL
  - Production of country liquor in most of the states

- **Export Quality Rectified Spirit (EQRS)**
  - Production of country liquor in Maharashtra

- **Absolute Alcohol (AA)**
  - Blending with petrol under EBP programme

- **TA / IS**
  - Solvent for cosmetics, paints & perfumes industries

- **Fusel Oil (FO)**
  - As a special chemical for furniture industry

- **Ordinary Denatured Spirit (ODS)**
  - Pharmaceuticals industry
  - Laboratories

**SANITIZER**
Dehydration of ethanol at high temperature yields **ETHYLENE** which can be further processed to produce polyethylene, styrene, polyvinyl chloride etc.

**ACETONE** is produced from ethanol by passing it over a catalyst at high temperature, which is useful in different industries as solvent and also for manufacture of other products.

**ACETIC ACID** is produced by oxidation of ethanol in the presence of catalyst.

**ETHYL ACETATE**

**LACTIC ACID**

**GLYCEROL**

**BUTANOL**
Value added products from Ethanol
SANITIZERS
High demand for hand sanitizers since the beginning of March had led to hoarding which caused a spike in prices and also sale of spurious products.

The hand sanitizer industry has been unable to meet the increased demand as it was not getting adequate supply of ethanol, the key ingredient in the manufacture of sanitizers.

Ethanol, an active ingredient in the production of hand sanitizers, is manufactured by sugar mills in India. and the Ethanol industry is more than capable to fulfil the demand of hand sanitizers.

Major ethanol producers groups like DSCL, Dalmia, Triveni, Dhampur, Haryana Co-op, Ghorpade, Jaywant, Daund sugar etc came up and started production of sanitizer within 1 months.
At 100% capacity utilization, the hand sanitizer industry is expected to have a requirement of 8m-10m litres/month of ethanol, as per a report in the Hindu Businessline.

India currently has an ethanol production capacity of 3.5bn litres/year, as per official records.

The Indian government brought hand sanitizers under the Essential Commodities Act on 19 March to prevent hoarding and also capped prices at Rs 100 ($1.32) for a 200 ml bottle until 30 June.

### DEMAND AND SUPPLY

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol (95-96%)</td>
<td>75-80%</td>
</tr>
<tr>
<td>Glycerol (95-98% )</td>
<td>1.5-2.0%</td>
</tr>
<tr>
<td>Hydrogen Peroxide (2-3%) (optional)</td>
<td>0.1%</td>
</tr>
<tr>
<td>Distilled water</td>
<td>22-27%</td>
</tr>
</tbody>
</table>
Some in-house sanitizer brands of sugar mills of Uttar Pradesh and Maharashtra.
Ethyl Acetate

\[ \text{CH}_3\text{COOCH}_3 \]
APPLICATION OF ETHYL ACETATE

- It is mainly used as an *extraction solvent* in the production of pharmaceuticals.

- It is commonly used to clean *circuit boards* and in some nail varnish removers.

- *Coffee beans and tea leaves* are decaffeinated with this solvent.

- It is also used in *paints as an activator* or hardener.

- Ethyl acetate has applications *as a solvent in inks* for flexographic and rotogravure printing.

- Ethyl acetate is *presently in high demand* as a valuable *ingredient/raw material* for various industries.
Ethyl Acetate currently has a **global market of $3.3 billion**
## Raw Material requirement for a 50TPD plant model

<table>
<thead>
<tr>
<th>Item</th>
<th>Purpose</th>
<th>Source</th>
<th>Consumption per T of Ethyl Acetate</th>
<th>Purchase rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECTIFIED SPIRIT</td>
<td>Reactant</td>
<td>From Distillery</td>
<td>0.57 T</td>
<td>In house production</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Market rate: 38 INR/Liter</td>
</tr>
<tr>
<td>ACETIC ACID CONSUMED</td>
<td>Reactant</td>
<td>Can be purchased from outside (easily available)</td>
<td>0.7 T</td>
<td>27 INR/Kg</td>
</tr>
<tr>
<td>PTSA/H2SO4</td>
<td>Catalyst for reaction</td>
<td></td>
<td>0.5 Kg</td>
<td>24 INR/kg</td>
</tr>
<tr>
<td>Steam</td>
<td>For process operations</td>
<td>From Distillery plant</td>
<td>2.8 T</td>
<td>In house production: Steam@1/kg Power @4/- unit.</td>
</tr>
<tr>
<td>Power</td>
<td>For process operations</td>
<td></td>
<td>215 kW</td>
<td></td>
</tr>
<tr>
<td>DM/Soft water</td>
<td>For process operations</td>
<td>From Distillery water treatment plant</td>
<td>1.4 m3</td>
<td></td>
</tr>
<tr>
<td>Soft water</td>
<td>Cooling tower makeup</td>
<td></td>
<td>3.6 m3</td>
<td></td>
</tr>
</tbody>
</table>
ISGEC is providing turn-key solution for Ethyl acetate plants. Feasibility shall be case to case basis.
You can contact to Mr. Anurag Goyal, 9958496535, anuraggoyal@isgec.co.in for your queries.
Value added products from Sugar Plant Byproduct

