



***METHANE TO MARKETS CONFERENCE***  
***NEW DELHI***

**POTENTIAL FOR CMM / AMM / CBM IN INDIA**

**By**

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- CH<sub>4</sub>-Valuable energy resource
- CMM
- AMM
- Possibilities for CMM / AMM in India
- Carbon Credit Potential
- Path forward
- Conclusions

# CH<sub>4</sub> - VALUABLE ENERGY RESOURCE



- CH<sub>4</sub> - A valuable energy resource gets generated during the process of coalification and remains adsorbed in the coal seams. This resource is being commercially harnessed in many countries using following techniques:
  - CBM - To exploit commercial value of gas ahead of mining and make the coal mining safe
  - CMM - To realize the commercial value from methane production during coal mining operations. Adds value and avoids accidents
  - AMM - To tap the remaining commercial value from residual methane gas from abandoned mines

# CH<sub>4</sub> - VALUABLE ENERGY RESOURCE



## TYPICAL CBM CONCENTRATIONS AND FLOWS FROM VARIOUS SOURCES

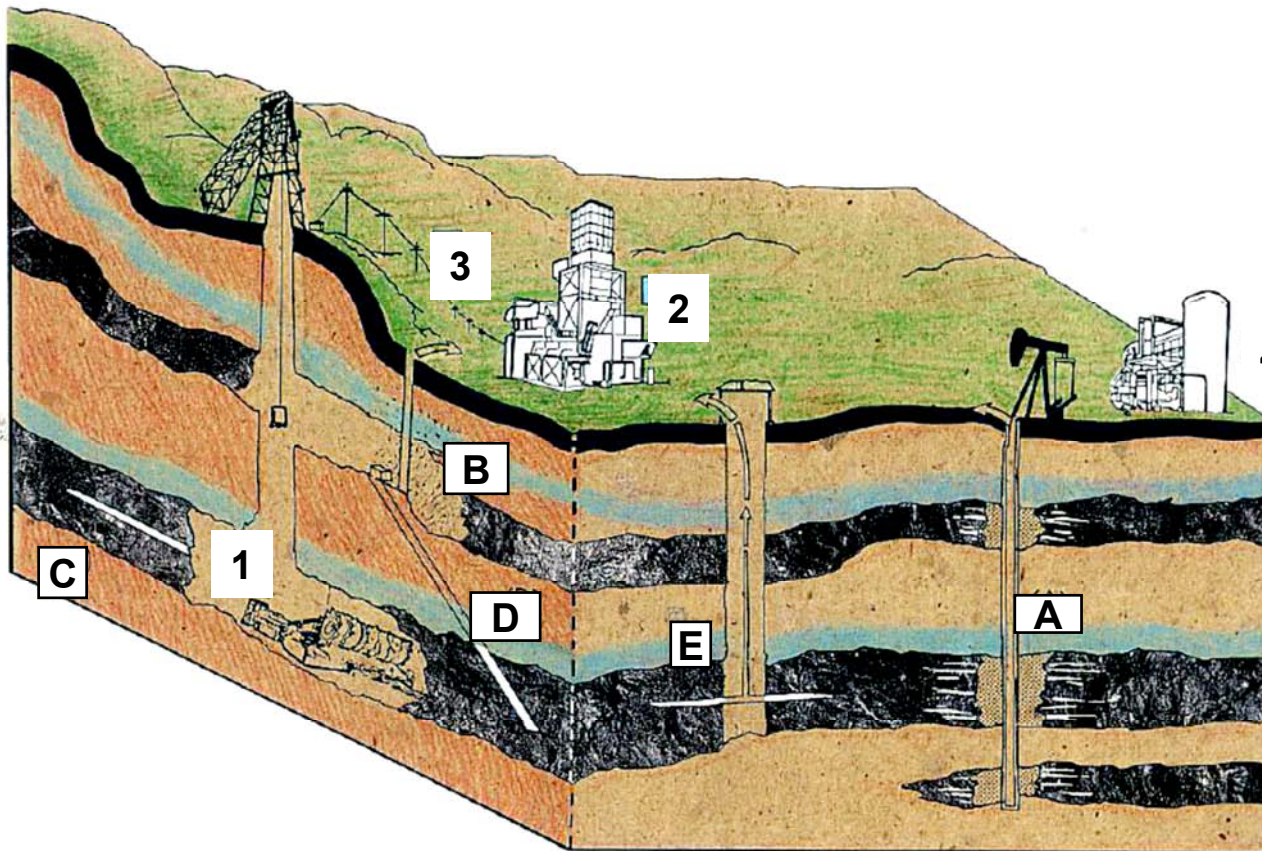
Characteristics	Methane Concentrations (%)	Pure Methane Flow, m <sup>3</sup> /d
CBM	>95	4000-10000
CMM	35-75	6000-194000
Ventilation Air	0.05-0.8	4000-130000
AMM	35-80	11000-86000

