

# COAL GASIFICATION

By

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# OUTLINE

- Underground Coal Gasification
  - Process
  - Advantages
  - Potential end use markets
- Surface Gasification
- Critical Issues
  - Technology Sourcing for UCG
  - Policy & Regulation for UCG/SCG
- Conclusions

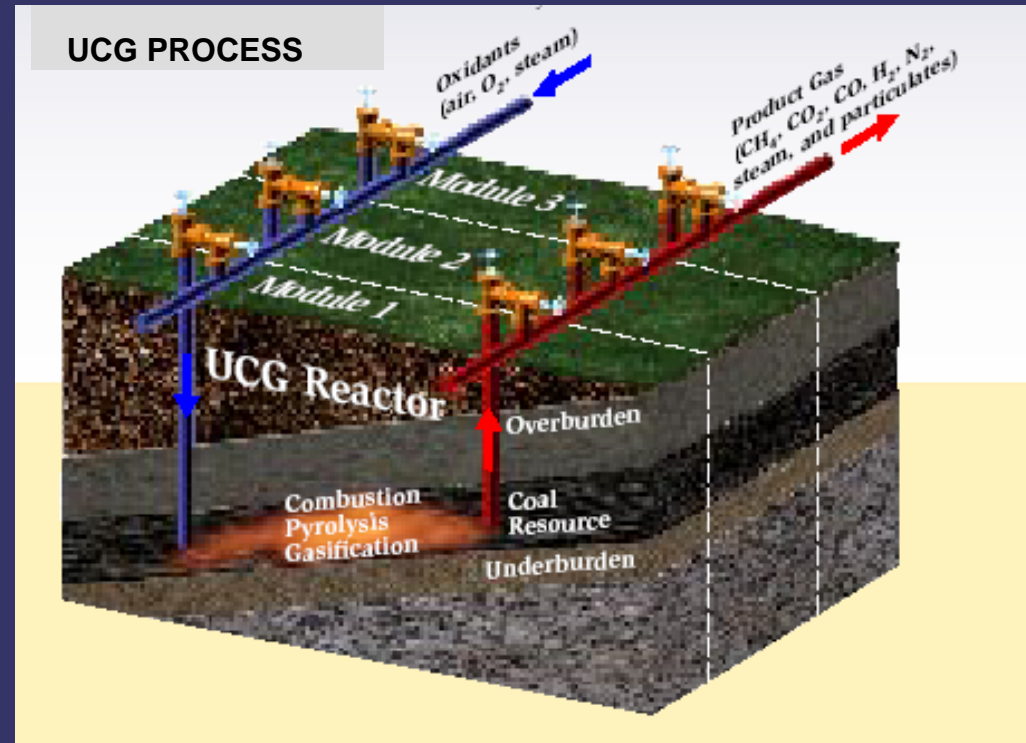


# COAL GASIFICATION

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## UNDERGROUND COAL GASIFICATION (UCG) - PROCESS

- Under the process of UCG, gasification of coal happens insitu by controlled burning
- About 350 m<sup>3</sup> gas can be produced per tonne of coal
- Bye products of significant commercial value will be hydrocarbons, phenols, anhydrous NH<sub>3</sub> and clean water
- UCG overcomes hazards of underground and open cast mining operations.
- In UCG process, ash/ slug removal is not required as they remain in the cavities
- Cost of production for this energy resource could be as low as US\$ 1.0-1.5 per MMBTU



