PRESENTATION

ON

ETHANOL/ ENA

(GRAIN BASED DISTILLERJ)

FUTURE ZEN CONSULTANTS LLP (www.futurezen.org)

CONCEPT TO MARKET SERVICES (C2M)

INDIA

ABOUT US

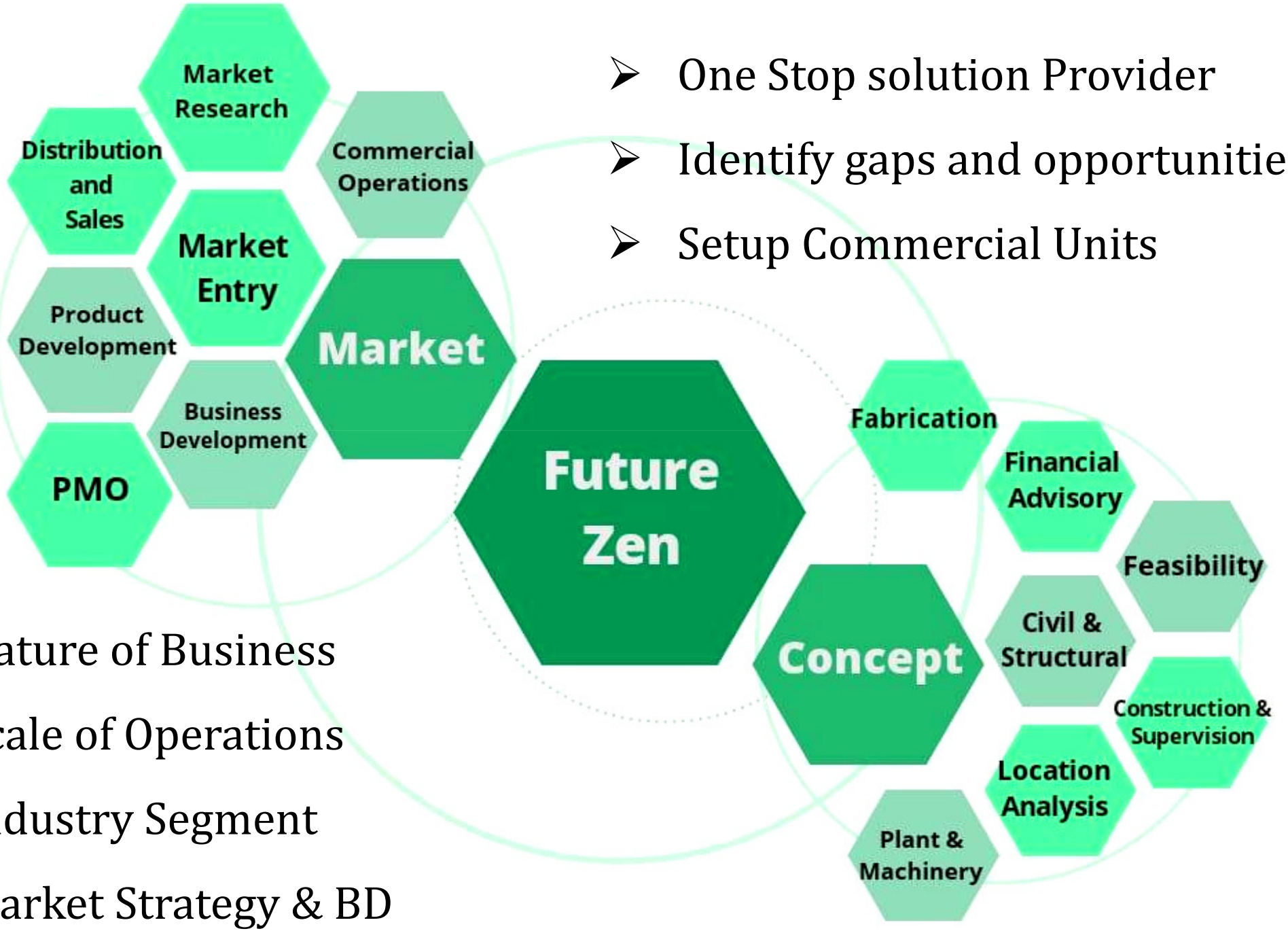
(FUTURE ZEN CONSULTANTS)