*Source: Technology status report, DTI, 2001*

# CH<sub>4</sub> - VALUABLE ENERGY RESOURCE



## METHANE GAS – EXTRACTION & UTILIZATION

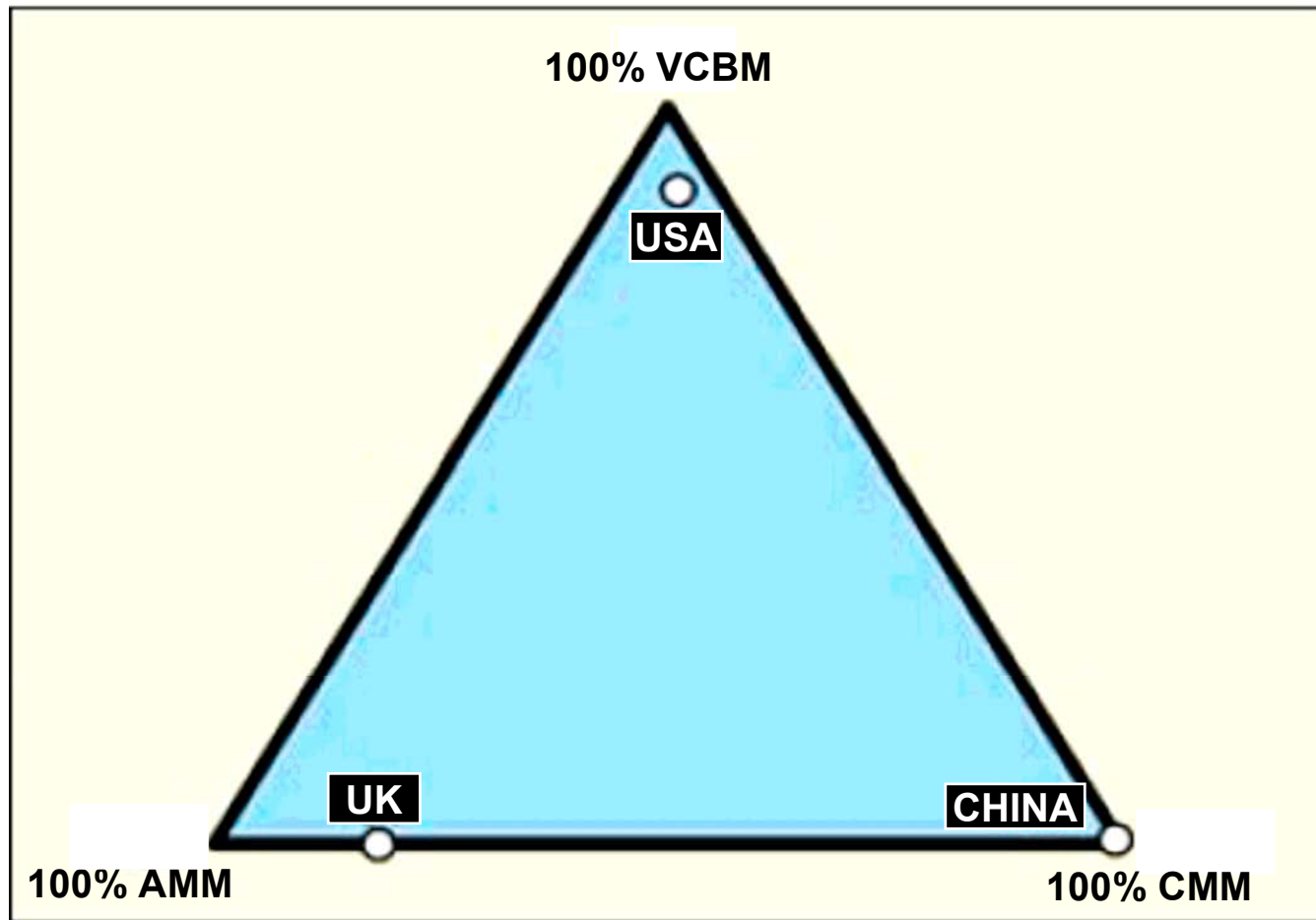


- (A) Vertical wells with stimulation to release gas
  - (B) Vertical wells into caved workings (goaf)
  - (C) Horizontal holes within the underground workings
  - (D) Inclined holes from other worked seams
  - (E) Horizontal holes from special purpose shafts
1. Improves safety & productivity
  2. Power generation
  3. Power transmission
  4. Fertilizer / petrochemical manufacture

# CH<sub>4</sub> - VALUABLE ENERGY RESOURCE



## COMMERCIAL METHANE SOURCES FROM COAL IN UK, USA & CHINA



# CH<sub>4</sub> - VALUABLE ENERGY RESOURCE



## INDIA'S CMM EMISSIONS (MILLION CUBIC METRES)

Year	1990	1994	1995	2000	2005
CMM Emissions (no utilization)	763*	957.3	959*	1106*	1363 *

Data provided in gigagrams has been converted to million cubic meters where 1MCM =0.679 Gg

Source: UNFCCC(1994); \* USEPA (2006)

# CH<sub>4</sub> - VALUABLE ENERGY RESOURCE



## CBM / CMM / AMM: INDIA

- CBM: DGH has awarded 26 blocks for extraction of CBM from virgin seams from 3 bid rounds, thus far
- UNDP/GEF/GOI collaboration Project : Under development in one of CIL's companies to demonstrate the commercial feasibility of utilizing methane gas
- AMM projects yet to be taken up





## METHANE EXTRACTION BY JIM WALTERS RESOURCES, INC., USA

- Jim Walter Resources, Inc (JWR) operates underground mines in Black Warrior & other basins in USA
- Methane drainage techniques developed for mining of coal from highly gassy seams
- Methane extraction and utilization added commercial value to coal mining
  - Methane drainage started in 1979 and commercial sales started in 1982



