



Presentation To

Coal India Limited

Under the aegis of

**Ministry of Coal,
Government of India**

Coal To Chemicals

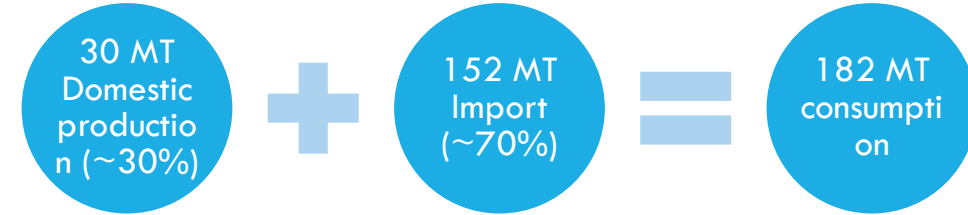
BHEL's Contribution to Aatmanirbhar Bharat

February 16, 2024

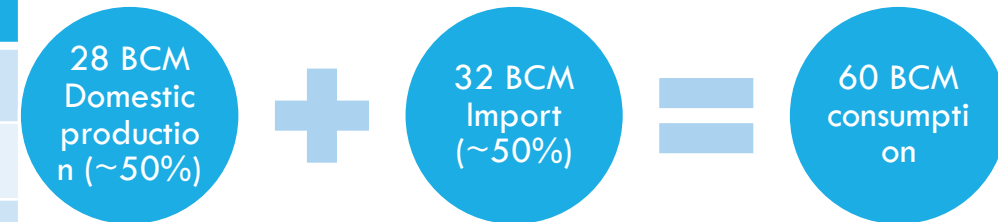
INDIA'S ENERGY MATRIX

India's total energy demand	
Coal	55.88%
Crude Oil	29.55%
Natural gas	6.17%
Nuclear Energy	1.09%
Hydro Electricity	3.91%
Renewables	3.40%

Crude oil Utilization	
Petro chemicals	~38%
Petrol	~15%
LPG	~14%
Pet coke	~8%
Naptha	~7%



Natural Gas Utilization	
Fertilizer Industry	~69%
Power Generation	~18%
Transportation	~13%



Gasification route is the way to reduce dependency on imports of Natural Gas and crude oil

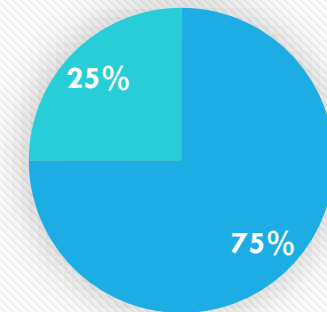
National Coal Gasification Mission envisages gasification of 100 MMT of Coal by 2030.