Future Zen Consultants - About Us

- **Future Zen Consultants (FZC) LLP** is an Business Advisory and Project Management Consulting (PMC) firm providing Concept to Market (C2M) solutions for the diversified industries across locations.
- FZC adds value to the business of the organizations by providing Project related Engineering and Management services.
- FZC expertise revolves around all the facets of Business Operations namely Engineering, Management, Finance & Accounting, Legal & Liaison, Sales & Marketing and Secretarial & Compliances.
- Our Vision is to take up innovation and new development projects under Greenfield category, through which we want to develop alternate products for the market to cater to all the sections of the society.

Future Zen Consultants - Services

- One Stop solution Provider
- Identify gaps and opportunities
- Setup Commercial Units



- Nature of Business
- Scale of Operations
- Industry Segment
- Market Strategy & BD

PROJECT REQUIREMENTS

(PRELIMINARJ)

Why this Project (1G Ethanol Project) ?

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- Central Government target to achieve 20% blending of ethanol with Gasoline by year 2025. This initiative will result in an annual saving of **30,000 Crore INR** out of India's oil import bill. This initiative would enable us to produce Fuel Ethanol.
- Integrated Multi Grain Processing unit would enable us to utilize the suplus grains produced in the Country for Ethanol and in turn improve earnings for stakeholders concerned.
- To bridge the Demand/ supply gap (40,000 KL per annum) in production of Indian Made Foreign Liquor (IMFL) and Country Liquor (CL).
- DDGS (by product produced) will be a nutritious protein source used as Animal Feed. DDGS would be least cost substitute for other feed sources.

Locational Analysis

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- Government Policies and Regulations
- Political and Strategic Considerations
- Preference to the End Products
- Good Connectivity (Rail Network/ National Highways/Golden Quadrilateral)
- Preference to Grains based Alcohol Technology due to limited availability of sugarcane
- Proximity to Warehouses, Market Yards and Sale Depots of Raw Material
- Substantial Water Availability
- Infrastructure Facilities like Power, Transport and Tele- Communications
- Affordable Housing, Boarding & Lodging, Hotels and Restaurants , etc
- Labour Availability
- Environment Impact and Disposal

Land Usage Pattern

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- Capacity Considered (Output): **100 KLPD (Kilo Litres Per Day)**

- Total Plot Area: **Approx 30 Acres**
  - Construction Area: 13 Acres
  - Green Belt Area: 10 Acres (33.33% of the Project Site)
  - Open Area: 07 Acres

Note:

- ✓ *Above Land Consideration might be sufficient even for 120 KLPD Capacity*
- ✓ Green Belt Area (33.33%) is as per Environment and Pollution Norms
- ✓ Land requirement may vary based on the project Capacity and land norms in respective states

Ideal Plant Layout:

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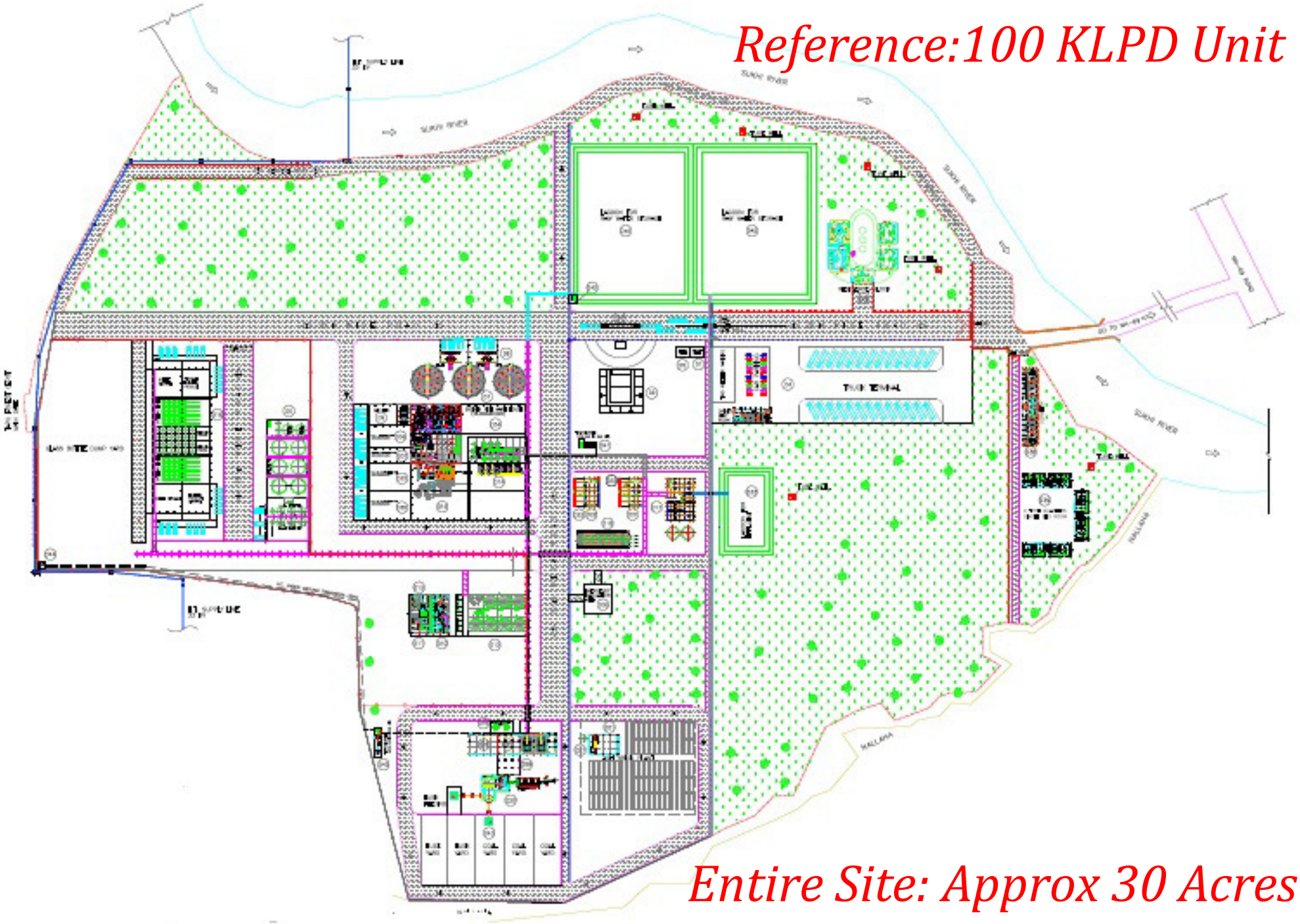
Reference:100 KLPD Unit



Entire Site: Approx 30 Acres

Statutory & Regulatory Compliances: Main Approvals

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- Land Conversion Certificate from State Government
- Environment Clearance (EC) from Ministry of Environment & Forests (MoEF)
- Consent for Establishment (CFE) from State Pollution Control Board (PCB)
- No Objection Certificate (NOC) from Local Village (Gram Panchayat)
- No Objection Certificate (NOC) from Director of Town & Country Planning (DTCP)
- No Objection Certificate (NOC) from State Fire Department (Home Department)
- No Objection Certificate (NOC) from State Forest Department
- LOI from State Prohibition & Excise Department
- *License from State Prohibition & Excise Dept (Based on Raw Material and Purpose)*
- Plans Approval from Factories Department
- Bore Wells Permission from Ground Water Department
- River Water Permission from Irrigation Department
- Power Feasibility and Sanction from State Electricity Department

Central Government Support: Interest Subvention

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- **Ministry of Consumer Affairs, Food and Public Distribution (Department of Food & Public Distribution)** has released Implementation of Policy for extending financial assistance for setting up New Distilleries (Grain or Sugarcane based) or expansion of existing distilleries to produce ethanol
- Interest subvention @ 6% per annum or 50% of rate of interest charged by banks which are eligible for re-finance from NABARD, whichever is lower, on the loans extended by banks which are eligible for re-finance from NABARD, shall be borne by the Govt of India for 5 years (including 1 year moratorium)
- Interest subvention under the scheme shall be provided on loan amount sanctioned and disbursed in respect of each project based on the proposed capacity, limited to the in-principle approval by Department of Food and Public Distribution(DFPD).

