Status of CMM Ownership and Policy Incentives in Key Countries: Considerations for Decision Makers

EPA Publication No:
430R19004

March 2019

EPA United States Environmental Protection Agency

U.S. EPA Coalbed Methane Outreach Program

Global Methane Initiative

Disclaimer

This report was prepared for the U.S. Environmental Protection Agency (USEPA). This analysis uses publicly available information in combination with information obtained through direct contact with mine and government personnel. USEPA does not:

(a) make any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any apparatus, method, or process disclosed in this report may not infringe upon privately owned rights;

(b) assume any liability with respect to the use of, or damages resulting from the use of, any information, apparatus, method, or process disclosed in this report; or

(c) imply endorsement of any technology supplier, product, or process mentioned in this report.

Acknowledgments

This publication was developed at the request of the U.S. Environmental Protection Agency, in support of the Global Methane Initiative. In collaboration with the Coalbed Methane Outreach Program, this document has been updated to reflect policy changes since the original publication date of July 2014.

Contents

Figures

Tables

Acronyms and Abbreviations

A$	Australian Dollar
AMM	Abandoned Mine Methane
ANH	Agencia Nacional de Hidrocarburos (National Hydrocarbons Agency) (Colombia)
ANLA	Autoridad Nacional de Licencias Ambientales (National Authority for Environmental Licenses) (Colombia)
ANM	Agencia Nacional de Minería (National Mining Agency) (Colombia)
C$	Canadian Dollar
CAR	Climate Action Reserve
CBM	Coalbed Methane
CCIR	Carbon Competitiveness Incentive Regulation (Nova Scotia)
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CESPEDES	Commission for Private Sector Studies for Sustainable Development
CH_4	Methane
CMM	Coal Mine Methane
CMOP	Coalbed Methane Outreach Program
CNY	Chinese Yuan
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide-Equivalent
EITI	Extractive Industries Transparency Initiative
EMC	Ejercicio de Mercado de Carbono (Carbon Market Exercise) (Mexico)
EPCs	Emission Performance Credits (Alberta, Canada)
ETS	Emissions Trading Scheme
GGAP	Greenhouse Gas Abatement Program (Australia)
GHG	Greenhouse Gas
GMI	Global Methane Initiative
ICE-CMM	International Centre of Excellence on Coal Mine Methane
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt Hour
LRBs	Land and Resource Bureaus (China)
M	Meter

m^2	Square Meters
m^3	Cubic Meters
MADS	Ministerio de Ambiente y Desarrollo Sostenible (Ministry of Environment and Sustainable Development) (Colombia)
MEM	Ministry of Energy and Mines (British Columbia, Canada)
MERCP	Mineral and Energy Resources (Common Provisions) Act (Queensland, Australia)
MLR	Ministry of Land and Resources (China)
MMA	Mines and Minerals Act (Alberta, Canada)
MME	Ministerio de Minas y Energía (Ministry of Mines and Energy) (Colombia)
MOE	Ministry of Energy (Mongolia)
MOM	Ministry of Mining (Mongolia)
MRA	Mineral Resources Authority (Mongolia)
$MtCO_2e$	Metric Tonnes of Carbon Dioxide-Equivalent
MW	Megawatt
MWh	Megawatt Hour
N/A	Not Applicable
NDC	National Determined Contribution (Mongolia)
NDRC	National Development and Reform Commission
NEA	National Energy Administration (China)
NSW	New South Wales (Australia)
OGC	Oil and Gas Commission (British Columbia, Canada)
PEMEX	Petróleos Mexicanos (Mexico State-Owned Petroleum Company)
RESA	Renewable Energy Sources Act of 2004 (Germany)
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources) (Mexico)
SENER	Secretaría de Energía (Secretariat of Energy) (Mexico)
SGER	Specified Gas Emitters Regulation (Nova Scotia)
SinoPec	China Petro-Chemical Corporation
SOE	State-owned Enterprise (China)
Tonne	Metric Ton
UNECE	United Nations Economic Commission for Europe
US$	United States Dollar

USEPA	United States Environmental Protection Agency
VAM	Ventilation Air Methane
VAT	Value-Added Tax
VCS	Verified Carbon Standard

Executive Summary

The Global Methane Initiative (GMI) was launched in 2004 as a voluntary, multilateral partnership that aims to reduce global methane (CH_4) emissions from five major CH_4 sources, including coal mines. GMI works to advance the abatement, recovery, and use of CH_4 as a valuable clean energy source by creating an international network of partner governments, private sector members, development banks, universities, and nongovernmental organizations. This network aims to build capacity, develop strategies and markets, and remove barriers to project development for CH_4 reduction in Partner countries. A number of countries are currently facing decisions related to legislation and regulation of coal mine methane (CMM) recovery and utilization, from ownership of gas resources to providing policy options such as financial incentives. On behalf of GMI, the United States Environmental Protection Agency (USEPA) has prepared this document, which presents cases studies from the following key coal producing countries: China, Mexico, Ukraine, Australia, Canada, Germany, Colombia, and Mongolia.

Ill-defined gas property rights and lack of clarity on obtaining ownership of the CMM/CBM[1] in many countries serve as obstacles to the development of gas utilization projects (USEPA, 2009c). Mineral resources, including CMM, may be national government-owned, as in China, Ukraine, Colombia, and Mongolia; state/provincially-owned as in Australia; or have a combination of national and private ownership such as in Canada, Mexico, and Germany. A number of other stakeholders are involved in CMM project development, in addition to the national and state entities responsible for leasing minerals and collecting royalties, such as:

- Ministries of energy, petroleum, and land management
- Energy regulators
- Departments of natural resources
- Ministries or agencies of environment and environmental protection
- Electric utilities
- Utilities commissions, utility regulatory commissions, public utilities commissions, or public service commissions

As CMM projects require coal mine cooperation and are often initiated by coal companies, the most straightforward ownership solution is to give coal mines first priority for CMM exploration and development, as in Ukraine and Germany. Another step to further encourage CMM

[1] Coalbed methane (CBM) refers to CH_4 that is found in coal seams. It is formed during the process of coalification, the transformation of plant material into coal. Coalbed methane is also known as virgin coal seam methane or coal seam gas. It is widely considered an "unconventional" source of natural gas.

utilization is to solicit coal mining areas as potential CBM concessions should the coal mine decline to explore for and/or develop the resource after a given time period.

Resource ownership is only one factor that determines successful implementation of CMM projects, and countries have developed additional policy incentives (Roshchanka et al., 2017).

Several financial policies, such as royalty relief, feed-in tariffs, carbon markets, and tax incentives, have been successful, while conflicting and unclear policies can make CMM projects uneconomic. This paper explores policies, regulations, and financial incentives used to prevent ownership conflicts, mitigate perceived legal barriers for project developers, and incentivize CMM utilization in these selected countries. While not covered in case studies in this paper, renewable portfolio standards that are expanded to alternative sources, such as CMM, are also effective in promoting CMM-based power.

An important consideration in developing policies is to ensure that safety regulations take precedence and that unsafe activities are discouraged. Policies requiring CMM capture and use, particularly over a given concentration (e.g., 30 percent CH_4), may encourage operators to maintain gas concentrations below 30 percent by dilution, which can be unsafe.

When mine gas drainage is undertaken before the coal extraction process begins, the collection systems are not likely to be disturbed by ground movement, and, if feasible, relatively high purities of gas can usually be produced. Concentrations of 60 percent CH_4 and higher should be achievable from pre-drainage methods, thus producing gas well outside of the explosive range (UNECE, 2010). Incentives such as royalty relief for pre-drained gas could be administered to encourage this method of degasification over other methods. Royalty relief can be successful as an incentive by encouraging the drainage of gas prior to mining. In Colombia, the royalty paid to the national government for unconventional gas, which includes CBM, is reduced by 40 percent.

Feed-in tariffs can promote CMM projects through higher prices for alternative electricity on the electricity market. Feed-in tariffs such as China's subsidies for CMM utilization and CBM/CMM-fueled power generation provide grid access for CMM-based electricity and make CMM projects more economic. Tax exemptions may provide an incentive to develop CMM projects. China provides exemption from value-added tax on CMM project equipment.

Working with such a wide variety of policies and stakeholders can also present a challenge for coal mines and CMM project developers. For this reason, it could be beneficial to create additional institutional support for the CMM sector. Examples of such institutional support are CMM clearinghouses and information centers in such countries as China, India, and Russia. Many organizations such as the GMI, the International Energy Agency, the United Nations Economic Commission for Europe, and the USEPA have been actively participating in the dissemination of information on CMM recovery and utilization through technical information sessions, development of documents and tools, and participation in international events (USEPA, 2009c).

1. Background

Methane (CH_4) is a greenhouse gas (GHG) 25 times as potent as carbon dioxide (CO_2).[2] Unlike other GHGs, CH_4 is the primary component of natural gas and can be converted to usable energy. The reduction of CH_4 emissions from coal mines therefore serves as a cost-effective method to reduce GHGs, increase energy security, enhance economic growth, improve air quality, and improve worker safety. Worldwide CH_4 emissions from coal mines were estimated to be nearly 630 million metric tons (tonnes) of CO_2-equivalent ($MtCO_2e$) in 2015 and are projected to increase to 671 $MtCO_2e$ by 2020 (USEPA, 2012a).

A number of countries are facing decisions related to legislation and regulation of CMM[3] recovery and utilization, from ownership of gas resources to providing royalty relief for produced energy. Several key coal producing countries have existing laws and policies that provide incentives for CMM recovery and utilization and mitigate ownership conflicts.

Section 2 of this document includes international case studies that describe the ownership approaches and legal treatment of CMM, as well as CMM incentives and policies in China, Mexico, Ukraine, Australia, Canada, Germany, Colombia, and Mongolia. As **Figure 1** shows, China, Ukraine, and Australia contribute significantly to global CMM emissions and are expected to continue this trend based on current coal production projections (USEPA, 2012a). These and other key countries were also selected because they showcase a variety of legislative and policy approaches for facilitating CMM projects. This document does not provide a comprehensive review of policies in each showcased country, and a list of further reading options is provided, including references for the United States Environmental Protection Agency (USEPA), the Global Methane Initiative (GMI), and other documents.

Section 3 describes options for ownership and leasing approaches, as well as policies and regulations, including financial incentives, to encourage capture and utilization of CMM.

[2] 2007 Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4). Chapter 2: Changes in atmospheric constituents and in radiative forcing, Table 2.14, Global warming potential for 100-year time horizon, p. 212. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf.

