Presentation

for

Methane to Markets Partnership Expo 2010

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Coal Bed Methane (CBM) to power the dual fuel converted engines of Indian Railways

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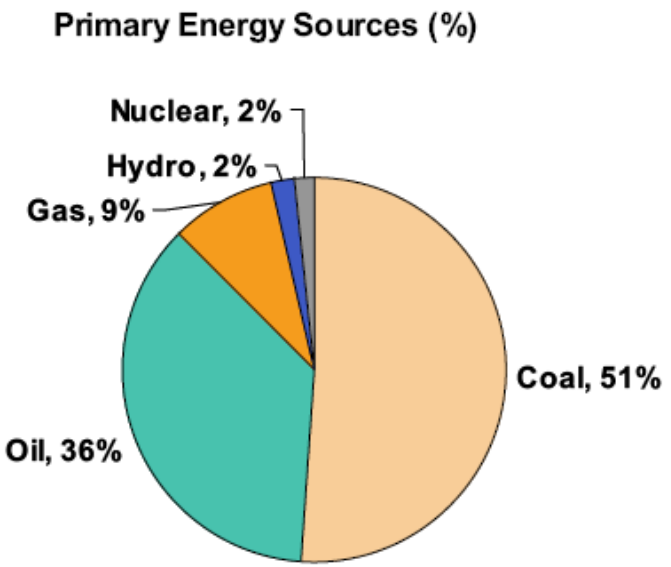
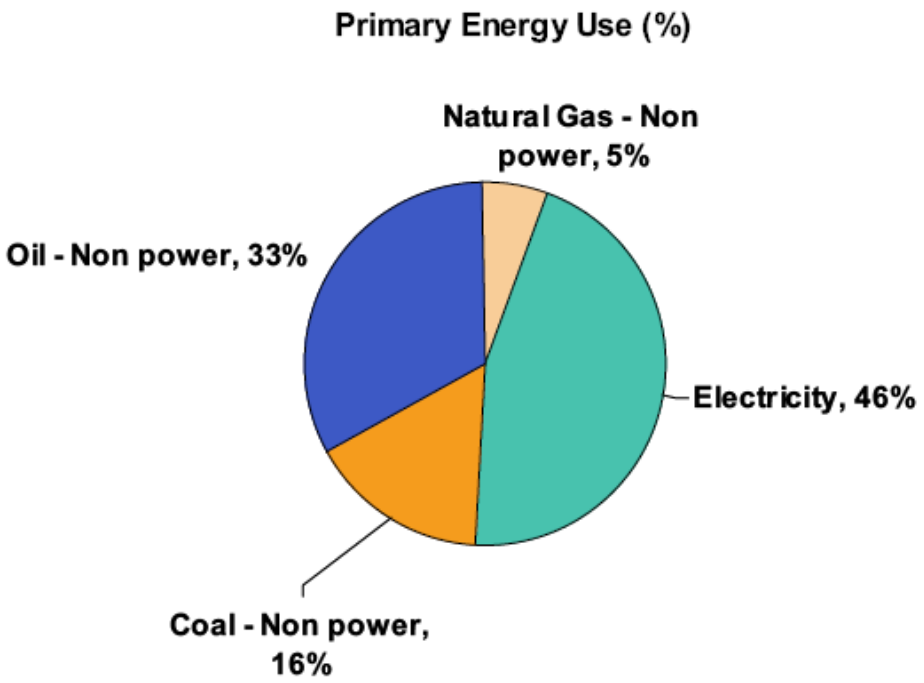
This presentation provides an overview on management of technologies of methane extraction from coal seams as CBM gas, its conversion into CNG fuel and its use for powering the dual fuel (HSD+CNG) Engines of Indian Railways.

Scope of presentation

- Indian Energy Scenario
- Coal Bed Methane
- CBM to CNG
- Powering the Dual fuel engines of Indian Railways
- Benefits of using CBM-CNG

