

8 COLOMBIA



8.1 Summary of Coal Industry

8.1.1 ROLE OF COAL IN COLOMBIA

Coal accounted for 8 percent of Colombia's energy consumption in 2007 and one-fourth of total exports in terms of revenue in 2009 (EIA, 2010a). Production trends indicate that coal could become the country's largest export product (M2M-Colombia, 2005). Colombia is the fourth largest world coal exporter, behind Australia, Indonesia and Russia, and provides 6.9 percent of the world's coal exports (EIA, 2010b). It exports 97 percent of its domestically produced coal, primarily to the United States, the European Union, and Latin America (EIA, 2010a).

Colombia had 6,814 million tonnes (Mmt) of proven recoverable coal reserves in 2009, consisting mainly of high-quality bituminous coal and a small amount of metallurgical coal (Table 8-1). The country has the second largest coal reserves in South America, behind Brazil, with most of those reserves concentrated in the Guajira peninsula in the north (on the country's Caribbean coast) and the Andean foothills (EIA, 2010a). Its reserves of high-quality bituminous coal are the largest in Latin America (M2M-Colombia, 2005).

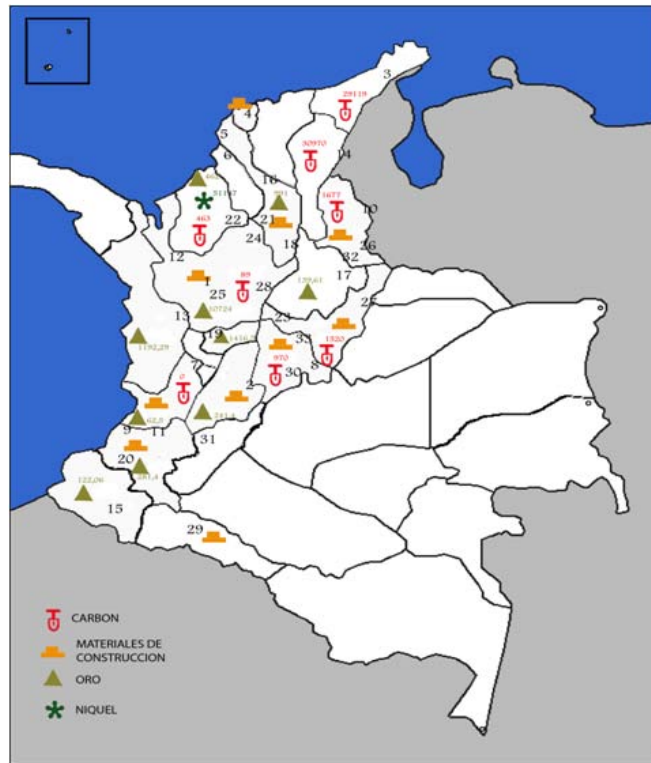
Table 8-1. Colombia's Coal Reserves and Production

Indicator	Anthracite & Bituminous (million tonnes)	Sub-bituminous & Lignite (million tonnes)	Total (million tonnes)	Global Rank (# and %)
Estimated Proved Coal Reserves (2009)*	6,434	380.0	6,814.0	11 (0.8%)
Annual Coal Production (2009)	72.1	0	72.1	12 (1.4%)

Source: BP (2010)

