



# **POTENTIAL USE OF HYDROGEN IN SMALL SCALE DRI**

**Conference on BLUE HYDROGEN - ENERGY SECURITY & HYDROGEN  
ECONOMY**

**MINISTRY OF COAL  
9 JUNE 2023**

**By  
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MD, Dev Energy**

## OUR OFFERINGS



### GASIFICATION

- *Single Stage*
- *Double Stage*
- *Circulating Fluidized Bed*



### ENGINEERED CARBON

- *Calcined Anthracite Coal*
- *Calcined Pet Coke*
- *Graphite Pet Coke*
- *Carbon black*



### SCRAP PROCESSING

- *Shredders*
- *Shears*
- *Balers*



### FLUE MANAGEMENT

- *Dust*
- *Sulphur oxides*
- *Nitrogen oxides*

## ***OUR ACHIEVEMENTS***

**India's First DOUBLE STAGE CLEAN COAL GAS System**

**India's First BONE CHINA TABLEWARE Plant on Coal Gas**

**India's First GRATE KILN IOF PELLET Plant on Coal Gas**

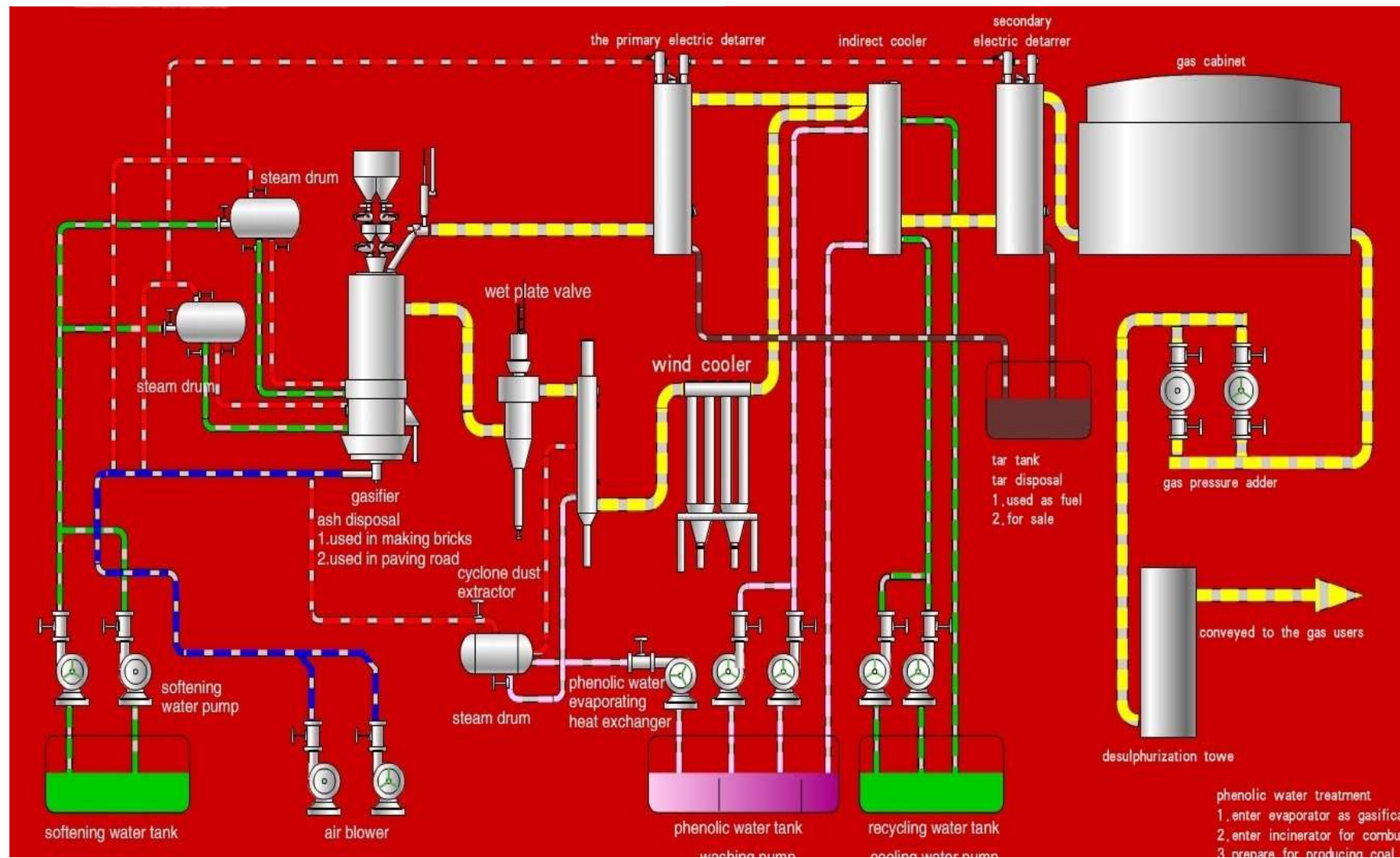
**World's First STRAIGHT GRATE IOF PELLET Plant on Coal Gas**

