27 Poland

27.1 Summary of Coal Industry

27.1.1 Role of Coal in Poland

Poland ranks ninth globally in coal production and produced 143.5 million tonnes (Mmt) in 2012, accounting for 1.82 percent of global production (EIA, 2013). Hosting the second largest coal reserves in the European Union, coal provides for two-thirds of Poland's energy demand and more than 75 percent (inclusive of peat) of its primary energy production (EIA, 2013).

Table 27-1. Poland's Coal Reserves and Production

Indicator	Anthracite & Bituminous (million tonnes)	Sub-bituminous and Lignite (million tonnes)	Total (million tonnes)	Global Rank (# and %)
Estimated Proved Coal Reserves (2011)	4,178	1,287	5465	16 (0.615%)
Annual Coal Production (2012)	79.2	64.3	143.5	9 (1.82%)

Sources: EIA (2013)

The World Energy Council estimates similar proven Polish coal reserves for anthracite and bituminous in 2011 at 4, 178 Mmt, and reserves for lignite and sub-bituminous of 1, 287 Mmt (EIA, 2011). An in-country estimate from 2002 estimates reserves of 63,000 Mmt and 14,000 Mmt, for hard coal and lignite, respectively (Palarski, 2003).

As seen in Figure 27-1, Poland's hard coal reserves are located in three fields: the Upper and Lower Silesian Basins, and the Lublin Basin. The Upper Silesian Basin (USB) is currently the major coal producer, while the Lower Silesian Basin is completely abandoned, and only one mine is operational at the Lublin Basin. Lignite basins are located in central and western Poland, with four of them currently in production (WEC, 2014).

Figure 27-1. Poland's Major Coal Basins

Poland's Lignite Deposits

Location of Hard Coal Basins

Source: Volkmer, 2008

27.1.2 STAKEHOLDERS

Table 27-2 lists potential stakeholders in coal mine methane (CMM) development in Poland.

Table 27-2. Key Stakeholders in Poland's CMM Industry

Stakeholder Category	Stakeholder	Role
Mining Companies	▪ Kompania Weglowa, S.A. ▪ Katowki Holding Weglowy ▪ Jastrzebska Spolka Weglowa, S.A. Company (JSW) ▪ Independent Mines: Budryk, Bogdanka and Jaworzno ▪ Siltech	Project hosts
Regulatory Agencies	▪ Polish Geological Institute	Project identification and assessment support
Natural Gas Transmission & Distribution Companies	▪ Polish Oil and Gas Company or PGNiG (http://www.pgnig.pl/?s,main,language=EN), OGP GAZ-SYSTEM (http://en.gaz-system.pl/)	Gas distribution and storage
Government Groups	▪ Ministry of Natural Resources ▪ Ministry of Economy ▪ Central Mining Institute	Licensing

Table 27-2. Key Stakeholders in Poland's CMM Industry

Stakeholder Category	Stakeholder	Role
Other	▪ U.S. Trade and Development Agency ▪ Metanel S.A. ▪ World Bank ▪ U.S. Environmental Protection Agency, www.epa.gov/coalbed/networkcontacts.html ▪ European Investment Bank ▪ European Union's PHARE Program ▪ Institute for Ecology of Industrial Areas (IETU) ▪ Strata Mechanics ▪ LNG Silesia	Project identification and assessment support

27.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

Coal is one of Poland's largest industries and employers, but inefficiencies resulted in large annual losses, spurring the government to reform the sector. In 1998, the government introduced a five-year (1998-2002) Hard Coal Sector Reform Program, which reduced employment from 248,000 to 140,000 by the end of 2002. In February 2003, the Polish government consolidated several failing coal firms to form Kompania Weglowa, which is now one of Europe's largest coal companies. Kompania Weglowa includes mines from five firms: Bytomska, Rudzka, Gliwicka, Nadwislanska, and Rybnicka. Table 27-3 illustrates Poland's declining mine statistics from 2004 to 2008. In November 2003, the government introduced a second program to further consolidate and reform Poland's coal sector – Program of Restructuring of the Hard Coal Mining Sector for 2003 to 2006 (World Bank, 2004). Poland received a World Bank loan of $100 million in 2004 to support the restructuring program, requiring a workforce reduction of 25,500 mining sector jobs from 2004 to 2006 and for voluntary closure of inefficient mines (World Bank, 2007).

