



 **4th WORLD FUTURE FUEL**
SUMMIT & EXPO
International Conference & Exhibition on Future Fuel

13th WORLD
PETRO  COAL 
CONGRESS
International Conference on Petroleum-Coal-Gas

15-16th Feb 2023

Coal Gasification and Coal -to -liquid Conversion

What is Gasification

- Gasification converts any **Carbon** containing material into **Synthesis gas**, composed primarily of Carbon monoxide and Hydrogen
- Uses high pressure combined with **Oxygen** or air & steam to convert carbon based materials directly into **Syngas** by **partial oxidation**
- Gasification process breaks carbon based materials down to the **molecular level**, so impurities can be relatively easily and inexpensively removed



Worldwide Coal Gasification Technologies

- **Entrained Flow Gasifiers**

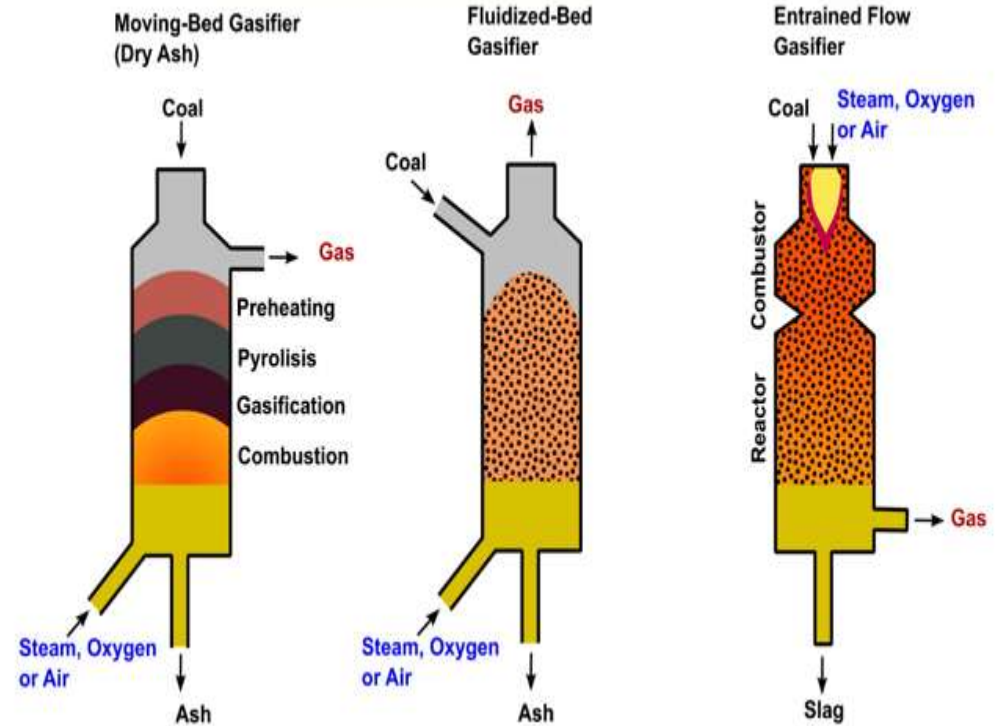
- ❖ Dry Feed
- ❖ Slurry Feed

- **Fluidised Bed Gasifiers**

- ❖ Bubbling
- ❖ Circulating

- **Fixed/ Moving Bed Gasifier**

- ❖ Dry ash
- ❖ Slagging

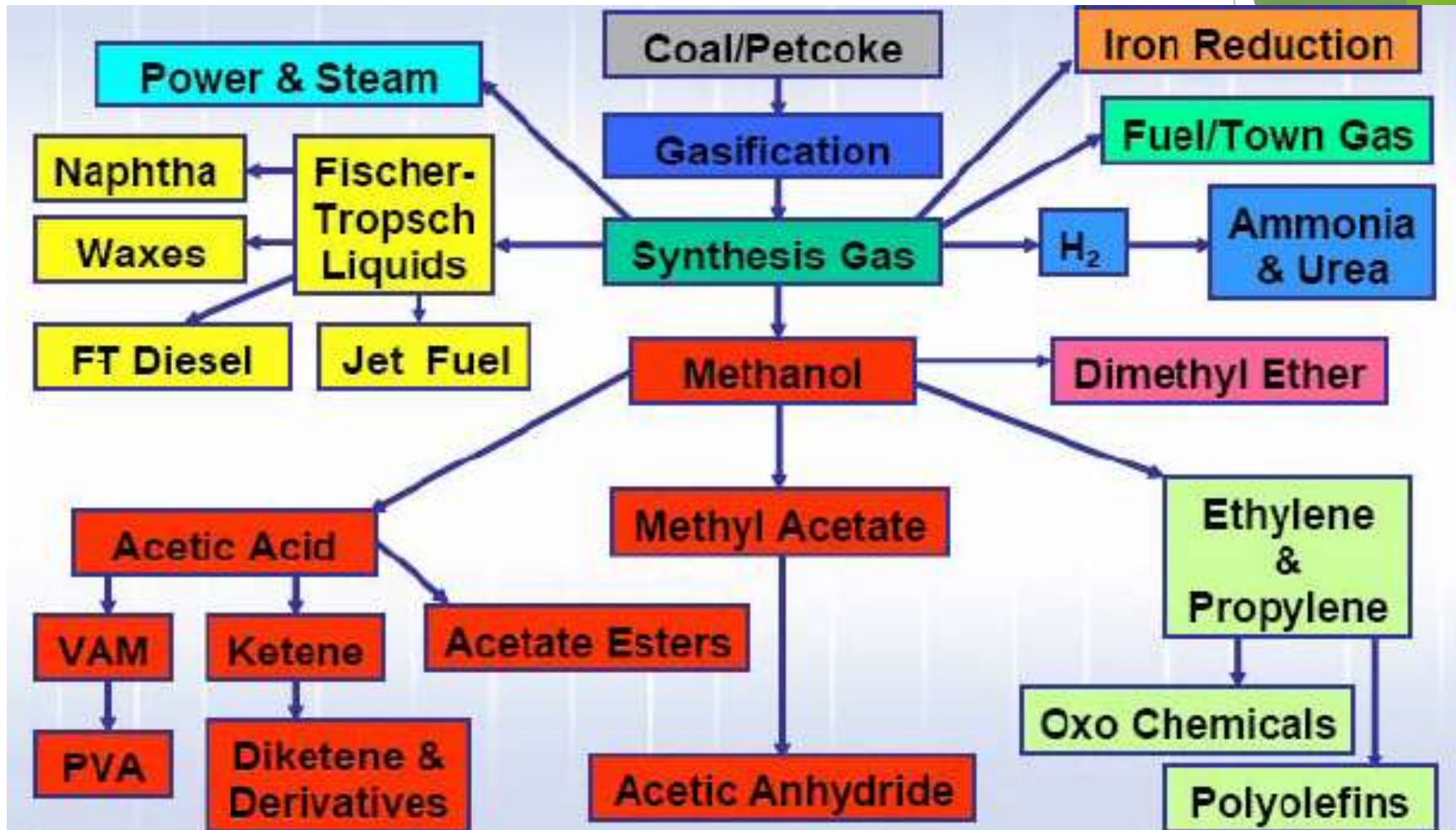


Coal choice may be the least flexible factor while considering the gasification technology; so, it is necessary to adapt the gasification technology according to the available type(s) of coal