[3] Coal mine methane (CMM) refers to CH_4 released from the coal and surrounding rock strata due to mining activities. In underground mines, it can create an explosive hazard to coal miners, so it is removed through ventilation and in some cases, drainage systems. In abandoned mines and surface mines, CH_4 might also escape to the atmosphere through natural fissures or other diffuse sources. CMM refers specifically to the CH_4 found within mining areas (e.g., within a mining plan), while coalbed methane (CBM) generally refers to CH_4 in virgin coal seams that have never been mined, and that have no mining plans.

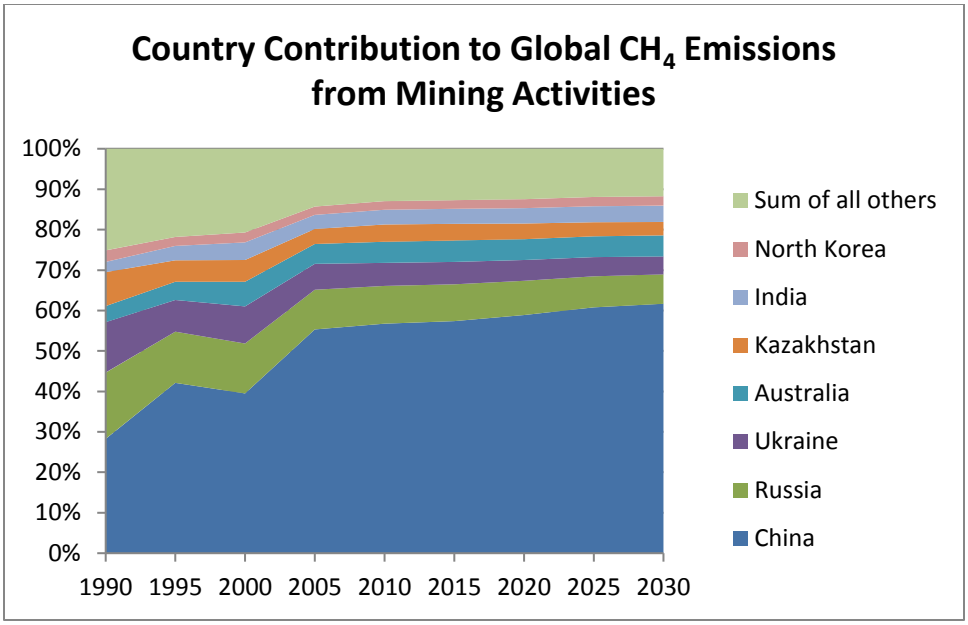

Figure 1: Contribution of Top CMM Emitting Countries to Global CMM Emissions (USEPA, 2012a)

2. CMM Case Studies

In the following case studies, we first describe the ownership and legal status of CMM, and then discuss policies and regulations that affect CMM project development. Mineral resources, including CMM, may be owned by national governments, as in China, Ukraine, Colombia, and Mongolia; state/provincially-owned as in Australia; or federally- and privately-owned such as in Canada, Mexico, and Germany. Administration of mineral resources may also take place at the national or state/provincial level, as in Canada where mineral resources are 90 percent federally-owned, but laws and leases are administered at the provincial level. These primary owners typically lease the mineral resources to lessees. In some countries, a lease can be referred to as a "license"; however, in other countries a "license" can mean a permit to explore and develop the resource. Throughout the case studies, we have attempted to clarify the meaning of these terms, while remaining true to the source documents.

Many stakeholders can be involved in administering these CH_4 resources, which, in and of itself, can create a challenge for CMM project developers and implementers. **Error! Reference source not found.** lists the potential stakeholders involved in CMM project development in addition to the national and state entities or ministries responsible for leasing minerals and collecting royalties.

Table 1: List of Potential Stakeholders for CMM Project Development

Entity	Level of Government	Role
Ministries of energy, petroleum, land management, etc.	National or state/provincial	Leasing of national or state/province-owned mineral resources, reclamation requirements
Energy regulators	National or state/provincial	Permitting and inspection of natural gas pipelines and electricity infrastructure
Departments of natural resources	National, state/provincial, or municipal	Drilling requirements and permitting, reclamation requirements, production reporting, inspection of mines and oil & gas operations
Departments of wildlife	National or state/provincial	Assess impact of project activities on wildlife
Ministries or agencies of environment or environmental protection	National, state/provincial, or municipal	Air and water quality rules and permitting, environmental impact analysis rules and evaluation, hazardous material regulations, reclamation requirements, carbon regulation/commitments/inventory
Electric utilities	National, state/provincial, municipal, or private	Facilitating grid access for produced electricity, purchasing electricity
Utilities commissions, utility regulatory commissions, public utilities commissions, or public service commissions	National, state/provincial, or municipal	Regulates rates and services of public utilities
Mine safety ministries or administrations	National or state/provincial	Enforce compliance with mine safety and health standards, including CH_4 concentration in air and approval of ventilation plans, inspections
Other occupational safety administrations	National or state/provincial	Enforce occupational safety requirements, perform inspections
Parks or historic site departments	National, state/provincial, or municipal	Ensure preservation of historical sites and artifacts

Entity	Level of Government	Role
Private surface land owners	Private (not applicable, N/A)	Granting access to land
Private mineral rights owners	Private (N/A)	Leasing mineral rights
Coal mines	National, state/provincial, or private	Project development, access to facilities/land, coordination of drilling activities
Existing gas lessees	Private (N/A)	Negotiate royalties, project collaboration, coordination of drilling activities
Environmental groups	Private (N/A)	Evaluation of leasing and adherence to regulations, public awareness of environmental issues
Carbon registries and carbon markets	National, state/provincial, or private	Market for trading of carbon emission allowances and credits
Geologic survey agencies	National or state/provincial	Survey and classify land, conduct resource assessments

With numerous stakeholders involved in CMM projects, it is important to segregate authority in promulgating regulations to avoid conflict. From a project development standpoint, it is essential to recognize that acquiring ownership of the CMM resource is only one facet of an extensive process from idea to execution; and other considerations, such as safety standards, environmental regulations, and incentive structures must be considered when implementing a CMM project.

2.1. China

Ownership and Legal Status

China's mineral resources are owned by the Central Government. China's Mineral Resources Law was passed in 1986 and did not list CBM independently as a mineral resource until it was amended in 1996, clarifying that CBM is one of China's 34 mineral resources. China's laws generally do not differentiate between CBM and CMM in legal terms. Exploration and mining of CBM is registered in the same manner as conventional oil and gas.[4]

[4] Since 1998, three centrally-controlled state-owned enterprises (SOEs) – China United Coalbed Methane Co., Ltd.; China National Petroleum Corporation; and China Petroleum and Chemical Corporation – registered for licenses to

As a result of government restructuring in the late 1970s, all coal exploration and mining activities must be approved by the Ministry of Land and Resources (MLR) or by provincial Land and Resources Bureaus (LRBs). Large coal mines in excess of 100 million tonnes of reserves must obtain licenses through the MLR; however, smaller mines may obtain permission from provincial LRBs. At the same time, the Central Government did not transfer management power to the local levels for the oil and gas sector, and thus, oil and gas activities, including CMM and CBM projects, must be registered through the MLR.

Because coal mine licensure is awarded for many mines at the local level, while CBM licensure is obtained from the top-level administration of the MLR, significant overlap occurs between coal and CBM licenses. By the end of 2007, 86 out of the total of 98 CBM mining licenses overlapped with 1,406 coal mining licenses, covering an area of 12,534 km^2. This has resulted in significant conflict, such as a case in Jincheng, Shanxi Province, where in 2003 a CBM licensee filed a complaint with the MLR against a coal licensee regarding its CH_4 recovery in the area. As a result, the State Council issued the "Opinions on Speeding up CBM Extraction and Utilization" (State Council General Office [2006] No. 47), which stipulates that with new exploratory licenses, CBM and coal resources must be prospected, evaluated, and their reserves must be determined. If the density of gas per ton in the coalbed surpasses that of the regulated standard and is suitable for development, a CBM and coal development plan must be composed, and coal production activity is not allowed without a CMM drainage system (IEA, 2009; Lin, 2011). The policy also states that coal mines must implement CMM measurement and monitoring activities.

Additionally, the MLR issued a notice that overlapping licenses are to be managed through negotiation as per the April 2007 "Notice on Strengthening Coal and CBM Comprehensive Prospecting and Mining Management" (MLR [2006] 96) (Lin, 2011). This notice also provided methods to address overlapping mining rights of coal and CBM/CMM:

> *Coal mining licensees should apply for a CBM license if they drain CBM by means of surface drainage within its mining area; but no CBM draining license is required for recovery of the underground gas (CMM).*
>
> *In cases of overlapping coal and CBM licenses, the coal and CBM licensees should negotiate a cooperation or production agreement based on the principle "CBM drainage first, coal mining second;" thus, conducting comprehensive prospecting and mining of coal and CBM. If both parties fail to reach an agreement, the MLR will conduct mediation. If both parties agree to mediation, one party will make compensations to the other for its investment in the resource. If mediation fails, the land and natural resources bureau will act in accordance with 'the principle of integrated gas drainage and coal mining, supporting the comprehensive prospecting and mining of CBM resources by the coal production enterprises in the project area' (Lin, 2011).*

exploration rights of approximately 65,000 square meters (m^2) of CBM blocks, comprising more than half of the total CBM blocks, while other SOEs, such as China Petro-Chemical Corporation (SinoPec), registered for smaller shares (Lin, 2011).

Incentives and Policies

The Chinese government has traditionally outlined CMM policy incentives in the Five-Year Plans compiled by the National Energy Administration (NEA). The Eleventh Five-Year Plan (2006-2010) included price management for CMM transported through city pipelines; gave priority to CMM-generated electricity on the grid with a subsidized price; and provided for financial subsidies for onsite, residential, and chemical feedstock use (Franklin, 2010).

The Twelfth Five-Year Plan for the first time explicitly included CBM. The plan called for CMM to be used primarily as a local fuel, with the number of residential users to approximately double to about 3.3 million households between 2010 and 2015, power generation capacity to quadruple to 2,850 megawatt (MW) as overall CMM utilization was projected to rise by about 5.5 billion cubic meters (m^3), and consumption projected to increase to 20 billion m^3 by 2015 (USEPA, 2015). The plan also called for total CMM output of 30 billion m^3 by 2015, comprising 16 billion m^3 from CBM and 14 billion m^3 from CMM (Huang, 2012; USEPA, 2015). In 2015, CBM production only totaled 4.37 billion m^3, but CMM drainage increased to 13.56 billion m^3, up 11.36 billion m^3 from 2005 (Huang et al., 2016).