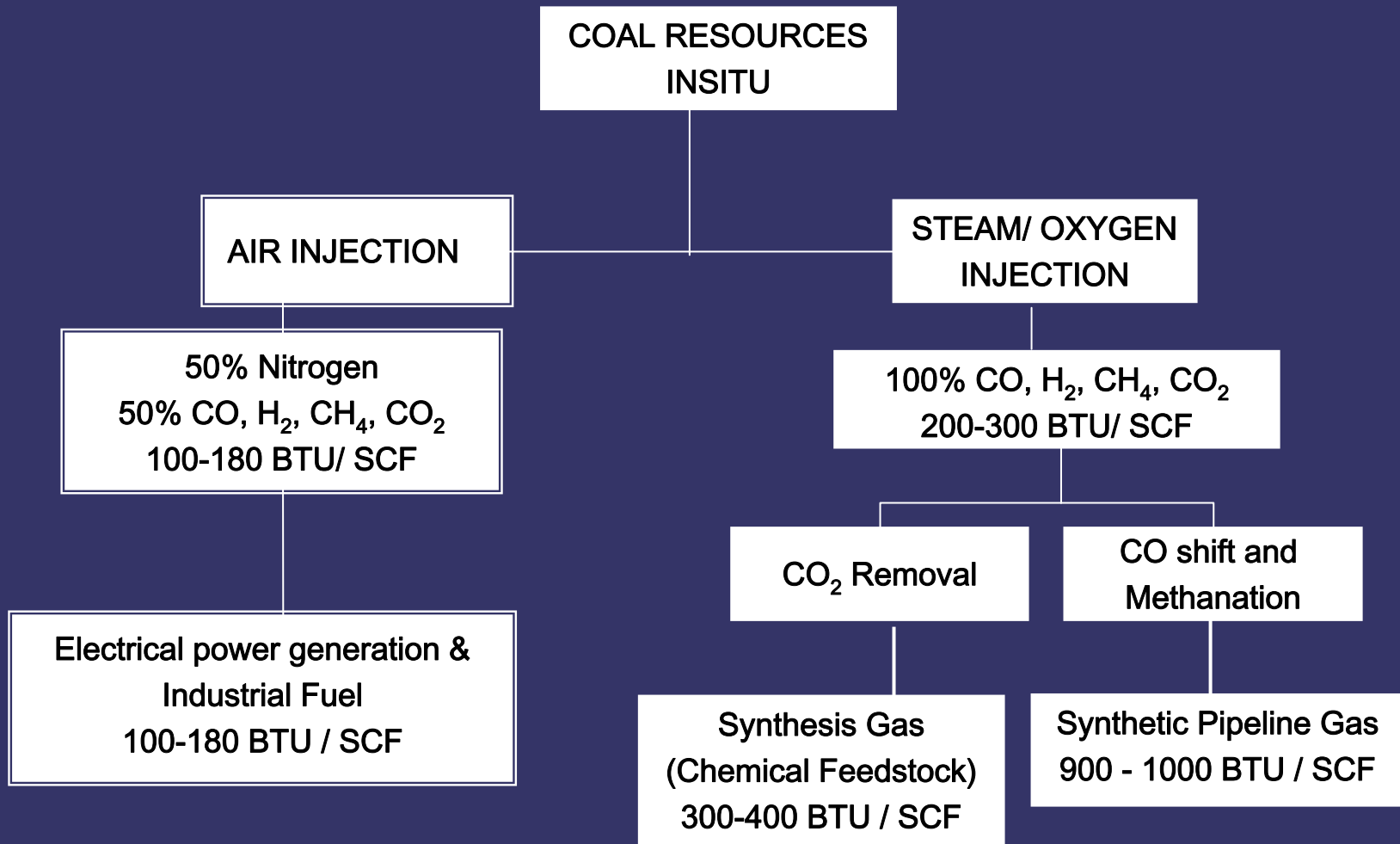
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## UNDERGROUND COAL GASIFICATION – ADVANTAGES

- Tapping energy from vast coal reserves which are not commercially viable to mine
- Back of the envelope calculations indicate huge energy potential of about 1000 MW power generation from a small block of 25 sq.kms, having 10 m thick coal seam
- Increases worker safety as no mining operations involved
- Low environmental impact
  - No atmospheric pollution.Coal mines involves coal dust pollution
  - No appreciable change in landscape
  - Less subsidence than conventional mining
  - Less Resettlement and Rehabilitation (R&R) issues
  - No surface disposal of ash and coal tailings
  - Potential GHG reduction activity (CO<sub>2</sub> sequestration in cavity)