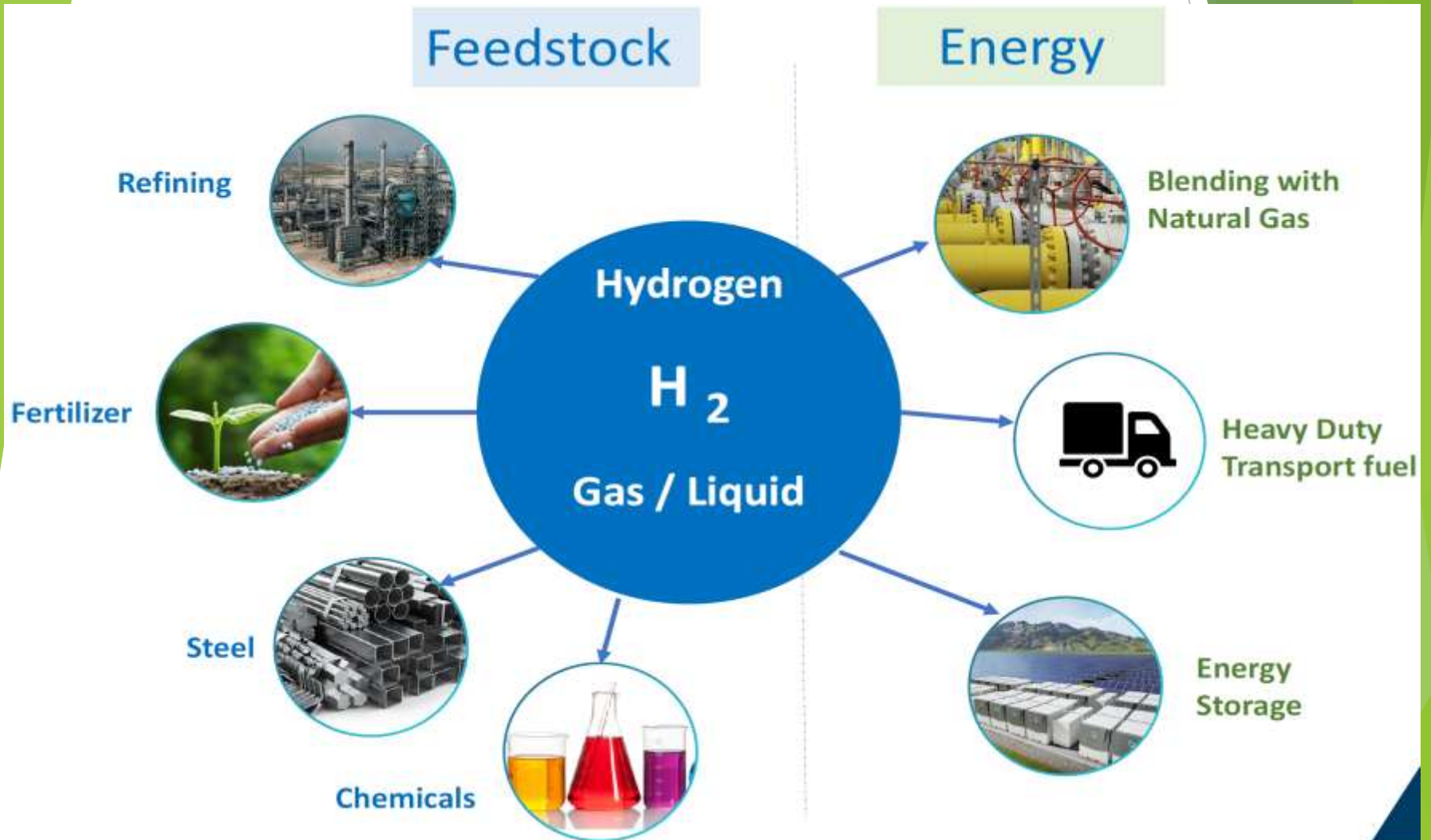
Benefits of Gasification

- Gasification plants produce significantly **low quantities of air pollutants**.
- Gasification can **reduce the environmental impact of waste disposal** because it can use waste products as feedstock - generating valuable products from these waste materials.
- Gasification's **by-products** are non-hazardous & are readily marketable.
- Gasification plants use significantly **less water** than traditional coal-based power generation, and can be designed so they fully **recycle the process water**, discharging none into the surrounding environment.
- **Carbon dioxide (CO₂) is being** captured from an industrial gasification plant using commercially proven technologies.
- Gasification offers the **cleanest**, very efficient means of producing chemicals & electricity from coal and the lowest cost option for **capturing CO₂** .

