

METHANE TO MARKETS PARTNERSHIP
COAL SUBCOMMITTEE
PROFILE OF MEXICO

I. INTRODUCTION

- **HISTORY OF COAL MINING.** The history of the coal industry in Mexico, as in other natural commodities, has 2 epochs, which are separated by the Mexican social revolt of 1910. The first record of commercial mining of coal dates back to 1850 in the state of Coahuila. Coal has contributed importantly in the development of industry in Mexico, starting with the development of the railroad industry. Although coal was substituted by oil in the period of 1910 to 1954 it remained a major raw material for the steel industry. The steel industry started formally in 1930, and with it the mining of iron-ore and coal. Coal mining in Mexico increased considerably with the opening of coking facilities in 1954, and in 1959 a fertilizer plant was opened in Monclova that used gas smoked out from the coking facilities. Starting in 1960 the CFE (Mexican Electricity Commission) developed a program on the generation of electricity through two coal-operated thermoelectric power stations, which were finally set up in Nava, Coahuila, from late 70's to early 90's. This program generated a very extensive coal exploration activity in the Fuentes-Rio Escondido Basin of Northern Coahuila and a consequent increase in coal mining activities (Verdugo and Ariciaga, 1991).

The Council of Mineral Resources (now the Mexican Geological Survey) started the exploration of coal and did the first appraisal of coal reserves in the 60's. Several attempts have been made to identify and calculate all the coal resources of Mexico since then, but most of the efforts now have been focused on the largest most economical basins that are located in the state of Coahuila in northern Mexico.

Current total annual production of steam and metallurgical coal of Mexico, is approximately 15.4 million metric tons. 6 million is metallurgical coal and 9.4 is steam coal used locally in Coahuila to generate electricity.

- **GEOLOGY AND CHARACTERISTICS OF COAL.** The geological history of México shows that there have been three events that were suitable for the development and formation of coal beds. The first event happened during the time span from the Upper Triassic to Middle Jurassic Epochs (200 - 170 Ma); the second event of favorable geologic conditions took place at the end of the Late Cretaceous Epoch during the Maestrichtian age (75-65 Ma); and the last third event happened during the Eocene Epoch, Lutetian – Bartonian Age (50 – 40 Ma).

The Triassic – Jurassic event is represented by the coals of Northwest México in the State of Sonora, and the coals present in the South of México in the State of Oaxaca.

The Maestrichtian age event is represented by the higher tonnage coals of the Sabinas and Fuentes – Río Escondido sub-basins in the State of Coahuila; the coals of Ojinaga and San Pedro Corralitos of the Chihuahua State; and the coals of Cabullona in the state of Sonora.

Eocene Epoch coals and lignites are present in the Colombia – San Ignacio region of Coahuila State.

Brunner and Ponce (1999), estimated 12.2 billion metric tons of coal in the Maestrichtian coals in the Coahuila State. Recently the Council of Mineral Resources calculated the total amount of “net coal” present in the Sabinas Sub-basin of Coahuila to be approximately 4.5 billion metric tons. No data is available at present regarding the rest of the sub-basins of Coahuila.

II. OVERVIEW OF CMM POTENTIAL

No publish data has been available so far as to the potential of CBM from the coals of Mexico. It is apparent from the quality of coal that the basins of Coahuila are the most promising sources of CBM, because of their bituminous characteristics and structural setting of the beds.

From the literature it is evident that Minerales Monclova, a mining company that produces a large percentage of the coking coal in Mexico, has been the only company in Mexico that has done research regarding the potential of CMM in the Sabinas Basin. PEMEX, the state-owned oil company, has done several studies on the potential of CBM in the region but their information is not available.

- **Gas content, quality of the gas, and permeability of coals of Coahuila.** Minerales Monclova (Santillan-Gonzalez, 2004) reports an average *in situ* content of gas in the coals of the Sabinas Sub-basin of 10 to 14 m³/t (343 to 480 scf/ton), and from 12 to 18 m³/t (411 to 618 scf/ton) in the coals of the Saltillito Sub-basin. Gas content however varies with depth of the coal, at 180 m its concentration lowers to 8 m³/t (275 scf/ton) in the Sabinas Sub-basin. Methane content in the gas is usually above 97% with lesser amounts of ethane, propane and carbon dioxide. Permeability by natural fracturing data available of the coal beds at 180 meters shows values around 33 md, although these values decrease one order of magnitude at depths over 300 m. The total resources of gas in the Maestrichtian coals of Coahuila is therefore estimated between 1.22 x 10¹¹ m³ and 2.2 x 10¹¹ m³, equivalent to 4.2 to 7.5 Tcf.

