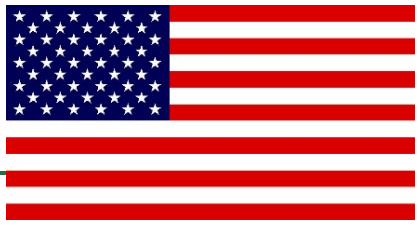
36 United States



36.1 Summary of Coal Industry

36.1.1 Role of Coal in the United States

The United States (U.S.) holds the world's largest estimated recoverable reserves of coal (more than 200 years based on current production levels). In 2012, the U.S. was the second largest coal producer in the world (922 million metric tons [MMT]) after China (3,651 MMT), and followed by India (589 MMT) (EIA, 2014a). Coal accounts for 24.7 percent of energy production in the U.S. (EIA, MER March 2014, Table 1.2). The U.S. exports approximately 12 percent of its coal production, while imports equal approximately 1 percent of its total domestic consumption (EIA, MER March 2014, Table 6.1). Table 36-1 quantifies recoverable reserves and recent coal production in the U.S.

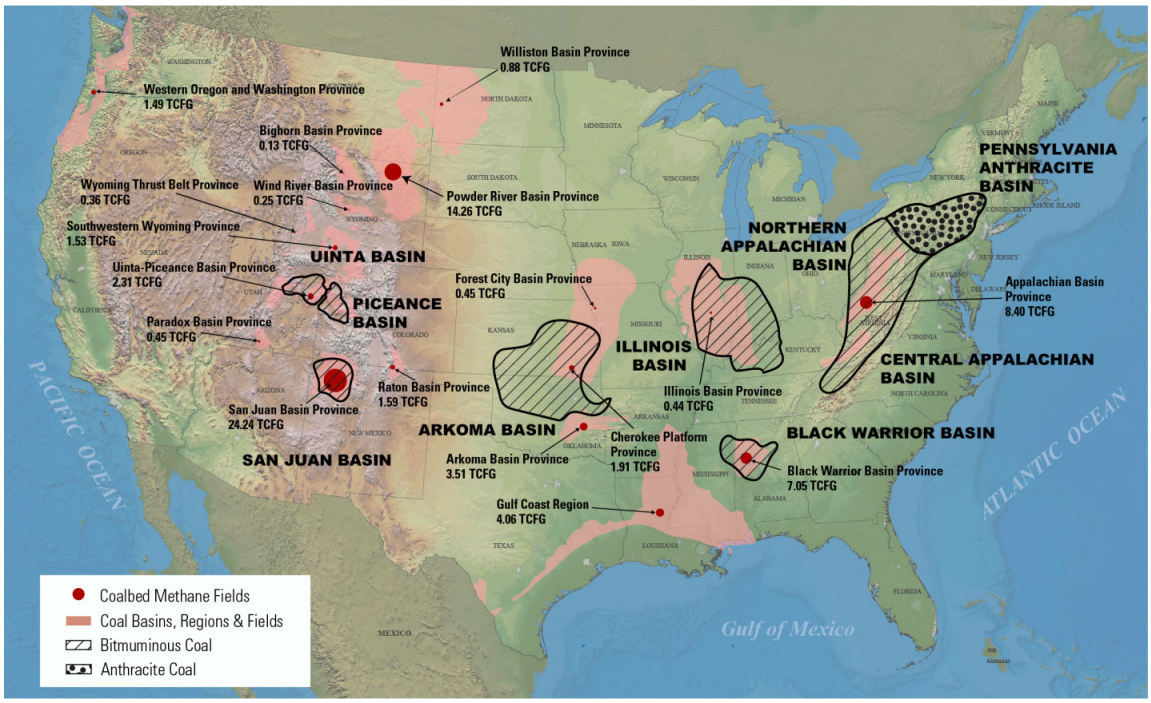
Table 36-1. U.S. Coal Reserves and Production

Indicator	**Anthracite & Bituminous** (million tonnes)	**Sub-bituminous & Lignite** (million tonnes)	**Total** (million tonnes)	**Global Rank** (# and %)
Estimated Proved Coal Reserves (2011)	107,276	127,340	234,615	1 (26.4%)
Annual Coal Production (2012)	850.51	71.6	922.12	2 (11.69%)

Source: EIA (2014a)

Figure 36-1 highlights U.S. coal basins, as well as the location of gassy U.S. coal seams.

Figure 36-1. Map of U.S. Coal Basins



Sources: USGS (2014); USEPA (2004)

Gassy coal seams of the U.S. are found in four geographic regions: the Appalachian Basins of the eastern U.S. (medium to high volatile bituminous and anthracite), the Illinois Basin in the Midwest (medium to high volatile bituminous), the Rocky Mountain Basins—Piceance, San Juan, and Uinta—in the western U.S. (sub-bituminous to medium/high volatile bituminous), and the Black Warrior and Arkoma Basins of the South/Southeast (sub-bituminous to medium/high volatile bituminous).