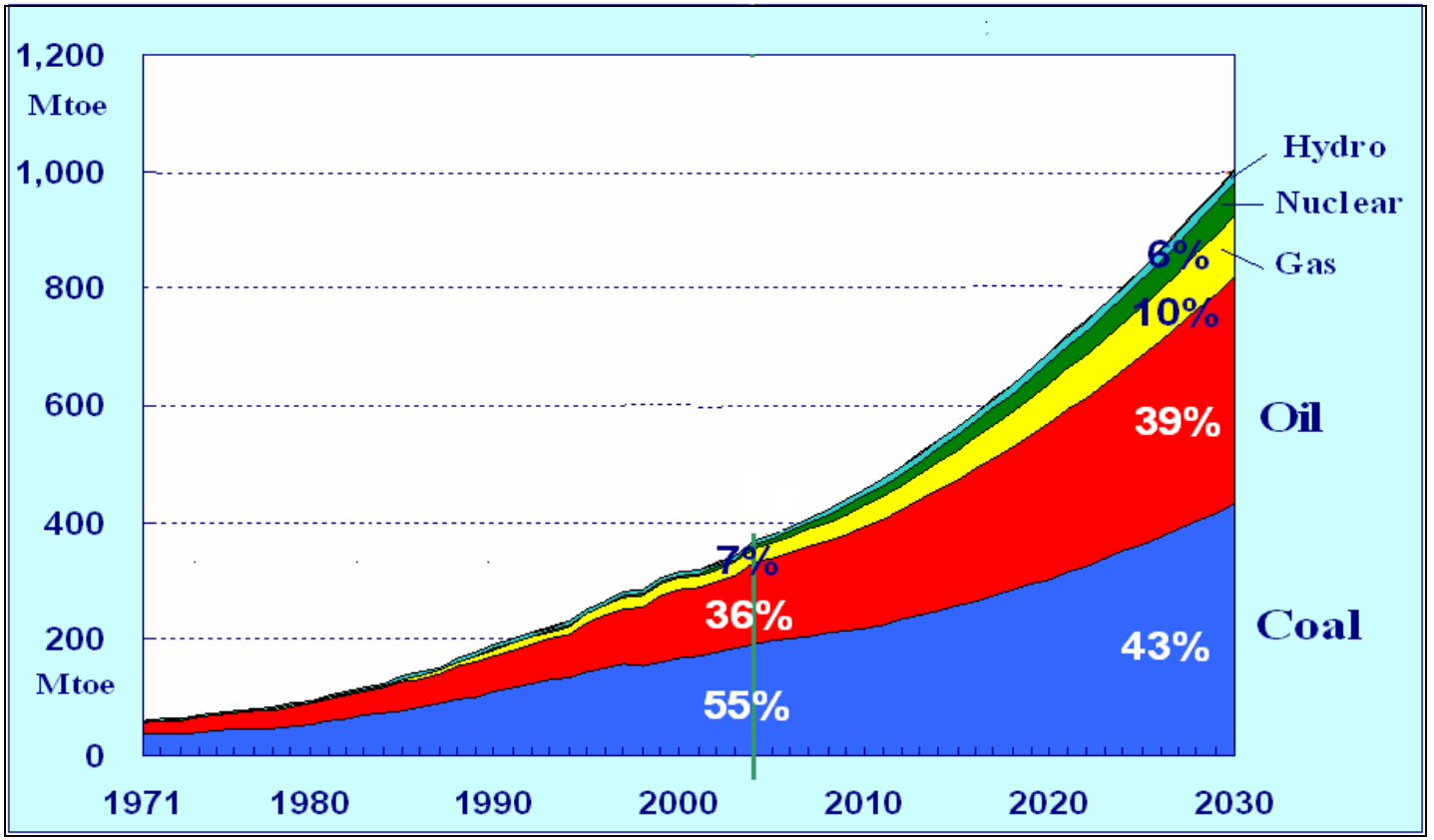
Energy consumption in India : Present





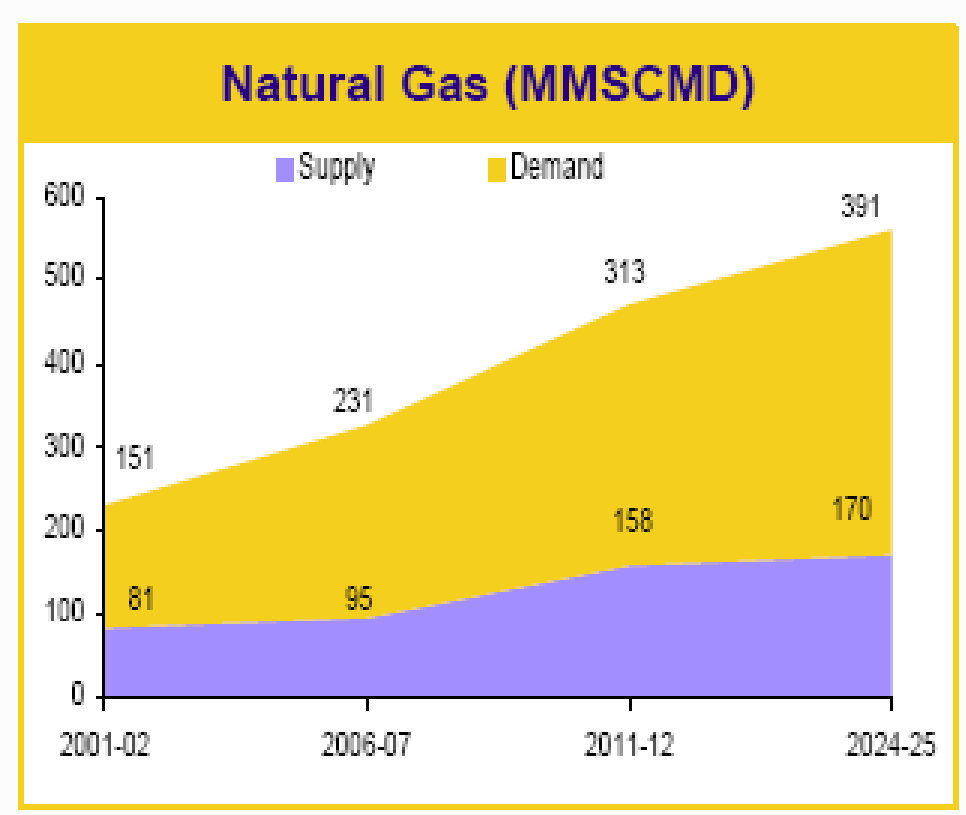
Source: Planning commission of India, 2006