Central Government Support: Caveats

- Interest subvention would be available to only those distilleries which will supply at least 75% of ethanol produced from the added distillation capacity to OMCs for blending with petrol
- In case of grain based distilleries, interest subvention would be applicable only if they are using or will be using dry milling technique to produce DDGS
- The DFPD will release the interest subvention amount on quarterly basis in advance to the nodal bank. The interest earned on the interest subvention paid in advance shall be adjusted in the next quarterly installment
- **Margin Money for the Project should be minimum of 5%, wherever tripartite agreement amongst the project proponents, the bank and the OMC for purchase of ethanol is executed**

Annual Ethanol Requirement by 2024-25

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- Maharashtra: **10,59,400 KL**
- Karnataka: **6,60,400 KL**
- Gujarat: **5,14,300 KL**
- Rajasthan: **4,75,800 KL**
- Madhya Pradesh: **4,33,100 KL**
- Andhra Pradesh**:** **3,77,900 KL**
- Telangana: **3,87,300 KL**
- Uttarakhand**:** **1,00,800 KL**
- Chhattisgarh: **1,94,400 KL**
- Jharkhand: **1,61,400 KL**
- Odisha: **2,50,300 KL**

There is a huge scope for New Distillery Units as per Ethanol requirement of OMCs

PROJECT REQUIREMENTS

(TECHNICAL & ENGINEERING)

Technology & Production Process

- Enzyme technology will be applied to improve project economics and sustainability in grains processing and achieve overall performance

- Three main steps in grains processing are :
  - Cleaning and fractionation of grain
  - Cooking, liquefaction and starching
  - Starch processing for producing ENA

