

20 CHINA



In 2019, China was the world's largest coal producer and consumer, and was also responsible for over 50 percent of world coal mine methane (CMM) emissions. With its signing and ratification of the Paris Agreement on Climate Change and the internal policies set out in the country's 13th 5-year plan (National Development and Reform Commission P.R.C., 2016), China has expressed its intention to reduce its greenhouse gas (GHG) emissions. Chinese government subsidies and a number of regulatory changes and policy incentives have made CMM projects more economically attractive. China's 13th 5-year plan (National Development and Reform Commission P.R.C., 2016) has made natural gas development a key part of the country's energy policy. China is making a concerted effort to increase the capacity of its natural gas pipeline infrastructure, explore new reserves (the majority of which are CMM and shale gas reserves), and developing innovative methane capture technologies. The country seeks to augment its energy production through CMM projects and just over 1,000 mines have implemented CMM projects.

20.1 Summary of Coal Industry

20.1.1 ROLE OF COAL IN CHINA

- Coal accounts for 60.4 percent of total national energy consumption in China.
- Coal production increased 31.6 percent between 2007 and 2013 before decreasing to 10.8 percent between 2013 and 2017.
- Natural gas consumption increased 340 percent between 2007 and 2017.
- Chinese electricity generation in 2017 was comprised of coal (60.4 percent), oil (19.4 percent), hydroelectric (8.3 percent), natural gas (6.6 percent), renewables (3.4 percent), and nuclear (1.8 percent) (BP, 2018).
- China's coal reserves and coal production are shown in Table 20-1.

Table 20-1. China’s Coal Reserves and Production

Indicator	Anthracite & Bituminous (million tonnes)	Subbituminous & Lignite (million tonnes)	Total (million tonnes)	Global Rank (# and %)
Estimated Proved Coal Reserves (2017)	130,851	7,968	138,819	4, 13.4%
Annual Coal Production (2017)	2,679	766	3,446	1, 46.4%

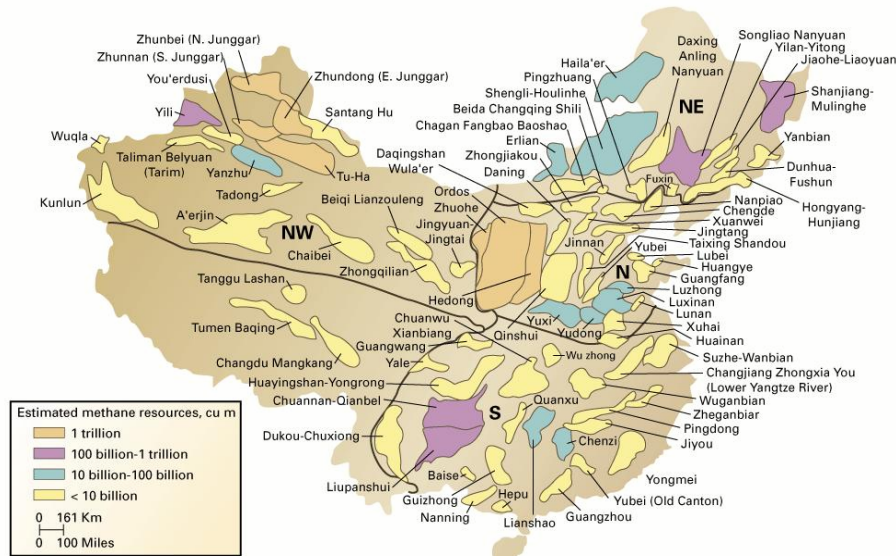
Sources: BP (2018), EIA (2019).

As shown in Figure 20-1, China has four major coal basins (USEPA, 1996):

- Sanjuang-Mulinghe, Songliao, Donhua-Fushun, and Hongyang-Hunjiang basins in the Northeast.
- Taixing-Shandou, Qinshui, Daning, Ordos, Hedong, Yuxi, Xuhuai, and Huainan basins in the North.
- Chuannan-Qianbei, Huayingshan-Yongrong, and Liapanshui basins in the South
- Tarim, Qaidam, and Junggar basins in the Northwest.