36.1.2 STAKEHOLDERS

Table 36-2 identifies mining companies that are currently draining gas and provides 2013 total drained gas estimates and end uses for their projects, as reported to EPA's Greenhouse Gas Reporting Program (GHGRP) (see page 351 for more details). These mining companies are key stakeholders in U.S. coal mine methane (CMM) development as they host CMM recovery and use projects.

Table 36-2. Key Coal Mine Companies Draining Gas at U.S. Mines

Mining Companies Draining Gas	Total Drained Gas in 2013 (thousand cubic meters per day)	End Uses
CONSOL Energy	1,954	Natural gas pipeline injection, Thermal dryer
Walter Energy	720	Natural gas pipeline injection
Alpha Natural Resources	289	Natural gas pipeline injection
Murray Energy	228	Natural gas pipeline injection
Cliffs Natural Resources	172	Natural gas pipeline injection
Drummond Company	153	Mine air heating

Table 36-2. Key Coal Mine Companies Draining Gas at U.S. Mines

Mining Companies Draining Gas	Total Drained Gas in 2013 (thousand cubic meters per day)	End Uses
Arch Coal	58	Electricity generation, Flare, Mine air heating
BHP Billiton	54	N/A
Hallador Energy	39	N/A
Oxbow Carbon & Materials	28	N/A
Bowie Resource Partners	11	N/A

Source: USEPA (2015a)

Additional key stakeholders include:

- CMM treatment and utilization equipment manufacturers;
- Project developers;
- Engineering, consultancy, and related services;
- Universities and research establishments (National Institute for Occupational Safety and Health [NIOSH], U.S. Geological Survey [USGS], U.S. Department of Energy [DOE]);
- Regulatory agencies, including agencies that approve projects (Mine Safety & Health Administration [MSHA]) and lease federal land (U.S. Bureau of Land Management [BLM], U.S. Forest Service); and
- Other organizations, including the National Mining Association and emissions credits brokers.

Many of these individual stakeholders are listed as Network Contacts on the U.S. EPA Coalbed Methane Outreach Program's (CMOP) website at http://www.epa.gov/cmop/networkcontacts.html.

36.1.3 Status of Coal and the Coal Mining Industry

All U.S. coal mines are owned and operated by private sector companies. Coal is produced in 25 states spread across three major coal-producing regions. In 2012, approximately 70 percent of production originated in five states: Wyoming, West Virginia, Kentucky, Pennsylvania, and Illinois. In addition, there are more than 7,500 abandoned underground mines (USEPA, 2004), 492 of which are considered gassy (USEPA, 2015a). Table 36-3 summarizes coal mining in the U.S. by mine type.

Table 36-3. Summary of U.S. Underground and Surface Mine Production, 2013

Type of Mine	Production (million tonnes)	Number of Mines
Underground (active) mines - total	309.5	395
Surface (active) mines - total	581.3	637

Source: EIA (2015)

36.2 Overview of CMM Emissions and Development Potential

In 2012, nearly 60 percent of all U.S. CMM emissions were released through underground mine ventilation fans. Other sources include methane released through gas drainage systems at underground coal mines that employ vertical and/or horizontal wells, fugitive emissions from abandoned coal mines, coal seams that are exposed to the atmosphere through surface mining operations, and post-mine emissions that are released from the handling and transportation of coal following mining activities. The U.S. has been a leader in CMM recovery and use since the 1990s. As of 2013, there were 22 projects at 16 active underground mines in the U.S., as well as 17 projects at 37 abandoned mines. Recovery and use projects at active underground U.S. mines reduced methane emissions by approximately 41 billion cubic feet in 2013 (USEPA, 2015a).

36.2.1 CMM Emissions from Operating and Abandoned Mines

Table 36-4 quantifies methane emissions from the U.S. mining industry in recent years. Underground coal mines in the U.S. contribute the largest share of methane emissions due to the higher methane content of coal in the deeper underground coal seams.