Phase 1: 4 MT

Phase 2: 6 MT

Phase 3: 90 MT

Type of Indian Coal based on Ash Content

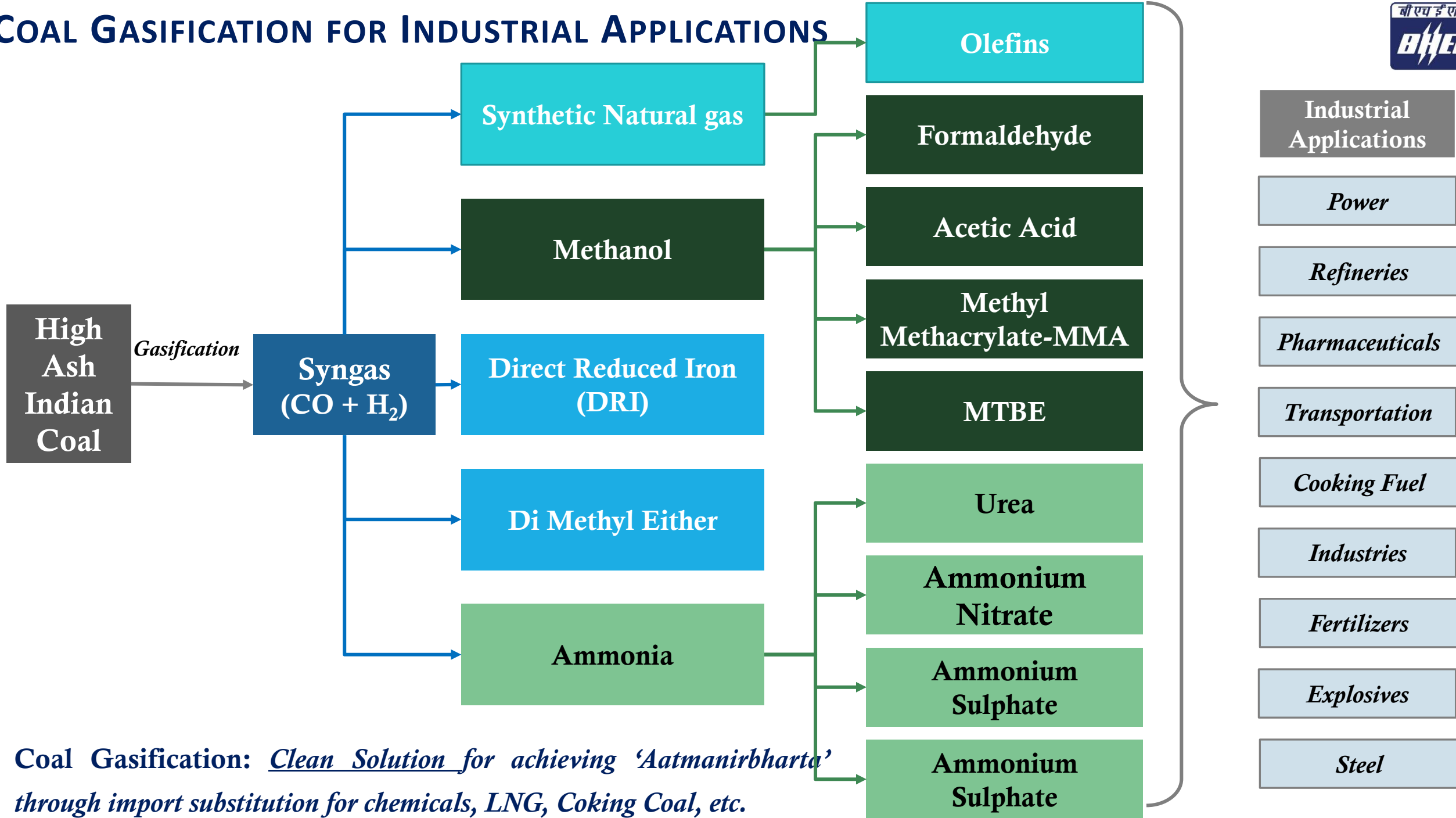


■ High Ash ■ Low Ash

PROMOTION SCHEME FOR COAL/LIGNITE GASIFICATION BY GOI

Category	Project Type	Grant
I	PSU	Overall 4050 Crs. (Max for project 1350 Crs.)
II	PSU/Pvt.	Overall 3850 Crs. (Max for project 1000 Crs.)
III	Technology Development	Overall 600 Crs. (Max for project 100 Crs.)
Total		8500 Crs.

COAL GASIFICATION FOR INDUSTRIAL APPLICATIONS



Coal Gasification: Clean Solution for achieving 'Aatmanirbharta' through import substitution for chemicals, LNG, Coking Coal, etc.

Characteristics of Indian Coal

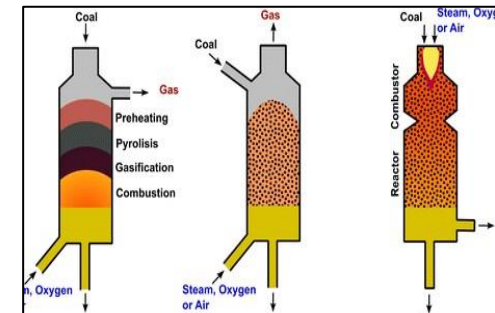
Non-coking Coal Related

- Major variation in quality of feedstock Coal between Mines
- High Ash, Low Rank, weathered / deactivated coal
- Large quantity of Coal Fines in Feedstock (Slurry & Fixed Based Technologies)