Figure 20-1. China’s Coal Fields

CHINA'S COAL BASINS AND COALBED METHANE RESOURCES



Source: Liu, 2007.

20.1.2 STAKEHOLDERS

- China plans to consolidate existing, small coal companies into several “super-large” coal mining companies, listed in Table 20-2, by 2020 (Reuters, 2018).

Table 20-2. Key Stakeholders in China’s CMM Industry

Stakeholder Category	Stakeholder	Role
Mining companies*	<p>Large coal groups, such as:</p> <ul style="list-style-type: none"> ▪ Shenhua Group (renamed China Energy Investment Corp. in 2017) ▪ China National Coal Group ▪ Datong Coal Mine Group ▪ Jizhong Energy Group ▪ Shaanxi Coal and Chemical Industry Group ▪ Shandong Energy Group ▪ Shanxi Coking Coal Group 	Project hosts
Developers**	<ul style="list-style-type: none"> ▪ China National Petroleum Corporation ▪ China United Coalbed Methane Corporation Ltd. ▪ CBM Exploitation and Development Company of the PetroChina Company Ltd. ▪ Far East Energy ▪ Lanyan CBM Company of the Jincheng Anthracite Coal Mining Group ▪ Sindicatum Carbon Capital, SCC Americas ▪ For a list of more developers, refer to (GMI, 2015) 	Project opportunity identification and planning
Engineering, consultancy, and related services**	<ul style="list-style-type: none"> ▪ China Coalbed Methane Clearinghouse (affiliated with the China Coal Information Institute) ▪ Guizhou International Cooperation Center for Environmental Protection 	Technical assistance
Universities and research establishments**	<ul style="list-style-type: none"> ▪ China Coal Research Institute ▪ China University of Mining and Technology ▪ China University of Petroleum, Beijing ▪ China National Administration of Coal Geology ▪ China Coal Information Institute 	Research and Technical assistance

Stakeholder Category	Stakeholder	Role
Regulatory agencies and government groups**	<ul style="list-style-type: none"> ▪ National Development and Reform Commission ▪ National Energy Administration ▪ Ministry of Ecological Environment ▪ State Administration of Coal Mine Safety, within State Administration of Work Safety ▪ China National Coal Association 	Drafting of legislation, implementation of laws, government oversight

Sources: * Xin (2015), ** GMI (2005), Huang (2019).

20.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

- In 2017, Chinese coal production was 66.0 percent bituminous, 16.7 percent coking, 11.8 percent anthracite, and 5.5 percent lignite (EIA, 2019)
- The Chinese government is in the process of closing small, inefficient, and unsafe mines: in 1990 there were over 100,000 mines; as of 2018 there were 5800, of which 4383 held licenses (IEA, 2009; Reuters, 2016; ITA, 2017; NEA, 2019).
- Coal is produced throughout China in 28 provinces, with the majority produced in the provinces of Shanxi, Inner Mongolia, Shaanxi, and Xinjiang by state-owned companies (EIA, 2015).
- The coal industry is worth 253.11 billion (United States dollars, USD) and the country's largest seven coal mining companies account for more than 60 percent of coal output (ITA, 2017). This percentage will likely grow as smaller, inefficient mines run by towns and municipalities are closed by the government.
- Most coal mines in China are underground mines. As of 2012, underground mining accounted for 90 percent of Chinese coal production (Huang, 2013).

20.2 Overview of CMM Emissions and Development Potential

- China's CMM and coalbed methane (CBM) reserves are the third-largest worldwide, after the United States and Russia, with 38.6 trillion cubic meters (TCM) of proven reserves and up to 317 TCM in potential reserves (Yong and Jianping, 2015; Thakur, 2017).
- The Global Methane Initiative CMM International Projects Database currently has 84 projects in operation for the optimization of degasification systems to reduce methane emissions from Chinese coal mines (GMI, 2019).