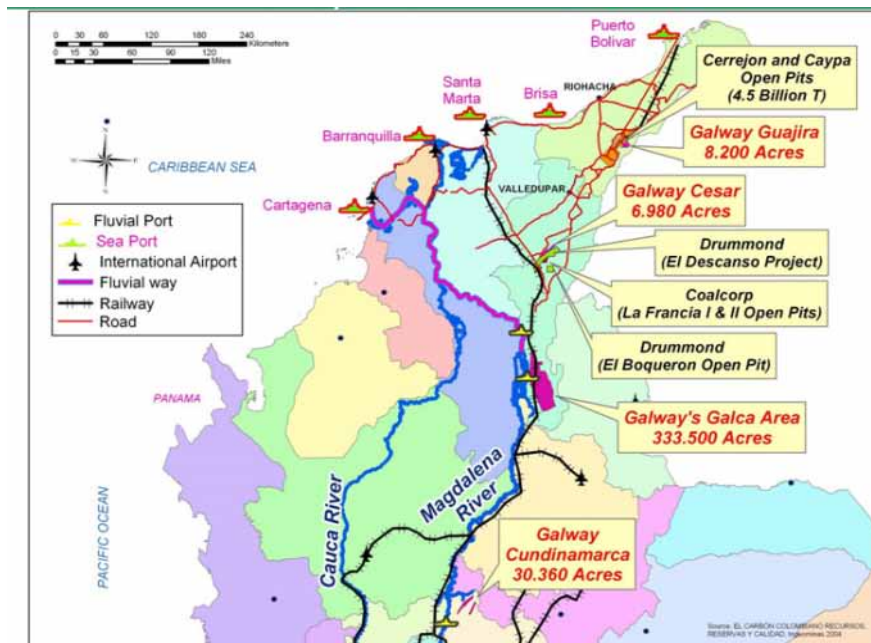
Coal production for export occurs mainly in the northern states of Guajira (Cerrejón deposit) and Cesar, and in Cordoba, but there also are widespread small and medium-size coal producers in Norte de Santander (metallurgical coal), Cordoba, Santander, Antioquia, Cundinamarca, Boyaca, Valle del Cauca, Cauca, Borde Llanero, and Llanura Amazónica (MB, 2005; M2M-Colombia, 2005). Figures 8-1 and 8-2 illustrate the locations of coal deposits and mines in Colombia.

Figure 8-1. Map of Colombian Minerals



Source: ANDI (2010)

Figure 8-2. Map of Colombian Coal Mines



Source: Galway (2007a)

8.1.2 STAKEHOLDERS

Table 8-2 lists potential stakeholders in Colombia's coal mine methane (CMM) industry.

Table 8-2. Key Stakeholders in Colombia's CMM Industry

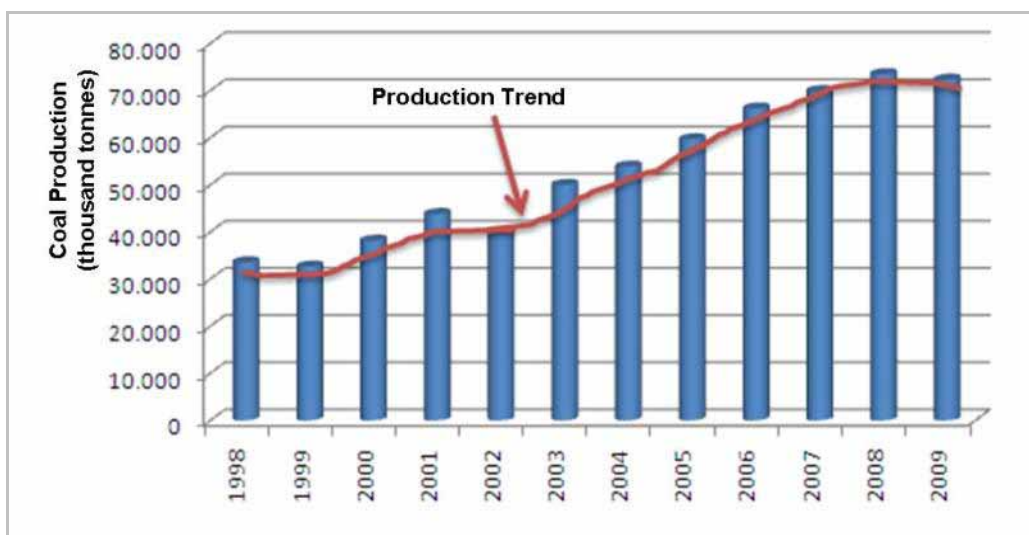
Stakeholder Category	Stakeholder	Role
Mining Companies	<ul style="list-style-type: none"> ▪ Prodeco (owned by Xstrata) ▪ Carbones de La Jagua (owned by Glencore) ▪ Cerrejón Coal Company (joint venture of Anglo American [AA], BHP Billiton [BHB], and Xstrata) ▪ AA ▪ BHB ▪ Glencore International ▪ Vale SA ▪ Carbones del Cerrejón LLC ▪ C.I. Prodeco S.A. ▪ Carbones de La Jagua S.A. ▪ CoalCorp ▪ Drummond Ltd. ▪ Acerías Paz del Río, S.A. 	Project hosts
Equipment Manufacturers	<ul style="list-style-type: none"> ▪ Wood Group Power Solutions, Inc. (part of the Gas Turbine Services Division of John Wood Group PLC) ▪ GE Transportation Systems – Electric drive systems (loaders and haulage) ▪ Goulds Pumps – Slurry and process pumps (pumps, compressors, valves and actuators) ▪ Grindex – Submersible drainage, sludge and slurry pumps (pumps, compressors, valves and actuators) ▪ Hansen Transmissions – Gear units and power transmission products (power supply, engines, transmission and drives) ▪ Voith Turbo GmbH & Co. KG – Start-up components (power supply, engines, transmission and drives) 	Methane treatment and utilization equipment
Developers	<ul style="list-style-type: none"> ▪ See http://www.epa.gov/coalbed/networkcontacts.html 	Project opportunity identification and planning
Engineering, Consultancy, and Related Services	<ul style="list-style-type: none"> ▪ See http://www.epa.gov/coalbed/networkcontacts.html 	Technical assistance
Natural Gas Transmission & Distribution Companies; Power Companies	<ul style="list-style-type: none"> ▪ Andina Electrica ▪ Gas Natural Fenosa 	Pipeline sales for power generation
Natural Gas Production and Transport	<ul style="list-style-type: none"> ▪ Chevron ▪ Ecopetrol 	
Universities; research facilities	<ul style="list-style-type: none"> ▪ Colombia National University – Mining Department ▪ Colombia Institute of Geology and Mining 	
Government Groups	<ul style="list-style-type: none"> ▪ Ministry of Mines and Energy ▪ National Agency of Hydrocarbons (ANH) ▪ Energy and Gas Regulatory Commission (CREG) 	Regulation and policymaking

