

**Coalbed Methane Committee
AAPG Energy Minerals Division
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Introduction

The evaluation and production of natural gas from coal beds falls under two broad categories, depending on the context in which the resource is being assessed and produced:

1. as an energy resource similar to other sources of natural gas, with the principal distinction being that the gas is coming from coal beds rather than conventional porous reservoir rocks. In this context, the produced gas is variously referred to as coalbed methane (CBM), coal bed natural gas, or coal seam gas (CSG)
2. gas produced in association with coal mining operations—termed coal mine methane (CMM).

CMM development is driven by three incentives: 1) increased mine safety through the reduction of methane being released into mine workings, 2) the energy value of the produced gas, and 3) the abatement of fugitive methane being released into Earth's atmosphere, where it acts as a potent greenhouse gas (GHG). In contrast, CBM development is driven largely by market forces related to its value as an energy resource, with additional governmental incentives occasionally being provided.

Much of the current interest in CMM is being sustained by programs sponsored through the United Nations, U.S. Department of Energy, U.S. Environmental Protection Agency, and other national organizations in countries including Australia, China, and Mexico.

The following table provides hyperlinks to resource overviews for countries having significant resources of coal, CBM, and CMM. This is followed by a table of hyperlinks to action plans developed under the auspices of the Global Methane Initiative (GMI). The goal of this program is to find ways of reducing atmospheric emissions of methane arising from four major industrial sources: agriculture, coal mining, municipal solid waste, and oil & gas production.

Coal Mine Methane Country Overviews, 2010 (PDF Format)

(Source: https://www.globalmethane.org/tools-resources/coal_overview.aspx)

Complete document	PDF, 342 pp, 5.8 MB)
TOC, Executive Summary, and Introduction	PDF, 29 pp, 417 KB)
Chapter 1: Argentina	PDF, 7 pp, 144 KB)*
Chapter 2: Australia	PDF, 11 pp, 197 KB)*
Chapter 3: Botswana	PDF, 6 pp, 131 KB)
Chapter 4: Brazil	PDF, 9 pp, 175 KB)*
Chapter 5: Bulgaria	PDF, 6 pp, 127 KB)*
Chapter 6: Canada	PDF, 14 pp, 419 KB)*
Chapter 7: China	PDF, 12 pp, 236 KB)*
Chapter 8: Colombia	PDF, 9 pp, 240 KB)*
Chapter 9: Czech Republic	PDF, 9 pp, 320 KB)
Chapter 10: Ecuador	PDF, 4 pp, 147 KB)*
Chapter 11: Finland	PDF, 3 pp, 117 KB)*
Chapter 12: France	PDF, 5 pp, 129 KB)
Chapter 13: Georgia	PDF, 6 pp, 216 KB)*
Chapter 14: Germany	PDF, 8 pp, 268 KB)*
Chapter 15: Hungary	PDF, 7 pp, 217 KB)
Chapter 16: India	PDF, 12 pp, 207 KB)*
Chapter 17: Indonesia	PDF, 9 pp, 409 KB)*
Chapter 18: Italy	PDF, 7 pp, 166 KB)*
Chapter 19: Japan	PDF, 5 pp, 192 KB)*
Chapter 20: Kazakhstan	PDF, 8 pp, 237 KB)*
Chapter 21: Mexico	PDF, 11 pp, 226 KB)*
Chapter 22: Mongolia	PDF, 11 pp, 219 KB)*
Chapter 23: New Zealand	PDF, 7 pp, 173 KB)
Chapter 24: Nigeria	PDF, 7 pp, 177 KB)*
Chapter 25: Pakistan	PDF, 7 pp, 169 KB)*
Chapter 26: Philippines	PDF, 8 pp, 238 KB)*
Chapter 27: Poland	PDF, 9 pp, 231 KB)*
Chapter 28: Republic of Korea	PDF, 7 pp, 307 KB)*
Chapter 29: Romania	PDF, 8 pp, 224 KB)
Chapter 30: Russia	PDF, 11 pp, 275 KB)*
Chapter 31: South Africa	PDF, 12 pp, 236 KB)
Chapter 32: Spain	PDF, 6 pp, 152 KB)
Chapter 33: Turkey	PDF, 6 pp, 221 KB)*
Chapter 34: Ukraine	PDF, 11 pp, 253 KB)*
Chapter 35: United Kingdom	PDF, 14 pp, 362 KB)*
Chapter 36: United States	PDF, 15 pp, 425 KB)*
Chapter 37: Vietnam	PDF, 6 pp, 151 KB)*