The Thirteenth Five-Year Plan, issued on February 14, 2016, increased the Central Government's subsidy for CMM utilization from 0.2 Chinese Yuan (CNY)/m^3 to 0.3 CNY/m^3 (Wenge, 2015), and continues to provide a 0.25 yuan/kilowatt hour (kWh) subsidy for CBM/CMM-fueled power generation, which is the same subsidy offered for biomass power generation. Between 2007 and 2012, the Central Government awarded subsidies of 1.839 billion CNY to support CBM/CMM development, which accounted for 9.195 billion m^3 (Huang, 2012). At the province level, Shanxi and Shaanxi Provinces provide additional provincial funding of 0.1 CNY/m^3, and Hunan Province provides 0.15 CNY/m^3 for CMM recovered and 0.2 CNY/m^3 for CMM used (Wenge, 2015).

These incentives were further supported through the Guideline on Further Accelerating the CBM/CMM Exploitation and Utilization issued by the State Council of the People's Republic of China in September 2013, No. 93. Developers have been offered increased fiscal funding subsidies, strengthened tax policy support, favorable market pricing mechanisms for CMM and pricing policies for CMM power pool purchases, strengthened organization leadership and management of CMM recovery and utilization, and the promotion of scientific and technological innovation (Wenge, 2015; Huang et al., 2016). As established by previous policies, developers are still exempt from the prospecting and licensing fee on CBM development, and no royalties are levied on CBM through 2020. Value-added tax (VAT) collected from coal mines recovering and utilizing CBM/CMM is returned to the coal mining companies, and no income tax is paid by enterprises developing technologies for CMM recovery and utilization. Import-related taxes and VAT are also exempted for CMM exploration, and development operations and equipment. Coal mine owners or developers investing capital in CMM projects through loans or self-equity financing can claim 40 percent of the capital value to offset income taxes (IEA, 2009; Huang, 2012).

In July 2017, a joint directive from 13 Chinese government agencies specified that the share of natural gas in total energy consumption should rise from six percent in 2015, to 10 percent by 2020, and to 15 percent by 2030. The directive also provided specific plans to achieve this goal. The primary mechanism to achieve this goal will be through an ambitious commitment to

displace coal with natural gas. Continued average annual growth of roughly 16 percent, as seen between 2000 and 2013, will be necessary to reach the initial 10 percent target of 2020 (Vanderklippe, 2017).

As a Non-Annex I party to the Kyoto Protocol, China previously dominated the CMM sector of the Clean Development Mechanism (CDM), hosting 84 registered CMM projects (UNFCCC, 2018). In July 2010, the special economic zone of Shenzen; the municipality of Chongqing; the cities of Beijing, Shanghai, and Tianjin; and the provinces of Guangdong and Hubei were named the sites of China's first low-carbon program by the National Development and Reform Commission (NDRC). The foundation of the China Emissions Exchange followed, and the first pilot carbon trading program was launched in Shenzen in June 2013 (China Daily, 2013). In September 2017, an International Centre of Excellence on Coal Mine Methane (ICE-CMM) was opened in Tian Jin, China, to support capacity building (see Section 3.3). In December 2017, China launched its national emissions trading scheme (ETS) for the power sector, under the oversight of the NDRC.

Further Reading

The following links provide additional information:

Energy Markets in China and the Outlook for CMM Project Development in Anhui, Chongqing, Henan, Inner Mongolia, and Guizhou Provinces:
https://www.epa.gov/sites/production/files/2016-03/documents/2014_coalchinaenergymarket_fullreport.pdf

Coal Mine Methane in China: A Budding Asset with the Potential to Bloom (International Energy Agency):
http://www.iea.org/publications/freepublications/publication/china_cmm_report.pdf

China GMI Country Profile:
https://www.globalmethane.org/documents/toolsres_coal_overview_ch7.pdf

2.2. Mexico

Ownership and Legal Status

Article 27 of Mexico's Constitution of 1917 provides that all natural resources, including hydrocarbons, are the property of the nation. The Mining Law regulates Article 27 and Article 4 of the Law states, "The mineral coal in all its varieties and the gas associated with the deposits of this one" as "minerals or substances, which constitute deposits in veins, strata, masses or beds, different from the components of land" (Mexico Mining Law, 2006). Petróleos Mexicanos (PEMEX), the state-owned petroleum company, has historically held exclusive authority over exploration, recovery, processing, and sales of oil and gas including CMM and CBM. The regulatory law emanating from Article 27 of the Constitution meant that coal mines could not legally sell CMM or use it to generate heat or electricity onsite, since exploration, production, processing, and sales of all hydrocarbons were the exclusive province of PEMEX.

Following a CH_4-related explosion at the Pasta De Conchos Mine in February 2006, Mexico's Congress and Senate amended the Mining Law, allowing coal mines to recover and use CBM and CMM from their operations for self-consumption or even their sale, though exclusively to PEMEX through a binding contract (Wallace, 2009; Kelafant, 2011). In 2011, the Ministry of Energy (SENER) submitted amendments to the law that add requirements for obtaining CBM permits. These amendments state that applications by mining concessionaires for a permit for CBM production must include a description of the scope of the project and the facilities for extraction, measurement, and use of CBM; as well as a specification of the intended use of the CH_4 (i.e., self-consumption, delivery to PEMEX, or both). The amendments also provide that in the case of projects for gas to be delivered to PEMEX, the ministry may refuse to issue a permit on certain grounds (e.g., where it considers that the project is not feasible, or the project infrastructure is inadequate to comply with the technical and qualitative conditions required at the point of delivery; López-Velarde and Almaraz, 2011).

Incentives and Policies

In support of the General Climate Change Law of 2012, the Mexican Congress passed a bill that levies a carbon tax on fossil fuel use. The Mexico Carbon Tax is meant to help Mexico meet its target of cutting GHG emissions by 30 percent by 2020 and 50 percent by 2050, and to promote the use of cleaner fuels. The bill requires companies to pay approximately United States dollar (US$)3.5 per tonne of CO_2 they emit, with prices adjusted annually by inflation. Defined by rules established by the Secretariat of Finance, companies can also surrender an equivalent amount of internationally recognized Certified Emission Reductions (CERs) from emissions reductions projects hosted in Mexico (García, 2017). Modifications to the Carbon Tax during its passage through Congress were made to exclude natural gas from the tax, because it is a relatively "clean" fossil fuel. At this time, CMM is not included in the tax scheme, and it does not change the assessment of tax on coal deposits despite the amount of methane emitted by the mine (Muñoz-Piña, 2015).

In November 2013, Mexico launched a voluntary carbon credit exchange, MÉXICO$_2$, which provides a platform for companies to obtain carbon credits through carbon emission reduction projects certified using internationally recognized methodologies and protocols, such as CDM, the Verified Carbon Standard (VCS), the Gold Standard, Plan Vivo, and the Climate Action Reserve (CAR). The program is operated by the Mexican Stock Exchange, and currently supports a 7.95 megawatt hour (MWh) energy-generating CMM project registered from CH_4 captured at two coal mines in the Sabinas basin and one in the Saltillito basin, using the CDM methodology (MÉXICO$_2$, 2017).

In November 2016, Mexico launched the Carbon Market Exercise, or the Ejercicio de Mercado de Carbono (EMC), which is a carbon market simulation to familiarize the Mexican Government and emissions-generating companies with the workings of a carbon market. A public-private working group, comprising the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) and the Commission for Private Sector Studies for Sustainable Development (CESPEDES), has been established to develop the National ETS regulations. Together, SEMARNAT and CESPEDES committed to establish ETS regulations by mid-2018 (Escalona and Pereyra, 2017).

Further Reading

The following link provides additional information:

Mexico GMI Country Profile:
https://www.globalmethane.org/documents/toolsres_coal_overview_ch21.pdf

2.3. Ukraine

Ownership and Legal Status

The State Classifier of Minerals defined CMM as a separate resource in 2007. CMM falls into the category of mineral resources owned and regulated at the national level (USEPA, 2009c). The government can issue exploration and production permits for up to 50 years. In 2012, the Central Government operated 71 percent of Ukraine's mines (110 out of 155), with the remaining mines being privately held (Yashchenko, 2013). At the same, production from private mines accounted for 71 percent of the total coal production. In 2016, Ukraine lost control of much of the Donbas coal basin due to an armed conflict, and only 49 mines operated on the territory that is controlled by the Ukrainian government (Yashchenko, 2017). As a result, Ukraine's coal production fell from over 80 million tonnes/year before 2014 to 31.6 million tonnes/year in 2016 (Yashchenko, 2017).

Ukraine's coal mines are also among the most dangerous in term of CH_4 emissions and risk of explosions. Because average mining depth reaches 730 meters (m; Plachkova, 2010), CH_4 concentrations could reach 40 m^3 per tonne of dry ash-free coal (Naftogaz, 2013). Over 75 percent of underground coal in Ukraine is produced in gassy mines.

In 2009, Ukraine's Parliament adopted the Law on Gas (CH_4) from coal beds. The law provides that the government can issue CMM leases along with new coal mining leases to mine operators. Existing mines are required to obtain permits for CMM exploration and production. The law also allows coal mines to sell their rights to CMM, but does not require it (Evans, 2009; Maciw et al., 2009; USEPA, 2009b). In addition, the law specifies that CMM owners can sell their gas into the natural gas transmission system if the gas meets quality requirements (USEPA, 2009a). The law prohibits both the production of CH_4-rich coal without degasification measures for reducing the CH_4 concentration to the adopted standards, and the development of new underground coal mines without degasification of CH_4-bearing coal strata.

Incentives and Policies

The Law on Gas (CH_4) from Coal Beds, adopted in 2009, also established that between 2010 and 2020, profits from the production and use of CMM are not subject to taxation (Verkhovna Rada, 2009).

In 2012, the Ukrainian Parliament modified the tax code so that unconventional gas production, including CBM, became subject to the subsoil use tax. In 2016, rent payments for the production of hydrocarbons above and below 5,000 m were set at a level of 14 percent and 29 percent, respectively, from the average market price for gas and oil (Verkhovna Rada, 2016). However,

only CBM is subject to taxation; CMM from degasification systems is exempted from taxation regardless of its quality (Verkhovna Rada, 2016).

The Ukrainian government has also taken steps to make the coal and gas industries more transparent. In 2013, Ukraine joined the Extractive Industries Transparency Initiative (EITI) and its 2014-2015 and 2016 reports contain data on coal production, the number of active coal mines, and the number of issued special licenses for subsoil use. The government also adopted sale auctions as a tool for distributing five-year special permits for subsoil use. The first auction for the geological exploration of the Novosvitlivska and Seleznivska areas for CMM extraction in the Luhansk region was announced in 2013 (Geonews, 2013). The auction for these projects, however, was cancelled in July 2014 due to hostilities in eastern Ukraine.

