

# **STATUS OF CBM IN MEXICO**

**By**

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**I. HISTORY OF COAL MINING IN MEXICO.** The modern history of coal mining in Mexico dates back to the second half of the XIX century. It was first mined in 1850 for the use in the vapor railroad locomotives. In post revolutionary times coal was slowly replaced by oil and its byproducts, and its use was limited to the steel industry (Consejo de Recursos Minerales, 1994). In 1960 the CFE (Federal Commission of Electricity) gave birth to a project for the use of coal to generate electricity. A small power plant of 37.5 MW was put in operation in 1964 in order to test the project, and from the late 70's to early 90's two new coal-powered electrical plants were constructed, José Lopez-Portillo and Carbon II that supply 1,200 MW and 1,400 MW respectively to the national net. Both plants were designed to consume the local coal present in the Fuentes-Rio Escondido basin of the North of Coahuila State (Verdugo y Ariciaga, 1991). A parallel government owned thermal coal mining company (MICARE) was developed to feed the power plants, that later was sold to a private enterprise.

## **II. GEOLOGY, CHARACTERISTICS AND COAL PRODUCTION**

Three geological events generated coal seams in Mexico. The first corresponds to the Late Triassic-Middle Jurassic, the second to the Late Cretaceous and a third to the Eocene. The anthracitic coals of Oaxaca and Sonora belong to the Triassic-Jurassic event and have little economic importance because of its structural set up. The coals of the basins known as Sabinas and Fuentes-Rio Escondido in Coahuila, Ojinaga and San Pedro Corralitos in Chihuahua, and Cabullona in Sonora belong to the Cretaceous event. The lignite seams of Colombia-San Ignacio in Coahuila belong to the latest event of the Eocene. The types of coal and its quality are described in Table 1.

Economic production at present is mostly from the state of Coahuila with a coal out-of-the-mine production of approximately 6 Mt of thermal coal and 6 Mt of metallurgical coal.

### **III. - COAL RESERVES**

The Council of Mineral Resources (now the Mexican Geological Survey, SGM) started the exploration of coal in Mexico and calculated the first reserves in the 60's. At present the SGM is updating their calculations regarding coal reserves of Coahuila.

Brunner & Ponce (1999) calculated resources of 12.2 billion t of coal from the Cretaceous coals of Coahuila. Recently the Mexican Geological Survey determined a net-coal resource of the Sabinas Basin of 4.5 billion t. There are no formal calculations of the coal resources of the rest of the basins.

### **IV. - CBM POTENTIAL OF MEXICO**

It is evident from their bituminous coal characteristics that the most promising sources of CBM in Mexico are at the Coahuila Cretaceous basins. The first test for degasification of the coals for mining dates back to the 1940's. More recently, in the early 90's the Pasta de Conchos Mine started a degasification program due to >1% concentration of methane in its ventilation air; the program consisted of horizontal drilling of seams prior to mining ([www.epa.gov/coalbed/intl/mexico.html](http://www.epa.gov/coalbed/intl/mexico.html)). Minerales Monclova has been one of the companies more active in degasification processes of their coal mines and has evaluated the feasibility of CMM recovery in the Coahuila basin (Santillán, 2003). PEMEX has done preliminary studies regarding the potential of CBM in the coals of Coahuila but unfortunately the results have not been published.

#### **IV.1. - Contents and quality of gas, and permeability of coals of Coahuila.**

Minerales Monclova reports contents *in situ* of gas in coals of the Sabinas basin in the range of 343 to 480 scf/t, and of 411 to 618 scf/t in the coals of Saltillito basin. The content of gas varies with depth of the seam being 275 scf/t at 180 m depth. The composition of the gas is in average 97% methane with minor amounts of ethane, propane and CO<sub>2</sub>. Permeability of the seams at 180 m depth is 33 md; however values decrease an order of magnitude at 300 m. (Santillán G., 2004).

**IV.2. - Methane vented to the atmosphere.** At present Minerales Monclova (MIMOSA) is venting to the atmosphere an average of 2.2 Bcf of gas per year, 86% via ventilation,

6% through horizontal drilling and 8% through vertical drilling of AMM. (MIMOSA, personal communication).

The total calculated emissions of methane to the atmosphere in Mexico in 2005 are 5.3 billion cf per year. (Scheehle, 2002).

#### **IV.3. - Resources of CBM in Mexico.**

Scout & Ambrose (2003) estimated, based on an average content of 300 scf/t, a resource potential of CBM for the Coahuila basins coals of 8.8 Tcf.

Based on the average content of CBM in the Sabinas and Saltillito basin given by Santillán (2004) and the calculated resources of coal for the Coahuila Maestrichtian coals we have calculated a CBM resource for these two basins in the range of 4.2 a 7.5 Tcf.

#### **V. MEXICAN LEGISLATION**

Article 27 of the Constitution of the United States of Mexico and its Ruling Law on the Subject of Hydrocarbons, states that all hydrocarbons belong to the Nation, and its exploration, recovery, processing and sales can only be managed by PEMEX. Since CBM is a hydrocarbon, although not related to oil as such, the methane can not be used by the coal miners and has to be vented to the atmosphere.

PEMEX has no economic interest for the CBM in Mexico due to the small size of the business and the lack of gas ducts in the Coahuila coal region. Production of natural gas by PEMEX amounts to 4.5 Bcf/day, while CBM potential production is 3 orders of magnitude smaller. CBM potential resources of Coahuila are less than 13% of the natural gas resources calculated by PEMEX.