- Filter cake
- Bagasse
Sugar factories produce filter cake @ 4.0-5.0 % on cane per year.
Press mud has the potential to generate CNG.
One ton of filter cake is capable of producing 30 kg of bio-CNG
Reject of bio-CNG processing is used as organic manure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Press mud</th>
<th>Average Value (% w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>70-72</td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>8-10</td>
<td></td>
</tr>
<tr>
<td>Volatile Solid</td>
<td>18-22</td>
<td></td>
</tr>
<tr>
<td>Organic matter on solid</td>
<td>72-76</td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>1.5-2.0</td>
<td></td>
</tr>
<tr>
<td>Wax</td>
<td>6-7</td>
<td></td>
</tr>
<tr>
<td>C/N ratio</td>
<td>13-15</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Biogas</th>
<th>Compressed Natural Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane (v/v)</td>
<td>55-65 %</td>
<td>92-98 %</td>
</tr>
<tr>
<td>CO2 (v/v)</td>
<td>35-45 %</td>
<td>2-8%</td>
</tr>
<tr>
<td>H2S (ppm)</td>
<td>500-30,000</td>
<td>&lt; 20 ppm</td>
</tr>
<tr>
<td>Other Impurities</td>
<td>Present</td>
<td>Mostly removed, Not present</td>
</tr>
<tr>
<td>Calorific Value</td>
<td>19500 kJ/Kg</td>
<td>52000 kJ/kg</td>
</tr>
</tbody>
</table>
ISGEC is providing turn-key solution for Bio CNG plants with proven Indian technology. Feasibility shall be case to case basis. You can contact to Mr. Anurag Goyal, 9958496535, anuraggoyal@isgec.co.in for your queries.
Milled bagasse forms about 27-30% of crushed Sugar cane

- Fresh bagasse has about 50-51% fibre
- This fibre is cellulose rich
- Bagasse fibre has about 25-30% cellulose
- A variety of end products can be obtained from cellulose polymer
- Being rich in carbon, it has good calorific value and hence finds application in fuel use and cogeneration
- Other major potential value added products include Bio-plastics and 2G- Ethanol
- Profit in Selling bagasse < Profit in Selling Power
- But for both bagasse saving is necessary
- For Bagasse saving reduce bagasse consumption choose high pressure cogeneration.

### Power generation in MW / Ton of baggase

![Graph showing power generation in MW per ton of bagasse](image)

- Upto 140kW/ton of cane power can be export which reduces overall production cost of power.
India has become one of the biggest centers of plastic usage with over 15,000 tons of plastic waste generated every year, of which only 60% is re-processed.

Countries all over the globe have begun to take steps on curbing its usage.

Bangladesh has prohibited plastic bags countrywide, Ireland has imposed a tax on plastic bags, while the UK and other European countries are contemplating about taxing them as well.

There are a few alternatives to plastics that are gaining attention at a global level.

Bioplastics is one such eco-friendly alternative to plastics, which could be an excellent replacement since their manufacturing results in fewer emissions of greenhouse gasses.
Bio-plastic companies in India

- Truegreen
- Plastobags
- Ecolife
- Envigreen
2ND GENERATION CELLULOSIC ETHANOL FROM BAGASSE

Cogeneration plant

- Bagasse
- Lignin

Steam/ammonia

- Pretreatment

Cellulase enzymes

- Enzymatic hydrolysis

Yeast

- Fermentation

- Ethanol

- Distillation

Electricity

- Boiler ash

Boiler ash
In the apparel industry, bagasse is utilised for production of textile rayon fibers such as viscose, modal and lyocell.

The bagasse is shredded, broken down with eco-friendly chemicals or other chemicals, and then when it is still in a liquid form, it is shot at very high pressure through tiny holes.