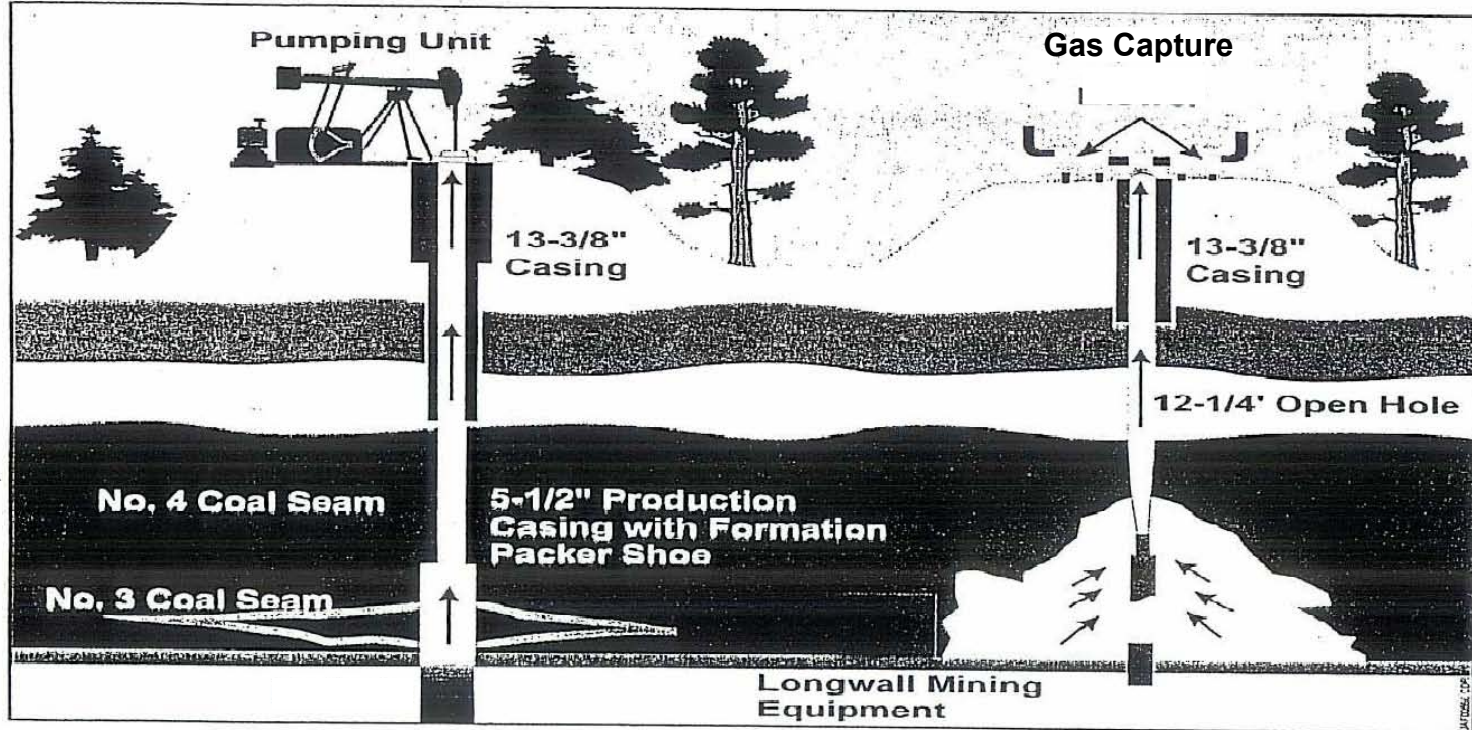
## METHANE EXTRACTION BY JIM WALTERS RESOURCES, INC., USA

- Methods adopted for methane drainage:
  - ❖ **Ahead of Mining: VCBM**
    - Hydraulically stimulated vertical wells
  - ❖ **During Mining: CMM**
    - Horizontal methane drainage boreholes
  - ❖ **After Mining: CMM**
    - Gob wells to remove methane released from strata above and below the coal bed which also prevents overflow of methane from gob into mine ventilation system
    - Gob wells are drilled and made ready for production in advance of longwall mining
    - Gob wells are high gas production wells