Energy consumption in India : Forecast



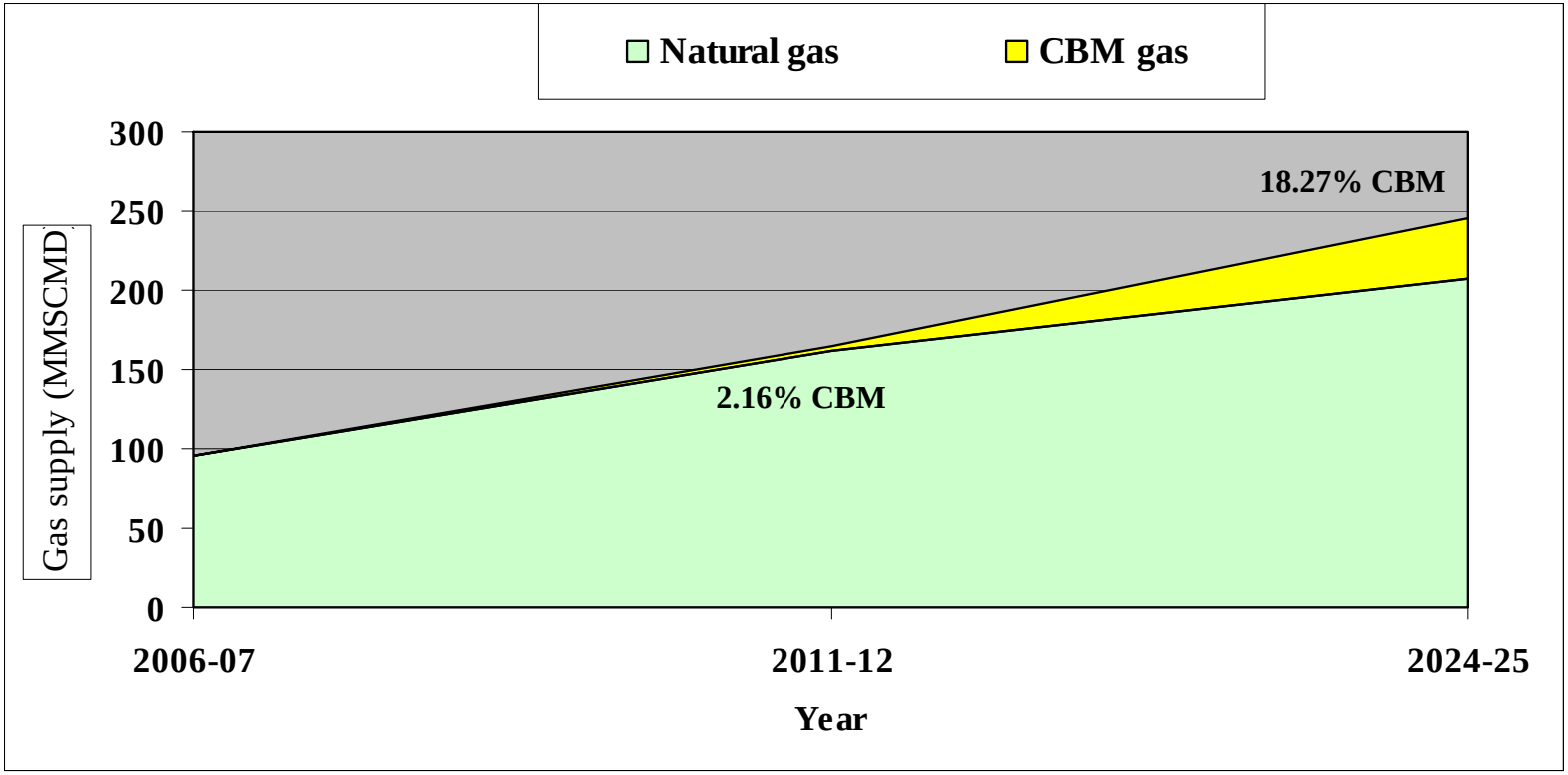
Source: BP statistics, 2006

Natural Gas: Demand Supply Gap in India



Source: RIL annual report, 2007, DGH India

CBM contribution to Natural Gas Supply



Source: DGH presentation, Excerpt from 12th 5 year plan, GoI

CBM Resources in India

Sl. No.	State	Estimated **CBM** Resource (in TCF)
1	Andhra Pradesh	3.5
2	Chattisgarh	8.5
3	Gujrat	12.4
4	Jharkhand	25.5
5	Madhya Pradesh	7.7
6	Maharastra	1.2
7	North East	0.3
8	Orissa	8.6
9	Rajasthan	12.7
10	Tamilnadu	3.7
11	West Bengal	7.7
	TOTAL	91.8

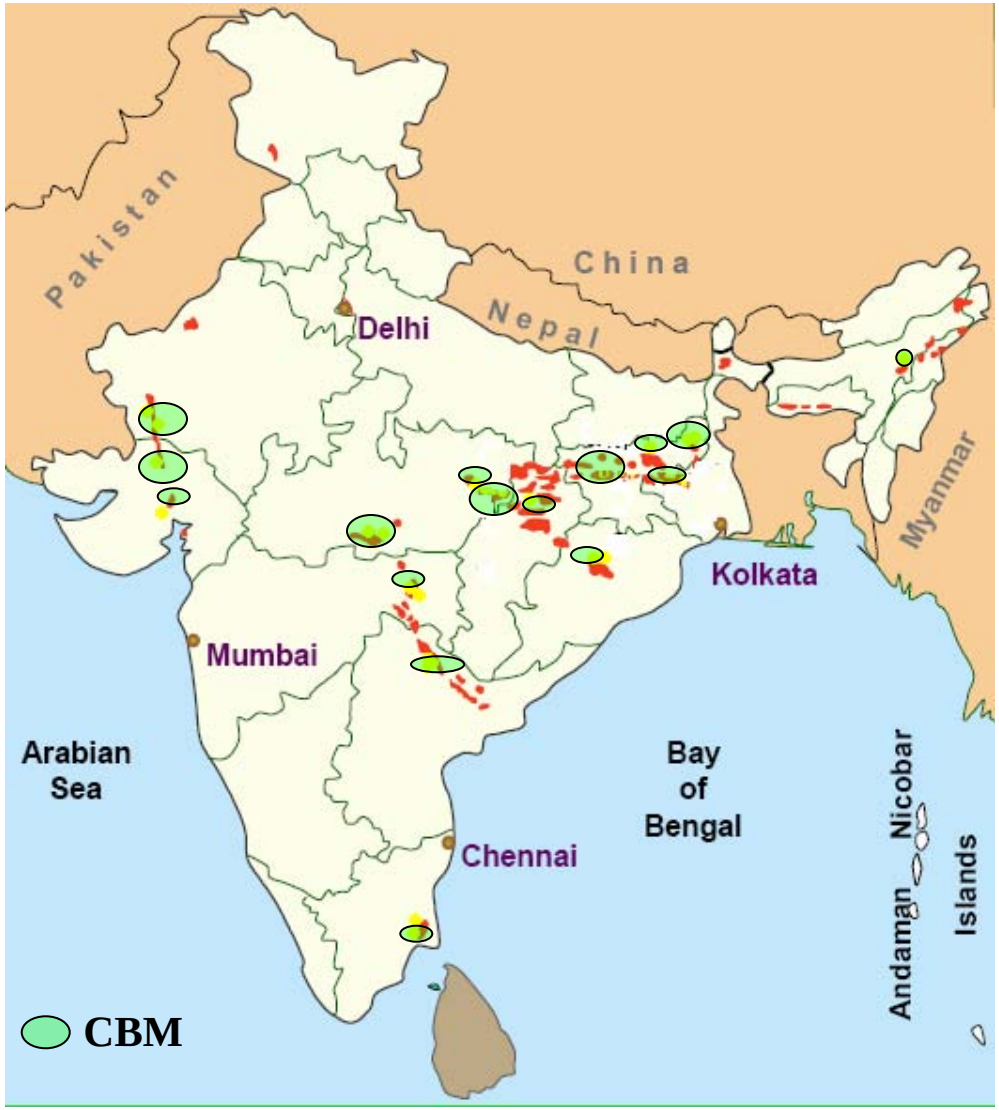
Source: DGH India presentation

CBM Resources of the World

Sl no	Country	Coal Resource (Billion Tonnes)	CBM Resource (Trillion cu. feet)
1	Canada	7000	229 - 2697
2	Russia	6500	469 - 2598
3	China	4000	579 - 1200
4	USA	3970	448 - 900
5	Australia	1700	310 - 510
6	India	495	49.4 - 91.8
7	Germany	320	60.1 - 88.3
8	U.K.	190	38.8 - 60.0
9	Poland	160	49.4 - 70.6
10	South Africa	150	49.4 - 70.6
11	Indonesia	17	3.5 - 7.1
12	Zimbabwe	8	1.4 - 1.8