Ethanol Process Flow Chart

Main Products

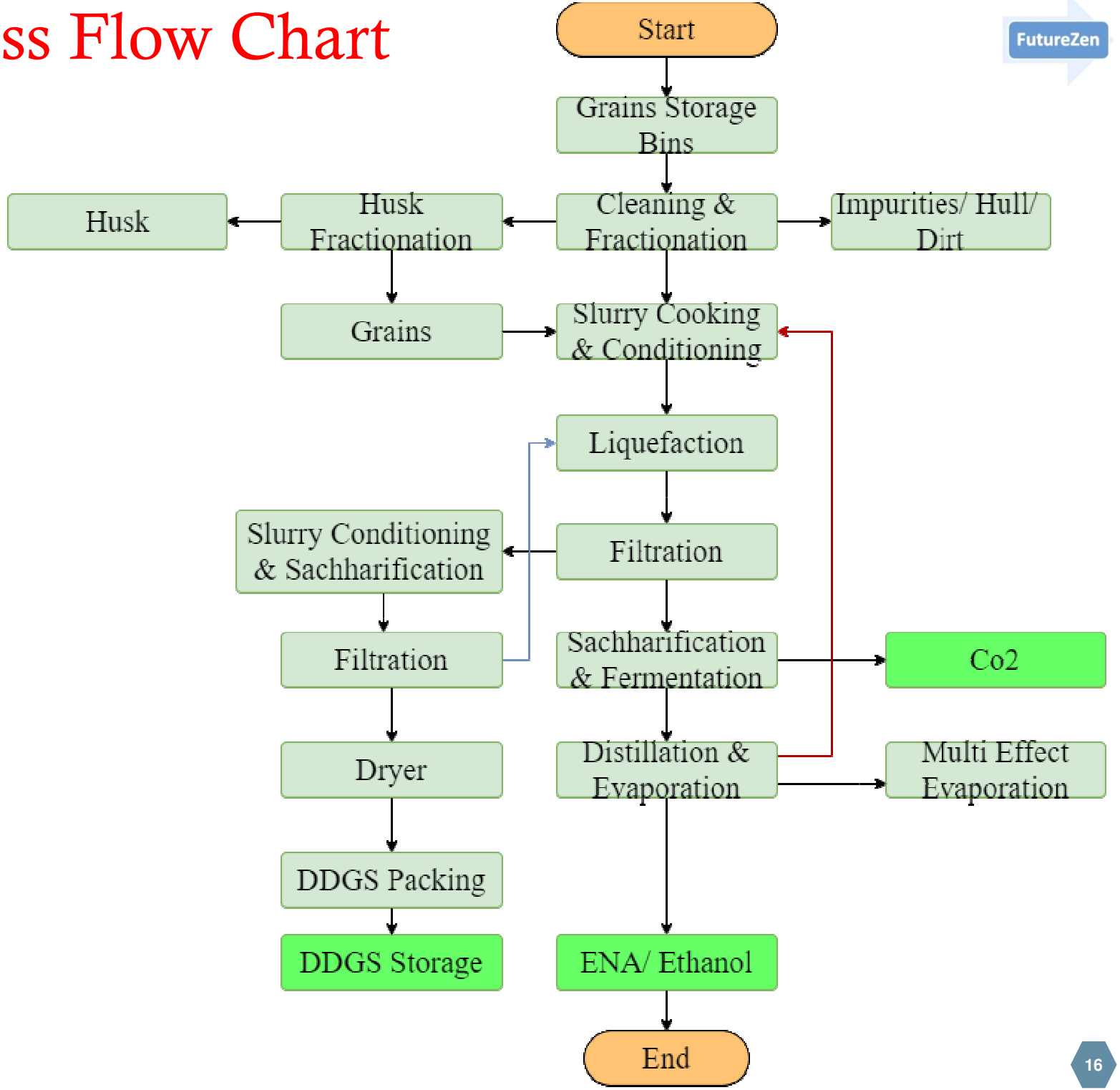
- Ethanol/ ENA
- Impure Spirit
- DDGS

By Products

- Co2
- Thin Slop Syrup

Other Products

- Fly Ash
- Gunny Bags



Process Description

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STORAGE

- Procured Grains will be pre-cleaned and unloaded into the Grain Silos. Moisture testing is done before unloading

GRAIN CLEANING, MILLING AND FLOUR HANDLING

- The grain will be lifted in bucket elevators, screened followed by removal of impurities.
- Cleaned Grains will then milled using dry milling process in Hammer Mills.
- The flour will be fed through the bucket elevator and conveyed to the Batch Tipping Machine through a Screw Conveyor.
- The flour addition will be metered through the Batch Tipping Machine with load cell arrangement, before transferring the flour to the Slurry Tank through another Screw Conveyor (pre-masher) for slurry preparation process.

Process Description…Continued

SLURRY PREPARATION & LIQUEFACTION

- Grain flour and process water will be fed at controlled rate to Slurry Tank. Mixed slurry will be taken to the Initial Liquefaction Tank where additional quantity of water will be added as per the requirement.
- Viscosity reduction Enzyme and stabilizing chemicals and a portion of liquefying enzyme are also added at this stage. This slurry will be then “cooked” in the jet cooker. The slurry will be continuously pumped to a steam jet cooker where high-pressure steam at 7.5 bar rapidly raises the slurry temperature. The mixture of slurry and steam will be then passed through the Retention Loop. The retention loop provide the desired retention time at a given flow rate.
- The cooked mash will be discharged to a Flash Tank. The cooking process, accomplished in the above manner, converts the slurry into a hydrated, sterilized suspension and is therefore susceptible to enzyme attack for liquefaction. The gelatinized mash from the Flash Tank will be liquefied in the Initial and Final Liquefaction Tank where liquefying enzyme will be added. The liquefied mash will be cooled in Mash Cooler and transferred to Saccharification cum fermentation section. This process initiates the formation of sugar.