- About 44 percent of large, state-owned mines are considered gassy and require ventilation before being safely mined (Huang, 2013).
- In support of the Global Methane Initiative, the U.S. Environmental Protection Agency (USEPA) has funded five feasibility studies and eight pre-feasibility studies in China:
 - The most recent study examined the TengHui Mine in Shanxi Province (USEPA, 2019):
 - The mine had 495 million cubic meters of CMM reserves.
 - In-seam borehole drainage was recommended.
 - An economic analysis found that natural gas would provide between 3.47 megawatts (MW) and 5.23 MW in onsite power production, providing an internal rate of return between 10.3 percent and 43.6 percent.

20.2.1 CMM EMISSIONS FROM OPERATING MINES

- China accounted for 43 percent of global coal mine methane emissions in 2017, totaling more than 13.5 billion cubic meters (BCM) of methane. Only 35 percent of this amount was utilized, with the rest escaping to the atmosphere (UNECE, 2017)
- Mines with CMM drainage capacities as of 2011 totaled 1,047 (Huang, 2013).
- China's CMM drainage volume experienced a five-fold increase between 2005 and 2013, reaching 12.6 BCM, up from 2.2 BCM in 2005 (Huang 2014).
- The volume of CMM recovered and used in 2013 was 4.25 BCM (Huang, 2014).
- The largest CMM power project in the world, located at the Sihe Mine in Jincheng, Shanxi Province, utilized 187 million cubic meters of CMM to run a 120-MW capacity power plant (Biao, 2014). It closed in 2014.

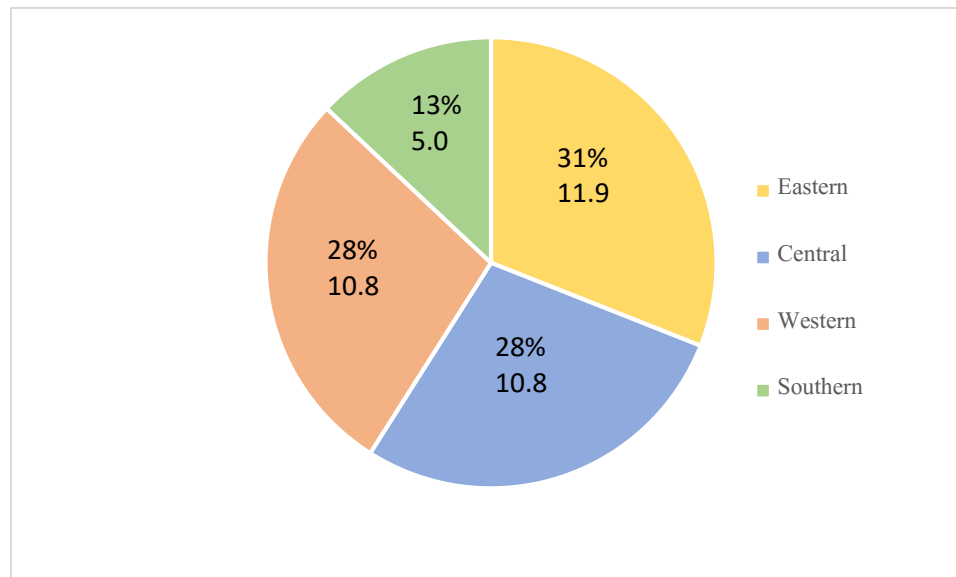
20.2.2 CMM EMISSIONS FROM ABANDONED COAL MINES

- The China Coal Information Institute established the Abandoned Mine Methane Project Advice Centre to advise and promote the country's abandoned mine methane use (CCII, 2010).
- Tens of thousands of coal mines have been abandoned since the 1990s—in Shanxi Province alone there are over 4,700 abandoned mines with reserves over 3 BCM of CMM (Hu et al., 2018). To date, no abandoned mine methane projects have been initiated in China (GMI, 2019).