On April 13, 2017, the Ukrainian Parliament passed the Law on the Electricity Market that does not include CMM as an alternative energy source eligible for special incentives (Verkhovna Rada, 2017). The status of many CMM projects implemented in the Donbas coal basin before 2014 is unknown due to the lack of information from territories that are not currently under the control of the Ukrainian government.

Further Reading

The following links provide additional information:

Developments in Ukraine and "Best Practices" for Regulatory Policies:
https://www.globalmethane.org/expo-docs/india10/postexpo/coal_evans.pdf

Coal Mine Methane Activities in Ukraine:
http://epa.gov/cmop/docs/cmm_conference_sept09/16evans.pdf

State Policy of Ukraine in Capturing and Utilizing Coal Mine Methane (Ministry of Energy and Coal Industry of Ukraine):
http://www.unece.org/fileadmin/DAM/energy/se/pp/coal/cmm/8cmm_nov2013/7_Ukraine_e.pdf

Ukraine GMI Country Profile:
https://www.globalmethane.org/documents/toolsres_coal_overview_ch34.pdf

2.4. Australia

Ownership and Legal Status

In Australia, resources are administered by state and territory governments. State governments own all on-shore resources within their jurisdiction and lease these out to exploration and mining companies under mineral/coal and petroleum/gas exploration leases. Arrangements vary between each state but essentially petroleum/gas lease holders have ownership of CBM, except where coal mine operators extract CH_4 as part of their coal mining operations (CMM). Various regulatory and procedural arrangements are in place to address overlapping petroleum and coal

leases (Karas, 2006). CMM projects are primarily in Queensland and New South Wales (NSW) (GMI, 2013).

Queensland

In November 2002, the Queensland government released a new regulatory regime to address issues that arise when CBM and coal exploration and production activities occur under different tenures granted over the same area. To formalize the measures, a new Petroleum and Gas (Production and Safety) Act was passed in 2004 to replace the Petroleum Act of 1923. Subsequently, the Mineral Resources Act of 1989 has been amended to clarify a number of issues, including management of coal and gas resources. In Queensland, a mining lease for coal provides some rights to CMM; however, generally CMM production is administered under the Petroleum and Gas (Production and Safety) Act of 2004 and requires a production license that can co-exist with a mining lease covering the same area (GMI, 2011).

The Mineral Resources Act of 1989 provides that coal mine lease holders may extract, produce, release, or dispose of CMM if it is: 1) a necessary result of coal mining, 2) necessary to ensure a safe mine working environment, or 3) necessary to minimize the fugitive emission of CH_4 during the course of coal mining operations. The coal mining lessee may only use the gas for beneficial uses related to mining such as power generation for onsite use or for heating. The CMM may not be sold, processed, used to generate power for sales, or be transported outside of the area of the mining lease. If a coal mining lessee wishes to utilize CMM for a non-mining purpose such as sales, the coal mine lessee may apply for a petroleum lease under the Petroleum and Gas (Production and Safety) Act of 2004, provided that the mining area does not overlap with an existing petroleum lease (Qld Mineral Resources Act of 1989, Div 8, C18CM, C18CN). If the coal mine lease holder does not wish to use CMM for their own purposes and the mining area overlaps with a petroleum lease, the mine may give the petroleum lease holder written notice that CMM is available. The petroleum lease holder then has 20 business days to accept in writing. The term "give" connotes that no payment will be received. If the petroleum lease holder does not want the gas, the mining lease holder may then flare or vent it, provided the situation meets certain requirements.

The Mineral Resources Act places restrictions on flaring and venting of CMM. Flaring CMM is prohibited if it is commercially or technically feasible to use CMM for the aforementioned beneficial mining purposes under the mining lease, or feasible to use for another purpose under a petroleum lease that the miner might be able to obtain. Venting CMM is authorized if it is not safe or technically practicable to use the gas for mining or to flare it. Venting CMM is also allowed if the CMM is being used under a GHG abatement scheme[5] under certain conditions (Qld Mineral Resources Act of 1989, Part 8, Div 1, 318CO).

Despite the new regulatory regime of the Petroleum and Gas (Production and Safety) Act and the amendments to the Mineral Resources Act, Queensland has replaced the state's five resource-specific Acts with the single Mineral and Energy Resources (Common Provisions) Act (MERCP) of

[5] A GHG abatement scheme means (1) the Electricity Supply Act 1995 (NSW), part 8A; (2) the Commonwealth's Greenhouse Gas Abatement Program; or (3) another scheme about the abatement of GHGs prescribed under a regulation.

2014. MERCP includes measures to consolidate provisions common to each of the Resource Acts, a means of common processes for the resource authorities, and a way to manage overlapping coal and petroleum resource authorities for coal seam gas; and provides assistance to achieving the purposes of each of the Resource Acts (Queensland Parliament, 2014).

New South Wales

The Mining Act of 1992 is the principal legislation governing mineral exploration in NSW. The Mining Act holds that a coal lessee may apply for the inclusion of petroleum or gas in the mining lease. The application may be refused if the land is subject to a petroleum exploration license or a petroleum mining lease under NSW's petroleum legislation, the Petroleum (Onshore) Act of 1991 (NSW Mining Act of 1992, Part 5, Div 4, Section 78). The Mining Act stipulates that royalties are to be paid on the petroleum recovered by the holder of a coal mining lease who successfully applies for the inclusion of petroleum in their mining lease (NSW Mining Act of 1992, Part 14, Div 3, Section 286). The now-repealed Coal Mines Regulation Act of 1982 formerly allowed a miner to extract CH_4 from the coal seam for purposes associated with mining coal (Breaden and Alexander, 2002); however, the succeeding Coal Mine Health and Safety Act of 2002 and the Coal Mine Health and Safety Regulation of 2006 are silent on this. Both the Mining Act of 1992 and the Petroleum (Onshore) Act of 1991 specify that royalties payable on petroleum recovered from a coal mining lease do not apply to CH_4 recovered in conjunction with coal mining operations, indicating that CMM is exempt from royalties in NSW while CBM is leased through the Petroleum Act and subject to royalty payments (NSW Petroleum [Onshore] Act of 1991, Part 7, Section 85; NSW Mining Act of 1992, Part 14, Div 3, Section 286).

Incentives and Policies

The Australian Government supports GHG emissions reductions, has committed to a five percent reduction below 2000 levels, and has recently proposed an additional reduction between 26 and 28 percent below 2005 levels by 2030. The Government has established an Australian dollar (A$)2.55 billion Emissions Reduction Fund through the Direct Action Plan, which seeks to efficiently and effectively source emissions reductions, where emissions reductions are purchased by the Government as they are generated. The Greenhouse Gas Abatement Programme (GGAP) was an Australian Government initiative to reduce Australia's net GHG emissions by supporting emissions reduction project opportunities during the period of the Kyoto Protocol (2008-2012). GGAP targeted large-scale, cost-effective, and sustainable projects across Australia's economy. GGAP prioritized projects that delivered emissions reductions exceeding 250,000 tonnes of carbon dioxide-equivalent (CO_2e) annually, and actively supported the development of CMM projects through the direct funding of four electric power projects for over A$43 million (M2M, 2005).

CMM emissions reduction projects that destroy CH_4 through the use of flares, electricity production devices, or flameless oxidation devices such as ventilation air methane (VAM) oxidation devices, qualify through the Carbon Credits (Carbon Farming Initiative – Coal Mine Waste Gas) Methodology Determination 2015, passed in February 2015; and the Carbon Credits (Carbon Farming Initiative – Coal Mine Waste Gas) Methodology Variation 2016, passed in

November 2016. Currently, an update of Australia's GMI Partner Country Action Plan and Coal Sector Action Plan is in progress (Guo, 2015).

In August 2012, the Australian Government and the European Commission announced their intention to link their emissions trading schemes. An interim one-way link was scheduled to start by July 1, 2015, under which Australian liable entities can surrender European Union allowances for compliance with their Australian carbon price liabilities. This was to be followed by a full two-way link by July 1, 2018 (Australian Government, 2013) but never did.

Further Reading

The following links provide additional information:

Financial and Regulatory Incentives for U.S. Coal Mine Methane Recovery Projects (page 14):

http://www.epa.gov/cmop/docs/cmm-financial-regulatory-incentives.pdf

Australian Coal Sector Update to the 22nd Session of the GMI Coal Subcommittee: http://www.unece.org/fileadmin/DAM/energy/se/pp/coal/cmm/10cmm_gmi.cs.oct2015/2_AUSTRALIA.Update.pdf
Australian Government Emissions Reduction Fund: http://www.environment.gov.au/climate-change/emissions-reduction-fund

Policies and Programs to Address Fugitive Emissions from Coal Mining in Australia (Australian Government, Department of Resources, Energy and Tourism):

https://www.globalmethane.org/expo-docs/canada13/coal_01_Murphy.pdf
GMI Australia Country Profile:

https://www.globalmethane.org/documents/toolsres_coal_overview_ch2.pdf

2.5. Canada

Ownership and Legal Status

In Canada, surface rights and mineral rights came with the purchase of land until the early 1900s. Since then, mineral rights have been government-owned and cannot be purchased, only leased, by individuals or companies. As a result, the mineral rights on more than 90 percent of Canada's land are currently owned by the national government (Crown-owned).

As in Australia, Canadian resources are administered by provincial governments. There are no CMM projects in Canada; however, CBM activity has commenced in Alberta, British Columbia, and Nova Scotia; and coal deposits containing gas exist in Saskatchewan as well. In all three active provinces, CBM is managed through petroleum leasing.

Alberta

In Alberta, all mineral and petroleum leases are administered through the Mines and Minerals Act (MMA) (Government of Alberta, 2000, Chapter M-17).

In 1991, the Alberta Energy Utilities Board and the Alberta Department of Energy published IL-91-11, a joint Information letter on CBM. The IL-91-11 sets forth the position that CBM is a form of natural gas and that under the MMA natural gas and coal are treated as distinct substances and are leased separately. Natural gas may exist in a variety of reservoir rocks, including coal seams. In 2003, the Government of Alberta amended the MMA to specifically address CBM beneath government-owned lands (Crown lands). Section 67(1) added to the MMA, stating, a "coal lease grants the right to the coal that is the property of the Crown in the location in accordance with the terms and conditions of the lease but subject to subsection (2), does not grant any rights to natural gas, including CBM." Ownership issues between coal and natural gas interests persisted on privately-owned or "freehold" lands. The Government of Alberta passed Bill 26 into law on December 2, 2010. Bill 26 added section 10.1 to the MMA and states that CBM "is hereby declared to be and at all times to have been natural gas" (Salmon and Wong, 2011).