Source: DGH India presentation

CBM Locations in India



CBM Blocks awarded by Govt. of India

	Block Name	State	Area (Sq.km.)	CBM Resource (BCM)	Expected production (MMSCMD)	Awardees
I. CBM-I						
1	RG(E)-CBM-2001/I	West Bengal	500	42	1.5	EOL
2	BK-CBM-2001/I	Jharkhand	95	45	1.9	ONGC-IOC
3	NK-CBM-2001/I	Jharkhand	340	62	2	ONGC-IOC
4	SP(E)-CBM-2001/I	Madhya Pradesh	495	49.3	1.8	RIL
5	SP(W)-CBM-2001/I	Madhya Pradesh	500	37	1.8	RIL
		TOTAL (A)	**1930**	**235.3**	**9**	
II. Nomination Basis						
6	RANIGANJ (NORTH)	West Bengal	350	43	1	ONGC-CIL
7	JHARIA	Jharkhand	85	85	2	ONGC-CIL
8	RANIGANJ (SOUTH)	West Bengal	210	28	1.5	GEECL
		TOTAL (B)	**645**	**156**	**4.5**	

Source: DGH India presentation

CBM Blocks awarded by GoI

	Block Name	State	Area (Sq.km.)	CBM Resource (BCM)	Expected production (MMSCMD)	Awardees
III. CBM-II						
9	SK-CBM-2003/II	Jharkhand	70	30.5	1	ONGC
10	NK(W)-CBM-2003/II	Jharkhand	267	43.6	1.3	ONGC
11	SH(N)-CBM-2003/II	Chattisgarh	825	33	1.2	RIL
12	ST-CBM-2003/II	Madhya Pradesh	714	29.3	1	ONGC
13	WD-CBM-2003/II	Maharashtra	503	19.9	0.7	ONGC
14	BS(3)-CBM-2003/II	Gujarat	790	87.2	1.3	ONGC-GSPCL
15	BS(1)-CBM-2003/II	Rajasthan	1045	95.1	1.5	RIL
16	BS(2)-CBM-2003/II	Rajasthan	1020	87.2	1.3	RIL
		TOTAL (C)	**5234**	**425.8**	**9.3**	

Source: DGH India presentation

CBM Blocks awarded by GoI

	Block Name	State	Area (Sq.km.)	CBM Resource (BCM)	Expected production (MMSCMD)	Awardees
IV. CBM-III						
17	RM-CBM-2005/III	Jharkhand	469	158	2.5	ARROW-GAIL-EIG-TATA
18	BB-CBM-2005/III	West Bengal	248	50	1.8	BPE
19	TR-CBM-2005/III	Chattisgarh	458	53.78	1.5	ARROW-GAIL-EIG-TATA
20	MR-CBM-2005/III	Chattisgarh	634	119	2	ARROW-GAIL-EIG
21	SP(N)-CBM-2005/III	Madhya Pradesh	609	16.72	0.7	REL-RNRL-GEO
22	SR-CBM-2005/III	Madhya Pradesh	330	31	1	COALGAS-DIL
23	KG(E)-CBM-2005/III	Andhra Pradesh	750	57.2	1.5	REL-RNRL-GEO
24	BS(4)-CBM-2005/III	Rajasthan	1168	82	1.6	REL-RNRL-GEO
25	BS(5)-CBM-2005/III	Rajasthan	739	38	1.4	REL-RNRL-GEO
26	GV(N)-CBM-2005/III	Andhra Pradesh	386	29.9	1	COALGAS-DIL-ADINATH
		TOTAL (D)	**5791**	**635.6**	**15**	
		GRAND TOTAL (A + B + C + D)	**13600**	**1452.7**	**37.8**	

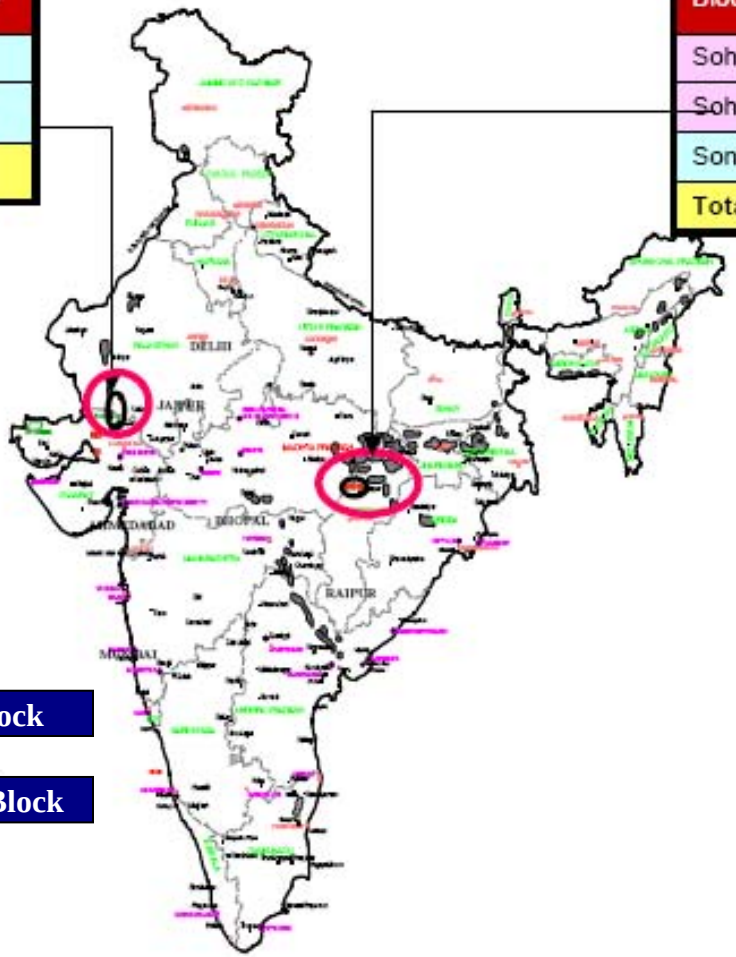
V. CBM-IV
Provisional results (awardees) for 8 of 10 CBM Blocks have been declared. Total area of 5040 Sq Km in 7 states.