México adapted the Kyoto Protocol under the Convention Framework of the Climatic Change of the UN in 1997 and ratified it in 2000, and therefore Mexico is committed to reduce the emission of greenhouse gases.

Members of Congress and the executive branch of the Federal Government of Mexico in the last five years have worked together to solve the legislation problem in order to stop the venting of methane to the atmosphere from different sources including the coal mining. Following is a description of events regarding those activities.

- Senator Verónica Velasco Rodríguez from the PVEM presented an amendment to the Mining Law in June 18<sup>th</sup> of 2003 that would have allowed the coal mining concessionaries the right to recover, use, store or sale the methane gas to PEMEX (Parliament Gazette No. 7, 2003-06-18). On October the 19<sup>th</sup> of the same year the proposed amendment was approved by the Senate and the Amendment was sent to Congress for their ratification.
- Congress discussed the amendment and modified in such a way that became economically not feasible the commercial extraction of methane; additionally it forbade the use of the gas by the coal miners. Congress sent back the modified initiative to the Senate on December, 28 of 2003, where although not rejected was not considered any further and was filed.
- Several other unsuccessful attempts were made during 2004 and 2005 by the Executive Branch of the Government to introduce changes in the Mining Law that would allow the use of CBM by the coal miners, under the premise that methane is a byproduct of the coal mining operations.
- On late February 2006 there was a catastrophic explosion at the Pasta de Conchos coal Mine in Coahuila, that killed 65 miners and brought the attention of the media to the dangers of CBM in coal mining and the venting of it to the atmosphere.
- On March 9 of 2006 an Amendment to the Mining Law was approved by Congress and sent to the Senate for their review and approval. Because of the importance of the degassing process to the security of the coal miners Senate acted immediately on it, and on the 20<sup>th</sup> of April of 2006 the amendment was approved by the Senate without any modifications.
- The amendment to the Mining Law mentioned above allows the coal miners to recover and use the CBM, CMM, AMM and VAM from their coal mining operations for any purpose chosen, and if the business is feasible allows the concessionaries to sell the gas to PEMEX through a contract. At present the

Ministries of Economy and Energy are working together on the proper ruling of the amendment and it is expected that will become available by the third quarter of this year. The basis for the use of methane by the miners, or sale of it to PEMEX, will be through a permit that will be issued by the Ministry of Energy, after the previous approval of the plan for development and degassing of the mine by the Under-Secretariat of Mines of the Ministry of Economy.

## **VII. CONCLUDING REMARKS**

CBM, CMM, AMM, and VAM have been vented to the atmosphere since coal mining started in Mexico in the XIX century. Since the adoption of the Constitution of 1917 all hydrocarbons have been considered to belong to the Nation and the Ruling Law regarding hydrocarbons indicates that the recovery and use of hydrocarbons can only be conceded to PEMEX, a government oil company. PEMEX has not been interested in the business of CBM because of the size of the business. This legislation has impeded the recovery and use of CBM from coal mining. There have been many efforts for more than a decade from private industry to change legislation to be able to recover methane from coal mining. Some legislators and the executive branch of the Mexican Government have added their efforts with the same goal, with no results up to 2005. The new legislation in 2006 opens a new era for the recovery of CBM and its use in Mexico. The amendment to the Mining Law and its regulation will become available for use on the third quarter of 2006 and will allow the coal miners to reduce the emission of methane to the atmosphere by 2007. Because of the long term interest of the Mexican mining industry to initiate the recovery and use of methane from their coal mining operations, and the interest of the Federal Government to reduce the methane vented to the atmosphere and the use of this source of energy, we have no doubts that our participation in the Methane to Markets Partnership will bring help to the industries to achieve their goals, mostly by helping to identify developers and/or financiers for the recovery and use of the methane to generate electricity.

TABLE 1. CHARACTERISTICS AND RESOURCES OF OUT-OF-THE-MINE COAL IN MEXICO. (After Flores-Galicia, 1991)

SITE	CARBON %	VOLATILES %	ASH %	TOTAL SULPHUR %	H <sub>2</sub> O %	CALORIFIC VALUE BTU/lb	RESOURCES IN SITU (MILLION t)
SABINAS-SALTILLITO-MONCLOVA SUB-BASINS, COAHUILA	45.61	16.97	40.43	1.0	1.26	13,000	2556
FUENTES-RIO ESCONDIDO BASIN, COAHUILA	32.07	30.50	33.27		4.16	8,246	1216
COLOMBIA-SAN IGNACIO BASIN, COAHUILA	32.4	42.6	44.0	3.5	4.10	11,140	252
MIXTECA BASIN, OAXACA. AREAS: - PLAZA DE LOBOS - PLANCHA-EL CONSUELO - SAN JUAN VIEJO	31.11 29.75 40.14	6.92 6.02 10.07	60.30 63.11 49.13	0.26 0.25 0.28	1.05 0.82 0.47	? ? ?	1625
BARRANCA BASIN, SONORA	77.3	4.8	10.6	0.37	8.0	11500	143
CABULLONA BASIN, SONORA	67.45	9.92	18.86	0.00	3.76	9055	80
SAN PEDRO CORRALITOS BASIN, CHIHUAHUA	27.37	26.75	45.86	0.34	18.2	?	90
TOTAL							4432

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