## METHANE EXTRACTION BY JIM WALTERS RESOURCES, INC., USA

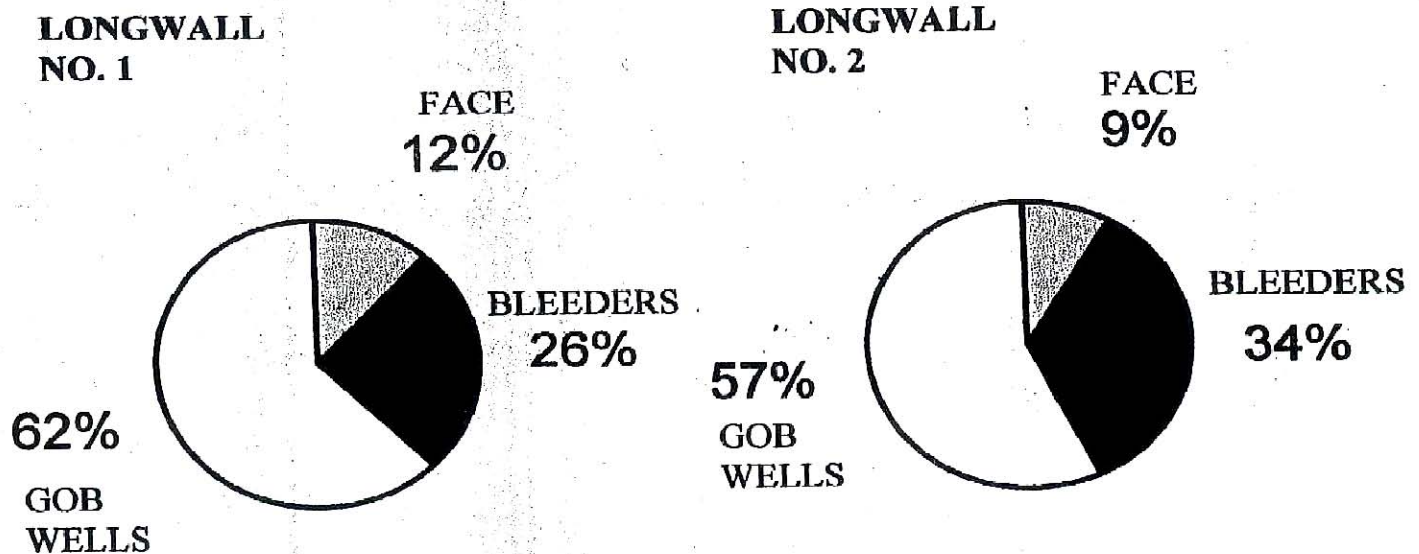
### *Frac and Gob Well Designs*





## METHANE EXTRACTION BY JIM WALTERS RESOURCES, INC., USA

### GOB WELL CAPTURE EFFICIENCY



# CMM - CASE STUDY



## METHANE EXTRACTION BY JIM WALTERS RESOURCES, INC., USA

Brookwood coal degasification field, Black Warrior basin, USA



**Gob gas plant**

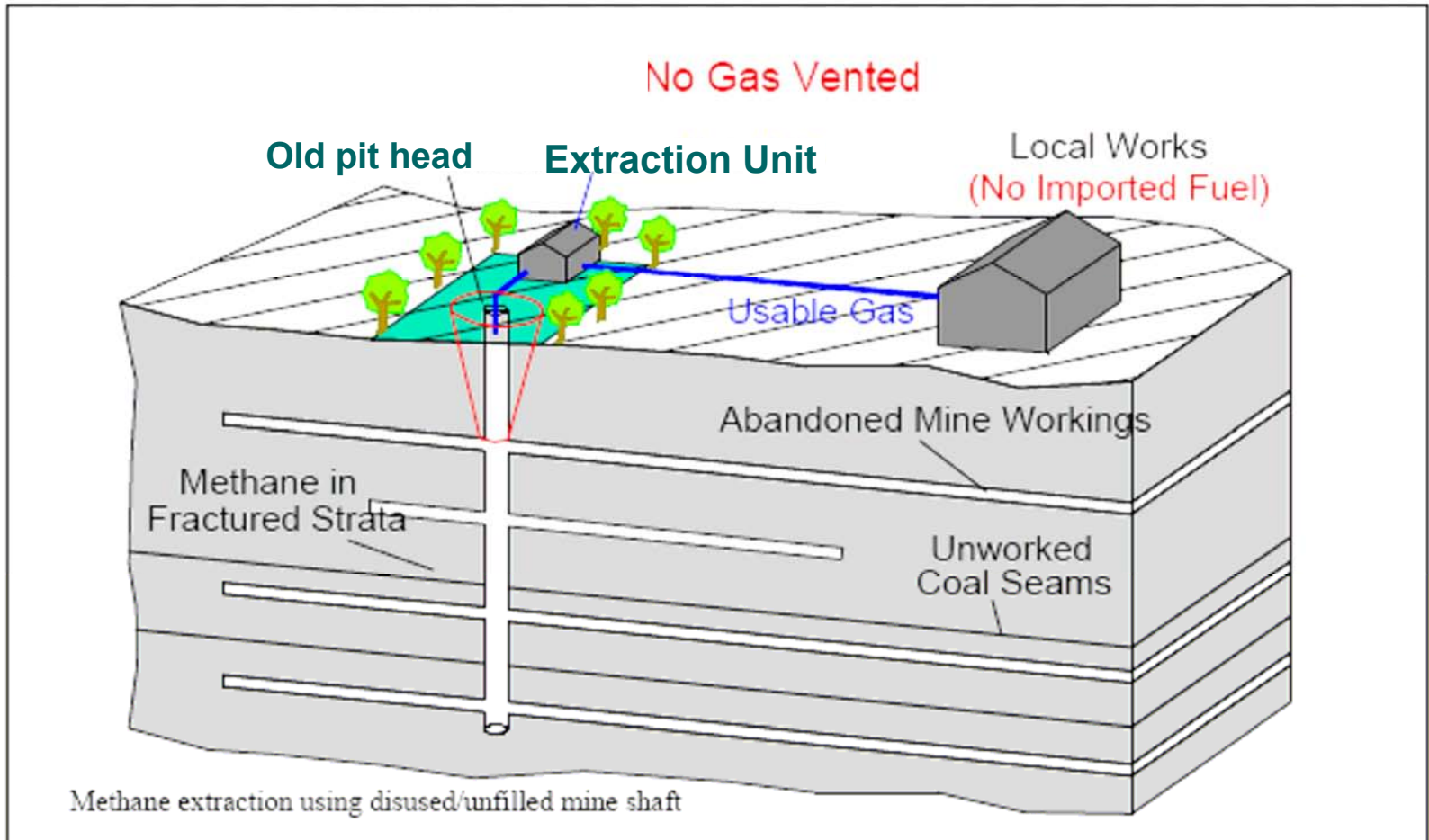


**Gas compression Station**



- Gas remaining in the disturbed unmined coal in an abandoned mine represents the AMM reservoir.
- Sealing of air leakage from surface to avoid dilution of the gas in the mine is important in AMM Projects
- Rising water levels in the workings reduce and isolate the volume of coal available for gas extraction
- AMM projects are in operation in countries like UK, Germany & USA