Source: DGH India presentation

RIL CBM Blocks

Block Name	(Area Sq. Km)
Rajasthan West	1045
Rajasthan East	1020
Total	2065

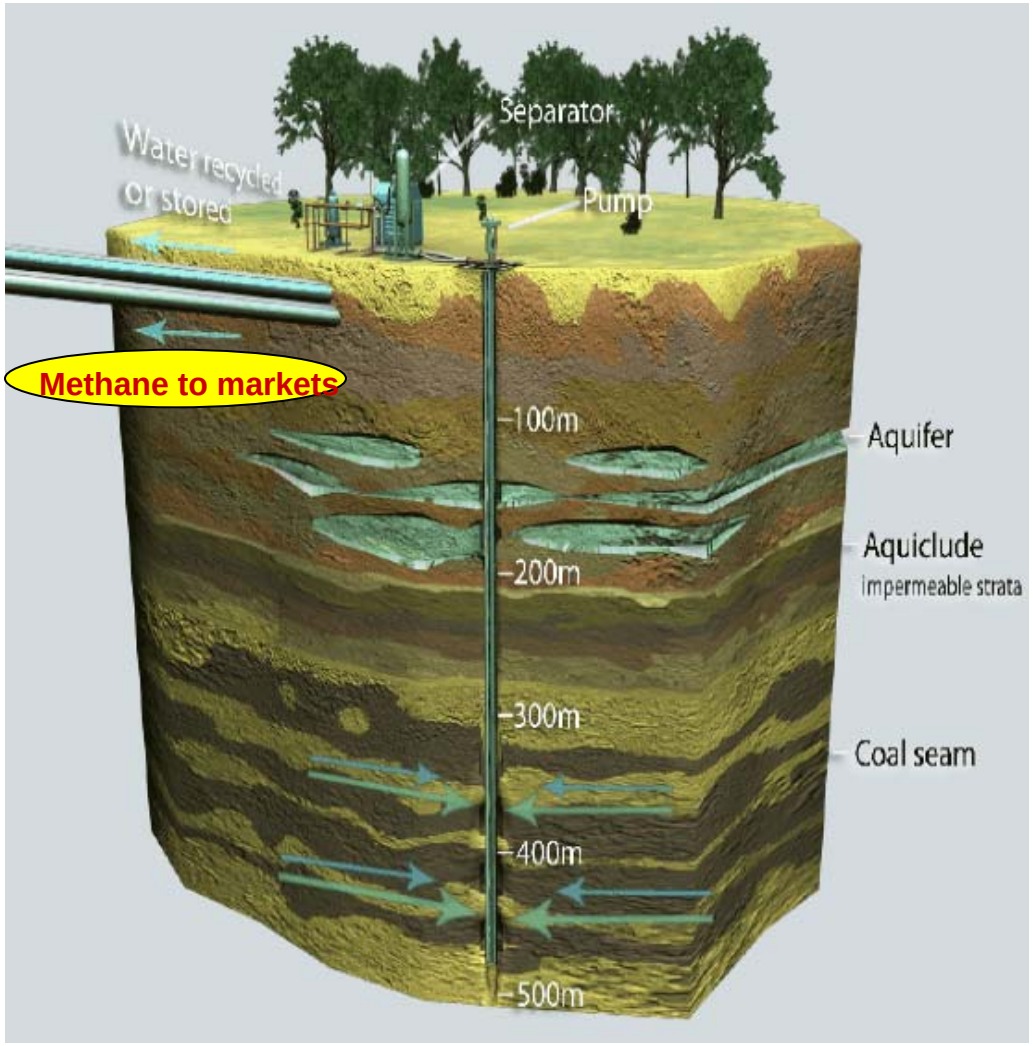
Block Name	(Area Sq. Km)
Sohagpur West	500
Sohagpur East	495
Sonhat	825
Total	1820