Process Description…Continued

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SACCHARIFICATION & INSTANTANEOUS FERMENTATION

- Yeast seed material will be prepared in water-cooled Yeast Activation Vessel by inoculating sterilized mash with Active Dry Yeast and then transferred to Fermentor
- The Liquefied starch slurry comprising Dextrin's will be partly taken for Yeast development in Yeast Activation vessel and majorly transferred into the Fermentor. Amyloglucozydase and other nutrient Enzymes are first added to Saccharify the Starch Slurry causing formation of Sugars. Immediately, the Active Yeast will be introduced in the system for simultaneous Fermentation.
- The process of fermentation converts the fermentable substrate into alcohol. Yeast in sufficient quantity will initiate fermentation rapidly & complete within Cycle time.
- The CARBON DIOXIDE evolved during the process is vented to atmosphere after recovery of alcohol in a scrubber.
- Simmering column is also added in the process to separate any trace of methanol content from the rectified spirit.

Process Description…Continued

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MULTI PRESSURE DISTILLATION

- The fermented mash is fed to “Multi Pressure Distillation system”. This plant is a combination of vacuum, pressurized and atmospheric pressure to get the most purified alcohol (ENA) and very low by-product (Technical Alcohol). This is done in an 8 stage distillation plant.

MULTI EFFECT & MULTI STAGE EVAPORATION (MEE)

- In a traditional ENA production process, Distillation of alcohol produces spent wash (Effluent) in 1:10 ratio.
- But in our plant, combined cycle evaporation plant reduces the ratio significantly which reduces the steam consumption in evaporation.
- This is first step towards the “Zero Discharge”.
- The distillate from the Evaporator is treated further in Condensate Polishing Unit

Process Description…Continued

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C0 GENERATION POWER PLANT

- 3MW Co-generation plant is sufficient for power requirements
- CPP consists of a high pressure water tube steam boiler steam turbine. Fuel in the steam boiler will be burnt with the help of air in the boiler furnace. Water will be circulated in the boiler drum and tubes thus getting heated by the flame burning in the boiler furnace. Water comes out of the boiler drum located at the top of the boiler as steam.
- High pressure superheated steam from boiler is passed through a steam turbine and at the lower pressure goes to the condenser. The condensed steam returns to the steam boiler as condensate and is again boiled as steam. While passing through the turbine, the high pressure and temperature steam rotates the turbine rotor and an electric alternator mounted on the same shaft. Electric power is generated by the alternator. This electric power generated is consumed for in-house requirements

Capital Expenditure – Plant & Machinery

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- Grain Storage & Cleaning Plant
- Grain Grading & Milling Plant
- Pretreatment of Grain & Liquefaction Plant
- Fermentation Plant
- Distillation
- Spent Filtration Plant
- Spent Wash Evaporator plant
- Dryer Plant (Animal Feed)
- Other Costs
  - Erection & Commissioning
  - Transport & Insurance
  - Taxes and Duties

Capital Expenditure – Utilities

- Steam Boiler & System
- Turbine & Power House System
- Effluent Treatment Plant
- Water Treatment & Management System
- Water Storage Lagoon
- Spent Wash Storage Lagoon
- Cooling Towers System, PRDS, Air System
- Storage Tanks (Along with Loading & Unloading System)
- Weighing Systems (Weigh Bridge)
- Lab Equipments & Chemicals
- Plant Lighting & Power Management
- Office Furniture & Equipments
- Factory Security System (Fire Fighting & Emergency Management systems)

PROJECT REQUIREMENTS

(PLANT OPERATIONS)

Raw Materials and Sourcing

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- **Raw Materials**
  - Broken Rice/ Rice: Starch: 65% ~ 75%
  - Maize: Starch: 60% ~ 70%
  - Sorghum/ Jowar Starch: 60% ~ 65%
  - Bajra/ Pearl Millet: Starch: 55% ~ 60%
  - Other Starch based Materials