Section 67(2) does, however, stipulate that:

> *The Minister, on the recommendation of the Alberta Energy Regulator that it is necessary to do so for safety or conservation reasons, may authorize the lessee of a coal lease to recover natural gas, including coalbed methane, contained in a coal seam in the location of the coal lease (Revised Statutes of Alberta 2000, Chapter M-17, Section 67(2)).*

British Columbia

In 2003, British Columbia enacted the Coalbed Gas Act, which stipulates that CBM is natural gas owned by the party who holds the natural gas rights (Woodside, 2011; BC Coalbed Gas Act, 2003). British Columbia's Ministry of Energy and Mines (MEM) issued an information letter, *Titles 05-02: Managing Co-existing Coal and Petroleum and Natural Gas Rights*, which outlines the policy for reducing conflicts and managing development where coal and CBM leases (tenures) overlap. The policy states that the MEM will inform tenure holders of coexisting coal or CBM tenures, when issuing new tenures, in order to make tenure holders aware of potential conflicts and to enable them to plan for exploration and development. All exploration and development activity, even of privately-owned (freehold) minerals, requires regulatory approval from the MEM for coal and the Oil and Gas Commission (OGC) for CBM. Before applying for approvals for coal or oil and gas activities, Crown and freehold rights holders must make reasonable efforts to confirm if there are coexisting rights holders. Where coexisting coal or CBM rights exist, rights holders must make reasonable efforts to negotiate and develop compatible resource exploration, development, and production programs between themselves. If the parties cannot develop collaborative work programs or resolve conflicts, a three-member review panel from MEM and OGC will examine the issues and facts associated with the development of the resources and recommend a resolution to the appropriate decision maker, which is the Director of the Project Assessment Branch of the OGC for CBM applications and the Chief Inspector of Mines of the MEM for coal activity permits (BC MEM, 2005).

Nova Scotia

Nova Scotia administers coal leases under the authority of the Mineral Resources Act of 1990. Petroleum (or oil), natural gas, and CBM or coal gas agreements are administered under the Petroleum Resources Act of 1989.

Nova Scotia refers to "coal gas" as "methane occurring naturally in coal seams and associated strata and includes methane obtainable by methane extraction" in the Petroleum Resources Act of 1989. In the case of existing leases in a given area, before entering into a coal gas agreement, the government will notify all holders of rights[6] in or adjacent to the area granted, allowing them to make representations concerning the proposed coal gas agreement. The government may add to, vary, or remove any terms or conditions of any petroleum, mineral, or gas storage lease in order to coordinate and maximize the public benefit from petroleum and mineral resource development (Nova Scotia Petroleum Resources Act. R.S., c. 342, s. 17).

With respect to coal mining, the Act forbids coal mine operators from disposing of any coal gas without the written approval of the government. The government may also attach terms to the approval such as conditions for conservation and utilization of gas (Nova Scotia Petroleum Resources Act. R.S., c. 342, s. 18).

Incentives and Policies

Under Alberta's Greenhouse Gas Reduction Program, Alberta requires facilities that emit more than 100,000 tonnes of GHGs per year to reduce emissions intensity by 12 percent, as of July 1, 2007. These reductions may be achieved by making improvements to their operations, purchasing Alberta-based offset credits, contributing to the Climate Change and Emissions Management Fund, or by purchasing or using Emission Performance Credits (EPCs). EPCs are generated by facilities that have gone beyond the 12 percent mandatory intensity reduction. Payments made to the Climate Change and Emissions Management Fund will be invested in projects and technology to reduce GHG emissions in Alberta (Government of Alberta, 2013). The Carbon Competitiveness Incentive Regulation (CCIR, 2018) replaced the Specified Gas Emitters Regulation (SGER) on January 1, 2018. Under the CCIR, the Alberta Climate Change Office sets product-based benchmarks for facilities in each sector. Compliance obligations are being phased in from 2008 to 2020. Approximately Canadian dollar (C$)1.4 billion is available until 2024 to support industry in the implementation of innovation projects that reduce GHG emissions.

British Columbia passed the Carbon Tax Act in May 2008. The Act puts a price on GHG emissions, providing an incentive for sustainable choices that produce fewer emissions. British Columbia started to phase in the escalating revenue neutral carbon tax on July 1, 2008. When introduced in 2008, the tax was initially set at C$10 per tonne of CO_2e. It was designed to rise by C$5 per year thereafter until it reached C$30 per tonne in 2012, after which it was frozen for five years (Elgie and McClay, 2013). Beginning April 1, 2018, British Columbia's carbon tax rate is C$35 per tonne of CO_2 emissions. The tax rate will increase each year by C$5 per tonne until it reaches C$50 per tonne in 2021. The initial price will be a minimum of C$10 per tonne of CO_2, and it will

[6] Rights granted pursuant to the Petroleum Act, the Mineral Resources Act (coal, for example) and/or the Gas Storage Exploration Act.

increase annually by C$10/tonne to reach C$50 in 2022. The new British Columbia carbon pricing scheme is in alignment with Canada's proposed national carbon price where province-level carbon pricing must be at or above the federal levels (BC, 2018). The tax is estimated to cover 70 percent of British Columbia's GHG emissions; however, the tax excludes fugitive emissions such as CMM emissions, stating that they "cannot currently be accurately measured."

Further Reading

The following links provide additional information:

Canada GMI Country Profile:
https://www.globalmethane.org/documents/toolsres_coal_overview_ch6.pdf

2.6. Germany

Ownership and Legal Status

In Germany, CMM resources are nationally-owned. According to the legal framework adopted at the federal level, the Federal Mining Authority is responsible for the administration of activity related to CMM exploration, extraction, and processing. CMM ownership rights are transferred to a coal mining company for the duration of a coal mining license, after which the capture and utilization of CMM requires a gas license for the subsequent 30-year period (USEPA, 2010). The Federal Mining Authority considers an application for license after the applicant has submitted a utilization program that clearly demonstrates that "planned activities are sufficient and within an acceptable time frame for the type, scope, and purpose of the methane extraction." A license can be refused or withdrawn if it is found to be inadequate with respect to legislatively-fixed factors, including the availability of sufficient funds, and the feasibility of a proposed extraction technology within a given timeframe and public interests (World Bank, 2007).

Incentives and Policies

Germany's primary policy incentive for CMM recovery and use projects is through a feed-in tariff for CMM used to generate power under the Renewable Energy Sources Act of 2004 (RESA). RESA requires electric grid system operators to connect plants generating electricity from mine gas to their systems and guarantees priority purchase and transmission of all electricity from such plants. RESA provides a guaranteed fixed payback tariff for 20 years through feed-in tariffs or fees paid for electricity produced from mine gas (USEPA, 2011). Depending on the size of the power plant, the tariff ranged from US$0.07 to US$0.09/kWh. Since 2004, between 160 and 190 MW of CMM power plant capacity has operated in Germany, of which approximately 75 percent is from abandoned mines (IEA, 2016; Backhaus, 2018).

Further Reading

The following links provide additional information:

Renewables and Coal Mine Methane in German Legislation: Recommendations for Ukraine:

https://www.globalmethane.org/documents/Backhaus_CMM-Utilisation_Germany_eng.pdf

Germany GMI Country Profile:
https://www.globalmethane.org/documents/toolsres_coal_overview_ch14.pdf

2.7. Colombia

Ownership and Legal Status

The national government owns all hydrocarbon and mineral resources in Colombia as stated in Article 332 of the Constitution of 1991. The Ministerio de Minas y Energía (Ministry of Mines and Energy) (MME) is responsible for regulating the energy sector, including:

- enforcement of the Colombian government's policies on exploration and production of hydrocarbons, and technical regulation;
- oversight of upstream activities such as drilling exploration wells and acquisition of seismic data; and,
- overseeing collection of production royalties.

Colombian laws empower the Agencia Nacional de Hidrocarburos (National Hydrocarbons Agency) (ANH), an administrative body under the MME, to award areas for exploration and production of hydrocarbons, including CBM. The Agencia Nacional de Minería (National Mining Agency) (ANM), another administrative body under the MME, is charged with managing the mineral resources of Colombia. The only rights that the mine owner currently has regarding CH_4 encountered during mining (CMM) is defined in Resolution 90325, which was passed in 2014. This resolution states that underground mines that encounter CMM during the mining process can use the gas for their own purposes (MME, 2014).

Currently, there is no regulation or law preventing a developer from applying for a license to explore and produce CBM in Colombia; an unconventional hydrocarbon license issued by ANH provides the right to explore for all unconventional gases, which includes CBM. If exploration of CBM was not the target of the original hydrocarbon license application, after award, a petition can be submitted to the ANH for permission to include coal-associated gas contained by the coalbeds during the exploration phase. Presently, the only apparent solution available to the owner of an existing coal license who wishes to sell gas or electricity to the market is to acquire an unconventional hydrocarbon license covering the coal lease. Agreement 004 of 2012 states that the Board of Directors of the ANH regulates the awards process for all hydrocarbon licenses, and, as a general rule, is carried out through a competitive bidding process. However, with rare exception, hydrocarbon licenses are issued by direct award with the prior authorization of the ANH Board of Directors. Therefore, the owner of the coal estate would have to petition the ANH for a direct award (Sepúlveda and Fajardo, 2016).

ANH has established certain prerequisites specific to CBM activities, such as prior experience in exploring and producing CBM, and demonstrated financial capacity. This process may thwart many coal mine operators, as they may lack the experience and financial capacity to acquire the

license. The work requirements and timing for CBM are different than those required for conventional licenses, simply because it can take longer to evaluate the CBM reservoir for its potential to produce (Sepúlveda and Fajardo, 2016).

Once a hydrocarbon license is secured, the National Code of Natural Renewable Resources, or Decree 2811 of 1974, requires that the developer must also obtain an environmental license. Decree 1220 of 2005, Decree 2820 of 2010, and Decree 2041 of 2014 (currently in force) issued by the Ministerio de Ambiente y Desarrollo Sostenible (Ministry of Environment and Sustainable Development) (MADS) establishes the basic procedures and requirements to obtain an environmental license for hydrocarbon exploration and production. Within the MADS is the Autoridad Nacional de Licencias Ambientales (National Authority for Environmental Licenses) (ANLA), which is responsible for granting the environmental licenses (ProColombia, n.d. and Ernst & Young, 2018).

A critical component to any mineral or hydrocarbon resource development in Colombia is the requirement to consider the local communities in the area. If the hydrocarbon license includes any portion of an area that is controlled by or populated by indigenous people or is a part of African-Colombian territories or communities, the developer is subject to a Prior Consultant Process with these communities. This process is termed "Consulta Previa" (DPLF, 2011). In 1997, the Court issued Ruling S039/1997, stating that an ethnic group's participation in Consulta Previa is a fundamental right. In 2008, Ruling C030/2008 was issued, which clarified how consultations were to be performed. The purpose of this consultation process is to identify any and all impacts of the proposed project's activities on the communities and must include measures that mitigate the negative impacts, while maximizing positive impacts. The Ministry of Interior regulates this process, and a certified letter from the Ministry indicating that the applicant has fulfilled this obligation is required as part of the environmental license application (Mininterior, 2017).