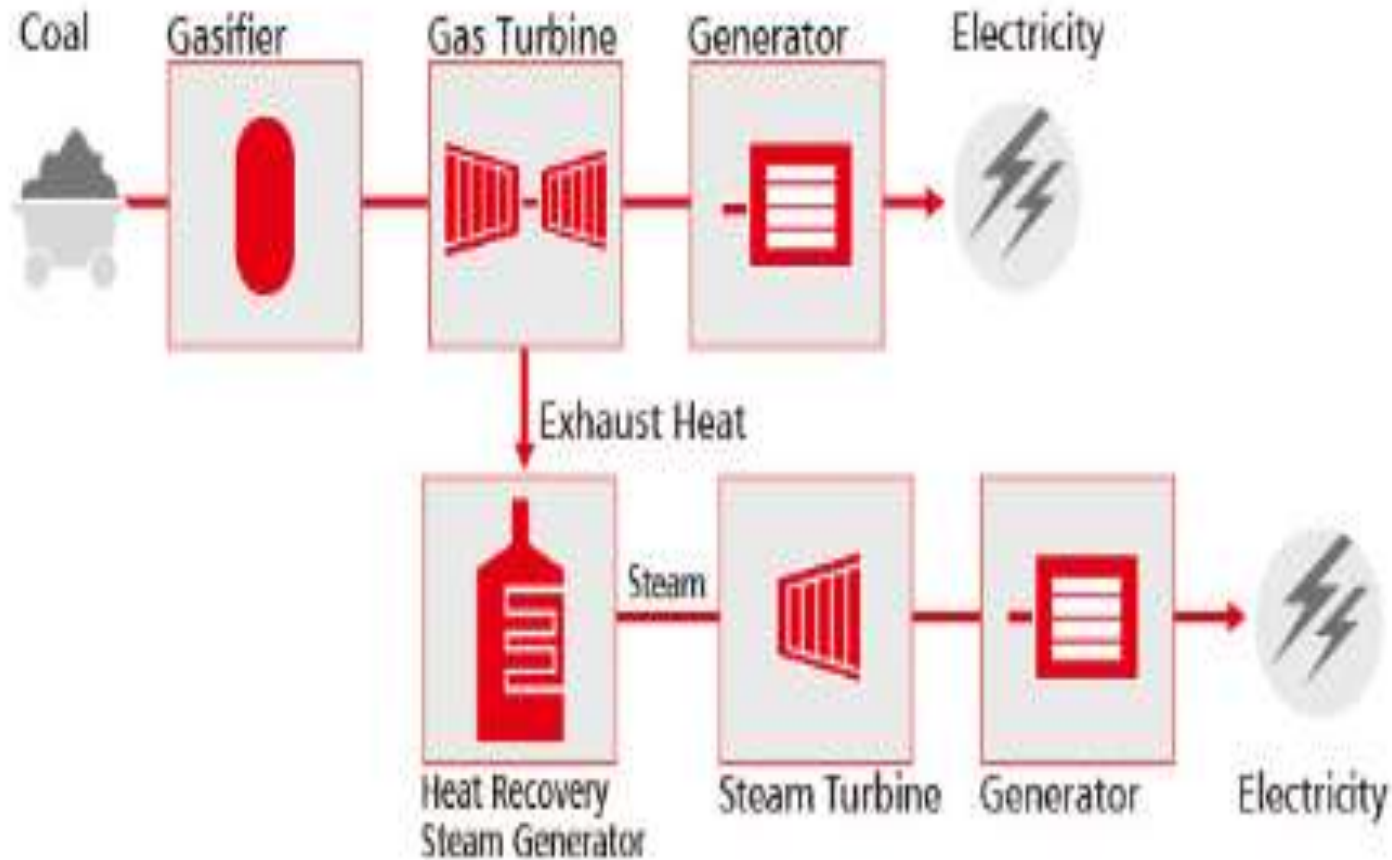
Gasification - Polygeneration Opportunities