- **General Raw Material Input to the System**
  - Starch: 55% ~ 70%
  - Moisture: 10% ~ 12%
  - Crude Fibre/ Protein/ Others: 25% ~ 30%

Broken Rice and Maize are commonly used Raw Materials

Utilities Requirements

Scenario Considered: 100 KLPD Capacity

- Boiler **: 30 MTPH**
  - Imported Coal (Indonesia/ Australia)
  - Indian Coal (Nearest Coal Mines)
  - Rice Husk (From Local Rice Mills)
  - Agro Waste/ Biomass
- Cogeneration Power Plant (CPP): **3MW**
- Process Water: ***Approx 10 Litres per Litre ENA***
- Testing Laboratory & QC
- Consummables
  - Chemicals/ Enzymes/ Yeast: **Approx 1 MT per MT Raw Material**
- Manpower Required: ***30(Technical) +25(Skilled) + 50(Unskilled)***

Plant Operations – Process Yield

Scenario: 100 Kilo Litres Per Day (100 KLPD)

	Particulars	Yield	UOM	Quantity	Remarks
Input	Grains (Broken Rice/ Maize)	100%	MT	220 to 230	For Average Starch 66% to 68%
Output	Ethanol	46%	KL	100	
	DDGS	22%	MT	48	
	Impure Spirit	6%	KL	6	6% of the ENA Yield
	Released Gases	20%	MT	50	Co2
Loss	Process Loss + Moisture	14%			

Yield will vary based on :

- Starch Content in Grains
- Moisture Content in Grains
- Process losses

For 60%, 62% & 64% Starch, Ethanol yield is approx 41%.42.5% & 44%

PROJECT REQUIREMENTS

(COMMERCIAL/ FINANCE)

Project Costing

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- Major Cost Elements
  - Land
  - Site Preparation & Site Development
  - Building, Civil & Structural Cost
  - Plant & Machinery (P&M)
  - Utilities & Miscellaneous Fixed Assets (Inclusive of COGEN Plant)
- Minor Cost Elements
  - Preliminary & Pre-operative Expenses
  - Contingency
  - Interest during Construction
  - Working Capital Margin

Cost of P&M and Utilities is Approx 65% to 70% of the Project Cost

Cost of Civil and Structural is Approx 15% of the Project Cost

Central Government: Ethanol Price Fixation

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- For the Ethanol Supply Year 2021-22, Price fixed by the Government for the ethanol produced from Grains
  - Ethanol produced from **Maize/Broken Rice**: **52.92** Rupees per Litre
  - Ethanol produced from **Rice (From FCI)** : **56.87** Rupees per Litre
- From the Financial Year 2022-23, Price fixed by the Government for the ethanol extracted from Sugarcane
  - Ethanol produced from **Sugarcane Juice**: **63.45** Rupees per Litre
  - Ethanol produced from **C-Heavy Molasses**: **46.66** Rupees per Litre
  - Ethanol produced from **B-Heavy Molasses**: **59.08** Rupees per Litre

- For FY 2021-22, Government has fixed the price of FCI rice to 20 Rs per Kg for production of ethanol. For the purpose of supply of surplus rice for the production of ethanol, companies can choose the nearest FCI depot as per requirement/logistics.

Project Margins Contribution

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- **Raw Materials:**
  - Rice (From FCI) for the year 2020-21: ***20 Rs per Kg***
  - Broken Rice (Based on Location): ***(15 - 17) Rs per Kg***
  - Maize (Varies based on Protein Content): ***(14 - 18) Rs per Kg***

- **Finished Products**
  - ENA: ***(52 - 56) Rs per Litre***
  - Impure Spirit: ***(28 - 30) Rs per Litre***
  - DDGS
    - For high Protein Content (Over 40%): ***(40 – 45) Rs per Kg***
    - For less Protein Content (Between 20% to 40%): ***(20 – 35) Rs per Kg***

DDGS substitute is De-oiled Soybean Meal. DDGS price fluctuates based on DOSM (Reduction in DDGS price during peak Season of Soybean availability)

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Thank You

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