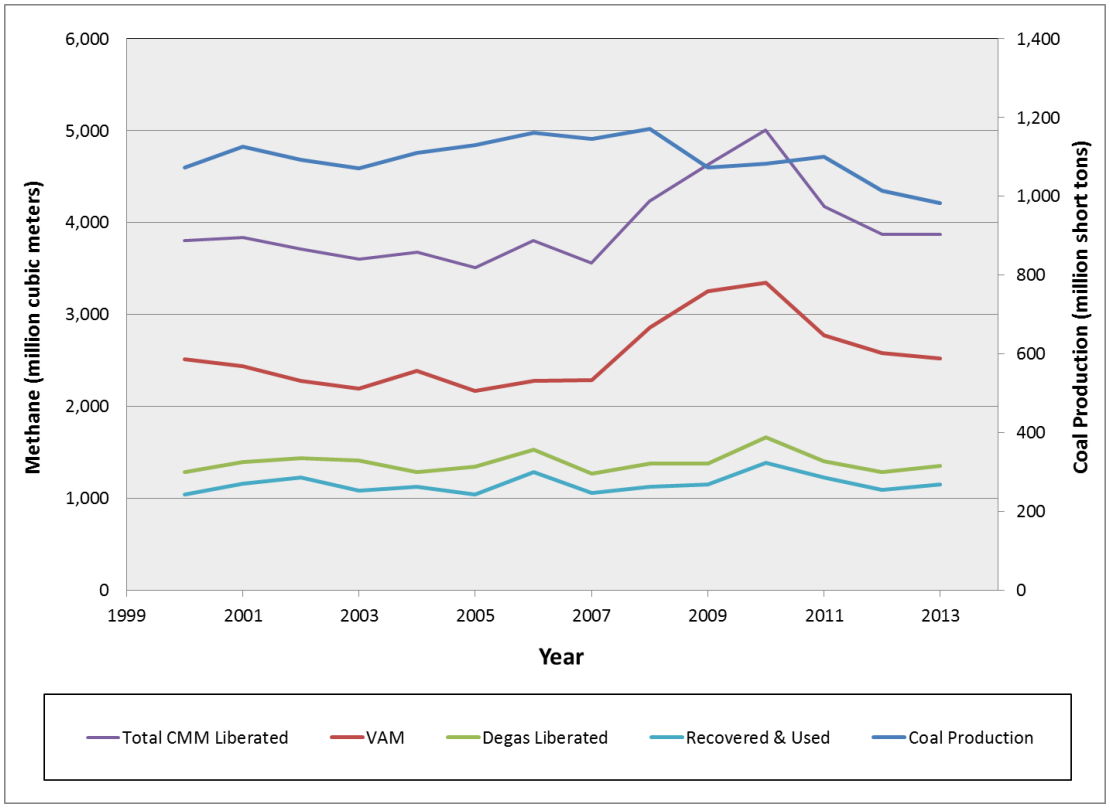
Table 36-4. U.S. CMM Emissions (million cubic meters)

Emission Category	1990	2005	2008	2009	2010	2011	2012	2013
Underground Mining	4,754.7	3,513.3	4,235.7	4,629.5	5,007.7	4,174.2	3,868.5	3,871.8
Surface Mining	632.5	698.1	750.4	677.3	677.3	683.2	603.0	570.4
Post-Mining (Underground)	541.5	449.7	429.4	392.0	397.3	405.2	393.7	386.6
Post-Mining (Surface)	137.0	151.2	162.6	146.7	146.8	148.0	130.6	123.6
Total for Operating Mines	6,065.6	4,812.4	5,578.0	5,845.6	6,229.1	5,410.6	4,995.8	4,952.4
Abandoned Mines	423.1	387.6	371.7	374.0	386.8	378.4	365.5	365.8
Total for All Mines	6,488.7	5,200.0	5,949.7	6,219.6	6,615.9	5,789.0	5,361.3	5,318.2

Source: USEPA (2015a)

The recovery and utilization of methane liberated from coal mine degasification systems has averaged 83 percent since 2000. This is due primarily to the deployment of large scale pipeline injection projects located in the eastern U.S. The remaining portion of the liberated CMM is vented and accounts for the 201 million cubic meters presented in Figure 36-2 for degasification emissions.

Figure 36-2. Active Underground Coal Mine Production and CMM Emissions in the U.S., 2000-2013 (million cubic meters)



Source: USEPA (2015a)

At the end of 2013, there were 22 methane recovery, destruction, or use projects in the U.S. Most of the projects involve upgrading CMM for injection into a commercial pipeline. However, these projects also include four other types of methane utilization and destruction, utilizing either flares and/or thermal oxidizers. In addition, there were 17 abandoned mine methane (AMM) projects operating at 37 abandoned mines in the U.S. All of these mines are located east of the Mississippi River in the Central Appalachian, Northern Appalachian, Illinois, and Warrior coal basins with the exception of two western mines, one in Colorado and one in Utah. One project—the Corinth Project located in southern Illinois—recovers methane from 14 mines that were abandoned between 1926 and 1998. Table 36-5 shows a summary of the various types of CMM utilization deployed at the mines.

Table 36-5. Summary of U.S. Mine Methane Recovery & Destruction Projects

	Number of Mines with Projects	Number of Projects	Types of CMM Utilization					
			Pipeline	Electric Generation	Heater	Boiler/ dryer	Flare	VAM
Underground	16	22	14	2	2	1	1	2
Abandoned Underground	37	17	14	2	0	0	1	0
Surface	0	0*	0	0	0	0	0	0

*There were two projects at the North Antelope Rochelle Mine that were shut-in in 2011.