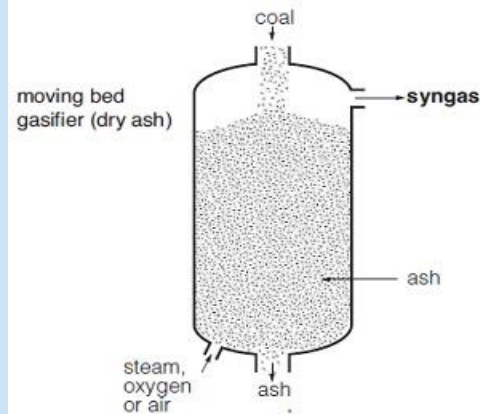
Environmental Related (Slurry & Quench Technologies)

- Large quantities of Waste / Black water generation
- Costly WW Treatment Plants to meet PCB Norms for 'Zero Discharge'



GASIFIER TECHNOLOGIES

Moving Bed Gasifier

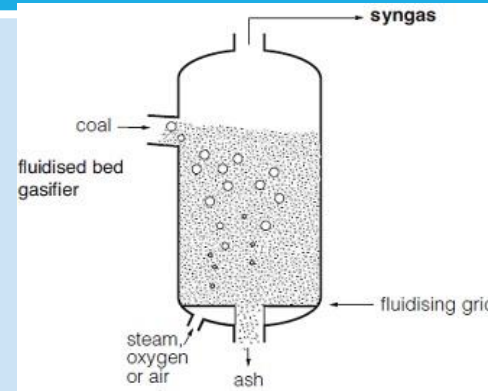


Operates @T: 800- 1100°C
& P : upto 30 bar
Coal Size: 6-30 mm, Dry ash

Suitable for high to moderate reactive fuels

Contains tar in syngas
Low through-put per unit area

Fluidised Bed Gasifier

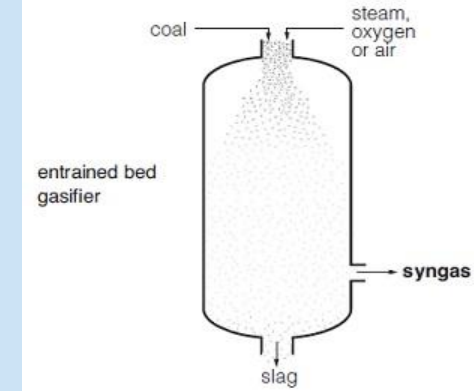


Operates @T: 800- 1100°C
& P: upto 30 bar
Coal size: less than 6 mm, Dry ash

Suitable for moderate reactive and low rank coals (high ash coals)

Fuel flexibility
Uniform temperatures
Dry ash removal system

Entrained Bed Gasifier



Operates @ T: 1200- 2000 °C
& P: 25-80 bar
Pulverized coal (<0.1mm), Molten ash

Suitable for low reactive fuels and high rank coals

High Carbon conversion
Commercially proven
High O₂ requirement
Molten ash removal

BHEL GASIFIER & COAL TO METHANOL PLANT

❖ Major System

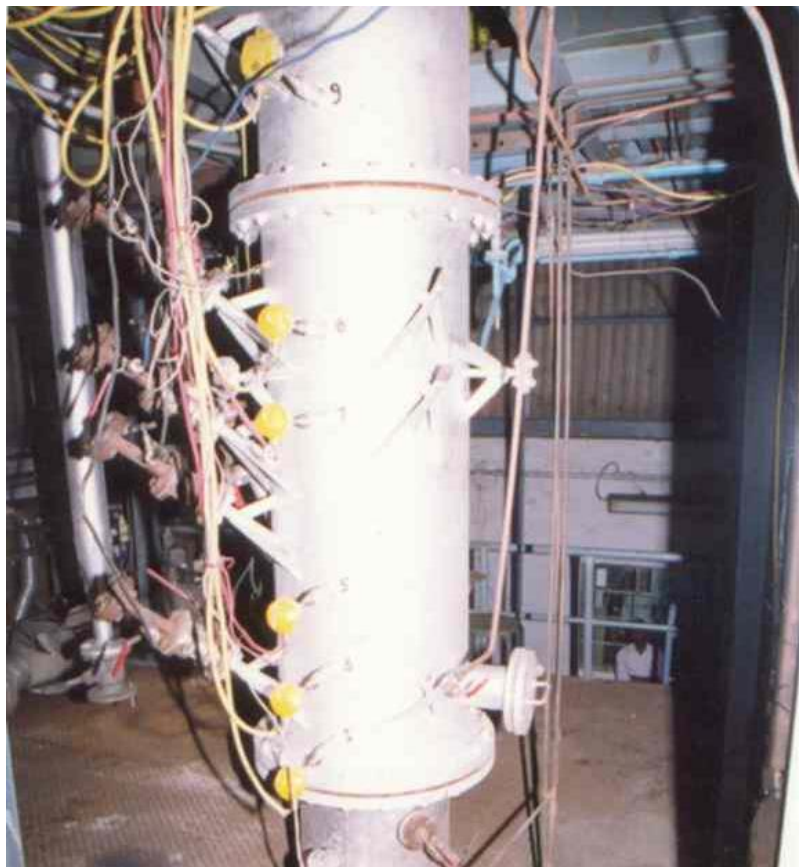
- Process design of H₂S Removal System, CO₂ Removal System, Water Gas Shift Reactor (WGSR) and Methanol Reactor, Methanol Distillation