**India's First PHENOLIC WATER REUSE System**

**India's First CERAMIC TILE PLANT on Coal Gas**

**India's largest REHEATING FURNACE on Coal Gas**

# Process Flow





**MINERA STEEL AND POWER LIMITED**

**PLANT CAPACITY** : 0.6 MTPA

**HEAT REQUIRED** : 290,000 Kcal / t

**INSTALLATION** : 2 X  $\Phi$  4.0 DSC

**COAL GAS REQUIRED** : 15,000 Nm<sup>3</sup>/h



## HSIL – AGI GLASPAC

**FURNACE** : 500 X TPD

**HEAT REQUIRED** : 300,000 Kcal / t

**INSTALLATION** : 1 X  $\Phi 4.0$  DSC

**COAL GAS** : 8000 Nm<sup>3</sup>/h





### Kajaria Ceramics Limited

**GAS OUTPUT** : ~ 15000 Nm<sup>3</sup>/h  
**INSTALLATION** : 2 X Ø3.6 DSC  
**RUNNING SINCE** : NOV 2015



### Modulo Ceramics P Limited

**GAS OUTPUT** : ~ 9000 Nm<sup>3</sup>/h  
**INSTALLATION** : 3 X Ø3.4 DSC  
**RUNNING SINCE** : APRIL 2019



## ***How did we do it ?***

**Search Proven technology – CHINA 2003**

**Build Partnerships - YISHENG 2003**

**Modular in Blocks – ALL NON-CORE BLOCKS – DO IT**

**Commercial Project – TURNKEY – BHARAT POTTERIES**

**LEARN - INDIGENISE – SCALE TO MSME - 2007**

**MAKE IN INDIA – SELL IN NUMBERS – 183 SOLD**



## ***DRI – Future of steel making***

**MIDREX**

**HYL – ENERGIRON**

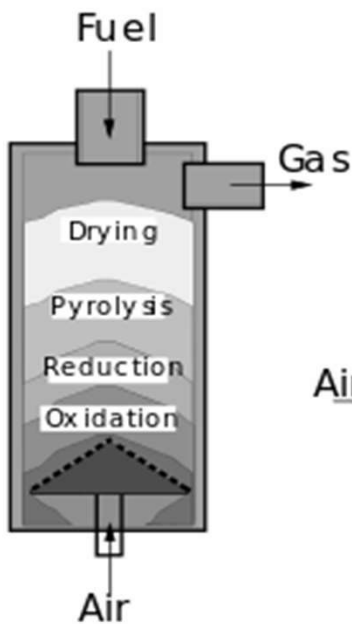
**POSCO - FINEX**

**SAAB - HYBRIT**

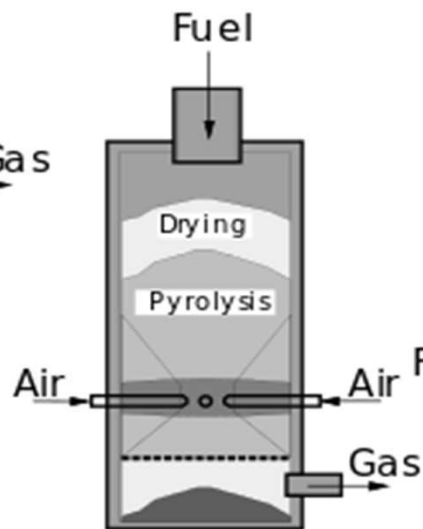
**WHAT DO THEY ALL NEED – SYN GAS !**

# *Types of Gasifiers*

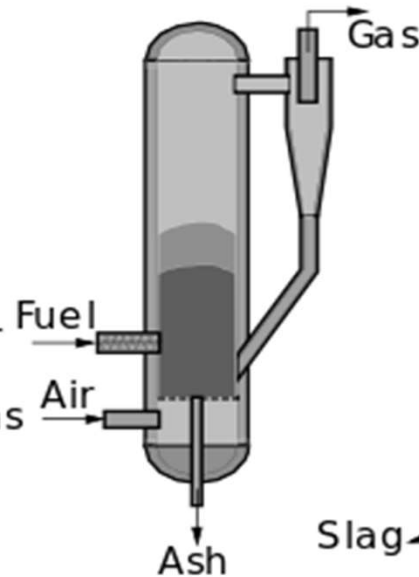
UPDRAFT



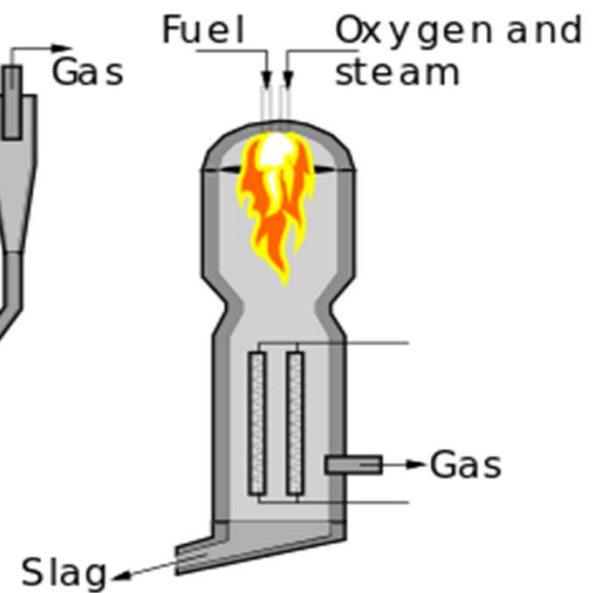
DOWNDRAFT



FLUIDIZED BED



ENTRAINED BED



## *Suitable to Indian 35% ash Coal*

### Fixed Bed

- Dry Feed
- High Pressure
- O<sub>2</sub> Fired
- Coal Size: 6-30 mm
- Difficulty effluent - Phenols, tar etc...
- Low output per m<sup>2</sup>
- Max. Ash - 20%



### Entrained Bed

- Wet - Slurry Feed
- High Pressure
- High Purity O<sub>2</sub>
- Coal Size: < 0.1 mm
- Max. IM - 11.5 %
- Max. Ash - 21%



### Fluidized Bed

- Dry Feed
- Medium Pressure
- O<sub>2</sub> Fired
- Coal Size: 0.5 – 5 mm
- Ease of effluent
- Moderate output per m<sup>2</sup>
- **Max. Ash - 35%**