There were several new projects deployed in 2012, as well as new types of CMM utilization added to existing projects. The Elk Creek Coal Mine project located at Oxbow's Elk Creek Mine in Gunnison County, Colorado is the second active underground coal mine in the U.S. to generate electricity from CMM and the first at a western coal mine. The planned three-Megawatt plant is currently operating one engine with two additional engines to be installed in the future. The project also utilizes a flare and heaters. In addition to selling electricity to a local utility, the project is expected to generate offset credits in the voluntary carbon market and is listed with the Climate Action Reserve or CAR (see page 356).

The VAM project at Murray Energy's Marshall County Mine (formally the McElroy Mine) in Marshall County, West Virginia began destroying methane in May 2012, and is the largest VAM project in the U.S. The project consists of three regenerative thermal oxidizers (RTO) that convert methane to carbon dioxide and water vapor. At startup of the RTO, the ceramic medium bed in the RTO is heated with a propane burner. VAM is then forced through the bed, methane is oxidized, and the released heat is recovered by the ceramic bed medium and the air flow is reversed. The heat recovered from the first cycle heats the incoming VAM and the process repeats. The methane concentration in the VAM ranges between 0.6 and 1.5 percent. The project is listed with CAR and is projected to reduce emissions by 322,000 tonnes of CO_2e per year.

In the U.S., flaring has not been widely implemented at active mines. However, the MSHA has approved flares at the Elk Creek coal mine and the Solvay trona mine. In addition, at two active mines drainage gas is used to preheat incoming ventilation air in cold months to both condition the incoming air and prevent the formation of large icicles at the ventilation shaft opening; these heaters essentially constitute horizontal flares.

36.2.2 COALBED METHANE FROM VIRGIN COAL SEAMS

The U.S. is the world's leading producer of coal seam gas or coalbed methane (CBM). Production has been established in 10 coal basins nationwide (primarily San Juan, Black Warrior, and Central Appalachian) as shown in Figure 36-1 (EIA, 2009a). Total annual CBM production in 2012 was estimated at 1,655 billion cubic meters (EIA, 2014b). Table 36-6 summarizes the proved U.S. CBM reserves by state.

Table 36-6. U.S. CBM Proved Reserves (billion cubic meters)

Location	2005	2006	2007	2008	2009	2010	2011	2012
Alabama	50.2	58.6	60.2	48.9	38.0	36.8	34.3	28.5
Arkansas	0.8	1.0	0.9	0.9	0.6	0.8	0.6	0.3
Colorado	191.8	179.6	222.8	233.3	208.1	183.6	186.3	143.7
Kansas	7.3	6.6	9.6	8.5	4.6	7.3	6.5	5.2
Louisiana	0.0	0.03	0.2	0.3	0.0	0.0	0.0	0.0
Montana	2.1	2.2	1.9	2.1	1.0	1.8	0.7	0.3
New Mexico	148.6	138.6	118.1	113.0	103.2	100.0	95.1	78.5
Ohio	0.0	0.03	0.03	0.03	0.0	0.0		
Oklahoma	16.1	19.4	35.8	14.5	9.6	9.2	7.8	12.4
Pennsylvania	1.3	1.4	3.1	2.9	3.7	3.7	3.5	3.0
Texas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
Utah	25.5	21.2	26.1	25.3	20.5	20.3	19.2	14.7
Virginia	44.5	51.3	55.2	52.4	64.0	49.6	46.0	43.5
West Virginia	5.3	5.5	7.2	7.0	6.2	6.2	3.9	3.0
Wyoming	69.3	69.3	77.5	78.7	65.9	76.0	71.9	49.2
Other States*	0.5	0.8	0.8	1.2	0.5	0.5	0.5	0.4
U.S. Total	**563.3**	**555.6**	**619.4**	**588.9**	**526.1**	**495.8**	**476.2**	**384.9**[4]

*Other States includes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, Oregon, South Dakota, and Tennessee.
Source: EIA (2014c)

36.2.3 Opportunities and Challenges to Greater CMM Recovery and Use

As shown in Table 36-7, the U.S. is a signatory to UNFCCC and the Kyoto Protocol, but did not ratify the Kyoto Protocol.

[4] Coal reserves are generally classified as "probable" and "proved," with the resources in the "proved" category having a high degree of being economically recoverable at current prices and operating costs. As coal is produced, the amount in the proved category is reduced by that amount. Additions to the proved category can be made through exploration findings or by moving reserves from the probable category to the proved category if those reserves are deemed to be economically recoverable to a high degree of certainty (usually by further development of the coal deposit). Both additions and reductions from the proved category can be made depending on the relative price of coal and operating costs and their effect on the economics of recovery. Another factor that influences the quantity of reserves reported is gas prices. With the steady decline in gas prices since 2008, this could also account for the decline in coal reserves during the same period.