# AMM APPROACH





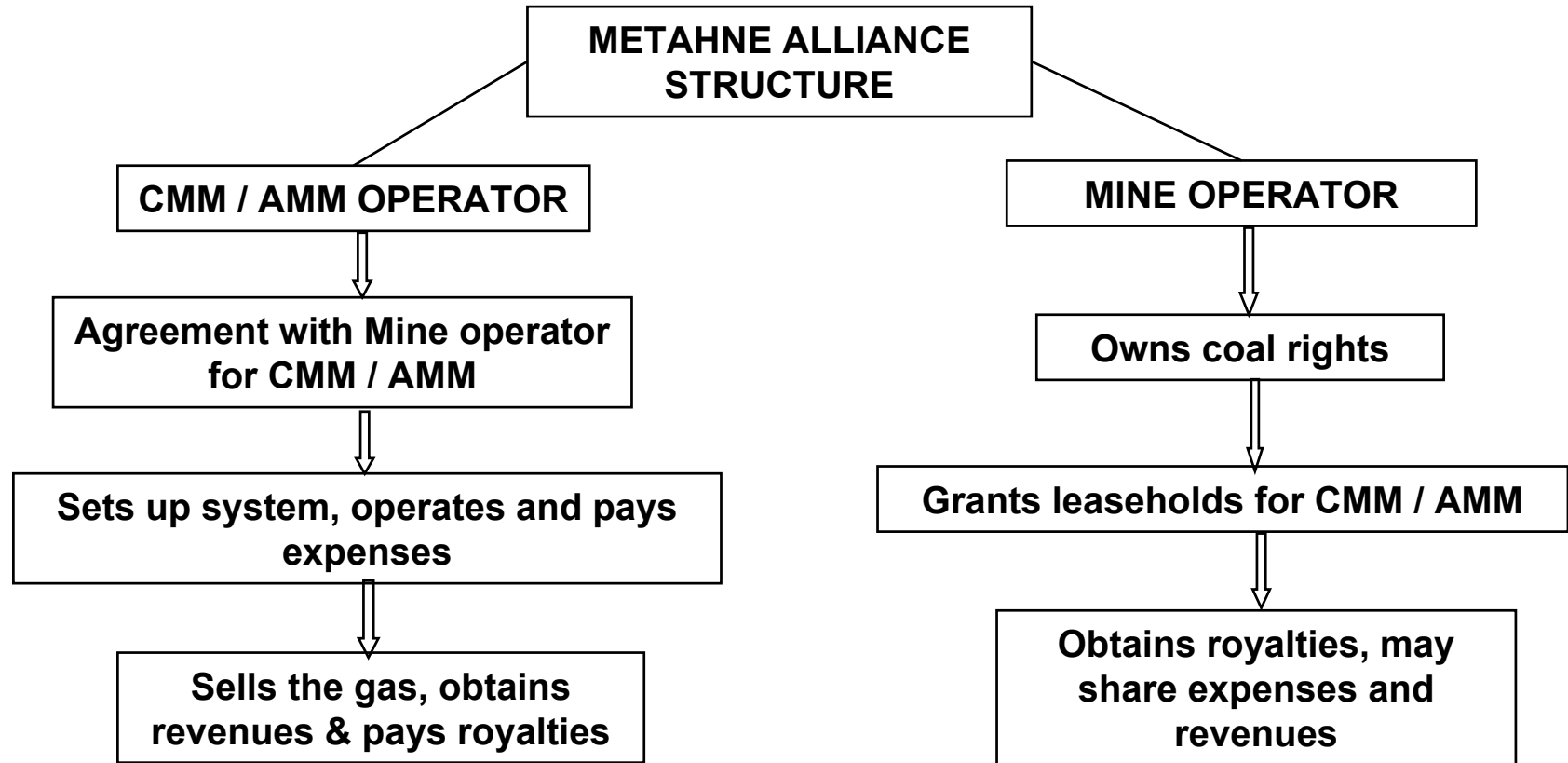
- Working and abandoned gassy coal mines in India can be ideal targets:
  - Areas where mining is planned (5-7 years ahead)
  - Active Mines
  - Abandoned Mines
- Coal companies may possibly consider developing these resources by forming an alliance with experienced operators.



# POSSIBILITIES FOR CMM / AMM IN INDIA



## PROPOSED ALLIANCE STRUCTURE





## CMM / AMM OPERATOR'S ROLE

- CMM / AMM Operator shall bring the following:
  - Resource modeling of coal seams under de-stressed conditions for initial gas resource and gas production estimates
  - Design and management of gas drainage systems
  - Gas clean-up techniques, gas enrichment and blending
  - Usage of gas



- Kyoto Protocol envisages greenhouse gas emission credits (carbon credits) for methane capture and utilization
  - Approved base line methodology for methane capture and utilization is in place for CMM projects
  - China has several CMM projects registered with UNFCC
  
- Revenue from a CBM / CMM could be substantially increased by sale of carbon credits



- Development of coal-field specific databases & carrying out assessment of potential
- Delineation of CMM / AMM blocks. Coal producing companies may carve out areas of few hundred square kms for methane drainage
- The blocks so formed may be allocated to experienced operators by forming joint ventures through:
  - International competitive bidding
  - Selection from pre-qualified operators
- Fiscal terms & conditions could be similar to CBM Exploration & Production Policy

# CONCLUSIONS



- Indian coalfields have a potential for exploiting the valuable energy source of methane from coal
- There has been progress in CBM, but steps for developing CMM & AMM need to be taken up



THANK YOU