The restructuring program also planned to privatize the country's coal industry by 2006. Privatization of Polish coal mines began with a sale of 45 percent of the Bogdanka mine to Management Bogdanka, a private company of investors. Other privatizations followed, with PricewaterhouseCoopers advising the Ministry of the Economy. Privatization of the coal industry was, however, halted by the Polish government in 2006. The World-Bank-supported restructuring program had been suspended by the Polish government in 2006 because the coal industry had become more profitable and only two mines had been closed through the project. The Polish government decided that any further mine closures would be handled by the mine companies and not by the Mine Restructuring Company (SRK). The loan balance was returned (World Bank, 2007).

The restructuring program has led to substantial changes in Poland's three major coal basins. Specifically, the Lower Silesian Coal Basin was closed leaving only the Upper Silesian Basin and the efficient Lublin Coal basin open for production and subsequent expansion. Post restructuring, the Polish coal industry has experienced "periods of profitability". However, market forces and increasing foreign coal imports have acted to threaten its domestic coal industry. Poland's goal of commercializing and privatizing the mining companies was completed by 2009 (Suwala, 2010).

Table 27-3. Poland's Coal Mines, 2004 versus 2008

Company	Number of Mines, 2004*	Number of Mines, 2008**
Kompania Weglowa (KW)	23 (51 Mmt/yr)	16
Katowki Holding Weglowy (KHW)	9 (19 Mmt/yr)	6
Jastrzebska Coking Coal Company (JSW)	5 (14 Mmt/yr)	6
Independent Mines: Bogdanka, Budryk, and Jaworzno	3 (11 Mmt/yr)	NA

Source: *World Bank (2004), **DOC (2008)

As per Poland's Central Mining Institute of Katowice, there were 33 coal mines in operation, with 29 of them classified as gassy, 20 of them employing degasification systems and 14 of them utilizing the drained methane as of 2008 (IEA, 2008).

27.2 Overview of CMM Emissions and Development Potential

The Global Methane Initiative (GMI) International CMM Projects Database currently identifies three active CMM recovery projects in Poland, in addition to four proposed projects (GMI, 2014). Poland has extensive experience in CMM recovery and utilization as demonstrated by JSW's unique project at Pniowek mine that implements three onsite end uses: electricity, heating, and cooling. A Cogeneration Power-Cooling System supplies power to the central air conditioning system and was the first of its kind upon its launch (UNECE, 2009). In addition to JSW, Kompania Weglowa has implemented a power project using CMM at the Knurow-Szcyglowice mine and is planning for a VAM project at the Brzeszcze Mine.

27.2.1 CMM Emissions from Active Mines

In 2010, coal mining was the source of 22.6 percent of the country's overall methane emissions (USEPA, 2012), with total emissions equaling 2,364 million cubic meters (m^3). Table 27-4 summarizes Poland's CMM emissions by mining category. The data in this table may vary from the USEPA data presented in the Executive Summary due to differences in inventory methodology and rounding of digits.

Table 27-4. Poland's CMM Emissions (million cubic meters)

Emission Category	2000	2005	2010	2015 (projected)*
Underground coal mines – mining activities	690.26	600.71	446.87	
Underground coal mines – post-mining activities	49.38	45.43	35.08	
Surface coal mines-mining activities	1.08	1.11	1.02	
Solid Fuel Transformation	6.37	5.96	6.91	
Emission from coke oven gas subsystem	4.43	3.92	6.14	
Total emitted	**740.73**	**647.25**	**482.97**	**530.39**

Sources: UNFCCC (2013); *USEPA (2012)

As of 1997, about 300 million m^3 was being drained from Polish coal mines annually, with 65 to 70 percent of drainage being used at the mine sites or sold to outside consumers, and the rest vented (Schwochow, 1997). Methane recovery, however, has declined over the years, mainly due to the closure of numerous mines. Of an estimated 870 million m^3 of methane emissions in 2006, less than 30 percent was removed through degasification (IEA, 2008). In 2008, 269 million m^3 was removed through degasification, with about 166 million m^3 utilized and 103 million m^3 released into the atmosphere (Skiba, 2009). In 2011, about 268.97 million m^3 was removed through degasification systems, which comprised approximately 13 percent of methane emissions for 2011 (UNFCC, 2013). Skiba reports that 259.7 million m^3 , or 31 percent of total methane emissions was captured by degasification systems in 2013, and drained gas volumes are expected to increase in 2014 Of this total, 187.8 million m^3 was used in 2013 (Skiba, 2014).

A 2005 study by Kwarciński showed that in 2003, venting systems resulted in emissions equal to 3.8868 Gg CH_4/Mg of extracted coal. Methane capture systems resulted in 0.6651 Gg CH_4/Mg of extracted coal. The post-mining processes led to 0.2873 Gg CH_4/Mg of extracted coal, and production waste contributed 0.0194 Gg CH_4/Mg of extracted coal (KOBiZE, 2011).