Table 36-7. The United States' Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC	June 12, 1992	October 15, 1992
Kyoto Protocol	November 12, 1998	--

Source: UNFCCC (2014)

At the present time, GHG emissions from coal mining activities are not regulated in the United States. The U.S. Environmental Protection Agency (USEPA) has developed voluntary programs aimed at partnering with industry, states and communities to reduce GHG emissions, including CMOP (www.epa.gov/cmop). CMOP is a voluntary program whose goal is to reduce methane emissions from coal mining activities by promoting profitable CMM recovery and use. By working cooperatively with coal companies and related industries, CMOP helps to address barriers to using CMM instead of emitting it to the atmosphere. In turn, these actions mitigate climate change, improve mine safety and productivity, and generate revenues and cost savings.

The California Air Resources Board (CARB) recently adopted the Compliance Offset Protocol Mine Methane Capture (MMC) Protocol. The MMC Protocol allows for projects which quantify GHG emission reductions from the capture and destruction of methane that would otherwise be vented to the atmosphere at active underground and surface mines (via VAM and mine methane drainage activities) as well as abandoned underground mines (via mine methane recovery). Under this protocol, projects must meet a number of eligibility requirements to qualify, plus all offsets are subject to verification.

CMM offset projects are also eligible for carbon credits through a number of voluntary GHG registries located in the U.S., namely the Verified Carbon Standard (VCS), CAR, and the American Carbon Registry (ACR). Whether a CMM project is eligible for carbon credits depends on a number of project specifics, such as project start-up date, end use technology (i.e., electricity generation vs. pipeline sales), and origin of methane (i.e., active vs. abandoned mines, surface vs. underground mines). Each GHG registry also has its own rules governing project eligibility, additionality, and registration. Currently, CMM projects at underground coal mines are eligible to some degree in all three GHG registries, the exception being that CAR does not accept CMM pipeline sales projects. AMM projects are accepted only by VCS, and SMM projects are accepted only by VCS and ACR.

Many states in the U.S. have developed renewable energy portfolio standards (RPS) or clean energy goals (CEG) that direct electricity providers to generate or obtain minimum percentages of their power from "eligible energy resources" by certain dates. Utilities in 42 states offer their customers "green pricing," in which customers opt to pay a premium on their electric bills to have a portion or all of their power provided from renewable sources (EERE, 2012). Six states include CBM or CMM in their renewable/alternative energy standards: Colorado, Indiana, Pennsylvania, West Virginia, Ohio, and Utah (DSIRE, 2014).

36.2.4 MARKET AND INFRASTRUCTURE FACTORS

Infrastructure Issues

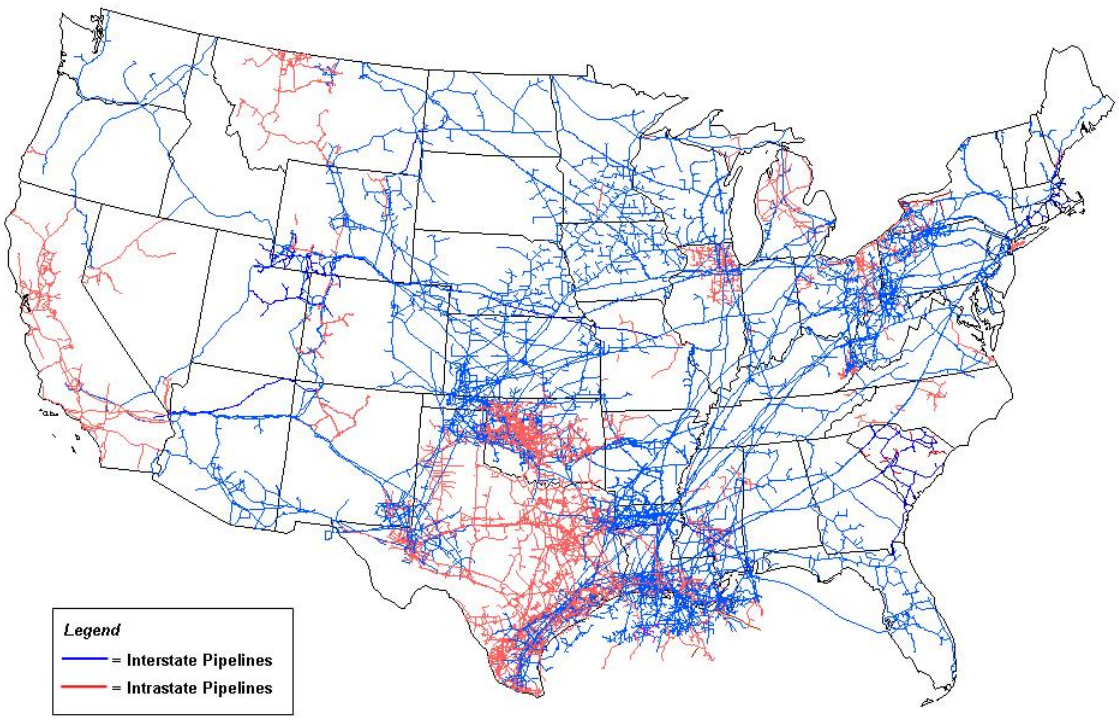
The majority of CMM recovery projects in the U.S. involve selling the methane directly to natural gas pipelines. Generally, only gas from wells drilled into virgin seams in advance of mining is suitable to meet the high-quality gas standards required by pipelines (usually 95 percent or greater