Coal to Hydrogen through Gasification



Integrated Gasification Combined Cycle- Power



Why renewed interest in Coal Gasification

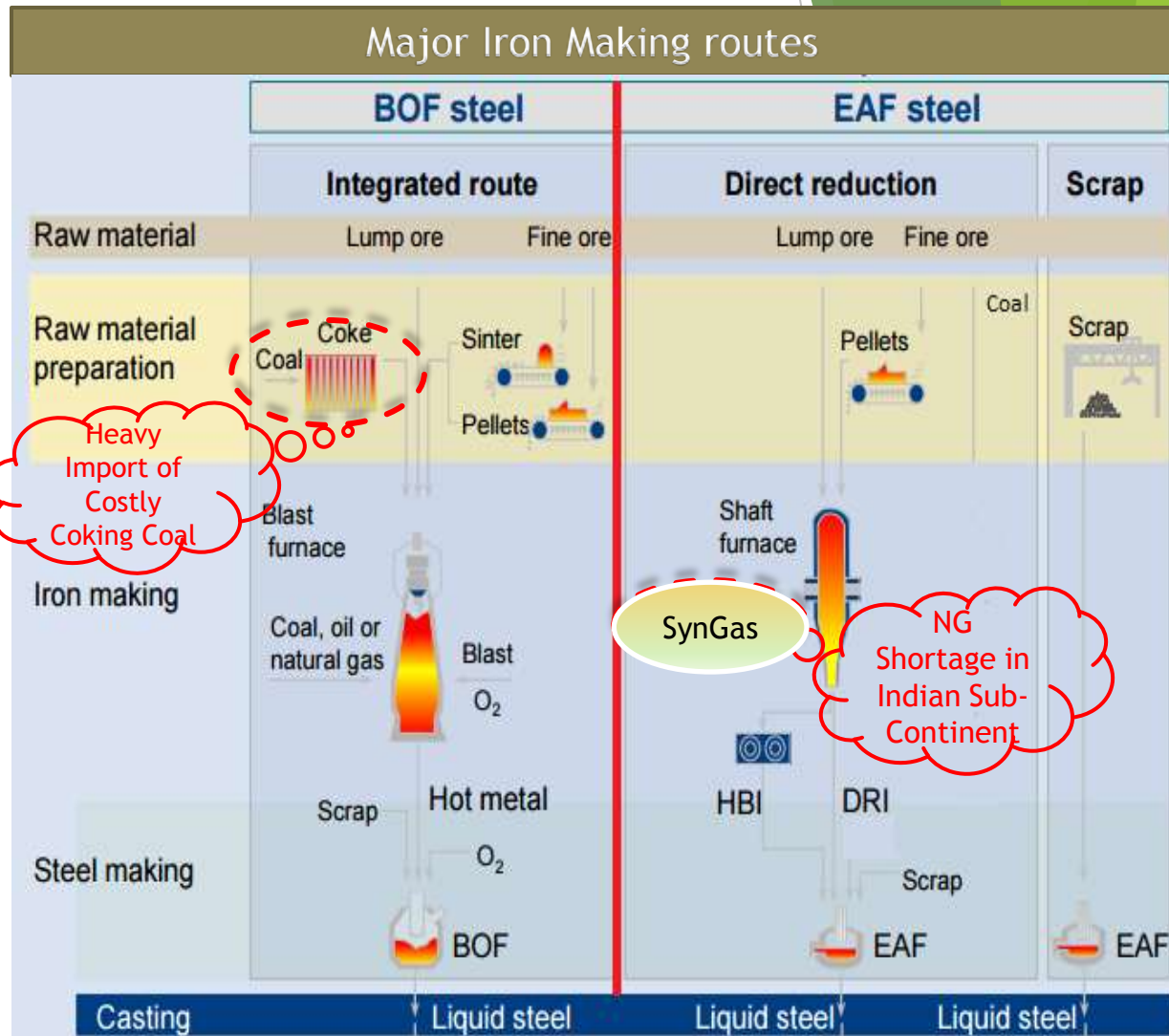
- Skyrocketing energy prices
- Availability of abundant non-coking coal in India
- Coal is more evenly distributed geographically, unlike oil
- Availability of now matured technology
- Coal gasification is widely used in SA & China and is a success story there

Selection of Coal Gasification Technology- Steel Making



Selection of Coal Gasification Project

1. Both of the Current Clean Conventional Routes of Iron making are dependent on Imports.
2. However, JSP also being a supporter of “Make In India” Ideology, tried to use non-coking coal in Clean Steel making.
3. Same is abundantly available in India & can be used effectively.



