



PYRAMID E&C

Renewable Hydrocarbon Solutions

- Ethanol Plants
- CO2 Liquefaction
- Bio gas reforming



OUR OFFERING

Pyramid E&C offers modern, efficient, and fully automated Conventional (1G) Ethanol, Cellulosic (2G) Ethanol and Green Petrochemical plants complying with the environmental requirement of Zero Liquid Discharge (ZLD) and Zero Green House Gas (GHG) emissions.

CONVENTIONAL (1G) ETHANOL

These plants utilize Corn, Rice, Maize, Wheat crops, Sorghum, Beet, Sugarcane or Molasses as the feedstock to produce bio Ethanol by fermentation of starches or sugars present in the feedstock. The conventional 1G ethanol production system consists of extraction, concentration, fermentation, distillation & dehydration units.

CELLULOSIC (2G) ETHANOL

Second-generation Cellulosic Ethanol plants utilize Lignocellulosic feedstock biomass comprising of cellulose, hemicellulose or lignin found in agri-residues e.g. Rice and Wheat straw, Cane trash, Corn Cobs, Cotton stalk and Bagasse. This feedstock is tough to ferment due to presence of Lignin as a binder. Pyramid E&C offers a patented process to separate fermentable materials from lignin and a proprietary enzyme for fermentation of cellulose, thus able to produce bio-ethanol. Rest of the process involves separation and storage similar to Conventional Ethanol.

Ethanol and Bio Gas Derivatives

Ethanol produced from biomass (1G or 2G) route can be further processed to produce Green versions of Ethylene, Ethylene Oxide and Ethylene Glycol for meeting regional demands or renewable input requirements of polymers for food and beverage containers.

Pyramid E&C has developed small scale modular Ammonia and Methanol plants to reform Bio gas into marketable liquid products thus improving the profitability of the operation and diversifying the local economy

We also provide skid mounted plants to convert the gases produced from fermentation operation to food grade Liquefied CO₂ or Dry Ice for medical use

The engineering and manufacturing of these plants is carried out at our Houston Technology Centre, High Value Engineering Centre at Thane and Modular Fabrication Yard at Mundra, Gujarat, India, thus providing most competitive price and delivery.





CONVENTIONAL (1G) ETHANOL PLANTS

Pyramid E&C offers cost-effective and most energy efficient 1G Ethanol plants capable of producing bio-Ethanol using corn, maize, wheat crops, waste straw, Sorghum plants, sugarcane, sugar beet as the feedstock.

Process

The feedstock is sent to milling unit to achieve desired particle size & capacity followed by a liquefaction unit where enzymes are added. This liquid is then forwarded to a fermentation stage, where the dilute ethanol is produced (ethyl alcohol). From here it is distilled and the light fraction (ethanol) is sent to a fractionation unit and eventually through dehydration before being pumped to storage as bioethanol.

The heavier fractions from the distillation process is sent through a separator where the stillage is centrifuged, and solids dried then sent to storage for further uses. The syrup component is concentrated, then dried and stored for further use as DDGS. Very little goes to waste as most of the by-products are used, if needed further separation equipment are provided to achieve Zero Liquid Discharge (ZLD) to meet local environment norms.

By-product CO₂ released during fermentation is captured and liquified for

sale as a by-product for refrigeration or carbonated drinks industry thus achieving Zero Green House gas (GHG) emission.

Standard Sizes (Ethanol Production)

- 100 KLPD
- 200 KLPD
- 400 KLPD

Typical Configuration

- Extraction
- Concentration
- Fermentation (Yeast or Microorganism)
- Distillation
- Dehydration
- CO₂ Recovery and Bottling System
- Zero Liquid Discharge Section

CELLULOSIC (2G) ETHANOL PLANTS

Pyramid E&C offers 2G Ethanol plants of proven technology capable of fermenting cellulosic feedstock e.g. Rice and Wheat straw, Cane trash, Corn Cobs, Cotton stalk and Bagasse to produce bio-Ethanol.