❖ Features

- Technology - Fluidized bed gasification
- In-house Technology developed by BHEL
- Patented Technology
 - **Total 50 Nos of IPRs**
- BHEL's Technology is most efficient for Indian high ash coal.
- Pilot plant Capacity-82TPA **@Hyderabad**



VIEWS OF GASIFIER PILOT PLANT



Gasifier reactor



Coal Hopper and Cyclones



Gasifier Freeboard

Pressurised Fluidized Bed (PFB) Gasification Technology- Advantages

- **Large variety of fuels** can be handled (Coal, Lignite, Biomass etc)
- **No pulverizing** required. Crushing is sufficient & Ability to accept fines
- **Smaller footprint** compared to Fixed bed technologies
- **No tar/ phenol formation** and hence easy gas cleaning
- Operates in non slagging mode with **dry granular ash discharge**
- Moderate gasifier temperatures, **low Heat loss through bottom ash**
- **No Moving parts** in fluidised bed technology
- **Better turn down ratio (~50%)**
- **Steady Product composition** due to uniform conditions in the gasifier

Brief Particulars of BHEL PFB Gasifier

Capable to Utilize High Ash Indian Coal
(35% - 45% Ash)

Coal Throughput: ~2600 TPD

Oxy-blown Technology

Single train Syngas Generation equivalent to:

- 750 TPD Methanol
- 2000 TPD Ammonium Nitrate

Solution from BHEL in Coal-to-Chemical Products

- **BHEL's gasification technology is suitable for various products and derivatives**

- ✓ Methanol
- ✓ Hydrogen
- ✓ Ammonia
- ✓ Ammonium Nitrate
- ✓ Synthetic Natural gas (SNG)
- ✓ Di-Methyl ether(DME)
- ✓ Olefins
- ✓ Formaldehyde
- ✓ Acetic acid
- ✓ Ammonium Sulphates