methane with minimal contaminants). However, medium-quality CMM (e.g., gob well gas) can be processed to remove contaminants and upgraded to pipeline quality. Several technologies for upgrading methane are now easily available through vendors (USEPA, 2008).

The existing U.S. gas pipeline infrastructure plays an important role in determining if and where pipeline sales are feasible. In the eastern U.S., the natural gas pipeline system is more extensive and is located closer to gassy coal mines than in the western U.S. In some instances, mines may need to construct a feeder pipeline to transport the CMM to the pipeline from the wellhead or from the gas upgrading/processing facility. Mines in the western U.S. often have little or no access to pipelines and thus the option for pipeline sales is limited, since building feeder pipelines would be cost prohibitive. Unlike Europe or China, large population centers in the U.S. are not typically located in close proximity to coal mines. Thus, there are not always readily accessible major methane markets near mines given the absence of reasonably accessible long-distance pipelines.

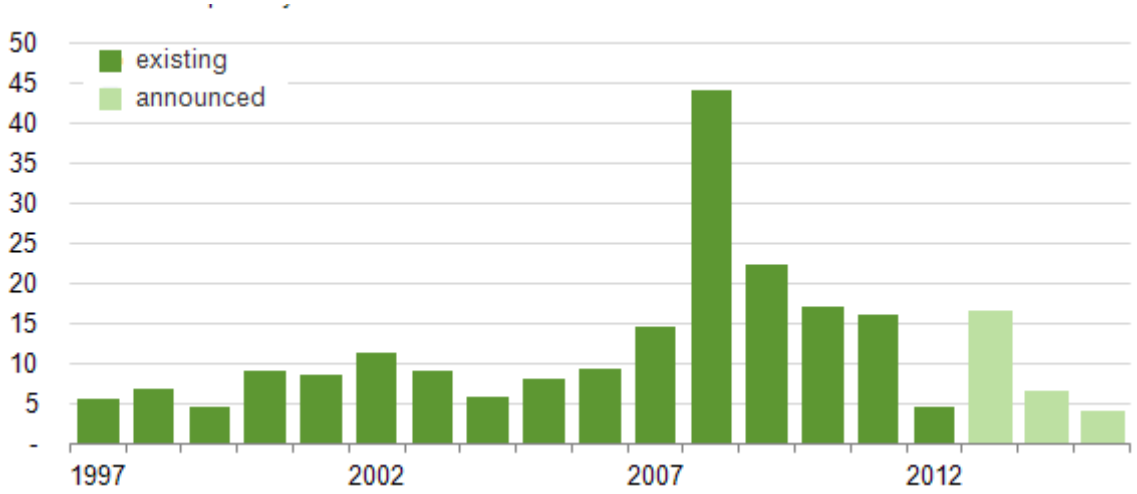
Figure 36-3 illustrates interstate and intrastate natural gas pipelines in the U.S. as of 2009. Figures 36-4 and 36-5 summarize the U.S. natural gas pipeline expansion from 1997 to 2012, with estimations through 2015. From 1997 to 2012, natural gas pipeline capacity was expanded by nearly 180 billion cubic feet per day and more than 32,000 miles of new natural gas transmission pipeline were placed in service. However, both natural gas pipeline capacity and mileage peaked in 2008, and new additions reported in 2012 were the lowest since 1997 (EIA, 2013b).