Source: MT (2007)

8.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

Colombia's coal production has been steadily rising, and over the past decade, has more than doubled from 32.8 Mmt in 1999 to more than 72 Mmt in 2009, as shown in Figure 8-3. The 2009 global recession led to a production decrease for the first time since 2002, but it is expected that Colombia's coal production will continue to increase in coming years as exploration and profitable developments continue throughout the north and interior of the country. Colombia is recognized for its vast, high grade coal resources along with its highly motivated and skilled labor force.

Figure 8-3. Colombia Historical Coal Production



Source: ANDI (2010); BP (2010)

Colombian coal mines are privately owned. Tables 8-3 and 8-4 list available specifics on Colombia's coal mining companies as of 2009. The Cerrejón Coal Company operates the Cerrejón Zona Norte Project, the largest coal mining operation in Latin America. It consists of three shareholding entities: Anglo-American, BHP Billiton, and Xstrata (leased from Glencore, which in turn purchased ExxonMobil's 50 percent stake in 2001). The open pit mine produces 28.4 Mmt per year (2006) and plans to increase production up to 50 Mmt per year are being considered, owing to the \$1 billion investment by Carbones del Cerrejón (MT, 2007).

The country's second largest coal mine, La Loma, is a mine-railway-port project operated by Drummond, which produced 21.7 Mmt in 2009 (Drummond, 2010). In 2008, Colombia gave Drummond permission to open the El Descanso Mine, which is expected to produce 6 Mmt in 2010 (Fox Business, 2010). Also in 2008, Galway began drilling exploration in the Carboluis project in San Luis Coal basin located in Santander, Colombia—an area with some 300 Mmt of coal (Galway, 2007b)—but the company has put that project on hold while it looks for equity partners (Union, 2010).

Colombia's coal is relatively clean-burning, with a sulfur content of less than 1 percent.