Incentives and Policies

Currently, Decree 4923 of 2011 sets forth a 40 percent reduction in royalties applicable to unconventional hydrocarbons, which includes CBM and CMM (Ernst & Young, 2016). There are no other incentives pertaining to either CBM or CMM development. Colombia's carbon tax began on January 1, 2017 and is currently set at US$5/tonne CO_2e (IETA, 2018). The tax applies to the sales and imports of all fossil fuels, including all petroleum derivatives, except for coal and natural gas power generation. The program allows for regulated entities to achieve reductions (and be exempted from the tax liability) through the use of offset projects. Offset projects must be located in Colombia and follow either CDM methodologies or those developed by recognized GHG programs like the VCS – both of which have CMM project methodologies (IETA, 2018).

Further Reading

The following links provide additional information:

CMM and its Strategic Role in Climate Change Mitigation: CMM Policies in Colombia: https://www.unece.org/fileadmin/DAM/energy/se/pp/eneff/8th_IFESD_Astana_2017/13_June/CMM_Climate_change/01_Pilcher.pdf

Global Methane Initiative (GMI) Coal Subcommittee Meeting and Coal Mine Methane Workshop findings:
http://www.globalmethane.org/news-events/event_detailsbyID.aspx?eventID=451

Colombia Coal Sector Update to the 20th Session of the GMI Coal Subcommittee:
https://www.globalmethane.org/documents/Coal-Subcommittee-Oct-2014-Colombia.pdf

GMI Colombia Country Profile:
https://www.globalmethane.org/documents/toolsres_coal_overview_ch8.pdf

2.8. Mongolia

Ownership and Legal Status

Mongolia's mineral resources are national government-owned and administered through the Ministry of Mining (MOM). Mongolia has plentiful coal resources, with proven reserves over 12 billion tonnes and unexplored resources ranging to at least an order of magnitude greater. The Mineral Resources Authority (MRA) and the Petroleum Authority are implementing agencies under the MOM and are charged with the responsible development of mineral and petroleum resources through licensure and the enforcement of regulations governing development. The MRA is responsible for the development and leasing of minerals such as coal under the Minerals Law (2006); and the Petroleum Authority, under authority of the Petroleum Law (1991), governs the exploration and production of liquid and gaseous hydrocarbons. Prior to 2014, the Ministry of Energy (MOE) claimed that any research or exploration for CH_4 associated with coal must also be permitted through its system. The original Mongolian Petroleum Law focused on exploration and development of conventional oil and gas resources and did not contemplate the occurrence of oil and gas deposits associated with coal seams or organic rich shale.

The Government of Mongolia passed an amendment to the Petroleum Law in 2014, which recognized CBM as an unconventional petroleum resource. In 2014, the Government of Mongolia re-organized the ministries and clarified responsibilities. As a result, the MOE could only be involved in CMM or CBM to the extent that it is used to generate power. MOM's subordinate agencies, the Petroleum Authority and the MRA, implement laws and regulations and enable licensing and permitting to promote the beneficial development of mineral and petroleum resources.

The Mongolian Parliament passed a resolution in 2015 that further clarifies procedures for obtaining a permit to explore and exploit coal-associated gas. This resolution was crafted as a way of avoiding conflict between operators that presently have production-sharing agreements for conventional oil and gas, and entities seeking to apply for unconventional petroleum exploration and exploitation permits. The resolution also requires that the Petroleum Authority notify a coal mine operator holding mining licenses granted by the MRA of any application to explore for CMM/CBM within the mining license block. Further, the mine operator has the opportunity to apply for a CMM exploration and exploitation license covering its license block

once notified. The mine operator must formally refuse the opportunity if the operator does not wish to develop the resource. With these recent governmental reorganization and legislative actions, companies interested in developing CMM or CBM can follow a relatively clear procedure from discovery through to production. Nevertheless, further regulation is being contemplated to remove remaining uncertainty in the process.

No exploration or Production Sharing Contracts have been negotiated for resources distinguished as CMM; however, members of the MRA have indicated that there are regulations that require coal lease holders to estimate the CH_4 resources associated with coal and the surrounding strata.

Incentives and Policies

Although Mongolia has abundant coal supply, the Government of Mongolia seeks to diversify its energy mix, including encouraging the

production of CMM and CBM (Ruiz and Pilcher, 2016). Incentives to date include reduced royalties on CBM (the Petroleum Law of 2014 included a fiscal incentive of a 10 percent royalty, instead of 15 percent for conventional resources; and a 2015 government resolution indicated royalties of 5 to 10 percent for CBM (Mendbayar, 2016). The Mongolian government is also considering other incentives such as subsidies for CMM utilization/CMM-generated power; and tax, fee, and royalty exemptions (Mendbayar, 2016). Mongolia's Nationally Determined Contribution (NDC) presents a commitment to reduce its GHG emissions by 14 percent by 2030. The NDC includes an increased share of renewable energy (wind, solar, hydro), but no increased natural gas usage, and, thus, no incentives for CMM.

Further Reading

The following links provide additional information:

Coal Mine Methane (CMM) Resource Assessment and Emissions Inventory Development in Mongolia:
https://www.globalmethane.org/Data/MNEC-CMM-Grant-Final-Report_FINAL.pdf

Methane Recovery and Utilization Opportunities:
https://www.globalmethane.org/documents/partners_mongolia_methane_opportunity.pdf

Mongolia GMI Country Profile:
http://www.globalmethane.org/documents/toolsres_coal_overview_ch22.pdf

2.9. Summary of International CMM Ownership and Policies

Table 2 summarizes the CMM ownership laws as well as policies and incentives for CMM project development in the countries profiled above in this report.

Table 2: Summary of CMM Ownership and Policies in Key Countries

Country	Ownership and Legal Status	Incentives and Policies
China	Central government-owned Coal and CBM are licensed separately but may overlap; surface pre-mine drainage requires a CBM license (administered as oil and gas); recovery of VAM in-mine drained, gob-drained CMM, etc., does not require a CBM license	Required to use or flare CMM > 30% CH_4; 0.3 CNY/m^3 subsidy for CMM utilization and a 0.25 CNY/kWh subsidy for CBM/CMM-fueled power generation; exemptions for prospecting and licensing fees as well as VAT on equipment Shanxi and Shaanxi Provinces: 0.1 CNY/m^3 subsidy for CMM utilization Hunan Province: 0.15 CNY/m^3 for CMM recovered and 0.2 CNY/m^3 for CMM used
Mexico	Federally-owned The recovery and use of CBM/CMM for onsite usage by coal mining concessionaires or for gas sales to government-owned gas company is allowed	Carbon tax on fossil fuel use has been implemented since 2014. Modifications to the Carbon Tax during its passage through Congress were made to exclude natural gas from the tax, and at this time, CMM is not included in the tax scheme. CERs from Mexico-hosted CMM projects may be used to avoid the tax.
Ukraine	National government-owned The government can issue CMM leases with new coal mining leases to mine operators; existing mines are required to obtain a permit for CMM exploration and production; mines may sell their rights to CMM	CMM project profits are not subject to taxation; flaring of CMM from degasification systems is prohibited; government also reduced rent payments by 14-29% in December 2015. If CMM is produced at state-owned mines, the National Energy and Utilities Regulatory Commission sets wholesale prices.

Country	Ownership and Legal Status	Incentives and Policies
Australia	State/provincially-owned Queensland: CMM utilization by mines is allowed onsite, offsite sales requires petroleum lease NSW: The coal lessee may apply for inclusion of petroleum or gas in the mining lease, provided the area is not already under a petroleum lease	Queensland: Flaring CMM is prohibited if it is commercially or technically feasible to use the CMM NSW: CH_4 recovered in conjunction with coal mining is exempt from royalties (CBM leased through Petroleum Act is subject to royalties) The government established an A$2.55 billion Emissions Reduction Fund to efficiently and effectively source emissions reductions, where emissions reductions are purchased by the government as they are generated; CMM emissions reductions projects using flares, electricity production devices, or flameless oxidation devices, such as VAM oxidation devices, qualify
Canada	Mineral resources are ~ 90% federally-owned, administered provincially, with the remaining privately-owned Alberta: The coal lessee may recover CMM with government approval, if necessary for safety or conservation reasons; otherwise, CMM/CBM is treated as natural gas British Columbia: Coal and CBM tenures may overlap; government has outlined a process for mitigating conflicts Nova Scotia: Coal and CBM rights may overlap; the government will notify existing rights holders before issuing overlapping rights and may alter existing lease to maximize resource development	Alberta: The Greenhouse Gas Reduction Program requires facilities emitting > 100,000 tonnes CO_2e per year to reduce emissions intensity by 12 percent, as of July 1, 2007 British Columbia: The carbon tax excludes CMM

Country	Ownership and Legal Status	Incentives and Policies
Germany	Federally-owned The government transfers CMM rights to the coal company for the duration of the coal license, with an option for a gas license after the coal mining ceases	Feed-in tariff for CMM used to generate power under the Renewable Energy Sources Act of 2004
Colombia	National government-owned Coal and CBM rights may overlap, hydrocarbon leaseholder (which includes CBM) has rights to CBM; coal owner has no rights to CBM, except in the case of underground mines that can only use the gas encountered while mining for their own use (Resolution 90325)	Royalty paid to the national government for unconventional gas (includes CBM) is reduced by 40%
Mongolia	National government-owned The exploration and production of liquid and gaseous hydrocarbons, including unconventional resources such as CBM, are governed under the Petroleum Law (1991) by the Petroleum Authority. The Petroleum Authority must notify a coal mine operator holding mining licenses granted by the MRA of any application to explore for CMM/CBM within the mining license block. The mine operator has the opportunity to apply for a CMM exploration and exploitation license covering its license block if notified, and the obligation to formally refuse the opportunity if it does not wish to develop the resource.	Reduced royalties for CBM

3. Incentivizing CMM Capture and Utilization through Ownership and Policy Incentives

The following sections discuss considerations and options for developing laws and policies that prevent ownership conflicts, mitigate perceived legal barriers for project developers, and incentivize CMM utilization. These options are based on successful laws and policies in key CMM-producing countries showcased in the previous section.

3.1. Clear Ownership Options

Ill-defined gas property rights and lack of clarity regarding the ownership of the CBM/CMM and permitting process in many developed countries serve as obstacles to the development of gas production and utilization projects (USEPA, 2009c). As international case studies show, there are numerous opportunities for conflicts to arise in the absence of clear CMM ownership rules, particularly where coal and gas rights overlap.