20.2.3 CBM FROM VIRGIN COAL SEAMS

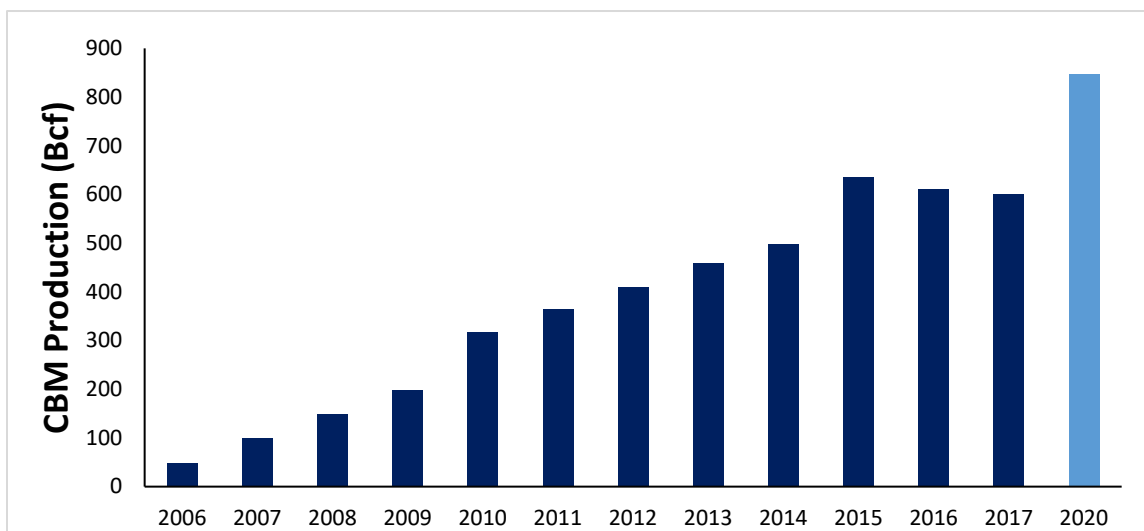
- China has an estimated 38.5 TCM of CBM reserves—these reserves are geographically diverse (Figure 20-2).

Figure 20-2. China's CBM Resources by Region (trillion m³)



Source: Yong and Jianping (2015).

- Geologic conditions for commercial CBM production are often difficult in China. Most coal seams have low permeability and the basins can be structurally complex.
- In 2015, China had 14,500 CBM wells, 65 percent of which are operating in the Qinshui and Ordos basins (Yong and Jianping, 2015).
- There has been a large governmental push to develop its CBM resources, which has been seen by the 517 percent increase in CBM production between 2005 and 2015 (Figure 20-3).

Figure 20-3. China's CBM Production over the Past Decade

Source: ARI (2019).

20.3 Opportunities and Challenges to Greater CMM Recovery and Use

20.3.1 MARKET AND INFRASTRUCTURE FACTORS

- In its 13th 5-year plan (National Development and Reform Commission P.R.C., 2016), China seeks to increase its proven CBM reserves by 420 BCM, increase CBM extraction and utilization to 10 BCM, increase its domestic natural gas capacity to 360 BCM, lay 40,000 kilometers of pipelines, improve laws to make natural gas investment more enticing, and increase the share of natural gas in primary energy production to 10 percent.
- Compared to 2016, China had increased proven CBM reserves by 10.48 BCM in 2017, extracting and utilizing 4.73 BCM of CBM. The total gas-in-place for CBM resources shallower than 2000 meters is estimated at 29.8 TCM and the technically recoverable resource is 12.5 TCM. (UNECE, 2017; BP, 2018; Zhou, 2018; Tao et al., 2019).
- As of February 2019, the Russian oil and gas company, Gazprom, had nearly completed a 2,010-kilometer pipeline that will link Russia's gas-rich, isolated Siberian CBM and gas fields to China, promising an annual supply of 1.3 trillion cubic feet (Paraskova, 2018). Once completed, this pipeline would supply relatively inexpensive natural gas; in turn this has the potential to significantly undercut capital-intensive CMM projects, particularly since the pipeline feeds into the area where China has been intensively developing CMM.