Table 8-3. Major Colombian Coal Producing Companies\Regions

Mine	Production in 2009 (million tonnes)
Cerrejón Coal Company	30.2
Drummond	20.6
Prodeco	10.2
Otros	3.8
Boyacá	2.2
Cundinamarca	2.4
Norte de Santander	2.0
Total	72.3

Source: ANDI (2010)

Table 8-4. Major Colombian Coal Mines

Mine	Type	Location	Owner	Production (million tonnes/ year)	Mineable Reserves (million tonnes)
Cerrejón Zona Norte	surface	La Guajira	Cerrejón Coal Company	28.4 (2006)	1,600
Carbones del Cerrejón	surface	-	-	-	-
EI Cerrejón Corte	surface	-	-	-	-
Mina Pribbenow /La Loma	surface	Cesar	Drummond	21.7 (2009)	485
El Descanso	surface	Cesar	Drummond	6 (2010)	960
El Hatillo	surface	Cesar	Vale S.A.	1.8 (2008)	500
Calenturitas	surface	Cesar	Glencore/Prodeco	5.0 (2005) 3.7 (2009)	
La Jagua	surface	Cesar	Glencore/Prodeco	8.5 (2003) 4.4 (2009)	260
La Jagua	underground	Cesar	Glencore/Prodeco	0.9 (1994)	(closed)
GALCA	exploratory	Cesar	Galway/Prodeco	exploratory	60–200
La Francia	surface	Cesar	Goldman Sachs (from CoalCorp Mining)	1.5	
Caypa	surface	Cesar	Carbones Colombianos del Cerrejon /CoalCorp Mining	0.175 (2007)	8.8
Río de Oro		Norte de Santander	Geominas		60–320
Paz del Río		Boyaca	Acerías Paz del Río S.A.	0.6 (2005)	
Puerto Libertador	surface	Cordoba			

Source: Jahnig (2007); USGS (2008); ANDI (2010); Mining Weekly (2008); Mining Weekly (2010); MB (2005)

8.2 Overview of CMM Emissions and Development Potential

8.2.1 CMM EMISSIONS FROM OPERATING MINES

The current potential for CMM projects in Colombia is limited as more than 90 percent of coal production is surface mined and most underground mines are relatively small. The mining department at Colombia's National University estimates there are 3,000 underground mines in Colombia that produce 6 thousand tonnes (Mt) of coal per year for the domestic market (MAC, 2010). These mines are not well regulated and have only basic ventilation systems and no methane drainage systems in place. Mining depths can be greater than 600 meters (m) and mines appear to be dangerously gassy as evidenced by the many methane explosions reported at underground mines back to the 1970s.

A methane gas build-up is believed to be the cause of the June 2010 explosion at the San Fernando mine in the town of Amaga, south of Medellin in Antioquia province that resulted in the deaths of 73 miners. The mine produces 240,000 tonnes a year of thermal coal from depths greater than 800 m (MAC, 2010). Amaga is also the site of a 1977 explosion which killed 86 people, while nine miners died in an explosion at a mine in the same province in 2009. Mine explosions have claimed 71 lives in Colombia from 2004 to 2009, according to emergency-management officials.

A pilot project to measure methane emissions is underway at the La Loma/Pribbenow Mine, operated by U.S.-based Drummond Company, Inc., one of the largest coal producers in Colombia. Located near La Loma in Cesar Departamento; the mine has estimated reserves in excess of 534 Mmt of high-Btu, low-ash and low-sulfur coal. There have been no published results although the project was confirmed by a general engineer at Drummond Inc., USA.

Table 8-5 shows Colombia's estimated CMM emissions.

Table 8-5. Colombia's CMM Emissions (million cubic meters)

Emission Category	1990	1995	2000	2005	2010	2015
					(estimated)	(projected)
Total emitted (= Total liberated – recovered & used)	130	139	207	241	282	328

Source: USEPA (2006)

8.2.2 CMM EMISSIONS FROM ABANDONED COAL MINES

No data on CMM from abandoned mines are available for Colombia at this time.

8.2.3 CBM FROM VIRGIN COAL SEAMS

Colombian coalbed methane (CBM) assessments put potential reserves in the range of 85–480 billion m³. Potential major CBM basins are the Bogota, Cauca, Catatumbo, Llanos, Middle Magdalena, and Cauca River basins. (Correa et al., 2009)

A CBM test well, considered the first in South America, was drilled to a depth of 910 m in the Cerrejon coal field in north-east Colombia in 1996. Desorbed gas contents ranged from 5 cubic meters (m³) per tonne at 200 m deep, to 12 m³ per tonne at 550 m (Schwochow, 1997).