As CMM projects require coal mine cooperation and are often initiated by coal companies, giving coal mines first priority for CMM exploration and development activities as in Ukraine and Germany provides the most straightforward ownership solution. A step further to encourage CMM utilization is to allow coal mining areas to be considered potential CBM concessions should the coal mine decline to explore for and/or develop the resource after a given time period.

3.2. Policy Incentives

Because ownership is only facet of successfully launching a CMM project, countries have developed various policy incentives, such as royalty relief, feed-in tariffs, tax incentives, and others. While not discussed in this report, renewable portfolio standards that are expanded to alternative sources such as CMM are also effective in promoting CMM-based power.

An important consideration in developing policies is to ensure that safety regulations take precedence and that unsafe activities are discouraged. Policies requiring CMM capture and use, particularly over a given concentration (e.g., 30 percent CH_4 concentration to use or flare the gas), may encourage operators to maintain gas concentrations below a certain percent by dilution, ignoring best practices and safety standards.

Royalties

In addition to safety regulations for issues such as mine air CH_4 concentrations, options exist to encourage safer CMM development practices. Pre-drainage is the only means of reducing gas flow directly from the worked seam, which can be important if the seam being extracted is the main gas emission source. Incentives such as royalty relief for pre-drained gas could be administered to encourage this method of degasification over other methods, as is the case in Colombia. Royalty relief can be a successful incentive by encouraging pre-drainage of gas prior to mining. Royalty relief can also apply to CMM projects.

Feed-in Tariffs

Feed-in tariffs can promote CMM projects through higher prices for alternative electricity on the electricity market. Feed-in tariffs, such as Germany's Renewable Energy Law, led to widespread CMM and abandoned mine methane (AMM) project development. China's subsidies for CMM utilization and CBM/CMM-fueled power generation provide grid access for CMM-based electricity and make CMM projects more economic.

Tax Incentives

Tax exemptions may provide an incentive to develop CMM projects. China provides an exemption from VAT on CMM project equipment, and Ukraine provides a tax exemption for CMM project profits. Tax incentives can come in many forms. In addition to federal VAT exemptions for equipment, tax relief can include delays or exemptions on CMM production or technology development, tax credits for investment loans, waiving import duties, and other state and local income tax relief (Wenge, 2015).

Other Financial Incentives

Direct funding is another way to offer incentives for CMM projects. For example, the Australian Emissions Reductions Fund contributes directly to actions that result in emissions reductions, including CMM projects. Similarly, the Australian GGAP initiative supported emissions reduction projects for a targeted period of time, including direct funding for CMM projects as part of four electric power projects. Although not discussed here, other options are project financing, loan guarantees, etc.

The economic returns of many CMM projects are lower than preferred rates which make it difficult to attract financing for strictly energy usage or sales. Additional revenue from environmental credits such as carbon credits or renewable energy credits can significantly improve rates of return and cash flow of projects. Carbon finance can provide the capital investment needed and improve the attractiveness of otherwise economically marginal CMM projects (USEPA, 2016).

3.3. Outreach and Education

Education and information dissemination can also play an important role in the development of CMM recovery and utilization projects. There are CMM clearinghouses and information centers in such countries as China, India, and Russia. In 1994, the Chinese government and the USEPA founded the first of these institutions, the China Coalbed Methane Clearinghouse, housed within the China Coal Information Institute. The Russian International Coal and Methane Research Center (Uglemetan) began operating in 2002 and the India CMM Clearinghouse in 2008.

Many organizations such as the GMI, the International Energy Agency, the United Nations Economic Commission for Europe (UNECE), and the USEPA have been actively participating in the development of CMM recovery dissemination practices through technical information sessions, development of documents and tools, and participation in international events (USEPA, 2009c). The Group of Experts on Coal Mine Methane have held capacity-building workshops and

seminars on CMM best practices in Kazakhstan, China, and India in 2017; and Poland and Colombia in 2018. In addition, past events such as USEPA's U.S. CMM Conference bring coal mines, project developers, government representatives, and technology providers together to foster ideas for further CMM project development. Under the auspices of the UNECE, the first International Center of Excellence (ICE)-CMM was opened in Katowice, Poland, in 2017. A second ICE was opened with the Shanxi Cooking Coal Group in Tian Jin, China, in September 2017. The centers support capacity building through dissemination of best practices on economically viable CH_4 abatement and utilization, safe underground coal mine practices, and environmentally responsible CH_4 management.

References

Australian Government (2013): Starting Emissions Trading on 1 July 2014 Policy Summary, July 2013. http://www.climatechange.gov.au/sites/climatechange/files/files/reducing-carbon/carbon-pricing-policy/cef-policy-summary-moving-ets.PDF

Backhaus (2018): *Utilization of CMM and AMM in Germany*, 25th World Mining Congress, June 2018.

BC (2018): British Columbia Ministry of Environment & Climate Change Strategy. https://www2.gov.bc.ca/gov/content/environment/climate-change/planning-and-action/carbon-tax

BC Coalbed Gas Act (2003): Coalbed Gas Act [SBC 2003] Chapter 18. http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_03018_01

BC MEM (2005): Titles 05-02: Managing Co-existing Coal and Petroleum and Natural Gas Rights, British Columbia Ministry of Energy and Mines, April 8, 2005. http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-gas-oil/png-crown-sale/information-letters/titles0502coexistingpngcoalrights.pdf

Breaden and Alexander (2002): Project finance for coal seam methane developments – An Australian bank perspective, Phil Breaden and John Alexander, Westpac Institutional Bank, Presented at The Australian Coal Seam and Mine Methane Conference, June 25-26, 2002. http://www.hpconsult.com.au/DLoad/CSM%20Conference%202002.pdf

CCIR (2018): Alberta Carbon Competitiveness Incentive Regulation Fact Sheet, April 2018. https://www.alberta.ca/assets/documents/cci-fact-sheet.pdf

China Daily (2013): Carbon market helps cut emissions, China Daily, Vol. 33, No. 10367, July 29, 2013.

DPLF (2011): Executive Summary - The Right of Indigenous Peoples to Prior Consultation: The Situation in Bolivia, Colombia, Ecuador, and Peru, Due Process of Law Foundation, 21 pp.

Elgie and McClay (2013): BC's Carbon Tax Shift After Five Years: Results, Dr. Steward Elgie and Jessica McClay, University of Ottawa, July 2013. http://www.sustainableprosperity.ca/dl1026&display

Ernst & Young (2016): Global Oil and Gas Tax Guide. https://www.ey.com/Publication/vwLUAssets/EY-2016-Global-oil-and-gas-tax-guide/%24File/EY-2016-Global-oil-and-gas-tax-guide.pdf

Ernst & Young (2018): Legal Guide To Do Business in Colombia 2018. https://www.ey.com/Publication/vwLUAssets/ey-legal-guide-to-do-business-colombia-2018/$FILE/ey-legal-guide-to-do-business-colombia-2018.pdf

Escalona and Pereyra (2017): Mexico's Update on ETS Development, Presented by Victor Escalona and Saul Pereyra, PMR PA16, New Delhi, 2017. https://www.thepmr.org/system/files/documents/PMR%20Mexico%27s%20Update%20on%20ETS%20Development%2014032017.pdf

Evans (2009): Coal Mine Methane Activities in Ukraine, Meredydd Evans, Presented at 2009 U.S. Coal Mine Methane Conference, October 1, 2009. http://www.epa.gov/cmop/docs/cmm_conference_sept09/16evans.pdf

Franklin (2010): Global Overview of Policies Affecting Coal Mine Methane (CMM) Recovery and Utilization, Presented by Pamela Franklin, Methane to Markets Partnership – Mongolia CMM Project Development Workshop, Ulaanbaatar, Mongolia, August 30-31, 2010. http://www.globalmethane.org/documents/events_coal_20100830_franklin.pdf

García (2017): Mexico Carbon Tax, Presented by Saúl Pereyra Garcia, Technical Workshop Carbon Tax: Design and Implementation in Practice, New Delhi, India, March 22, 2017. https://www.thepmr.org/system/files/documents/Mexico%20Carbon%20Tax_PMR_march_2017.pdf

Geonews (2013): List of subsoil sites, put up for auction for special permits in 2013 (in Ukrainian). http://geonews.com.ua/files/perelil_1aukcion_2013.doc

GMI (2011): Australian Coal Action Plan, Global Methane Initiative, 2011. https://www.globalmethane.org/documents/coal_cap_australia.pdf

GMI (2013): Global Methane International Coal Mine Methane Projects Database. Accessed July 2013. http://www2.ergweb.com/cmm/index.aspx

Government of Alberta (2000): Mines and Minerals Act. Revised Statutes of Alberta, Chapter M-17. http://www.qp.alberta.ca/1266.cfm?page=m17.cfm&leg_type=Acts&isbncln=9780779755608&display=html

Government of Alberta (2013): Greenhouse Gas Reduction Program, 2013. http://environment.alberta.ca/01838.html

Guo (2015): Australia Coal Sector Update to the 22nd Session of the Global Methane Initiative (GMI) Coal Subcommittee, Dr. Hua Guo, Commonwealth Scientific and Industrial Research Organization, Presented at the 22nd Session of the GMI Coal Subcommittee, Geneva, Switzerland, October 27, 2015. http://www.unece.org/fileadmin/DAM/energy/se/pp/coal/cmm/10cmm_gmi.cs.oct2015/2_AUSTRALIA.Update.pdf

Huang (2012): Preferential Policy and International Action of CBM/CMM Development in China, Huang Shengchu, China Coal Information Institute, presented at the Coal Mine Methane Abatement Seminar, Australia, September 4-5, 2012. https://www.globalmethane.org/documents/events_coal_120904_qinggang.pdf

Huang et al. (2016): Coal Sector Updates in China, Huang Shengchu, Zhang Zhaogeng, and Su Chen, China Coal Strategic Research Center, presented at the Coal Subcommittee of The Global Methane Initiative Coal Subcommittee Meeting, Geneva, Switzerland, October 24, 2016. http://www.unece.org/fileadmin/DAM/energy/se/pp/coal/cmm/11cmm_gmi.cs_oct2016/2_GMI-China_coal.pdf

IEA (2009): Coal Mine Methane in China: A Budding Asset with the Potential to Bloom, International Energy Agency, February 2009. http://www.iea.org/publications/freepublications/publication/china_cmm_report.pdf

IEA (2016): Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz EEG) https://www.iea.org/policiesandmeasures/pams/germany/name-22369-en.php

IETA (2018): Colombia: An Emissions Trading Case Study, January 2018. https://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/2018/Colombia-Case-Study-2018.pdf

Karas (2006): Information received from John Karas, Manager, Coal Industry Section, Australia Department of Industry, Tourism, and Resources, 2006.

