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METHANOGENESIS OF IN-SITU COAL: A LEAPFROGING TECHNOLOGY FOR SUSTAINABLE ENERGY EXTRACTION FROM NON-EXTRACTABLE COAL DEPOSITS

by

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AGENDA

- Extraction of Coal Energy by Conventional Mining Methods
- Constraints
- Closed-Loop-Fossil-Fuel Systems
- Methanogenesis
- Associated Advantages

EXTRACTION OF COAL ENERGY BY CONVENTIONAL MINING METHODS

- Total Geological Coal Resources: 253.30 Bt
- Extractable Coal Reserves: 52.24 Bt
- BAU: Extraction of only 21% of the total energy
- BCS: Recovery of at the most 30% of the total energy
- 70% of energy untapped and un-recovered forever
- Can India afford this luxury?

CONSTRAINTS IN COAL EXTRACTABILITY

- Forestland, national parks, bio-reserve, and other eco-sensitive zones
- Current regulations
- Mineability and extractability of a deposit depends on:
  - Grade and market price of coal
  - Extraction technology
  - Infrastructure
  - Safety and environmental considerations
- All geological resources are not mineable
- All mineable reserves are not extractable

RECOVERY OF ALMOST TOTAL ENERGY

- Recover almost total energy
  - More cleaner forms
  - From surface itself
  - Making energy extraction totally safe
- Application of Closed-Loop Fossil Fuel systems
  - Plants and fossils, buried underground, under high pressure and temperature, with passage of time, get converted into coal, petroleum, and other fossil fuels; burning of which emit CO_2, a GHG, which needs to be mitigated to reduce global warming

CLOSED-LOOP FOSSIL FUEL CYCLE

Coal
Oil
Gas &
Other
Hydrocarbons

Power Generation
Fuel Processes
Modules

With application of CO_2 sequestration technology, this CO_2 can be put back in non-extractable coal formations to get preferentially adsorbed over methane and displace methane to be recovered as an additional fuel

CO_2

Indigenous & proven microbes in coal formations, through well heads; the coal and sequestered CO_2 get converted into methane

This conversion of coal into methane by microbes is known as methanogenesis of in-situ coal

Indigenous & Proven Microbes

Methanogenesis can enhance the rate of recovery of methane substantially

METHANOGENESIS

- A continuous, natural, online phenomenon
- Accelerating the rate: a new concept
  - Injecting, and optimising the bacterial colonies
  - Creating right conditions
  - Providing sufficient nutrients
- Conversion of almost entire in-situ coal
- Extraction of almost total energy
- A renewable source of methane
- 1372 m^3 of methane/tonne (70% carbon content)
- 530 m^3 of methane/tonne of CO_2 sequestered

ENERGY AVILABILITY

- Total energy in the deposit: about 3.3 million peta joule
- 250 thousand billion cubic meter of methane
- 10 million peta joule of energy
- 100 years time span: 50% conversion & 50 % recovery
- Recovery of 2.5 million peta joule of total energy
- 25,000 peta joule of energy every year
- Coal & Lignite combined: 6602 peta joule (2003-04)
- Total conventional energy from primary sources < 13,000 peta joule
- Capable of revolutionizing the energy scenario of the country

ASSOCIATED ADVANTAGES

- CO_2 sequestration potential > 1000 billion cubic meter
- About 2000 MMTCE of carbon credit
- About 20 MMTCE annually
- About Rs. 20 billion every year
- A source of renewable methane

CONCLUSION

- Methanogenesis of non-extractable coal deposits can revolutionize the concept of energy extraction from coal & thus, the energy scenario of the country
- Capable of making the country fully energy secured
- Extraction of energy in cleaner form & free from all barriers
- World wide it is a new concept
- India is capable of having edge over other countries due to its upcoming biotechnology
- Capable of occupying front seat in its development and application, like IT industry.

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