## *Selection Matrix*

### COAL

Ash % / AFT / Hardness / Viscosity / VM % / Reactivity

### GAS QUALITY

CO + H<sub>2</sub> % ; CO / H<sub>2</sub> / H<sub>2</sub>S Level

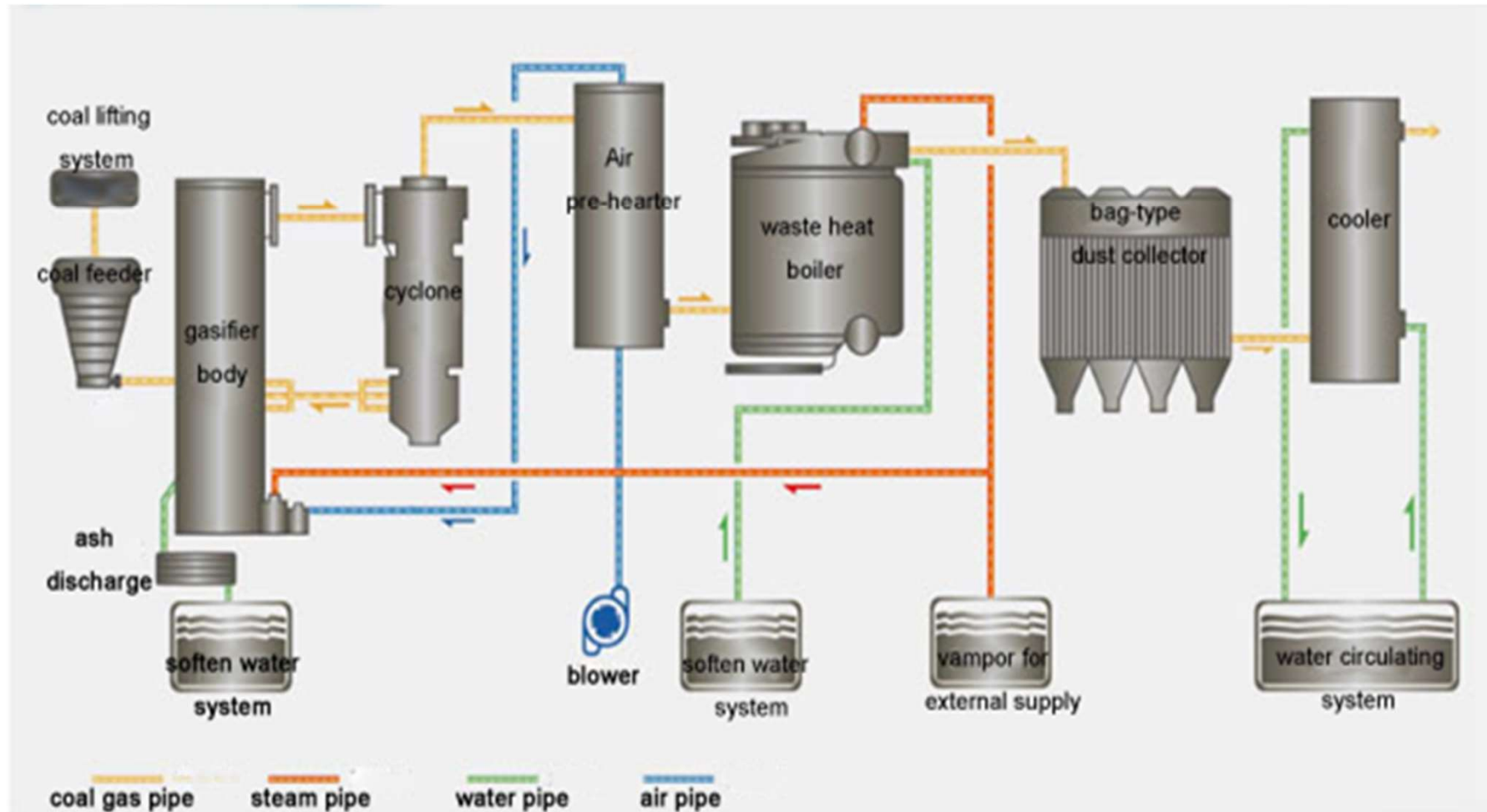