Selection of Fixed Bed Technology

Well demonstrated, mature and Proven Technology with low risk. More than 100 Gasifiers in operation

Suitable for low Rank, high ash content Coal.

High Carbon conversion efficiency (approx. 95%).

High Cold Gas efficiency (85%) due to counter-current operation.

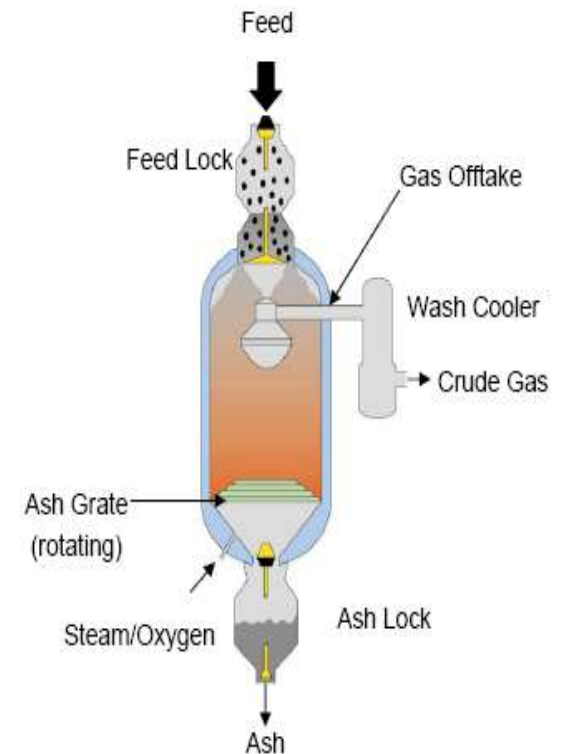
Low Oxygen consumption.

Gas Composition suitable for Steel / Fertilizer Industry.

Ash fusion temperature of Indian Coal is high, therefore, dry bottom type is preferred.

No Coal drying & grinding required, hence less energy consumption & not hazardous.

Valuable By-Products like Tar, Oil, Phenol, Ammonia etc.