कोयला मंत्रालय
MINISTRY OF
COAL

Coal-to-Chemical products through JVs between CIL-GAIL and CIL-BHEL

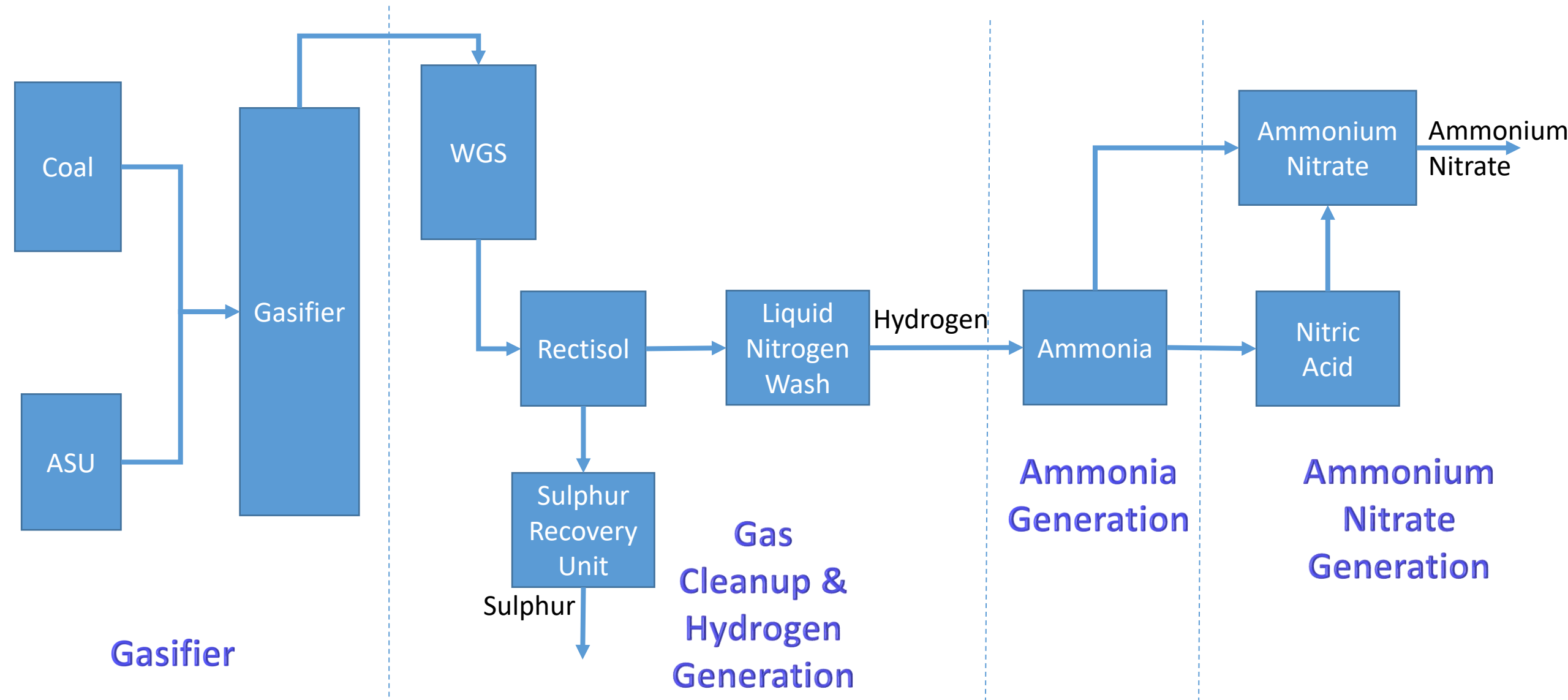
Import Substitution

- Methanol to be blended with petrol
- Di-Methyl Ether (DME) to be blended with LPG
- Ammonia for manufacturing Urea and Ammonium Nitrate
- Steel making through gas based Direct Reduced Iron