- **Opportunities.** Minerales Monclova (MIMOSA) has been draining the coal beds, prior to mining, through in-seam horizontal boreholes since 1992, with efficiency above 30% (Brunner and Ponce, 1999). At present MIMOSA generates from their underground mines an average of 5.2 million m³ of gas per month, 86% is drained off via ventilation, 6% through in-seam directionally drilling boreholes, and 8 % from gob wells (MIMOSA, personal communication). All gas is at present vented to the atmosphere. There is also a VAM Oxidation market in Sabinas as reported in EPA (2003), where it is estimated that a total of 27 MW of net usable capacity is available from oxidation of the VAM being vented by MIMOSA underground mines.

- **Present Projects for use of CMM and CBM.** At present because of present Laws and Regulations in Mexico, the exploration, recovery and sale of methane, regardless of its origin, is restricted to PEMEX, the oil state-owned company. Therefore no CBM, CMM, AMM or VAM projects have been developed in the country. Nevertheless MIMOSA, aware of the deleterious effect of venting

methane to the atmosphere, has been preparing for almost a decade an integral project to recover and use some of the gas drained from their underground mines and has been working with the Federal Administration to implement the project under the present rules.

III. CHALLENGES

- **Legislation.** Currently the Mexican Constitution and the Law that regulates the Article 27th regarding hydrocarbons states that all hydrocarbons belong to the nation and its exploration, recovery, processing and sale of them has to be handled by PEMEX. Since methane is a hydrocarbon, although not necessarily related to oil in its origin, it has been a CBM controversy among the administrators and legislators of Mexico, not so much on its ownership that is no doubt of the Nation, but regarding its recovery and use when it originates from coal mining. Because of its importance as an energy source that is being vented to the atmosphere, its effect in global warming as a greenhouse gas, its toxic effect on miners and its explosive character under mining conditions, the present Federal Administration of Mexico together with interested Congressmen and Senators are looking for forms to modify current legislation without changing the spirit of the Constitution regarding the ownership of the methane. A bill is being prepared and discussed at present to be introduced this year to Congress for the coal miners to have the right to use CMM to generate heat or electricity on site.
- **Kyoto Protocol.** Mexico adopted the Kyoto Protocol in December of 1997 and ratified in September of 2000. It is the intention of the Federal Government to do all that is possible to diminish the amount of methane flush from coal mining to the atmosphere.

IV. MARKET ASSESSMENT.

- Mexico has not calculated the total amount of methane that is liberated to the atmosphere from coal mining. As mentioned above, MIMOSA, one of the largest underground producers of the Sabinas area, discharges to the atmosphere approximately 65 million m³ (2.2 bcf) of gas per year out of its underground mines. Given the proper legislation most of this gas can be recovered to produce electricity for local consumption of the mine operations and the remnant sold to CFE, the state-owned electricity company.
- At present no tax credits or benefits of any kind are being planned for those mining companies that could recover the gas and use it. If future regulations allow the recovery and use of the CMM at the Mines location, all investments related to these projects will have to be carried out by the private companies, with help of international CO₂ credits that can be obtained from other countries.

V. OUTLOOK AND SUMMARY

- The future recovery and use of methane from gas expelled from the underground mining operations in Mexico will come from the Maestrichtian (Cretaceous) bituminous coals of northern Mexico, and most importantly from the Lampacitos and Sabinas Sub-basins of the state of Coahuila.
- All uses of methane, because of its economics will probably be for the local generation of electricity.

- The Federal Government, with the help of the legislators is trying to put together a bill that would allow coal miners to recover and use the methane contained in the CMM.
- If proper legislation goes forward as expected, companies will accomplish their projects, and will take advantage of the emissions trading program and the Methane to Markets Partnership to improve the economics of the projects.

VI. REFERENCES

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