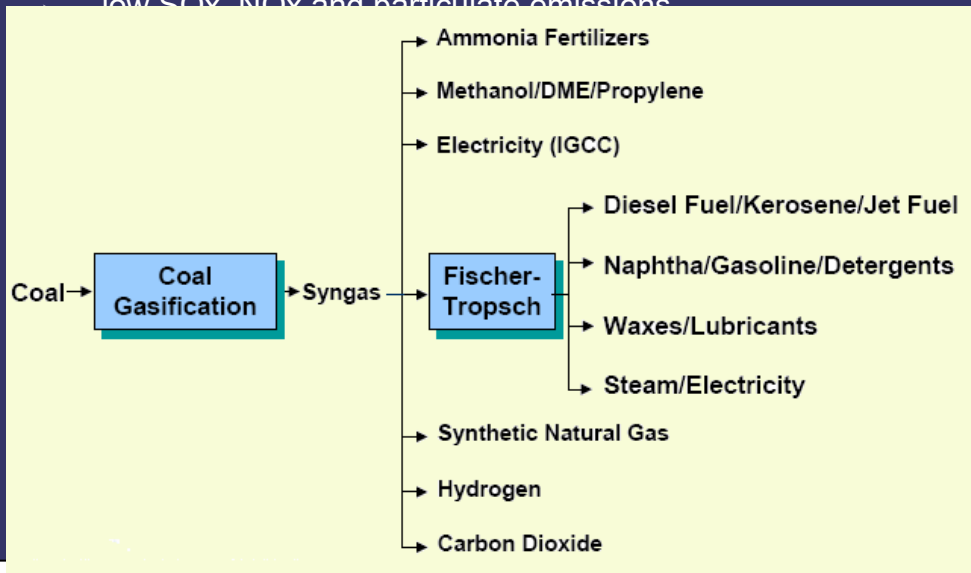
## POTENTIAL END USE MARKETS FOR UCG



## SURFACE GASIFICATION

- Developed in 1800s to produce town gas and city lighting.
- Renewed interest due to rise in oil prices, depleting oil&gas reserves and IGCC technology
- Coal is exposed to hot steam and controlled amounts of air or oxygen under high temperatures (250° - 900°C) and pressures
- Produces Syngas, hydrocarbons, tars, water vapours, anhydrous ammonia and phenols. The gas comprises of N<sub>2</sub>, CO<sub>2</sub>, CO, H<sub>2</sub>, CH<sub>4</sub>, O<sub>2</sub>, etc
- Environment friendly

low SO<sub>x</sub>, NO<sub>x</sub> and particulate emissions



and at lower costs.

### End Uses

- **Substitute for natural gas**
- **Power generation using low Btu gas as fuel**
- **Manufacture of chemicals and fertilizers**
- **Conversion to Liquids (CTL)**



## CRITICAL ISSUES

- Technology Sourcing for UCG
- Policy & Regulation for UCG/SCG
  - Under active consideration by the GoI (Ministry of Coal)



## TECHNOLOGY SOURCING FOR UCG

### UCG Technology development in USA

- USA witnessed major UCG testing activity in the 1960's 70's and 80's
- Number of UCG pilot tests were undertaken through the joint efforts of the industry, research institutes and government agencies to study the economic viability and environmental acceptability of UCG
- The latest field experiment was a joint industry – DoE UCG test conducted near Hanna, Wyoming in 1987-88, known as Rocky Mountain 1 (RM 1). Based on results of this pilot demonstration:
  - Cost for the UCG gas produced via directionally drilled wells, developed (US \$ 2.20/MMBtu)
  - UCG projects can be undertaken in an environmentally acceptable manner
- The characteristics of Hanna coals that have been gasified, have similarity to the low rank Indian lignites
- UCG interest has been renewed . Pilot projects are being planned in the next 2 years





## TECHNOLOGY SOURCING FOR UCG

- **Uzbekistan:** UCG is understood to be in progress on commercial scale in Angrenskaya, Uzbekistan, where the gas is said to be used for fuelling 650 MW power plant
- **Russia :** Skochinsky Institute of Mining, Moscow developed UCG technology for the erstwhile USSR countries
- **Australia :** Demonstration plant producing UCG gas since 1999
  - Longest burn outside FSU
- **China:** Has the largest on-going UCG programme. 16 trials have been carried out or currently operating since the late 1980's with main targets being the abandoned underground mines



## POLICY & REGULATION

- **Regulatory frame work:** In India, present regulatory framework does not cover grant of Prospecting Licenses (PL) or Mining Leases (ML) for the purposes of underground or surface gasification of coal
- **Area overlap :** Some of coal/lignite areas suitable for UCG, overlap the deeper oil & gas PELs (Barmer basin Rajasthan and Cambay basin in Gujarat)
- Applications by companies for UCG blocks await clearances owing to the above issues



## POLICY & REGULATION

- Gas produced by coal gasification may not be natural gas according to PNG Rules 1959, made under the Oilfields (Regulation and Development) Act 1948:

“Petroleum means naturally occurring hydrocarbons in a free state, whether in the form of natural gas or in a liquid, viscous or solid form, but does not include helium occurring in association with petroleum, or coal, or shale, or any other substance, which may be extracted from coal, shale or other rock by application of heat or by a chemical process.”

- **Thus, UCG may not get covered under this definition**



# COAL GASIFICATION POLICY & REGULATION

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## Coverage under the existing coal mining laws

- Under the existing Coal Mines (Nationalisation) Act 1973, as amended till date, grant of areas to companies other than PSUs is allowed for captive consumption of coal, for:
  - *the production of iron and steel*
  - *generation of power*
  - *washing of coal obtained from a mine*
  - *production of cement, or*
  - *such other end use as the Central Government may, by notification, specify*
- **A Gazette Notification by the Central Government to include captive mining of coal for UCG as end use on the similar lines of power, production of iron & steel and cement under Coal Mines (Nationalisation) Act, 1973 may bring the much wanted clarity for allotment of UCG blocks under MMDR Act, 1957**
- Fiscal incentives similar to CBM policy such as 7 years tax holiday, zero customs duty, freedom to market and price the syn gas may be considered.



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## CONCLUSIONS

- Both Underground and Surface gasification are proven technologies
- Technologies can be sourced for both underground and surface gasification of coal with the joint efforts of Indo-US working group on coal
- The Government may consider issue of Gazette Notification under the Coal Nationalisation Act, 1973 to allow captive mining of coal for producing syn gas as end use and fiscal incentives similar to CBM would result in expeditious development of this resource.



*Thank You*