This long strand of fibre is then solidified and spun into yarn. Rayon fibres are thus produced.
SUGARCANE FIBRES: NOT ONLY TO EAT, JUST KNIT IT!

- Sugarcane rayon is glossier has a delightful lustre and more silk-like than wood pulp rayon.
- The bagasse fibre can be noticeably long, but it should not be shorter than 6 to 12 mm. If the fibre is not of the desired length it might not hold together.
- Earlier, the Japanese dominated or rather had a sole authority over producing sugarcane fibre for apparel purpose. In Japan, several companies used blend of sugarcane and selvage denim to reproduce some of the finest quality jeans.
BAGASSE IN APPAREL INDUSTRY
BAGASSE IN PAPER INDUSTRY

- Globally, 9% of paper fiber comes from fibers other than wood and **bagasse pulping** has been attracting the pulp and paper industry’s more interests these days.
- Currently, there are believed to be around 30 countries that use bagasse for paper manufacture.
CASE STUDY OF A BUSINESS MODEL FOR A 5000 TCD BIO-REFINERY COMPLEX
### BIO-REFINERY: Case study

#### Basis

<table>
<thead>
<tr>
<th>Cane crushing capacity</th>
<th>5000 TCD (4000 TCD for Refined + Pharma Sugar; 1000 TCD for Ethanol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing days</td>
<td>160</td>
</tr>
<tr>
<td>Co-gen off season days</td>
<td>7 (No need of bagasse purchase for distillery off crop operation)</td>
</tr>
<tr>
<td>Juice extraction plant</td>
<td>4 mill tandem – AC VFD planetary gear box and rope coupling</td>
</tr>
<tr>
<td>Refined Sugar processing plant capacity</td>
<td>4000 Tons cane per day</td>
</tr>
<tr>
<td>Pharma sugar plant</td>
<td>140 Tons per day (included above)</td>
</tr>
<tr>
<td>Process Plant</td>
<td>Phospho-floatation system followed by Ion Exchange process with brine Recovery System</td>
</tr>
<tr>
<td>Final Product sugar</td>
<td>EU2 grade refined sugar of $\leq 45$ IU colour</td>
</tr>
<tr>
<td>Reduced mill extraction</td>
<td>+96.5</td>
</tr>
<tr>
<td>RBHR</td>
<td>+91</td>
</tr>
<tr>
<td>Steam consumption</td>
<td>36% on cane with refinery</td>
</tr>
<tr>
<td>Bio CNG plant</td>
<td>120 TPD (Filter cake processing capacity)</td>
</tr>
<tr>
<td>Steam generation Plant</td>
<td>120 TPH, 125 ata, 545 deg C</td>
</tr>
<tr>
<td>Steam/fuel ratio</td>
<td>2.65 : 1</td>
</tr>
<tr>
<td>Power generation Plant</td>
<td>24 MWe extraction cum condensing turbine</td>
</tr>
</tbody>
</table>
### BIO-REFINERY: Case Study

<table>
<thead>
<tr>
<th>Basis</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distillery Plant</td>
<td>70 KLPD (Total spirit)</td>
</tr>
<tr>
<td>CO2 Plant</td>
<td>30 TPD</td>
</tr>
<tr>
<td>Distillery off season days</td>
<td>179</td>
</tr>
<tr>
<td>Distillery feedstock</td>
<td>Sugarcane syrup in crop and B heavy in off season</td>
</tr>
<tr>
<td>Ethyl acetate plant capacity</td>
<td>20 tons per day</td>
</tr>
<tr>
<td>Sanitizer plant capacity</td>
<td>1 KLPD</td>
</tr>
<tr>
<td>Slop fired boiler</td>
<td>26 TPH, 45 ata, degC</td>
</tr>
<tr>
<td>Power generation</td>
<td>3.0 MW</td>
</tr>
</tbody>
</table>

- No need of bagasse purchase for slop fired boiler for distillery off crop operation
- Steam, power supply to ethyl acetate production from slop fired power plant
- Power supply to Bio CNG plant from slop fired power plant
ISGEC is providing turn-key solution for Bio Refinery complexes. Feasibility and capital cost/ROI shall be case to case basis. You can contact to Mr. Anurag Goyal, 9958496535, anuraggoyal@isgec.co.in for your queries.
CONCLUSION