- Since 2011, seven provinces initiated carbon emission trading markets. By the end of 2017, the pilot markets covered almost 3,000 entities across 20 industry sectors—total trading volume reached 200 million tCO₂e and total trading value was 45.1 billion yuan (~\$6.4 billion USD) (EDF, 2017).
- High electricity prices in provincial mines made CMM power production the most common utilization method in China (Ruiz et al., 2016)
- Liquefied natural gas would not be feasible in conventional gas-rich areas like Inner Mongolia; however, southwest China’s expanding pipeline network offers increasing possibilities for CMM utilization in towns and municipalities (Ruiz et al., 2016).
- A detailed discussion of China’s market for CMM may be found in USEPA’s document, *China’s Energy Markets: Anhui, Chongqing, Henan, Inner Mongolia, and Guizhou Provinces 2015*, at <https://www.epa.gov/cmop/coal-mine-methane-china>.

20.3.2 GOVERNMENT POLICY AND REGULATORY INFORMATION

- China is the largest emitter of GHGs in the world and is a signatory to the UNFCCC, the Kyoto Protocol, and the Paris Agreement (Table 20-3).

Table 20-3. China’s Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC*	June 11, 1992	January 5, 1993
Kyoto Protocol**	May 29, 1998	August 30, 2002
Paris Agreement***	April 22, 2016	September 3, 2016

Sources: * UN (1992), ** UN (1997), *** UN (2015).

- Through the Non-Annex I Party to the Kyoto Protocol, China has hosted GHG mitigation projects such as CMM projects under the Clean Development Mechanism, which create revenues through credit trading. As of 2019, China had 3,863 registered Clean Development Mechanism projects (UNEP DTU, 2019).
- China’s 13th 5-year plan (National Development and Reform Commission P.R.C., 2016), which outlines the country’s 2016–2020 strategy, stipulated aggressive environmental goals, including reducing carbon dioxide emissions by 18 percent from 2015 levels by 2020 (LSE, 2016).
- Per the Paris Agreement, China is committed to reducing total carbon emissions per unit of gross domestic product by 60–65 percent from 2005 levels by 2030. China

- reached its 2020 goal by 2018, providing optimistic forecasts for its ability to meet its emissions reduction obligations (UNCC, 2018).
- All mineral resources are state-owned. Coal mines exceeding 100 million tonnes in reserves must obtain licenses through the Ministry of Natural Resources (restructured in 2018). Smaller mines only need to obtain permits from the provincial Natural Resources Department.
 - CMM has been registered as a mineral since 1996, and exploration and mining of CMM are registered the same way as conventional oil and gas. CMM/CBM projects require permits from the Ministry of Natural Resources regardless of the project's size.
 - Developers are exempt from prospecting and licensing fees on CBM development, and no royalties will be levied on CBM through 2020. The value-added tax collected from coal mines recovering and utilizing CBM/CMM is returned to the CBM/CMM companies, and no income tax is paid by enterprises developing technologies for CMM recovery and utilization. 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 their income taxes (IEA, 2009; Huang, 2012).
 - China's Central Government provides 3 billion RMB (450 million USD) for coal mine safety projects each year, most of which is used for mine gas recovery projects. Coal mines can collect 15–20 RMB per ton from coal sales to be applied to degasification projects (Huang, 2010).
 - In 2016, China raised the national subsidy for each cubic meter of CMM used from 0.2 yuan to 0.3 yuan to help struggling CMM projects remain solvent (Ng, 2016).
 - Initially, the China United Coalbed Methane Corporation, Ltd. had monopoly rights to CMM projects in the country; however, a 2007 liberalization of regulations effectively ended this monopoly and allowed for other companies to partner with foreign businesses for project development (Huang, 2007).
 - Project energy usage must follow the “Energy Conservation Law of the People's Republic of China” and the energy-saving regulations and measures of state and local governments.
 - The State Administration of Coal Mine Safety Inspection monitors worker safety in China. Laws and regulations such as the “Coal Mine Safety Regulation” should be followed when developing CMM exploitation and utilization projects.
 - For a detailed discussion of ownership and policy issues related to CBM and CMM in China and worldwide, see USEPA's document, *Legal and Regulatory Status of CMM Ownership in Key Countries: Considerations for Decision Makers*, at <https://www.epa.gov/sites/production/files/2016-03/documents/mongolia-cmm-ownership-policy-white-paper-july2014.pdf>.