Process

2G bioethanol technology uses plant Lignocellulosic biomass as a feedstock which comprises of three major components viz. Lignin, Cellulose and Hemicelluloses. Cellulose and Hemicelluloses are the structural carbohydrates while lignin is heterogeneous phenolic polymer

Pre-treatment

Due to the presence of lignin in “Lignocellulosic” materials, and compared to the accessibility of sucrose in sugar cane and starch in grains, cellulose and hemicelluloses are not easily and readily available for saccharification and fermentation. A “pre-treatment” step is hence required to facilitate conversion of cellulose and hemicelluloses to fermentable sugars.

Hydrolysis

Hydrolysis process is used to convert hemicellulose and cellulose content of lignocellulosic biomass into fermentable monomeric sugars. Pyramid E&C uses a Patented and proven process and enzyme to achieve hydrolysis. The reference plant for the process currently operates in Ohio, USA.

Fermentation

In the Fermentation process, the hexoses and pentoses are converted into ethanol by employing highly efficient proprietary microorganisms patented and purchased from a third party depending on feedstock to achieve Simultaneous Saccharification and Co-fermentation

Distillation & Purification

From fermented mash, fuel grade Ethanol is produced through conventional extractive distillation as Ethanol and water form an azeotropic mixture.

Main Plant Section

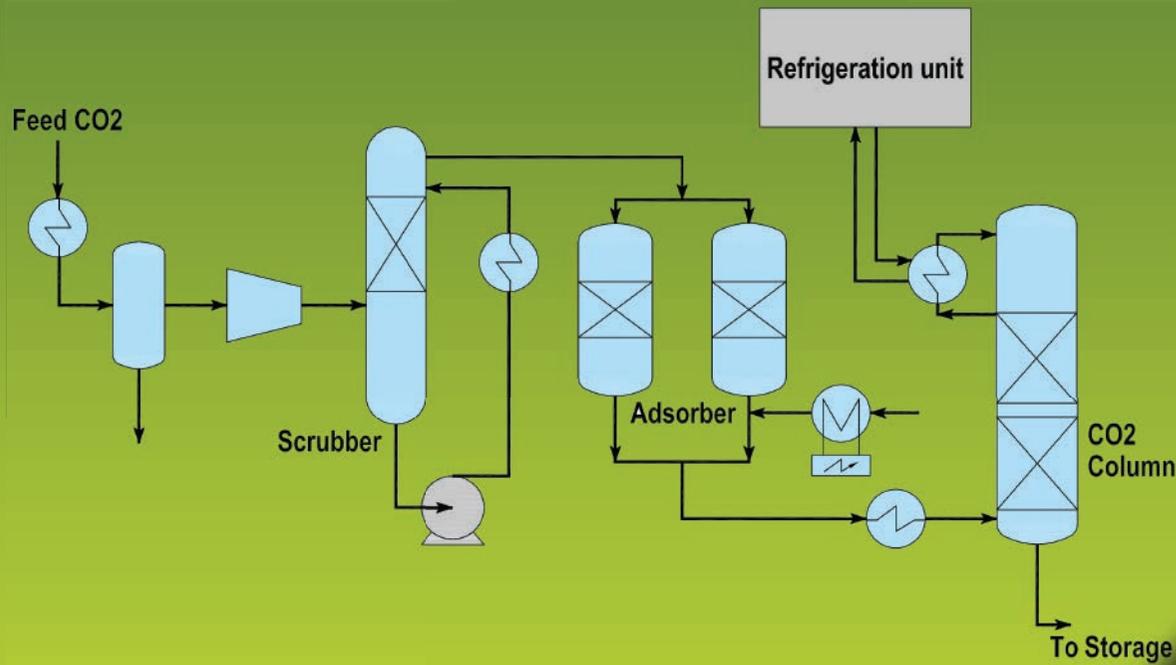
- Feedstock treatment
- Enzymatic Saccharification
- Fermentation
- Distillation
- Dehydration
- Separation
- CO2 Recovery and Bottling System
- Zero Liquid Discharge Section



CO2 RECOVERY

Pyramid E&C offers plants of to capture and transform carbon di-oxide into marketable products and stop emissions

Process



Products

- Food Grade CO₂
- Liquified CO₂
- Medical Grade Dry Ice
- Carbon Pipelines



Bio Gas Reforming

Pyramid E&C offers compact, modular solutions to convert Bio Gas into Syngas and thereafter into n, Methanol or Ammonia by latest generation Catalytic and Pressure Swing Adsorption (PSA) processes. Syn Gas is reformed using proprietary NICR® technology, which uses electricity to power the endothermic reaction hence eliminating open flame, associated hazards, and pollution at the installation. All the plants are containerized to prevent rust and damages during shipment. The key design features include:

Compact and Mobile



Quick Start and Stop



Six months delivery



No Flaring



Renewable power options



Low Carbon footprint



Five years Catalyst life



Containerized Shipping



Safe



No Flames



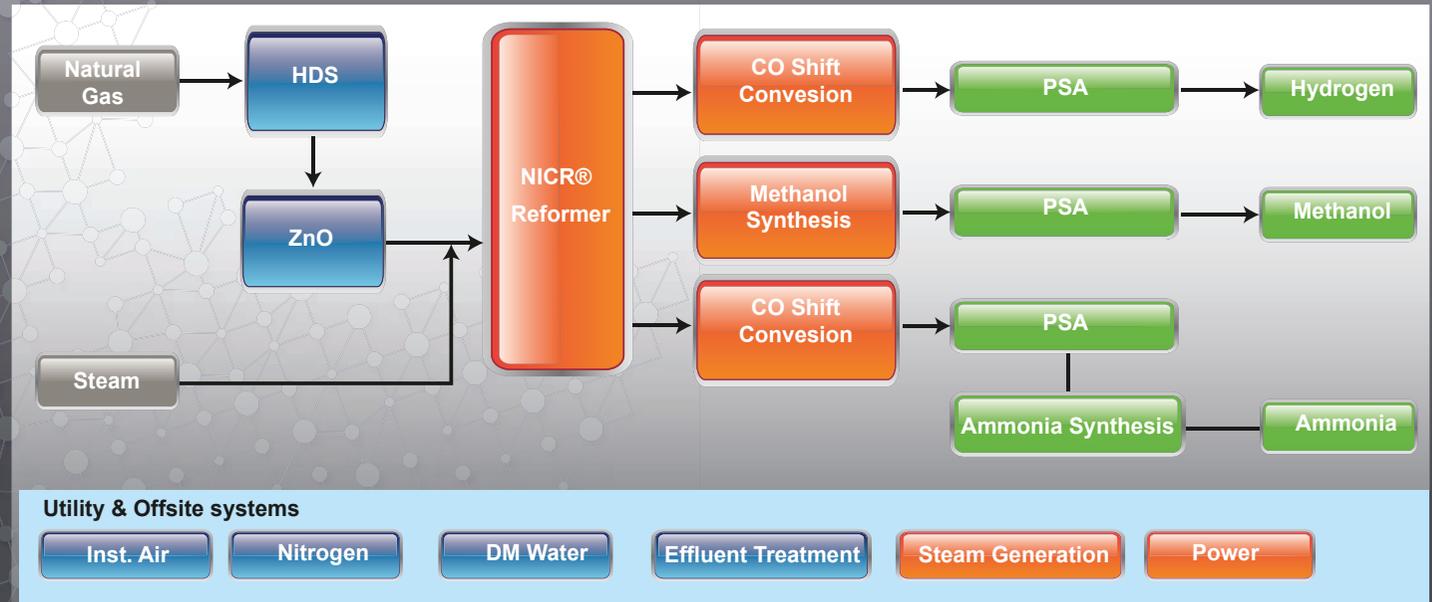
Remote Monitored



Unmanned operation



The hydrogen, methanol and ammonia plants supplied by Pyramid E&C comprise of containerized units which can be readily installed, commissioned, and operated. The plants are performance tested at our manufacturing facilities before shipping.



AMMONIA

Pyramid E&C offers cost-effective, small-scale ammonia production plants using steam reforming of Bio Gas and Nitrogen. The low-cost plant is a profitable option for monetizing natural gas as global demand for ammonia is increasing for usage as fuel, fertilizer, hydrogen carrier as well as refrigerant.



Standard Sizes (Ammonia Production)

- 25 TPD
- 50 TPD
- 100 TPD

PROCESS

Gas Treatment and Compression

Feed Gas is compressed and treated to remove natural gas liquids, water and acid gases.