In present scenario, only sugar and cogeneration plant is not the viable solution. Sugarcane has enough potential to cope up with market imbalance. Sugar factories will have to be multi product industry so that it can be sustainable in ups & down of climate, economic disturbance of country.
ISGEC - OVERVIEW

- Founded & Incorporated in **1933** as small sugar plant and workshop
- Our Group Turnover is **INR 5120 Crore** *
- With strong financial fundamentals, we are a **Zero debt company**
- We rank **279 in the ET 500 listing**, **259 in the Fortune India 500 listing** and **397 in the Business Today 500 list**. Emerged as **brand name “ISGEC”**.
- We have a total Employee Strength of approx. **3000**
- We have more than **85 years in Business** with Heavy industrial engineering solution.
- A strong portfolio of more than **190 Sugar /Distillery/Refinery projects**, **800 Cane crushing mills** across **49 countries**
MANUFACTURING FACILITY

YAMUNANAGAR (HARYANA)
MANUFACTURING FACILITY

YAMUNANAGAR (HARYANA)

- Carbon Steels
- Low Alloy Steels (T-11 and T-22)
- High Alloy Steels (T-91)
- Stainless Steel (TP304, TP347)
MANUFACTURING FACILITY

YAMUNANAGAR (HARYANA)

SHOP FOR ASSEMBLING AND MACHINING
MANUFACTURING FACILITY

YAMUNANAGAR (HARYANA)

SEPARATE AREA FOR STAINLESS STEEL FABRICATION FOR REFINERY AND DISTILLERY EQUIPMENTS
MANUFACTURING FACILITY

YAMUNANAGAR (HARYANA)

HEAT TREATMENT

Furnace max. size: 20m x 8m x 8m
MANUFACTURING FACILITY

RATTANGARH (HARYANA)
STEEL CASTING FACILITY

UTTAR PRADESH STEEL, MUZAFFARNAGAR
AUTOLISP – for auto generation of drawings and bill of materials.

SUGARS – for integrated sugar & distillery complex design.

STAAD PRO – for structural design.

CADISON – plant design

SOLID WORKS – for 3d modeling.

COSMOS – for finite element analysis (FEA)

CAESAR-II – for piping stress analysis

ANSYS – for simulation and analysis

PRO STEEL – for 3d modeling of structure.