- Huang, S. (2007): Progress and Project Opportunities of the CMM Development and Utilization, China Coal Information Institute, presented at the Methane to Markets Partnership Expo, Beijing, China, October 30–November 1, https://www.globalmethane.org/expo-docs/china07/postexpo/coal_china.pdf.
- Huang, S. (2010): Current Status and Policy from Works of Methane Emission Reduction in China, presented at the Methane to Markets Partnership Expo, New Delhi, India, March 3, https://www.globalmethane.org/expo-docs/india10/postexpo/china_huang.pdf.
- Huang, S. (2012): Preferential Policy and International Action of CBM/CMM Development in China, China Coal Information Institute, presented at the Coal Mining Methane Abatement Seminar, Australia, September 4–5, https://www.globalmethane.org/documents/events_coal_120904_qinggang.pdf.
- Huang, S. (2013): Perspectives and Challenges of CBM/CMM Industry in China, presented at the 13th International Symposium on CBM/CMM and Shale Gas in China, Beijing, China, October 24–25.
- Huang, S. (2014): Coal Sector Updates in China, Huang Shengchu, presented at the 20th Session of the Global Methane Initiative (GMI) Coal Subcommittee, October 22, 2014, Geneva, Switzerland.
- Huang, S. (2019): Big Challenges of Chemical Plants in Comparison with Coal Sector in China and Suggested Policies for Safety Improvement in Chemical Sector, Huang Shengchu, China Coal Magazine, No.7, 2019, Beijing, China.
- IEA (2009): Coal Mine Methane in China: A Budding Asset with the Potential to Bloom, International Energy Agency, Paris, France, February, <https://webstore.iea.org/coal-mine-methane-in-china-a-budding-asset-with-the-potential-to-bloom>.
- ITA (2017): China—Mining and Materials, International Trade Administration, <https://www.export.gov/article?id=China-Mining-and-Materials>.
- Liu (2007): Case Study on CMM/CBM projects in China, Liu Wenge, China Coal Information Institute, presented at CMM Development in the Asia-Pacific Region: Perspectives and Potential, Brisbane, Australia 4-5 October 2006.
- LSE (2016) (London School of Economics): 13th Five-Year Plan, <http://www.lse.ac.uk/GranthamInstitute/law/13th-five-year-plan/>
- National Development and Reform Commission P.R.C. (2016): 13th 5-year Plan for Natural Gas Development, 天然气发展“十三五”规划, <https://policy.asiapacificenergy.org/node/3044>.
- NEA (2019): Number of Coal Mines with Licenses and Production Capacities in China in 2018, Announcement of National Energy Administration, March 26, 2019.