Global Methane Initiative Partner Sector Action Plans

- [Australia](#) (PDF, 8 pp, 153 KB)
- [China](#) (PDF, 10 pp, 248 KB)
- [Colombia](#) (PDF, 10 pp, 570 KB)
- [European Commission](#) (PDF, 15 pp, 257 KB)
- [India](#) (PDF, 14 pp, 163 KB)
- [Mexico](#) (PDF, 11 pp, 127 KB)
- [Nigeria](#) (PDF, 11 pp, 206 KB)
- [Turkey](#) (PDF, 5 pp, 303 KB)
- [Ukraine](#) (PDF, 3 pp, 61 KB)
- [United States](#) (PDF, 6 pp, 105 KB)

Overview of Current CBM Production and Reserves

Production and reserves of natural gas from coal beds in the United States have declined since 2008 due, in part, to the drop in price for natural gas, but it is still an important resource globally. Research on CBM remains active, however, as indicated by the 61 technical papers published in 2014, including a book edited by Thakur and others (2014) that contains the proceedings of the North American Coalbed Methane Forum's 25th Anniversary meeting. [The North American Coalbed Methane Forum celebrated 30 years of forums (1985-2015) at the meeting on May 20-21, 2015 (<http://www.nacbmforum.com>).] These references have been added to the 75-page CBM bibliography available on the EMD members-only web site (http://emd.aapg.org/members_only/coalbed/index.cfm).

Mastalerz (2014, figure 7.3) included a map showing world CBM resources, production, and exploration activities as summarized below.

CBM Resources by Country (2010) (from Mastalerz, 2014)	
Country	2010 Resources, Tcf
Russia	2,824
China	1,100
Alaska	1,037
U.S. (minus Alaska)	700
Australia	500
Canada	500
Indonesia	435
Poland	424
France	368
Germany	100
UK	100
India	70
Ukraine	60
Zimbabwe	40
Kazakhstan	25

Annual CBM Production by Country (2010 data) (from Mastalerz, 2014)	
Country	Production, Bcf
U.S. (minus Alaska)	1,886
Canada	320
Australia	190
China	50
Alaska	1
Russia	0.5
India	0.4
Kazakhstan	0.4

Summaries of CBM Production for Selected Countries

USA

EIA (2009a) shows a map of U.S. lower 48 states CBM fields (as of April 2009). U.S. annual CBM production peaked at 1.966 Tcf in 2008 (EIA, 2009b, 2010, 2014a). CBM production declined to 1.466 Tcf in 2013 (EIA, 2014a), the lowest level since 2001, representing 5.5% of the U.S. total natural gas production of 26.5 Tcf (Figure 1). Note that U.S. CBM production in EIA (2014a, Table 15) is different than in EIA (2014b, Table 1). According to EIA (2014a), the top 8 CBM producing U.S. states during 2013 (production in Bcf) were Colorado (444), New Mexico (356), Wyoming (331), Virginia (93), Oklahoma (65), Alabama (62), Utah (50), and Kansas (30). Annual CBM production by U.S. state (through 2013) is available at EIA (2015a). Cumulative U.S. CBM production from 1989 through 2013 was 32 Tcf. CBM production continues even though few new wells are being completed, reflective of the very long productive lives of CBM wells.