Figure 36-3. U.S. Interstate Natural Gas Pipelines, 2009



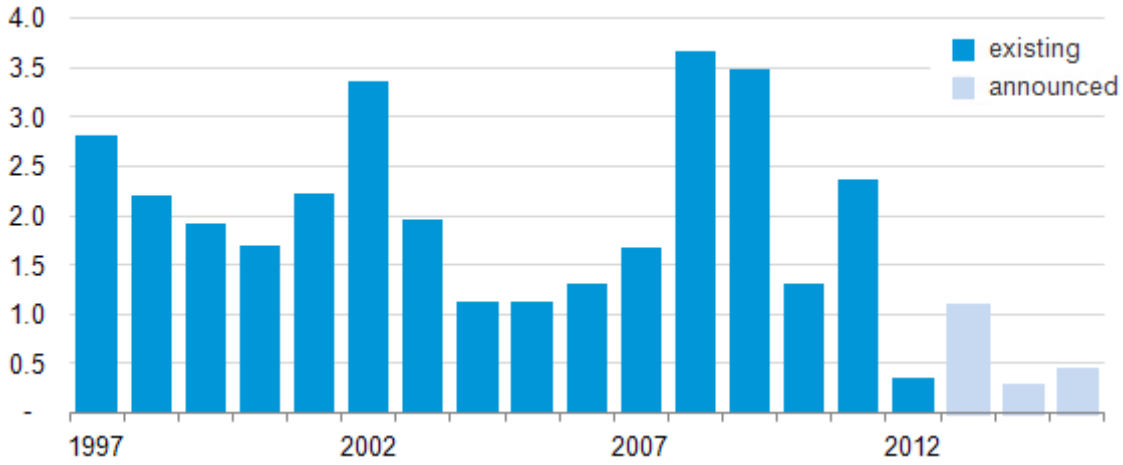
Source: EIA (2009b)

Figure 36-4. Annual Increases in U.S. Natural Gas Pipeline Capacity (billion cubic feet per day)



Source: EIA (2013b)

Figure 36-5. Annual Increases in U.S. Natural Gas Pipeline Length (thousand miles)



Source: EIA (2013b)

Institutional Issues

Disputes over ownership of methane produced from coal seams can present a barrier to further development of the CMM industry in the U.S. Ownership of carbon-based mineral rights is often divided between the oil/natural gas estate and the coal estate. Whether on public or private land, the coal lessee has had the right to capture and discharge methane without paying royalties to maintain safe working conditions. Although some states have attempted to clarify the ownership issue through legislation, the U.S. government has only done so in specific regions. BLM, within the U.S. Department of the Interior, has established an incentive in Wyoming's Powder River Basin that encourages pre-mine gas drainage prior to surface mining in return for reduced natural gas royalty payments to the U.S. government. The areas in which this incentive applies are called Conflict

Administration Zones (CAZ). The CAZs were established with BLM Instruction Memorandum No. 2003-253 in 2003 and were re-delineated in December of 2009 (BLM, 2010) and again in January of 2013 (BLM, 2013). Other disputes are settled on a case-by-case basis.

For in-mine boreholes and gob wells at active mines, mine operators receive approval directly from MSHA. However, licenses are granted by the state in cases where the wells are drilled for exploration and production for pre-mine drainage on property outside the jurisdiction of MSHA and for production of methane from abandoned mines that no longer fall under MSHA's jurisdiction.

Mineral leases are either owned by the U.S. government, as is the case in many parts of the West, or privately owned, as is the case in most other areas of the country. For private leases, laws in each individual state govern ownership of the resource. Federal law governs U.S. government-controlled leases, and the BLM manages the mineral rights on those properties.

The markets for coal, gas, and electricity have been largely deregulated. Power generation is deregulated, and there is free and open access in the wholesale market. Power transmission rates are regulated, but there is open access to transmission lines. Power distribution (retail) also continues to be regulated, the prices of electricity being regulated closely by regional public utility commissions. For natural gas, generation and distribution are deregulated and there is open access in the wholesale market, with free and open competition. However, transportation of coal and natural gas is regulated by the federal government for interstate transport and by states for intrastate transport.

U.S. natural gas prices rose fairly steadily from 2001 until they peaked in 2008 and then declined during 2009-2012, as shown in Table 36-8.

Table 36-8. Recent U.S. Natural Gas Prices

Year	U.S. Natural Gas Wellhead Price (dollars per thousand cubic meters)
2012	$93.94
2011	$139.49
2010	$158.21
2009	$129.61
2008	$281.46
2007	$220.72
2006	$225.66
2005	$258.86
2004	$192.82
2003	$172.34
2002	$104.18
2001	$141.26

Source: EIA (2014d)

In 2012, coal delivered to the U.S. steam-electric utility plants averaged $45.77 per short ton, while coal delivered to coke plants (metallurgical) averaged $190.55 per short ton (EIA, 2013a).

Financing

Capital investment costs for CMM projects vary greatly depending on the project scope and site-specific requirements. Similarly, operating costs vary greatly depending on the site characteristics. The vast majority of direct project funding has come from the private sector, especially mining companies or private investment firms that have provided the capital investment for gas processing, blending, and transport for pipeline sales.

Several U.S. government agencies provide funding resources for CMM recovery and utilization projects located in the U.S. DOE grants have provided funding for a number of demonstration projects. The Small Business Administration operates a loan fund that assists small businesses engaged in energy technology and energy efficiency by guaranteeing loans if key conditions are met. EPA's Environmental Finance Program assists communities in funding environmental projects by helping to lower costs, increase investment, and build partnerships.