Kelafant (2011): Outlook for CMM in Mexico and Colombia, presented by John Kelafant, Advanced Resources International and the 2011 U.S. CMM Conference, Park City, UT, October 19-20, 2011. http://www.epa.gov/cmop/docs/cmm_conference_oct11/Kelafant.pdf

Lin (2011): China's Evolving Energy Governance: A Case Study of Mining Rights Disputes, Energy Governance Case Study #14, Lin Yanmei, Centre on Asia and Globalization, Lee Kuan Yew School of Public Policy, National University of Singapore, December 2011. http://www.spp.nus.edu.sg/docs/energy-case/%2314-China.pdf

López-Velarde and Almaraz (2011): New regulations for coal-bed methane permits, Rogelio López-Velarde and Ruben Almaraz, International Law Office, June 27, 2011. http://www.internationallawoffice.com/newsletters/detail.aspx?g=191e141d-cdfd-4583-8181-54723feec18f

M2M (2005): Australia Department of Industry, Tourism, and Resources, M2M Country Specific Profile, 2005.

Maciw et al. (2009): Ukraine: New Regime For Coalbed Methane, Christina Maciw, Tetyana Budyakova, Vitaliy Radchenko and Inna Saakova, June 15, 2009. http://www.mondaq.com/x/81176/Oil+Gas+Electricity/New+Regime+For+Coalbed+Methane

Mendbayar (2016): CBM and CMM Development in Mongolia – New Policies to Stimulate Clean Energy Projects, Global Methane Forum, Washington DC, March 29-30, 2016. https://www.globalmethane.org/forum/presentations/coal/tuesday-session-2/Badarch_CMMCBM_developmment.pdf

MÉXICO$_2$ (2017): Environment, Voluntary Carbon Market, Accessed August 4, 2017. http://www.mexico2.com.mx/medio-ambiente.php?id=6

Mexico Mining Law (2006): http://www.economia.gob.mx/files/comunidad_negocios/industria_comercio/ley_minera_mining_law.pdf

Mininterior (2017): Procesos de Consulta Previa [Processes of Previous Consultation], Accessed August 2, 2017, http://www.mininterior.gov.co/mision/direccion-de-consulta-previa/procesos-de-consulta-previa

MME (2014): RESOLUCIÓN 90325 DE 2014, issued by the Ministry of Mines and Energy, Official Journal No. 49.104 of March 26, 2014.

Muñoz-Piña (2015): Mexico's Carbon Tax, Partnership for Market Readiness, https://www.thepmr.org/system/files/documents/5.%20Carlos%20Munoz%20Pina.pdf

Naftogaz (2013). Unconventional Sources of Hydrocarbons of Ukraine. Book VII: Coalbed methane, gas hydrates, impact structures and superimposed depressions of the Ukrainian shield (in Ukrainian). National Joint-Stock Company «Naftogaz of Ukraine», Taras Shevchenko National University of Kyiv, Institute of Geology and Geochemistry of Combustible Minerals of National Academy of Science of Ukraine, PJSC «Donetsksteel», Ukrainian State Research Institute «Ukrndiproekt» Kyiv, Nika. http://www.geol.univ.kiev.ua/lib/mono_USHU/7_Ukrainian_Shield.pdf

Nova Scotia Petroleum Resources Act. R.S., c. 342. http://nslegislature.ca/legc/statutes/petrol.htm

NSW Mining Act of 1992. http://www.legislation.nsw.gov.au/maintop/view/inforce/act+29+1992+cd+0+N

NSW Petroleum (Onshore) Act 1991. http://www.legislation.nsw.gov.au/maintop/view/inforce/act+84+1991+cd+0+N

Plachkova (2010): Energy: History, Present and Future (in Ukrainian). Libra, Kyiv. http://energetika.in.ua/ua/books/book-1/part-2/section-7/7-7

ProColombia (n.d.): Manual of Environmental Licensing in Colombia. https://www.anm.gov.co/sites/default/files/DocumentosAnm/manual_of_environmental_licensing_in_colombia.pdf

Qld Mineral Resources Act of 1989. https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/M/MineralReA89.pdf

Queensland Parliament (2014): Mineral and Energy Resources (Common Provisions) Act 2014, Act No. 47 of 2014. https://www.legislation.qld.gov.au/LEGISLTN/ACTS/2014/14AC047.pdf

Roshchanka, V., M. Evans, F. Ruiz, and N. Kholod. (2017): A strategic approach to selecting policy mechanisms for addressing coal mine methane emissions: A case study on Kazakhstan, Environmental Science and Policy, Volume 78, 2017, Pages 185-192, https://doi.org/10.1016/j.envsci.2017.08.005.

Ruiz and Pilcher (2016): CBM and CMM development in Mongolia, World Coal, May 18. https://www.worldcoal.com/cbm/18052016/cbm-and-cmm-development-in-mongolia-2016-805/

Salmon and Wong (2011): EnCana Corporation v. ARC Resources Ltd.: ownership of CBM within freehold Alberta lands, Karen A. Salmon and Adrienne Wong, Borden Ladner Gervais LLP, July 19, 2011. http://www.lexology.com/library/detail.aspx?g=bf0567eb-4c60-4e8d-b7a2-db3c080c5a25

Sepúlveda and Fajardo (2016, September 9): Personal communication with Víctor Manuel Sepúlveda and Dolly Yaneth Fajardo of ANH in Bogotá.

UNECE (2010): Best Practice Guidance for Effective Methane Drainage and Use in Coal Mines. ECE ENERGY SERIES No.31. United Nations Economic Commission for Europe and Methane to Markets. New York and Geneva. February 2010. http://www.unece.org/fileadmin/DAM/energy/se/pdfs/cmm/pub/BestPractGuide_MethDrain_es31.pdf

UNFCCC (2018): CDM Project Search, 2018. https://cdm.unfccc.int/Projects/projsearch.html

USEPA (2009a): Ukraine makes progress on CMM legislation and green electricity tariff, CBM Extra May 2009, pp.1–3. U.S. Environmental Protection Agency, Coalbed Methane Outreach Program. http://www.epa.gov/cmop/docs/spring_2009.pdf

USEPA (2009b): Ukraine passes coal mine methane legislation, CBM Extra September 2009, p. 8. U.S. Environmental Protection Agency, Coalbed Methane Outreach Program. http://www.epa.gov/cmop/docs/september_2009.pdf

USEPA (2009c): Analysis of International Best Practices for Coal Mine Methane Recovery and Utilization, U.S. Environmental Protection Agency, January 2009. http://www.epa.gov/cmop/docs/analysis_best_practices.pdf

USEPA (2010): Coal Mine Methane Country Profiles, United States Environmental Protection Agency, December 2010. https:/www.globalmethane.org/tools-resources/coal_overview.aspx

USEPA (2011): Financial and Regulatory Incentives for U.S. Coal Mine Methane Recovery Projects, United States Environmental Protection Agency, August 2011. http://www.epa.gov/cmop/docs/cmm-financial-regulatory-incentives.pdf

USEPA (2012a): Global Anthropogenic Non-CO2 Greenhouse Gas Emissions: 1990-2030, United States Environmental Protection Agency, December 2012. https://www.epa.gov/sites/production/files/2016-08/documents/epa_global_nonco2_projections_dec2012.pdf

USEPA (2015): Energy Markets in China and the Outlook for CMM Project Development in Anhui, Chongqing, Henan, Inner Mongolia, and Guizhou Provinces, United States Environmental Protection Agency, April 2015. https://www.epa.gov/sites/production/files/2016-03/documents/2014_coalchinaenergymarket_fullreport.pdf.

USEPA (2016): Coal Mine Methane (CMM) Finance Guide, United States Environmental Protection Agency, March 2016. https://www.epa.gov/sites/production/files/2016-04/documents/cmop_finance_guide_march_2016_revision.pdf

Vanderklippe (2017): China renews commitment to less coal, more natural gas, The Globe and Mail, July 10, 2017. Accessed September 1, 2017. https://beta.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/china-renews-commitment-to-less-coal-more-natural-gas/article35627780/?ref=http://www.theglobeandmail.com&

Verkhovna Rada (2009): Law on Gas (Methane) from Coal Beds (in Ukrainian). Verkhovna Rada of Ukraine, Kyiv. http://zakon3.rada.gov.ua/laws/show/1392-17.

Verkhovna Rada (2016): The Tax Code of Ukraine (in Ukrainian). Verkhovna Rada of Ukraine, Kyiv. http://zakon2.rada.gov.ua/laws/show/2755-17/print1514999537255627

Verkhovna Rada (2017): Law on the Electricity Market (in Ukrainian). Verkhovna Rada of Ukraine, Kyiv. http://zakon5.rada.gov.ua/laws/show/2019-19

Wallace (2009): Coal in Mexico, Robert-Bruce Wallace, Informa Economía de la Universidad Nacional Autónoma de México, Issue 359, July-August 2009. English. http://www.economia.unam.mx/publicaciones/econinforma/pdfs/359/brucelish.pdf

Wenge (2015): The Experience with CMM Development: A Case Study Focusing on Policy from China, Presented by Liu Wenge, China Coal Information Institute, at the Global Methane Forum, Washington, DC, March 29, 2015. https://www.globalmethane.org/forum/presentations/coal/tuesday-session-2/Liuwenge_Experience_with_CMM_Development.pdf.

Woodside (2011): No need for a canary, Alberta defines coalbed methane! David M. Woodside, Miller Thompson LLP, February 16, 2011. http://www.lexology.com/library/detail.aspx?g=8354cf3d-cfae-4db8-861c-d83ee3b93a9d

World Bank (2007): A Strategy for Coalbed Methane (CBM) and Coal Mine Methane (CMM) Development and Utilization in China, Energy Sector Management Assistance Program, 2007, Formal Report 326/07, World Bank, Washington, DC.

Yashchenko (2013): State Policy of Ukraine in Capturing and Utilizing Coal Mine Methane, Igor Yashchenko, Presented at the Methane Expo 2013, Vancouver Canada, March 12-15, 2013. http://www.unece.org/fileadmin/DAM/energy/se/pp/coal/cmm/8cmm_nov2013/7_Ukraine_e.pdf

Yashchenko (2017): Status of Coal Mine Methane Degasification and Utilization in Ukraine, Igor Yashchenko, Ministry of Energy and Coal Industry of Ukraine (in Ukrainian), Presented at the 12 Session Group of Experts on Coal Mine Methane, Geneva, Switzerland, October 24-25, 2017. http://www.unece.org/fileadmin/DAM/energy/se/pp/coal/cmm/12cmm_oct2017/24_October/10_Mr_Yashchenko_Ukraine_r.pdf