U.S.G.S. (2014) includes hyperlinks to USGS CBM assessment publications and web pages. Ruppert and Ryder (2014) included coal and coalbed methane resources and production in the Appalachian and Black Warrior Basins.

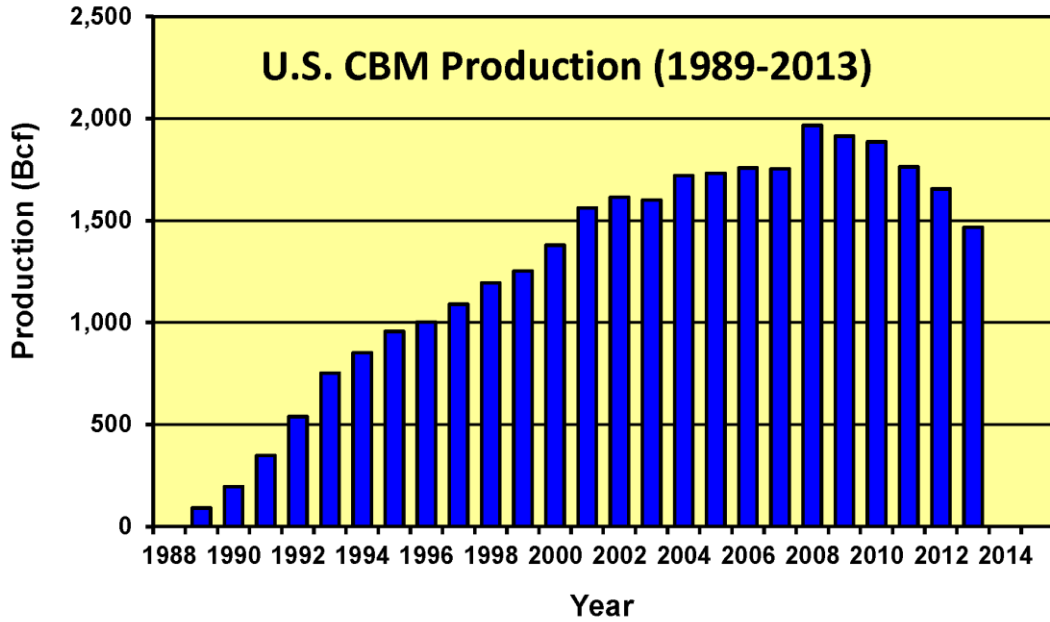


Figure 1. United States CBM production (1989–2013)(compiled from EIA).

United States annual CBM proved reserves peaked at 21.874 Tcf in 2007 (EIA, 2009b, 2010, 2014a), and declined to 12.392 Tcf in 2013 (EIA, 2014a), the lowest level since 1999, representing 3.5% of the U.S. total natural gas reserves of 354 Tcf (Figure 2). Annual CBM proved reserves by U.S. state (through 2013) is available at EIA (2015b).