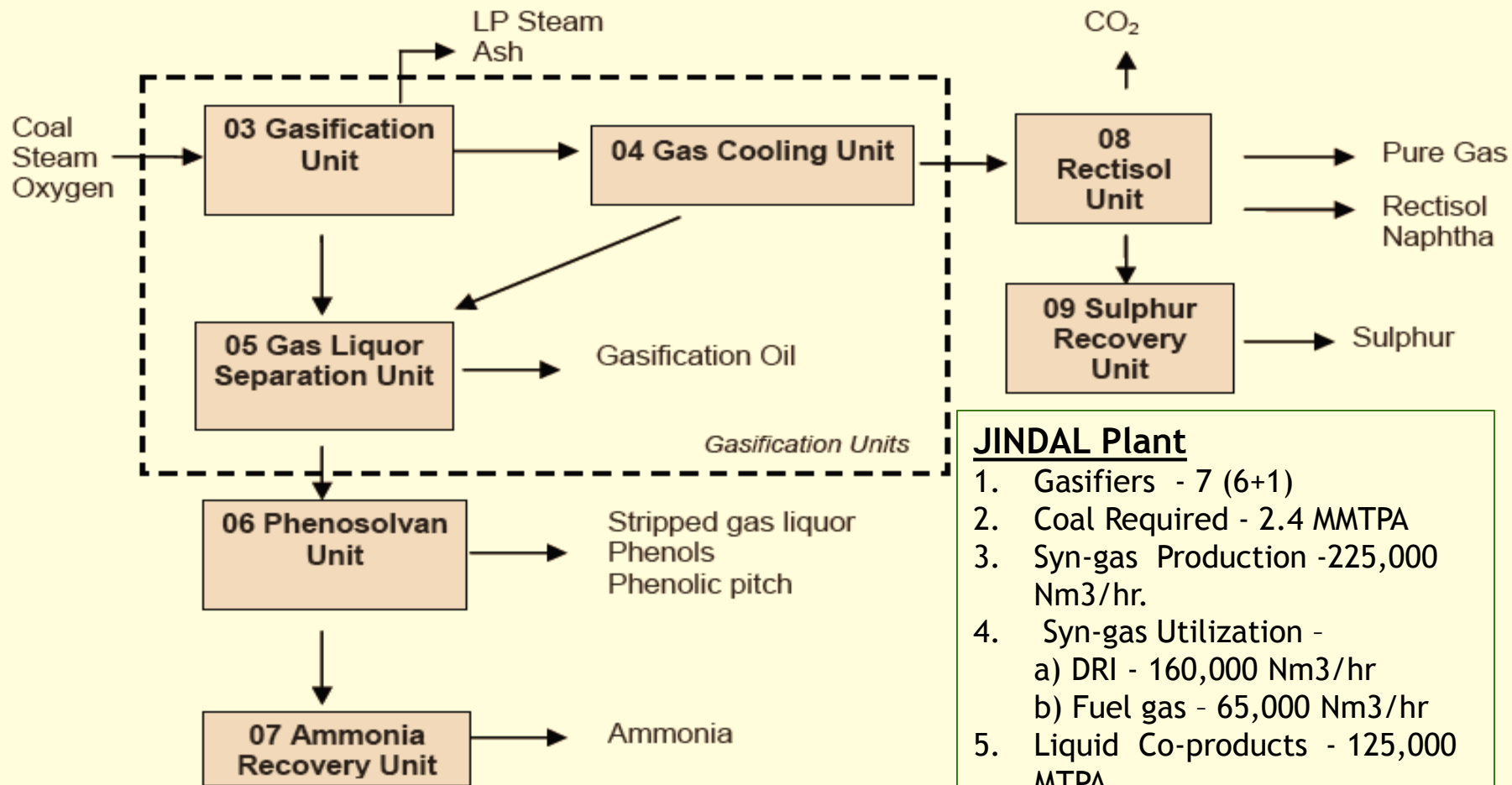


Fixed Bed Dry Bottom Gasifier

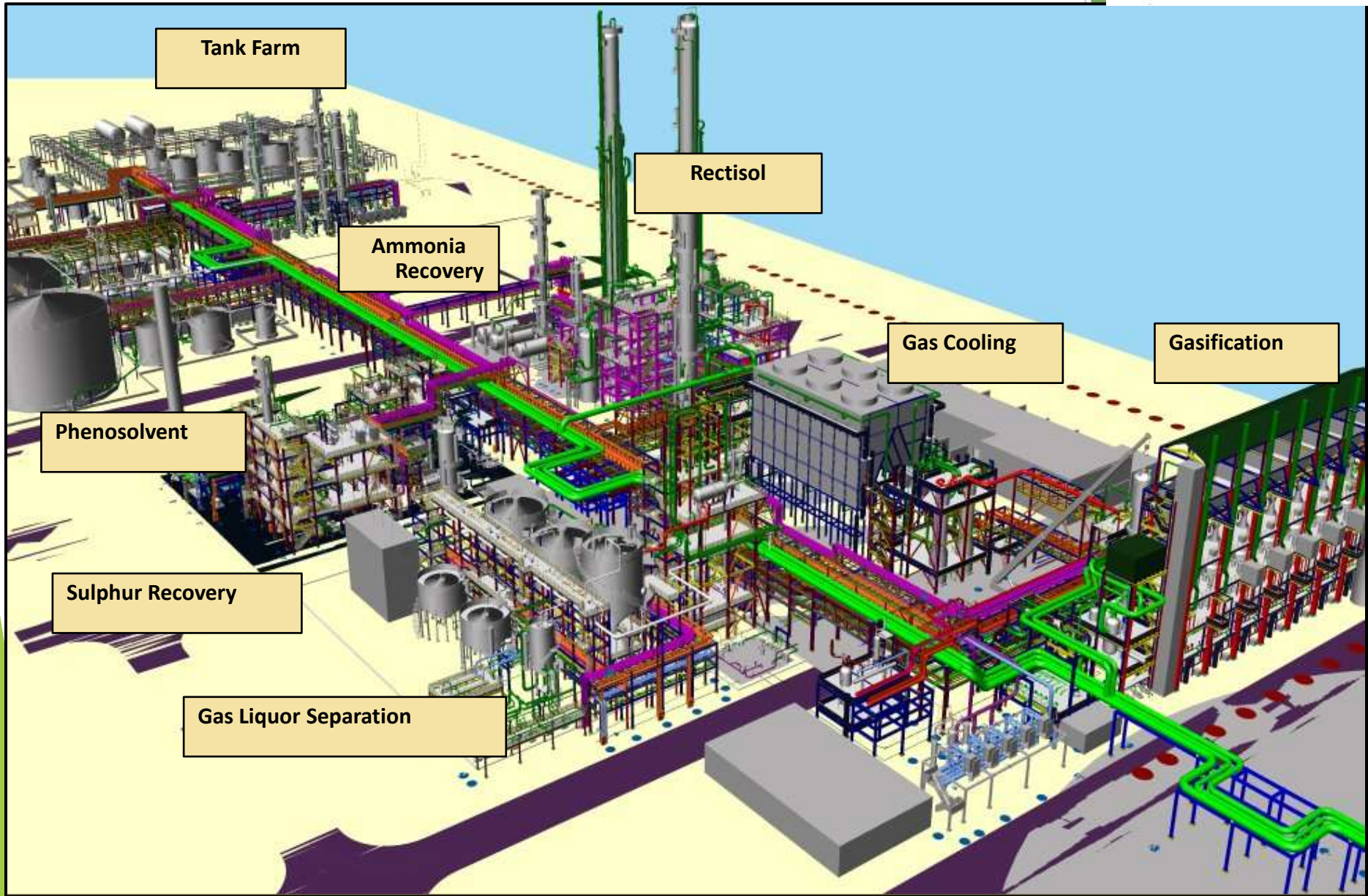
Salient Features of Coal Gasification plant, JSP

- ◆ **No of Gasifiers : 06 + 01**
- ◆ **Feed stock : Non coking coal of 34-35% ash**
- ◆ **Technology : SLTC, S Africa & Lurgi , Germany**
- ◆ **Coal requirement : 270 ton/hr**
- ◆ **Syn gas produced : 2,25,000 Nm³/h**
- ◆ **Calorific value : 3450 kcal/Nm³**

Syn-gas Production route & Units in CGP



Coal Gasification Complex at a Glance



Gas Liquor Separation Unit





Ammonia Recovery Unit



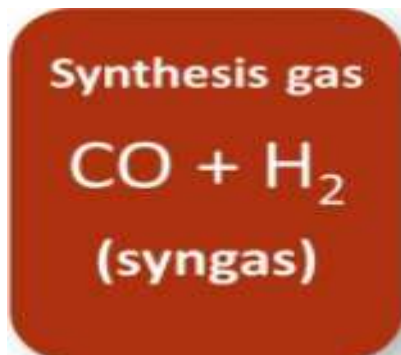
Sulfur Recovery Unit



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Carbon Capture and Utilization Initiatives at JSP

- Only Steel Plant in India to Capture 2000 TPD Concentrated CO₂
- Using CO₂ through Bio reactors to produce an algae, Spirulina (Dietary supplement)
- Exploring captured CO₂ usage into Bio-Ethanol/Methanol Pilot Project
- Conversion of CO₂ to Carbon mono oxide and synthesis gas using dry reforming (Circular Carbon Economy)
- Steel making (DRI) through blue hydrogen (Syngas/COG PSA route)



Thank You