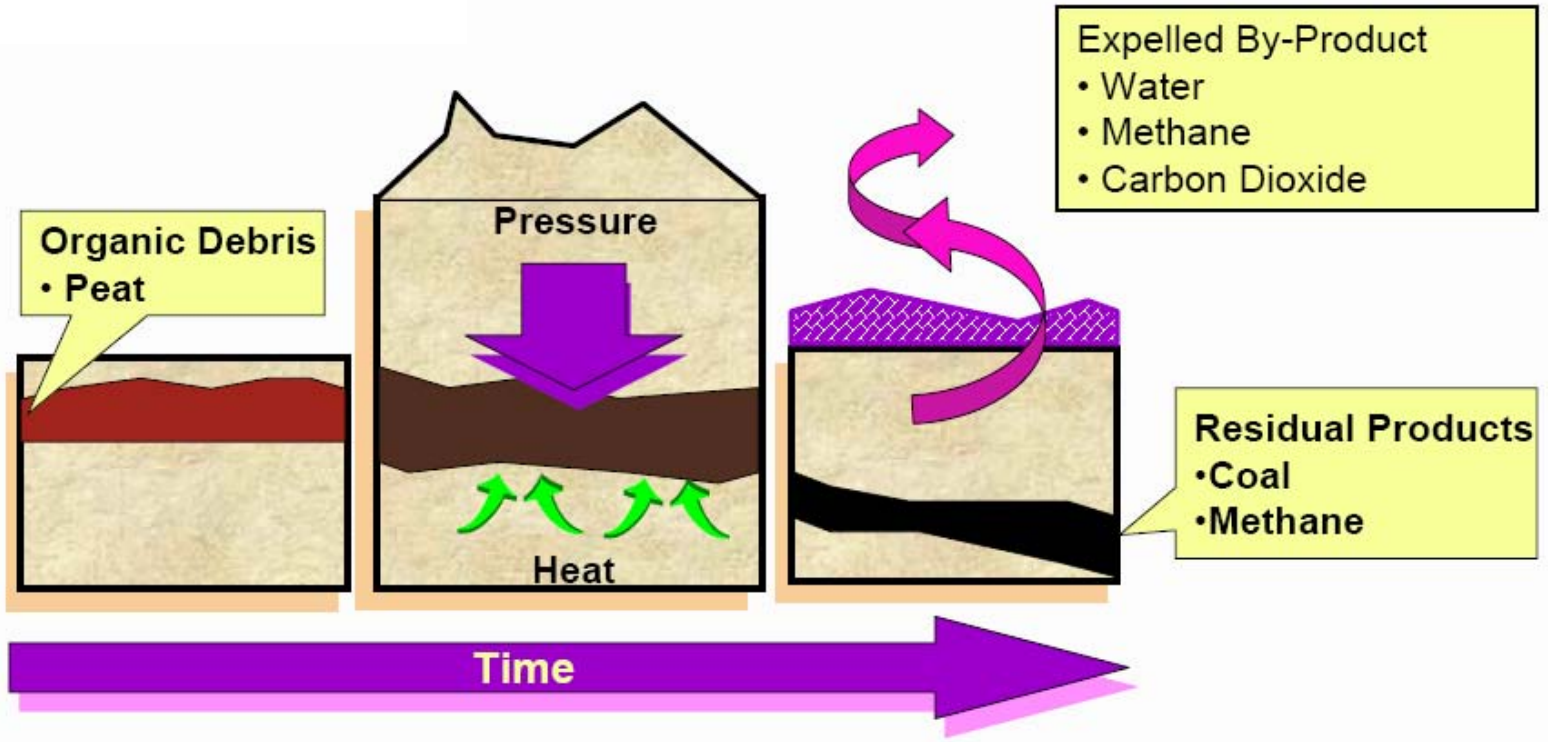
1st CBM round Block

2nd CBM round Block

Extraction of Methane from Coal seams

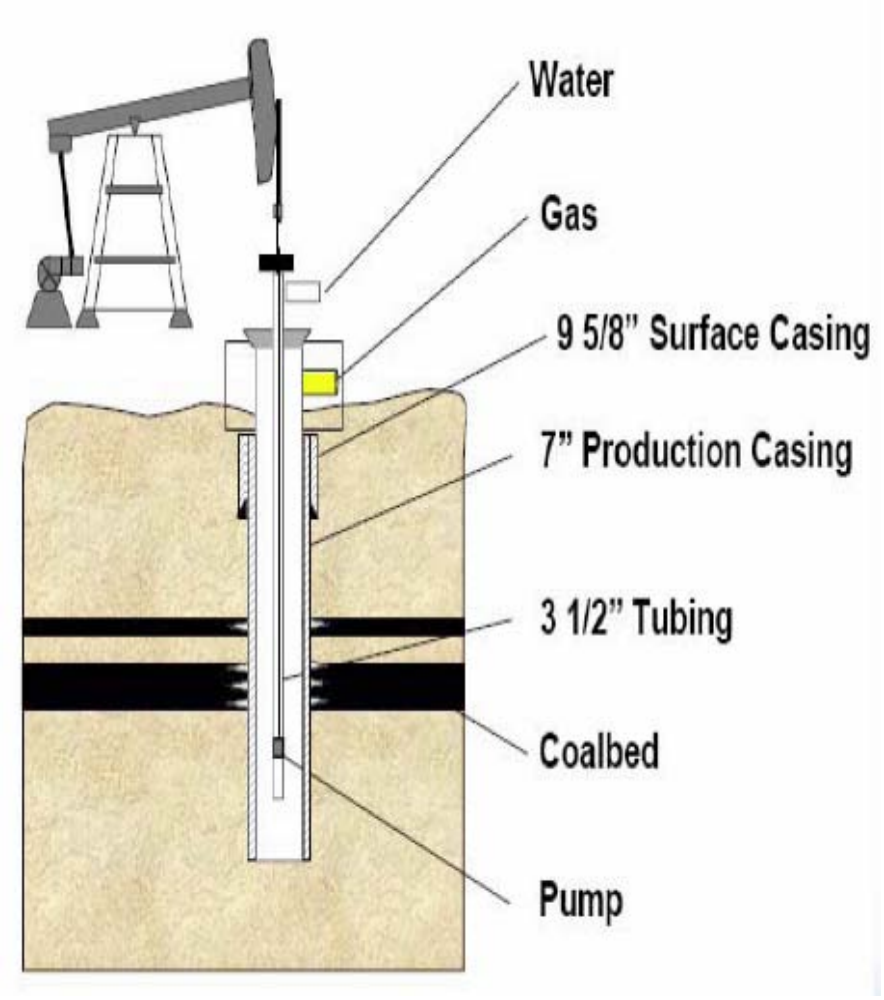


Methane Generation



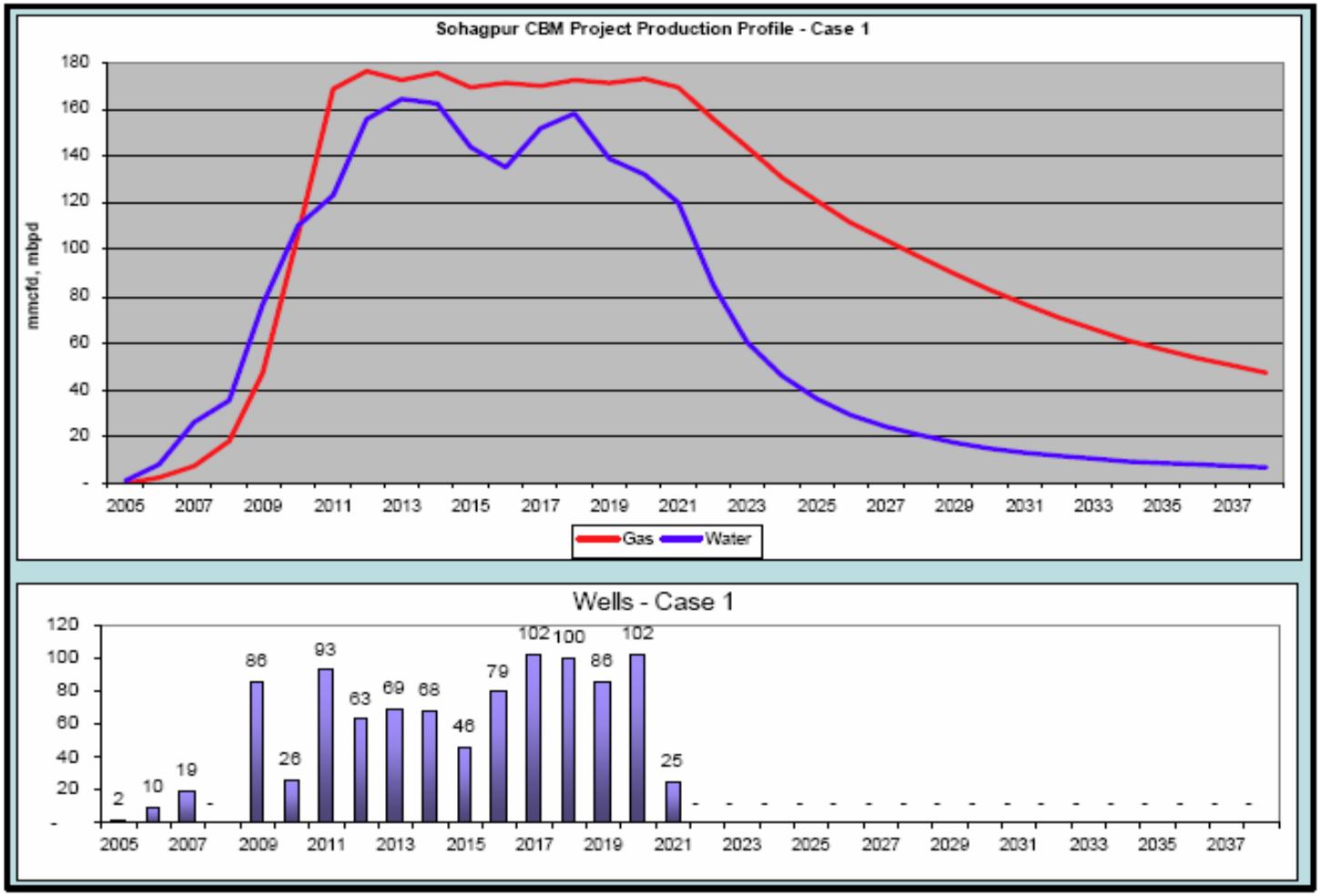
- Methane is associated with all coals
- A tonne of coal can hold 4 to 15 cubic meters of CBM. Higher gas content of 30 to 40 cubic metres are also reported in the US coal basins.