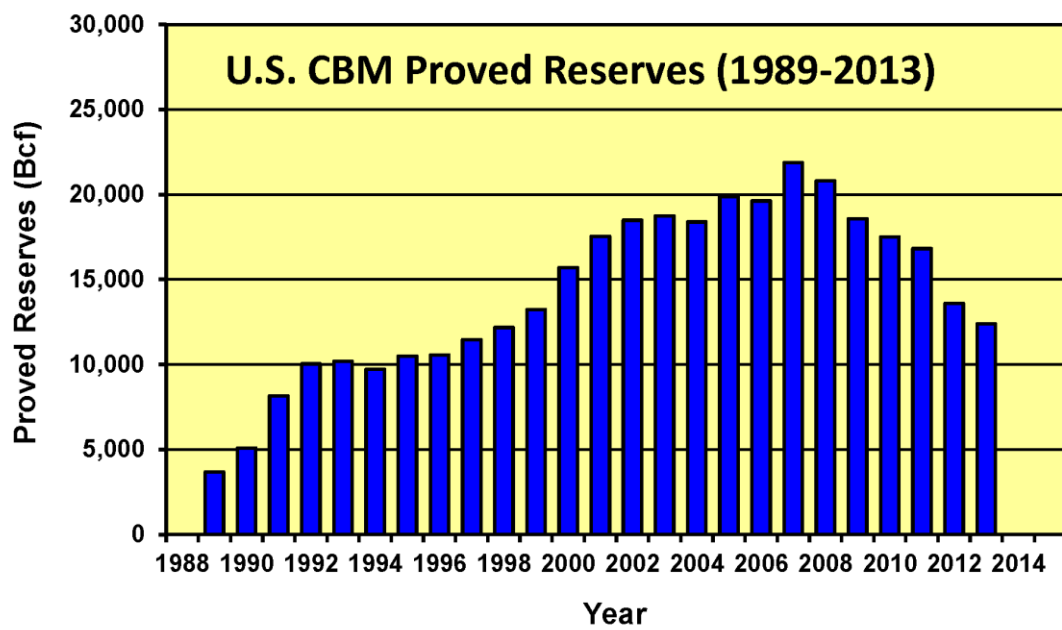


Figure 2. United States CBM proved reserves (1989-2013)(compiled from EIA).

Australia

Flores (2013, figure 9.15) included a map showing coal seam gas (CSG) potential in Australia noting that the coal beds range in age from Permian to Tertiary in about 30 coal-bearing basins. Blewett (2012) included maps showing the distribution of demonstrated black coal resources and gas resources in Australia. CSG reserves in 2012 are divided into six coal basins in eastern Australia: Surat Basin (69%), Bowen Basin (23%), Gunnedah Basin (4%), Gloucester Basin (2%), Sydney Basin (1%), and Clarence-Moreton Basin (1%)(Flores, 2013).

EIA (2015c) reported that economically recoverable CSG reserves in Australia was 33 Tcf in 2012, primarily in the Surat and Bowen Basins in Queensland. Commercial CSG production in Australia began in 1996 and was 246 Bcf in 2012 (~13% of total natural gas production).

China

A map showing coal basins and CBM resources in China is at https://www.globalmethane.org/tools-resources/coal_overview.aspx. EIA (2015d) reported that CBM production from wells and underground coal mines in China was 441 Bcf in 2012. Tao (2014) indicated there were 12,574 CBM wells in China at the end of 2012; the Southern Qinshui Basin is the largest CBM producing basin in China. The first CBM exploration well in China was drilled in 1991 (Zhang and others, 2014). Flores (2013) indicated that a significant amount of the CBM resources in China are from coal mine methane (CMM) with the first CMM project in 1991. Information on coal mine methane activity in China is in EPA (2015). According to Dodson (2014), “Chinese shale gas production fell so far short of expectations that the Asian behemoth quickly turned to CBM” and “CBM may well find itself relied on increasingly in China, as the country looks to offset its coal dependence.”

Canada

CBM production in Canada comes mainly from Cretaceous and Tertiary coals in the Western Canada Sedimentary Basin (Flores, 2013). According to the web site <http://www.energy.alberta.ca/NaturalGas/750.asp>, there were 19,269 CBM wells in Alberta, Canada as of December 31, 2012. Most of the new production was from the Horseshoe Canyon Formation with some deep wells to the Mannville Formation coals.

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Upcoming Meetings Focusing on CBM & CMM:

June 3, 2015: Global Methane Initiative (GMI) Coal Subcommittee Meeting and Coal Mine Methane Workshop, Bogotá, Colombia.

https://www.globalmethane.org/news-events/event_detailsByEventId.aspx?eventId=451

October 5-8, 2015: 32nd Annual International Pittsburgh Coal Conference and U.S. Coal Mine Methane Conference, Pittsburgh, PA. <http://www.engineeringx.pitt.edu/pcc/>

October 28, 2015: United Nations 10th Session Group of Experts on Coal Mine Methane, Salle XI, Palais des Nations, Geneva

<http://www.unece.org/index.php?id=38525#/>