In October 2004, the Drummond Company announced that it would begin drilling for CBM at its properties in the country. While most of the gas will fuel power generation at its facilities, Drummond also planned to sell any surpluses on the open market. Drummond estimates that there are 62.2 billion m³

(2.2 trillion cubic feet) of methane in its mines and it has signed a contract with Ecopetrol to extract CBM from the La Loma and El Descanso mines (EIA, 2010a).

8.3 Opportunities and Challenges to Greater CMM Recovery and Use

Colombia has signed and ratified the UNFCCC and Kyoto Protocol, as indicated in Table 8-6. As a Non-Annex I Party to the Kyoto Protocol, Colombia has no national emissions targets and is eligible to host mitigation projects under the Clean Development Mechanism. Therefore, Colombia is eligible to secure project revenues from the sale of greenhouse gas (GHG) emission reduction credits.

Table 8-6. Colombia's Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC*	June 13, 1992	March 22, 1995
Kyoto Protocol**	---	November 30, 2001

Source: *UNFCCC (2010a); **UNFCCC (2010b)

8.3.1 MARKET AND INFRASTRUCTURE FACTORS

Colombia has enjoyed a boom in energy and mining investment over the past 5 years as the government has driven back rebels who once controlled large parts of the country and targeted oil pipelines as part of a long running insurgency (MAC, 2010). Although there is ongoing civil conflict with guerrillas and paramilitary organizations, the government has reestablished its presence in all of the country's 1,099 municipalities. Attacks by insurgents against rural towns decreased by 91 percent from 2002 to 2005 and attacks on the country's infrastructure dropped by 60 percent between 2002 and 2006 (Haynesboone, 2008).

The natural gas market in Colombia has grown rapidly as the government has increasingly encouraged gas use as part of its energy diversification policy. The main gas consumer is heavy industry followed by electricity generation, residential use, and conversion to CNG for vehicle use. Gas use as a percentage of overall energy use has risen from 6.8 percent in 1998 to 16.8 percent in 2007 (Diaz, 2009).

ECOGAS was formed in 1997 to develop and operate more than 3,600 km of natural gas trunk pipelines in Colombia. Three main lines form the back bone of the transmission network: one links the gas fields on the north-east coast to the central Colombia area; another links Bogota to the transmission network; and the third transports gas through the western Andean foothills. ECOGAS was privatized in 2006 and Transportadora de Gas Internacional (TGI) and Promigas are now the two largest pipeline operators carrying 95 percent of volumes. Six other small private firms operate the remaining small stretches of the system (EIA, 2010a; Diaz, 2009).

8.3.2 REGULATORY INFORMATION

The key governmental body involved in the energy sector in Colombia is the Ministry of Mines and Energy, which is responsible for the overall policy making and supervision of the electricity sector in Colombia. It regulates generation, transmission, trading, interconnection, and distribution, and approves generation and transmission programs. The ministry delegates supervisory authority over the electricity sector to a number of its agencies, specifically Comisión Reguladora de Energía y Gas (CREG) and Unidad de Planeación Minero Energética (the Union of Mineral and Energy Planning). CREG regulates

the transportation and distribution of electric power and gas and adjusts policies and procedures by which these services can reach consumers and allow market competition between providers (DOE, 2005).

The National Hydrocarbons Agency (ANH) was created in 1999 to administer and integrate the country's hydrocarbon reserves. It had the effect of generating a higher level of confidence in Colombia's hydrocarbon potential as an attractive investment target (Diaz, 2008). ANH grants exploration and exploitation rights to private entities and provides overall management of Colombia's hydrocarbon reserves.

In 1997, the National Council of Social and Economic Policies approved the "Strategies for Strengthening the Colombian Mining Sector," which favored modernization of the sector. As a result, the Code of Mines clarified the State's role as resource manager, regulator, and controller of coal exploitation; included the concept of sustainable development in the coal mining industry; and provided greater clarity with respect to contractual issues. Decentralization of the mining industry resulted in the creation of governing bodies, which were assigned certain functions of the mining authority.

8.4 Profiles of Individual Mines

No profiles of underground mines are available for Colombia at this time. See Table 8.4 for details of the major surface mines.

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