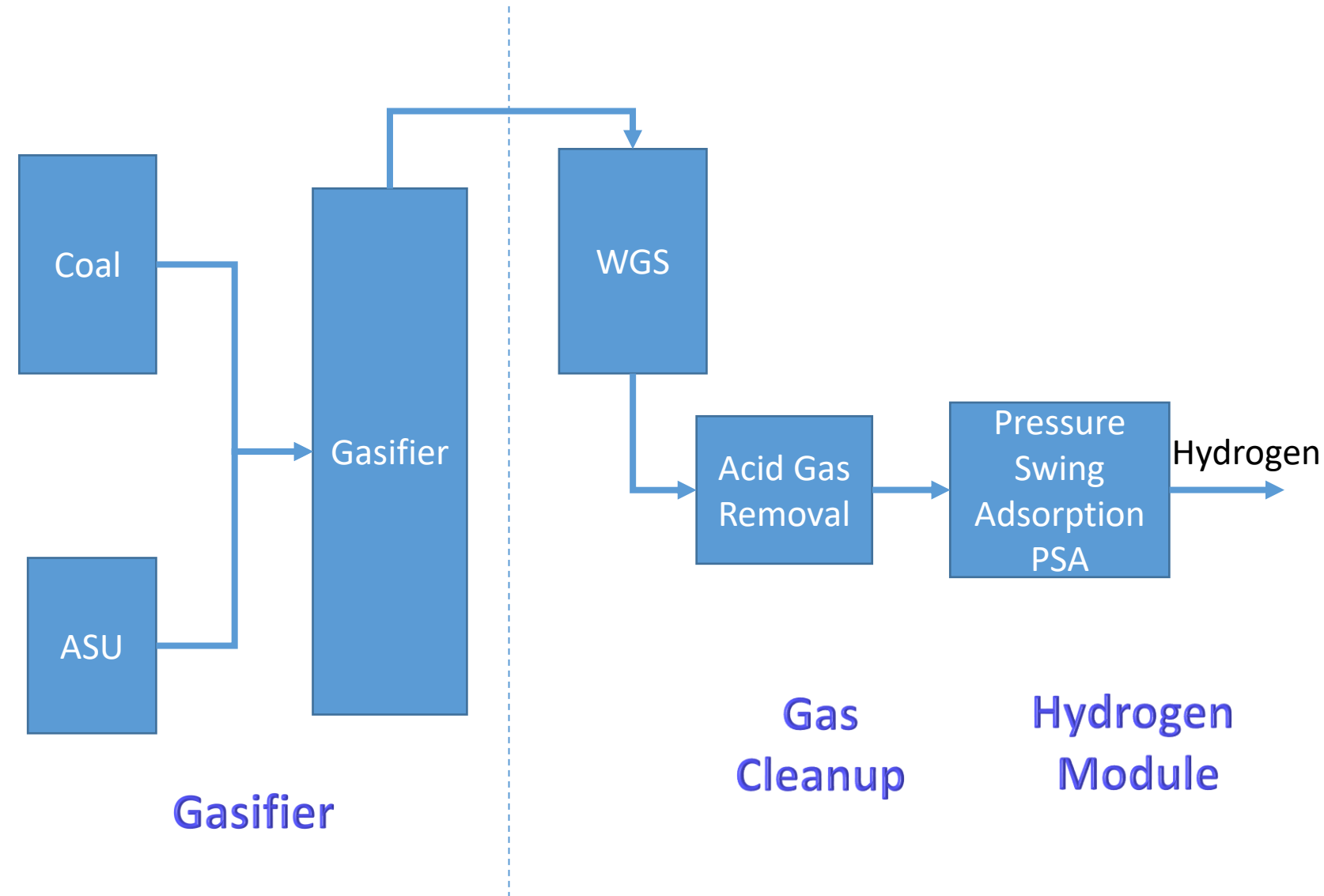
PRALHAD JOSHI
UNION MINISTER OF PARLIAMENTARY AFFAIRS, COAL & MINES, GOVT OF INDIA. (MP, DHARWAD CONSTITUENCY)

#CabinetDecisions
Pralhad Joshi pralhadjoshi.in

Typical Coal to Ammonium Nitrate process



Typical Coal to Hydrogen Process



- Coal gasified with Oxygen + Steam
- Ash Particles are removed using cyclones and Candle filters
- WGS will convert CO into Hydrogen
- Acid gases will be removed using amine based process
- PSA will purify the Hydrogen to suite for Fuel Cell Applications

BHEL's Manufacturing Capability

16 manufacturing facility across India & two engineering centres, R&D units
 Erection & commissioning centres in four regions of country for EPC activities

Our Process Industries customers



Coal to Chemicals

- Process Design
- Gasifier Island , Gas cooling & HRSG
- Coal & Ash Handling
- Gas Cleaning
- Compressors, Turbines ,Pumps
- Cryogenic Oxygen Plant, Absorption & Stripper columns, Reactors
- Controls & Instrumentation
- Erection & Commissioning
- Balance of Plant

ALL major components of Coal to chemicals are in the product basket of BHEL

A SNAPSHOT OF BHEL'S MANUFACTURING FACILITIES



*Engineering and manufacturing capability
for most equipment needed for 'Coal to
Chemicals'*

TO SUM UP

- ❖ In India, coal will be the main fuel feed stock for power generation and conversion to chemicals.
- ❖ **BHEL has hands on experience in design, engineering, fabrication, erection and operation of gasifier and integration to chemicals and power.**
- ❖ **BHEL ready with gasifier technology to Setup Coal to chemicals and DRI(Direct Reduced Iron) plants.**

THANK YOU