Tax credits were used to encourage the production of so-called "unconventional" sources of natural gas, including virgin coal seam CBM and CMM. Known as "Section 29" tax credits (referring to the chapter of the Internal Revenue Service tax code), they allowed for tax credits beginning at nominally $3 per barrel of oil equivalent and gradually being reduced. The credits were enacted in 1980 and expired on 31 December 2002. The Section 29 tax credit is widely believed to have spurred CBM production throughout the U.S. Reauthorization of Section 29 (now Section 45) credits was removed before the Energy Independence and Security Act of 2007 was passed in the 110th Congress (NBSA, 2007). The tax credits were reinstated and revised under the Energy Improvement and Extension Act of 2008 (IRS, 2009) and ended on 31 December 2013.

Although royalty fees are negotiable for private leases, a standard royalty of 12.5 percent of revenues on sales is usually paid by the operator/lessee to the owner of the mineral estate. Severance taxes are paid to state governments on revenues from natural gas sales. Power sales and other uses generating revenues are also taxed. The U.S. does not have a Production Sharing Agreements regime. The U.S. has removed all gas tariffs for gas exports / imports to or from Mexico and Canada through the North American Free Trade Agreement enacted in 1994.

36.2.5 REGULATORY INFORMATION

Methane recovery projects must comply with stringent environmental standards, especially in environmentally sensitive areas and near urban centers. Environmental protection measures generally can be categorized as pollution control measures and habitat/land use protection. Pollution control requirements include (1) air quality standards for production of nitrous oxides, sulfur oxides, and particulate matter; (2) water quality standards limiting stormwater and wastewater discharge from facilities; and (3) noise abatement. Habitat/land-use restrictions include compliance with the Endangered Species Act and protection of forests and habitat such as limiting access in roadless and wilderness areas. In some instances, especially on federal lands, it is often necessary to prepare a formal environmental impact assessment.

Safety relating to operating a CMM recovery project is governed by two regulatory agencies. MSHA has jurisdiction over mining-related matters including operation of any in-mine drilling and gas gathering equipment. MSHA also retains jurisdiction over most surface equipment. The Occupational Safety & Health Administration has jurisdiction over worker health and safety for equipment unrelated to the mining operation (e.g., gas engines away from mine facilities).

In 2009, U.S. EPA issued the Mandatory Reporting of Greenhouse Gases Rule that requires reporting of GHG data and other relevant information from large sources and suppliers throughout the U.S. The GHGRP (http://www.epa.gov/ghgreporting/index.html) requires underground coal mines above the reporting threshold to report methane liberated through ventilation streams and degasification systems. The mines report the net ventilation and drainage flows along with the portion of that flow that is emitted and the portion recovered for utilization or flaring. If the recovered methane is flared, the CO_2 from methane destruction is also reported. Methane utilized in an engine or other combustion device requires that the facility reports CO_2 emissions under the subpart covering combustion devices, if it is a size and type that fits the subpart requirements.

In June 2013, President Obama announced a series of executive actions to reduce carbon pollution, prepare the country for impacts of climate change, and lead international efforts to address global climate change. As part of this Climate Action Plan (White House, 2013a), President Obama issued a Presidential Memorandum directing EPA to complete carbon pollution standards for the power sector (White House, 2013b).

In March 2014, the White House released the "Strategy to Reduce Methane Emissions," which outlines steps to further cut methane emissions from landfills, coal mining, agriculture, and oil and gas systems through cost-effective voluntary actions (White House, 2014). For the coal mining sector, the strategy includes both a voluntary element through CMOP, and a component highlighting potential regulatory action on federal lands under BLM's jurisdiction. In April 2014, BLM released an Advanced Notice of Proposed Rulemaking (ANPRM) to gather public input on the development of a program for the capture and sale, or disposal of waste mine methane[5] on lands leased by the federal government (BLM, 2014).

36.3 Profiles of Individual Mines

Information on U.S. mines can be found on CMOP's interactive "CMM Recovery at Active and Abandoned U.S. Coal Mines: Current Projects and Potential Opportunities" map (http://epa.gov/cmop/resources/map.html). The map and accompanying matrix provide information about current projects and potential opportunities to develop CMM recovery and utilization projects at active U.S. coal mines. The information presented is a condensed version of CMOP's earlier report "Identifying Opportunities for Methane Recovery at U.S. Coal Mines: Profiles of Selected Gassy Underground Coal Mines 2002-2006" (http://epa.gov/cmop/docs/profiles_2008_final.pdf), which provides information about specific opportunities to develop methane recovery and use projects at large underground coal mines in the U.S. The report contains profiles of 50 U.S. coal mines that may be potential candidates for methane recovery and use, as well as on-going recovery and use projects at 14 of the mines.

36.4 References

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BLM (2013): Maintenance of Conflict Administration Zone (CAZ), U.S. Bureau of Land Management, updated 10 January 2013.

[5] Term used by BLM meaning methane emitted from coal mines, or CMM.

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