- Ng, E. (2016): China Raises Coal Bed Methane Gas Subsidy to Help Fight Air Pollution, March 1, South China Morning Post, <https://www.scmp.com/business/article/1919458/china-raises-coal-bed-methane-gas-subsidy-help-fight-air-pollution>.
- Paraskova, T. (2018): Russia's Huge Natural Gas Pipeline to China Nearly Complete, OilPrice.com, <https://oilprice.com/Latest-Energy-News/World-News/Russias-Huge-Natural-Gas-Pipeline-To-China-Nearly-Complete.html>.
- Reuters (2016): China to Close More than 1,000 Coal Mines in 2016: Energy Bureau, February 22, <https://www.reuters.com/article/us-china-energy-coal/china-to-close-more-than-1000-coal-mines-in-2016-energy-bureau-idUSKCN0VV0U5>.
- Reuters (2018): China's State-Owned Coal Firms Target 12.65 mln Tonnes of Capacity Cuts: Xinhua, January 15, <https://www.reuters.com/article/us-china-coal/chinas-state-owned-coal-firms-target-12-65-mln-tonnes-of-capacity-cuts-xinhua-idUSKBN1F41EU>.
- Ruiz, F., C.L.M. Long, and R.C. Pilcher (2016): CBM and CMM in China, World Coal, August 19, <https://www.worldcoal.com/cbm/19082016/cbm-and-cmm-in-china-2016-2269/>.
- Tao S, Chen SD, Pan ZJ. Current status, challenges, and policy suggestions for coalbed methane industry development in China: A review. Energy Sci Eng. 2019; 7(4): 1059 - 1074. <https://doi.org/10.1002/ese3.358>.
- Thakur, P. (2017): Chapter 1—Global Reserves of Coal Bed Methane and Prominent Coal Basins, Advanced Reservoir and Production Engineering for Coal Bed Methane, Elsevier Inc., <http://scitechconnect.elsevier.com/wp-content/uploads/2016/12/3-s2.0-B9780128030950000016-main.pdf>.
- UN (1992): Chapter XXVII: Environment, 7. United Nations Framework Convention on Climate Change, United Nations Treaty Collection, https://treaties.un.org/Pages/ViewDetailsIII.aspx?src=IND&mtdsg_no=XXVII-7&chapter=27&Temp=mtdsg3&clang=en.
- UN (1997): Chapter XXVII: Environment: 7. A Kyoto Protocol to the United Nations Framework Convention on Climate Change, United Nations Treaty Collection, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-a&chapter=27&clang=en.
- UN (2015): Chapter XXVII: Environment, 7. d Paris Agreement, United Nations Treaty Collection, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=en.

- UNCC (2018): China Meets 2020 Carbon Target Three Years Ahead of Schedule, United Nations Climate Change, <https://unfccc.int/news/china-meets-2020-carbon-target-three-years-ahead-of-schedule>.
- UNECE (2017): New Centre of Excellence on Coal Mine Methane in China Will Help to Reduce the Greenhouse Gas Footprint of Coal Mining and Enhance Safety, United Nations Economic Commission for Europe, May 19, <https://www.unece.org/info/media/presscurrent-press-h/sustainable-energy/2017/new-centre-of-excellence-on-coal-mine-methane-in-china-will-help-to-reduce-the-greenhouse-gas-footprint-of-coal-mining-and-enhance-safety/doc.html>.
- USEPA (1996): Reducing Methane Emissions from Coal Mines in China: The Potential for Coalbed Methane Development, U.S. Environmental Protection Agency, Coalbed Methane Outreach Program, 1996, <https://nepis.epa.gov/EPA/html/DLwait.htm?url=/Exe/ZyPDF.cgi/900O0H00.PDF?Dockey=900O0H00.PDF>.
- USEPA (2019): Pre-Feasibility Study for Methane Drainage and Utilization at the TengHui Coal Mine, Shanxi Province, China, https://www.epa.gov/sites/production/files/2019-05/documents/epa_gmi_tenghui_05-2-19.pdf.
- UNEP DTU (2019): CDM Pipeline Spreadsheet, UNEP DTU Partnership, Centre on Energy, Climate, and Sustainable Development, February 1, <http://cdmpipeline.org/publications/CDMStatesAndProvinces.xlsx>.
- Xin (2015): Introduction of 10 major coal companies and their listed companies, <https://www.jianshu.com/p/8ac7d79089f2>.
- Yong, Q. and Y. Jianping (2015): A Review on Development of CBM Industry in China, AAPG Asia Pacific Region Conference, February 12–13, http://www.searchanddiscovery.com/documents/2015/80454yong/ndx_yong.pdf.
- Zhou, O. (2018): China's New Proven Oil and Gas Reserves Fall to 10-Year Low in 2017, S&P Global Platts, July 18, <https://www.spglobal.com/platts/en/market-insights/latest-news/oil/071818-chinas-new-proven-oil-and-gas-reserves-fall-to-10-year-low-in-2017?hootpostid=5d6cc31c098faafd0c7a0f2c228bae64>.