A typical CBM well



CBM surface facility

CBM production profile: Sohagpur Blocks



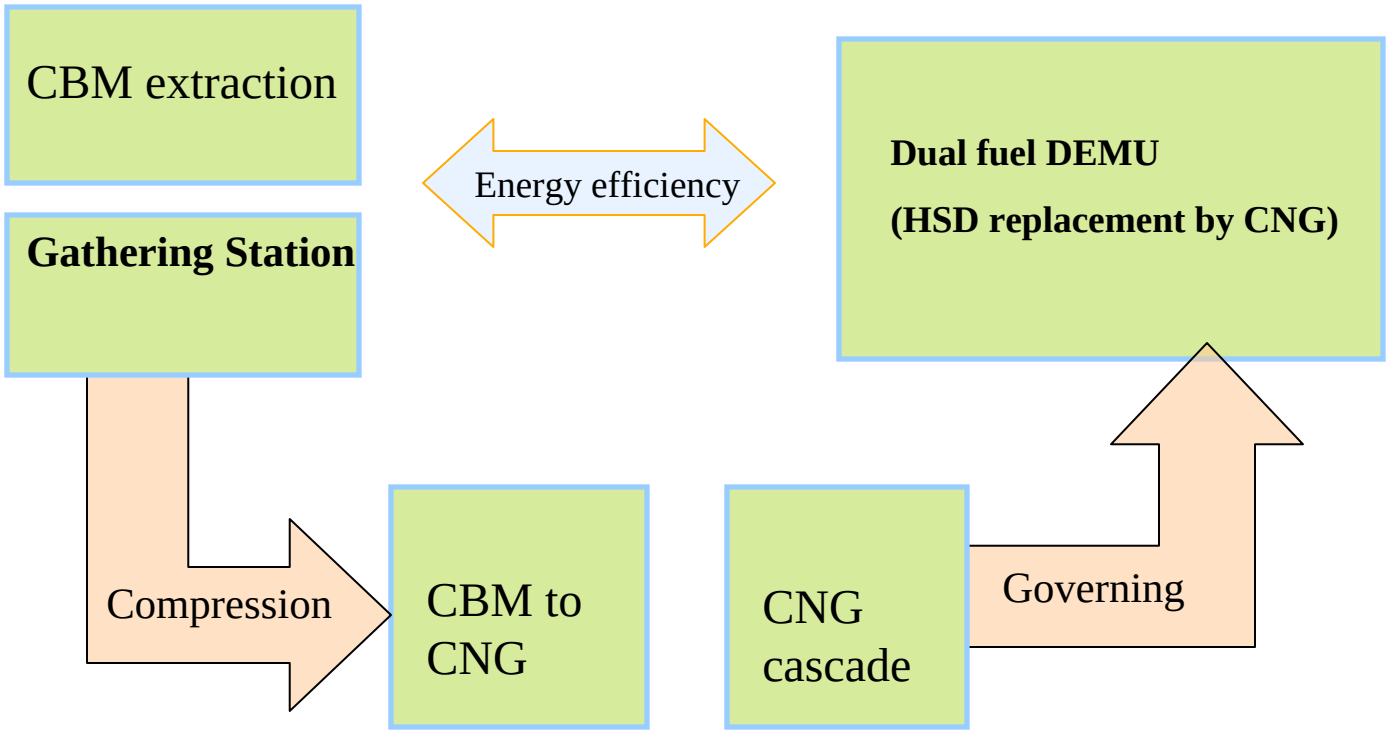
Source: Advanced Resources International Feasibility report, CMPDI website

Why CBM-CNG ?

- CBM resource available across 11 states in the country

- Availability of CBM gas at multiple locations such as Shahdol, Apuppur, Asansol, Mehsana, Durgapur etc.

Conversion of Methane to CNG to engine power



CBM-CNG outlet in operation

RIL has also received CGD and CNG retail rights for Shahdol, MP.

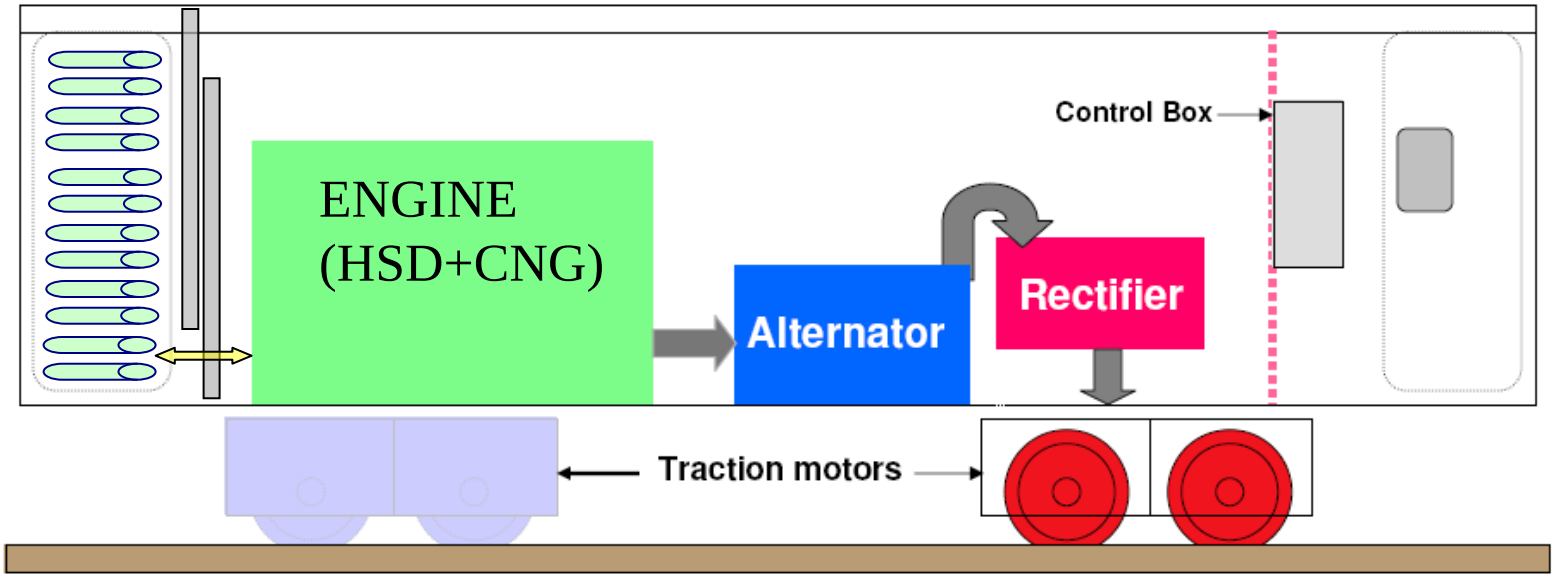
Indian Railways: Annual Energy Consumption