Reforming

The steam reforming process is carried out in the proprietary Electric Reformer (NICR®) using electrically heated tubes filled with Nickel catalyst pellets. An Air separation plant is used for providing oxygen required for partial oxidation of natural gas and nitrogen for ammonia synthesis converter. The hot syngas from the reformer is cooled in a series of heat exchangers to recover heat.

Shift Conversion

The cooled syngas from the reformer is directed over the shift catalyst to lower the concentration of carbon monoxide in syngas and increase the yield of hydrogen. The gases from shift converter are cooled before entering the purification unit.

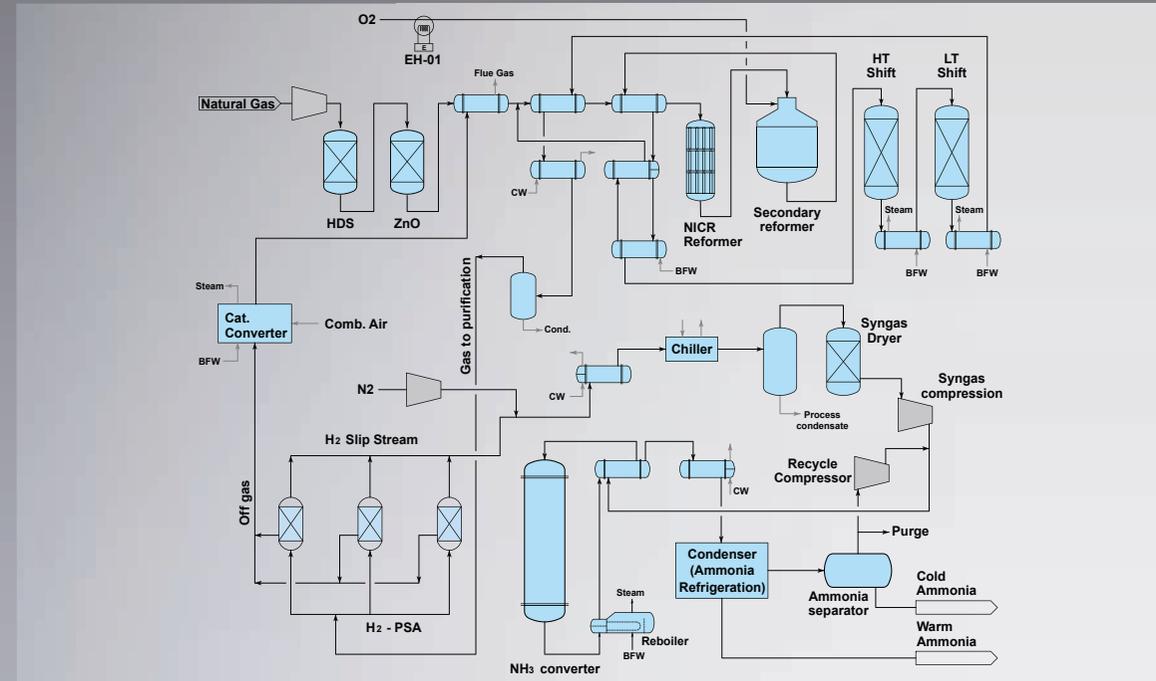
Purification

A Pressure Swing Adsorption unit is employed to separate hydrogen from syngas. The off gases from the PSA unit are consumed in a catalytic converter to heat incoming natural gas stream.

Ammonia Synthesis

The purified hydrogen is mixed with nitrogen in desired proportion, compressed and fed to ammonia synthesis reactor consisting of two stage fixed beds with intermediate cooling. The product gas from the synthesis converter is cooled by incoming syn gas natural gas and condensed to get liquid ammonia.

The off gases from PSA are released during low cycle and consumed in a catalytic converter to heat the boiler feed water (BFW) to steam.



PYRAMID E&C

About Pyramid E&C

Pyramid E&C is an international provider of Technology, Services, Products and Solutions for Conventional and Renewable Hydrocarbon processing facilities and has delivered more than 700 projects since inception in 1995, thus achieving significant business maturity globally. The company has strong knowledge base in Oil & Gas, Refining & Petrochemicals, Steam Methane Reforming and Bio Ethanol businesses. The proven capability and necessary infrastructure to engineer, manufacturer and commission international quality plants is the hallmark of Pyramid E&C's hydrocarbon processing solution delivery capability.



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