### GAS USAGE

DRI / Fuel / SNG / Methanol / DME / Ammonia

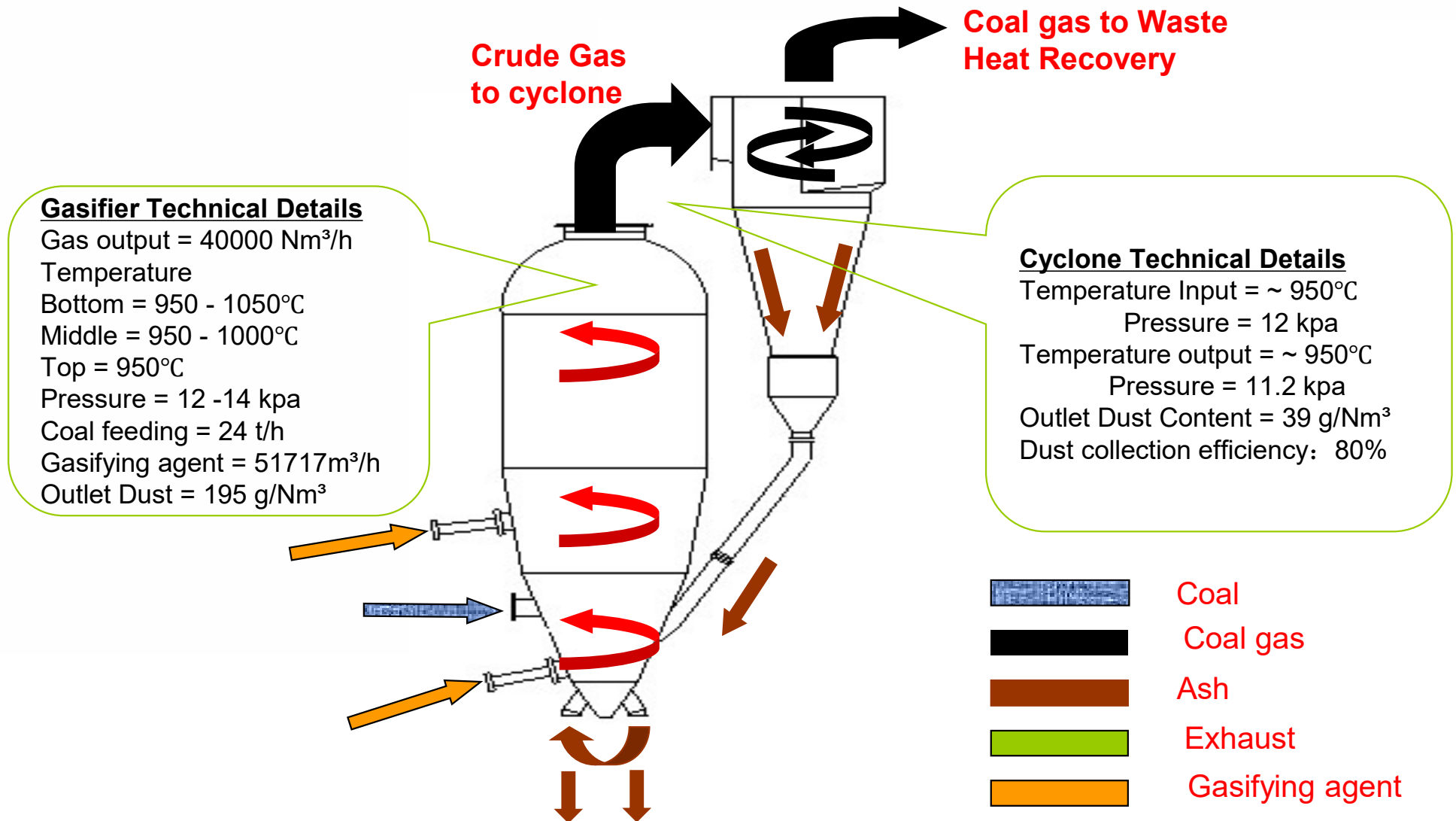
### PLANT SIZE

15000 / 40000 / 80000 / 120000 Nm<sup>3</sup>/ hr

## CFB – Basic Technology

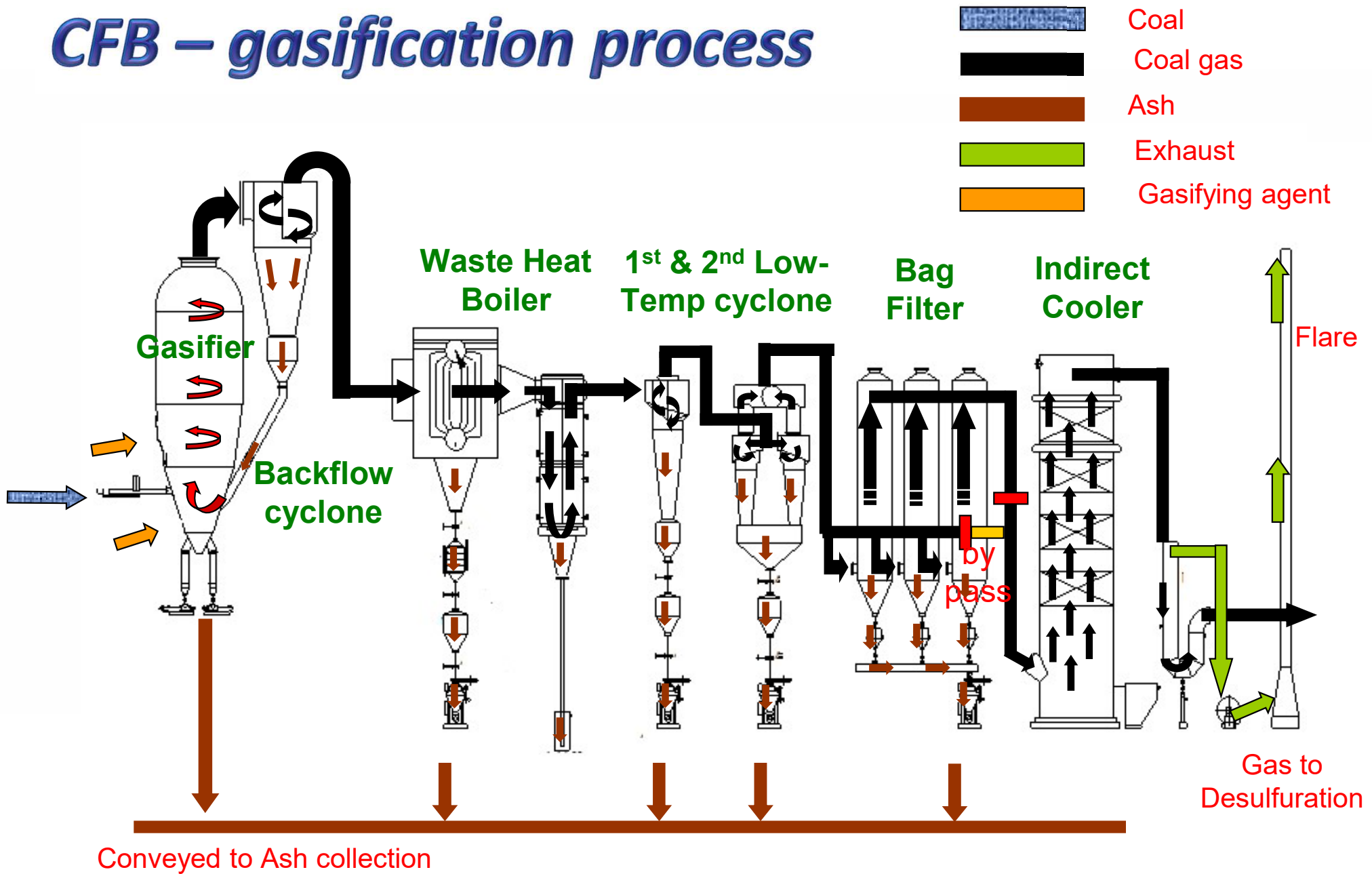