NAVSION – works viewer
MANUFACTURING STANDARDS AND CAPABILITIES

- **ISO 9001:2008** Approval by Lloyds Register of Quality Assurance
- **ASME ‘S’ ‘U’ ‘U-2’ & ‘U-3’ Stamps**
- **ASME ‘N’ Stamp**
- **‘R’ Stamp**
- **‘NB’ Stamp**
- Approval by Lloyds as a **Class I fabricator** of fusion Welded Pressure Vessels up to 300 mm (12”) thickness
- **China Safety** Quality License
- **ISO 14001 : 2004**
- **OHSAS 18001 : 1999**
- Approved by **Saudi Aramco, Qatar Petroleum, GASCO, SABIC, KNPC, TAKREER, ADCO, ADGAS**
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Project &amp; Location</th>
<th>Capacity</th>
<th>Products</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>DSCL, Ajbapur</td>
<td>225 KLPD 80 TPH Slop boiler</td>
<td>Ethanol</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>2.</td>
<td>DSCL, Hariawan</td>
<td>160 KLPD 55 TPH Slop boiler</td>
<td>Ethanol + ENA</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>3.</td>
<td>U.P Co-op, Najibabad</td>
<td>40 KLPD 13.5 TPH Slop boiler + 1.2MW Power plant</td>
<td>Ethanol</td>
<td>EPC complete plant with civil</td>
</tr>
<tr>
<td>4.</td>
<td>U.P Co-op, Azamgarh</td>
<td>30 KLPD 13 TPH Slop boiler + 1 MW Power plant</td>
<td>Ethanol + ENA</td>
<td>EPC complete plant with civil</td>
</tr>
<tr>
<td>5.</td>
<td>Dalmia, Nigohi</td>
<td>60 KLPD 22 TPH Slop boiler</td>
<td>Ethanol</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>6.</td>
<td>Dwarikesh, Bundki</td>
<td>100 KLPD 40 TPH Slop boiler + 5 MW Power plant</td>
<td>Ethanol</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>7.</td>
<td>Sri Sai Priya, Bagalkot</td>
<td>120 KLPD 55 TPH Slop boiler</td>
<td>Ethanol + ENA</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>8.</td>
<td>SSM, Yamunanagr</td>
<td>109 KLPD 42 TPH Slop boiler + 5.6 MW Power plant</td>
<td>Ethanol</td>
<td>EPC complete plant with civil</td>
</tr>
<tr>
<td>9.</td>
<td>NSI, Kanpur</td>
<td>Pilot Grain liquefaction plant</td>
<td>Mash / Wash</td>
<td>Complete plant</td>
</tr>
</tbody>
</table>
30 KLPD turnkey based project for U.P. Cooperative, Azamgarh
40 KLPD turnkey based project for U.P. Cooperative, Najibabad
160 KLPD turnkey based project for DSCL Sugars, hariawan
160 KLPD turnkey based project for DSCL Sugars, Hariawan
160 KLPD turnkey based project for DSCL Sugars, Hariawan
40 KLPD turnkey based project for U.P. Cooperative, Najibabad
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40 KLPD turnkey based project for U.P. Cooperative, Najibabad
Distillery Vinasse Integrated Concentration System
120 KLPD distillery plant with slop fired boiler for Shri Saipriya Sugars Karnataka, molasses based distillery under execution. (3D-model)
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Project &amp; Location</th>
<th>Capacity</th>
<th>Type of refinery</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Durrah Advance company, Saudi Arabia</td>
<td>2500 TPD standalone refinery.</td>
<td>Standalone carbonatation + IER</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>2.</td>
<td>PT SMIP, Indonesia</td>
<td>650 TPD expandable to 1000 TPD standalone refinery with civil work</td>
<td>Carbonation + IER</td>
<td>EPC complete plant</td>
</tr>
<tr>
<td>3.</td>
<td>CAUSCO, Vietnam</td>
<td>500 TPD backend sugar refinery</td>
<td>Phospho-flotation + IER</td>
<td>Turnkey complete plant</td>
</tr>
<tr>
<td>4.</td>
<td>Kibos Sugar and allied industries Limited, Kenya</td>
<td>350 TPD backend refinery</td>
<td>Phospho-flotation + IER</td>
<td>Turnkey complete plant</td>
</tr>
<tr>
<td>5.</td>
<td>WNSC, Sudan</td>
<td>2400 TPD refinery process plant</td>
<td>Phospho-flotation</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>6.</td>
<td>Dalmia Bharat, Nigohi</td>
<td>900 TPD backend refinery.</td>
<td>Phospho-flotation</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>7.</td>
<td>Triveni Engineering &amp; Industries limited, Sabitgarh,</td>
<td>150 TPD Pharmaceutical refined sugar production</td>
<td>Phospho-flotation + IER</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>8.</td>
<td>PT SMS, Indonesia</td>
<td>350 TPD back end refinery</td>
<td>Phospho-flotation</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>S.No.</td>
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<td>--------------------------------------------------------</td>
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<td>--------------------------</td>
</tr>
<tr>
<td>9</td>
<td>PT MSM, Indonesia</td>
<td>700 TPD backend refinery.</td>
<td>Backend, Carbonation + IER</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>10</td>
<td>PT PNS, Indonesia</td>
<td>700 TPD backend refinery.</td>
<td>Backend, Carbonation + IER</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>11</td>
<td>Haryana Cooperative Sugar Limited Karnal, (Hayana)</td>
<td>450 TPD back end refinery including civil work</td>
<td>Backend Phosphoflotation</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>12</td>
<td>U. P. State Sugar Corporation Limited, Pipraich, UP, India</td>
<td>650 TPD refinery including civil work</td>
<td>Backend Phosphoflotation</td>
<td>Turn key complete plant</td>
</tr>
<tr>
<td>13</td>
<td>U. P. State Sugar Corporation Limited, Munderwa, UP, India</td>
<td>650 TPD refinery including civil work</td>
<td>Backend Phosphoflotation</td>
<td>Turn key complete plant</td>
</tr>
</tbody>
</table>
PICTURES OF PROJECTS

2500 TPD Standalone Refinery, Durrah Advanced DC, Yanbu
2500 TPD Standalone Refinery, Durrah Advanced DC, Yanbu
PICTURES OF PROJECTS

600TPD carbonatation refinery,
PT PNS Sugar Refinery, Indonesia
PICTURES OF PROJECTS

600TPD carbonatation refinery,
PT PNS Sugar Refinery, Indonesia
500 TPD Tala Sugar Refinery, Mexico
Thank you!