Energy Source	Traction use	Non Traction use	Total use	Energy Bill
Diesel	2.2 bn lts	40 m lts	2.24 bn lts	$ 1.87 bn
Electricity	11 bn units	2.3 bn units	13.3 bn units	$1.25 bn

Year	Total no. of Locomotives	Diesel Engines	%
2007	8153	4816	59
2008	8330	4843	58

Source: Basic statistics 2008-09, MoPNG Economic division report

Dual fuel Engine operation



DEMU (Diesel Electric Multiple Unit)

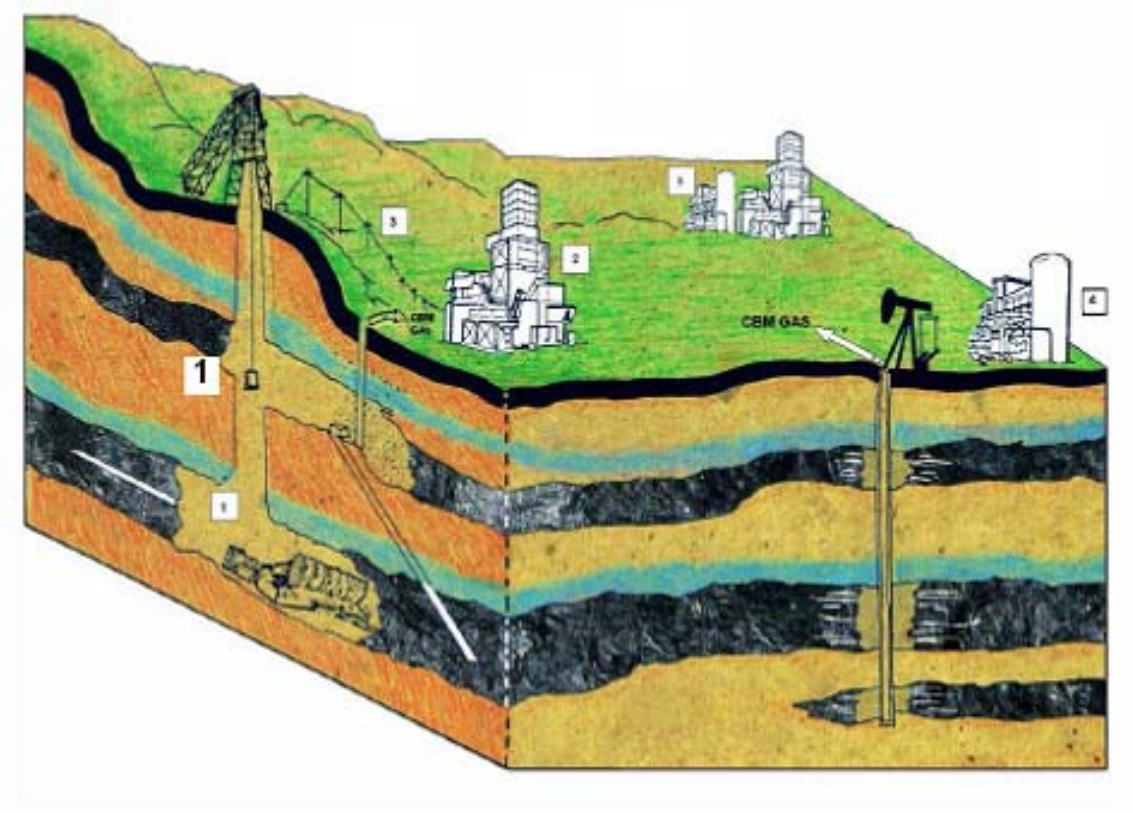
Special safety features in DEMU

- Flame arrester
- Leak detector & auto shut off valve
- Pressure relief devices
- Separate chamber for storage of CNG cylinders, completely isolated from engine room

- Approval from CCoE, Nagpur

CBM: A Mine Hazard Transformed into a Clean Fuel Source

CBM gas similar to natural gas , containing 90-95% methane. CBM removal improves safety and productivity of coal mines.



CNG propulsion : Encouraging facts

- Rail Design & Standards Organisation (RDSO) is modifying existing diesel loco engines to run on CNG. The RDSO was sanctioned Rs 22.3 Cr in Rail Budget 2008-09.

- Indian railways along with Cummins conducted successful trail runs on DEMU 19002 with CNG from its Shakurbasti ***locomotive*** shed in North-West Delhi. Field trails of 2000 KM done.

CNG propulsion : Encouraging facts

- FCCA (Ferro Carril Central Andino) in Peru, is running a CNG Locomotive on a freight line since 2005. Some CNG locomotives are able to fire their cylinders only when there is a demand for power, which, theoretically, gives them a higher fuel efficiency than conventional diesel engines.

- California: The Napa Valley Wine Train converted a locomotive to 60% natural gas and 40% diesel fuel mixture. This converted locomotive was upgraded to utilize a computer controlled fuel injection system in May 2008, and is now using 100% CNG.

Savings per DEMU

- Cost of CBM-CNG is 50-60 % lower as compared to Diesel for unit power.
- With 50% CNG substitution, around Rs 24 lakhs can be saved annually.
- Environmental savings: Priceless.

Path Forward…..

- Existing DEMUs : Conversion to dual fuel engine (HSD+CNG)

- All new DEMUs : manufacture with pure CNG engine.

Benefits of using CBM-CNG

- Environment friendly fuel. Earning of carbon credits.
- Much safer than Gasoline, Diesel fuels or LPG.
- Offers superior drivability even under severe hot and cold conditions as it is already in gaseous state.
- Superior combustion efficiency.

Benefits . . . . .contd.

- Reduces engine wear thus engine life is extended.
- Offers lower maintenance cost.
- Freedom from adulteration by solvents, kerosene or any other harmful substance.
- Produces least CO2 emissions per vehicle kilometer traveled.

Conclusion

The era of CBM Energy in India would improve the environment, reduce the effects of green house gases and shall bring the much needed energy security for sustainable growth.

developing Public Private Partnership . . . .

THANK YOU

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