# CFB – gasification process





# CFB – gasification process



## 40000 x 2 TONGLIAO GOLD COAL CHEMICAL



## 40000 x 3 RANPING XINFAHUAYU ALUMINA

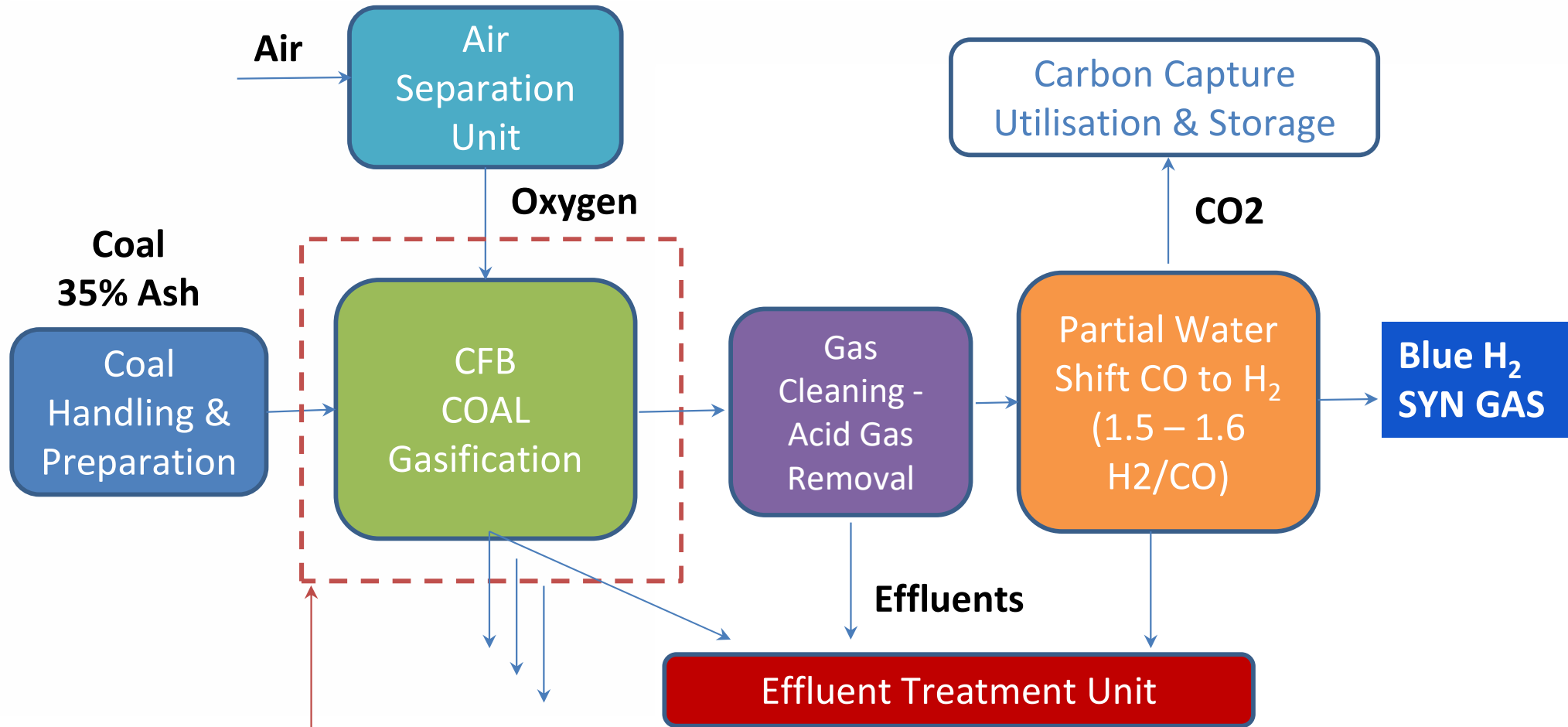




## ***DRI – why CFB ?***

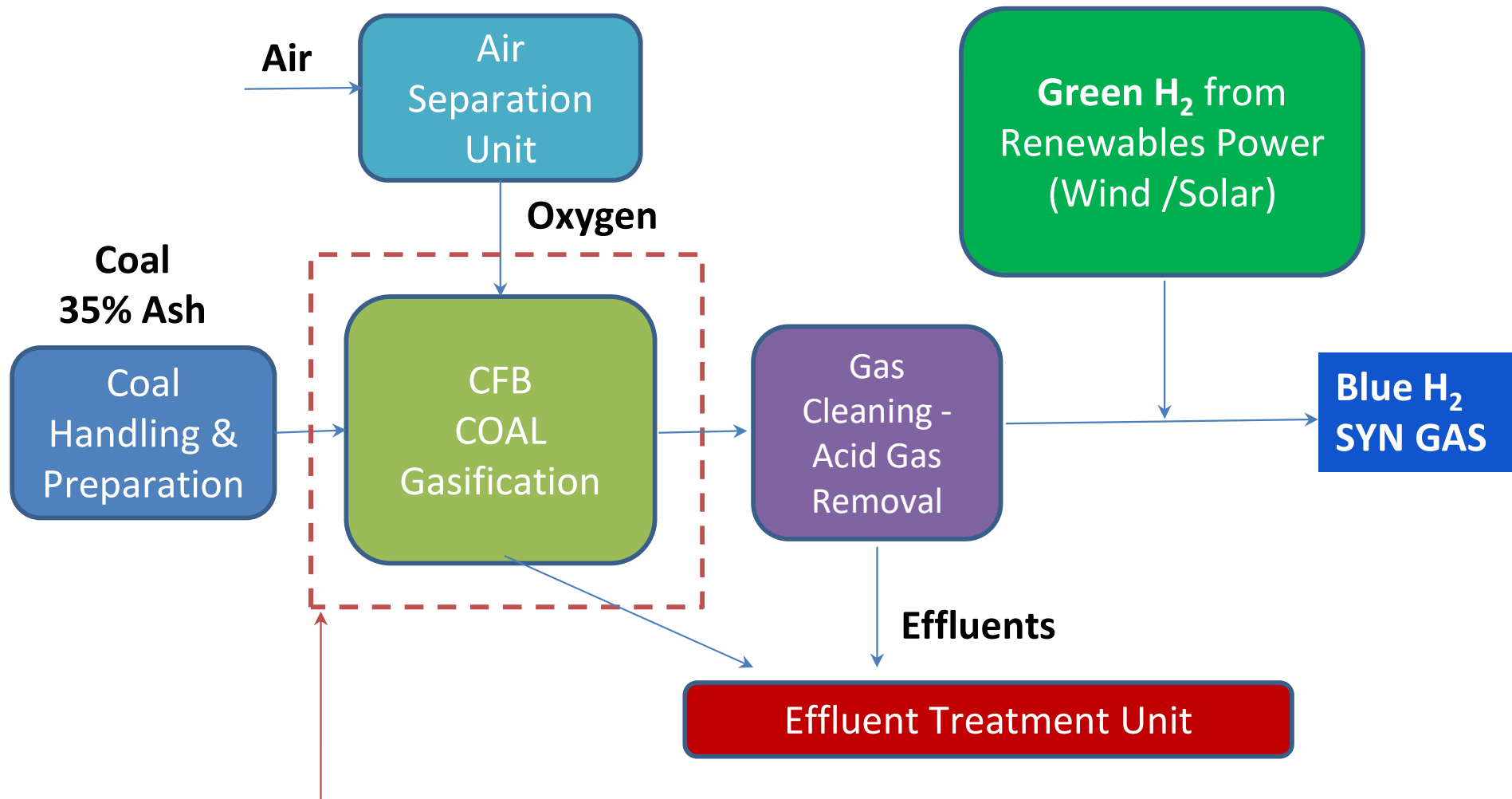
PARAMETER	REALITY	CFB ?
Carbon source	INDIAN COAL ~ 35 % ASH – MOST VIABLE	POSSIBLE
Reductant	CO + H <sub>2</sub> / H <sub>2</sub> IN RIGHT RATIO	POSSIBLE
Scale	Ideal for MSME - 0.6 mtpa ~ 40,000 Nm <sup>3</sup> /hr	POSSIBLE
Capex	Low – as No Proprietary Technology	POSSIBLE
Pressure	Simple Plant at Medium ~ 15 Bar	POSSIBLE
Effluent	Easily treatable and handleable	POSSIBLE
Efficiency	High Heat and Carbon Conversion	POSSIBLE
Indigenisation	Make in India	POSSIBLE

## ***DRI – CFB Blocks***



**CORE – WHERE PROVEN TECHNOLOGY IS NEEDED**

## ***DRI – CFB Blocks – Green Option***

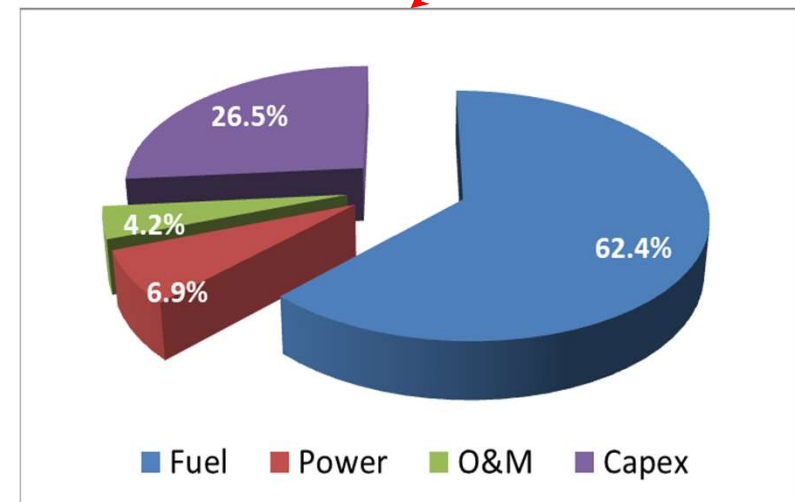


**CORE – WHERE PROVEN TECHNOLOGY IS NEEDED**



## ***DRI – PROJECT ECONOMICS***

DRI MTPA	Scale	SYN GAS Nm3/hr	CFB	Coal, TPD	CAPEX* INR Cr	SYN GAS, \$/mmbtu**
0.6	Small	40,000	1 + 1	450	350	11.51
1.5	Large	120,000	3 + 1	1440	900	10.69



\* 30% Accuracy

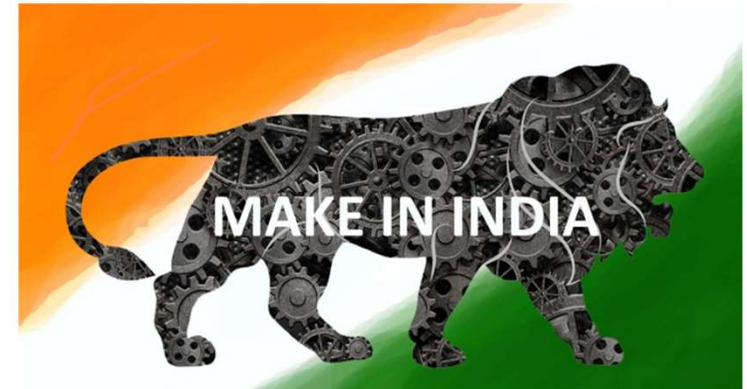
\*\* Project Economics Assumptions

## ***DRI – Project Economics Assumptions***

- **USD 1 = INR 82**
- **Coal Price – 9,000 INR / ton ( 5200 Kcal / Kg )**
- **Cost of Power – 8 INR / kWh**
- **Escalation – 1%**
- **Plant deterioration – 1%**
- **O & M Cost – 3 % of Capex / annum**
- **Power consumption – 14000 kWh / hr**
- **ROI: 15 %**

## *Roadmap ....*

- Learn from Chinese
- Proven Technology
- Experience
- No Licensee Fee
- Break up – Block approach
- Technical and operations support
- ‘Make in India’ – Localization of plant equipment



**Time to move to a Detailed Project Report**





**You have a Question, Lets talk**

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