Although the number of gassy mines has decreased in Poland by 48 percent from 1989 – 2005, absolute gassiness has dropped by only 19 percent over the period, indicating an increasing share of gassy coal mines in the country. This scenario represents an opportunity for CMM recovery and utilization projects (IEA, 2008). CMM capture is forecasted to increase to 320.5 million m^3 by 2015, with an estimated utilization potential of 1068 GWh (Skiba, 2009).

Poland has an open, emerging market economy that should be conducive to CMM project implementation, and Polish mining authorities are supportive of CMM development initiatives (IRG, 2003). Actions similar to the World Bank's industry restructuring loan should also constitute positive factors favoring project development.

GMI awarded a grant in 2008 to the Central Mining Institute of Katowice, Poland to provide "Detailed Characteristics of the Ventilation Air Methane Emissions from Ten Gassy Underground Coal Mines in Poland," and another in 2009 to perform a "Pre-feasibility Study for Degasification and Methane Capture Before Mining at the Pawlowice I Coal Field.," A third grant was awarded to the Institute for Ecology of Industrial Areas in 2008 to perform an "Abandoned Mine Feasibility Study and Coal Mine Methane to Liquefied Natural Gas Assessment" at the Zory coal mine in the

Silesian region (M2M Agreements, 2008; M2M Agreements, 2009). Most recently, U.S. EPA initiated a pre-feasibility study to examine the use of in-mine horizontal wells to degasify seams in advance of mining, as well as for developing horizontal GOB wells.

The Ministry of Environment has launched a project to further investigate surface directional drilling in advance of mining as an effective degasification tool. If successful, then the volume and quality of CMM could increase providing additional gas for utilization (Skiba, 2014).

27.2.2 CMM Emissions from Abandoned Coal Mines

No data quantifying emissions from abandoned Polish mines are currently available, though the methane volume in abandoned coal mines in the USB was estimated in 2006 to range from 150 to 200 billion m^3 (Nagy, 2006).

27.2.3 CBM from Virgin Coal Seams

Estimated in-place coal seam gas resources in Poland are summarized in Table 27-5. One estimate of resources in actively mined and undeveloped coals in the USB yields 1,300 billion m^3 of coal bed methane (CBM) to a depth of 1,500 m. A different method used by the Polish Geological Institute yields a more conservative estimate of 350 billion m^3, of which 210 billion m^3 exists in virgin coal. Including the Lower Silesian and Lublin basins, total in-place CBM resources range from 425 to 1,450 billion m^3 (Schwochow, 1997).

Table 27-5. Poland's In-Place CBM Resources

Coal Basin	Gas Content		Gas in Place	
	m^3/Mg	m^3/t	billion m^3	Tcf
Upper Silesian, first estimate*				
Active mines to 1,000 m (3,280 ft)	—	—	370	13.1
Undeveloped coal to 1,000 m (3,280 ft)	—	—	340	12.0
Coal at 1,000–1,5000 m (3,280–4,920 ft)	—	—	590	20.8
Subtotal	≤ 22	≤ 20	1,300	45.9
Upper Silesian, second estimate†				
Coal to 1,500 m (4,920 ft)	≤ 20	≤ 18.1	350	12.4
Lower Silesian‡	≤ 30	≤ 27.2	25-50	0.9-1.8
Lublin‡	25	22.7	50-100	1.8-3.5
Total	**≤ 97**	**≤ 88**	**425-1,450**	**15-51**

Sources: *Hoffman and Weil (1993); †Surówka (1993); ‡Grzybek (1996), as presented in Schwochow (1997)

The USB first attracted CBM developers in early 1990s. Several CBM concessions were granted from 1991 – 1997, but none of these could establish commercial production of CBM. CBM production in Poland is contingent on the availability of highly specialized equipment, as well as expertise (Hadro, 2008).

27.3 Opportunities and Challenges to Greater CMM Recovery and Use

Poland has signed and ratified the UNFCCC and Kyoto Protocol, as indicated in Table 27-6. As an Annex 1 country, Poland is eligible to host Joint Implementation (JI) projects that can acquire revenue from the sale of carbon credits. In February 2008, the first JI project in Poland was initiated to capture and utilize CMM at the KWK Borynia Coal Mine (JI, 2008). Subsequent to the Borynia Mine project, Kompania Weglowa implemented a JI project in 2009 at the Knurow-Szczyglowice Mine in cooperation with Chugoko Electric Power of Japan to produce electricity from CMM.

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Table 27-6. Poland's Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC	June 5, 1992	July 28, 1994
Kyoto Protocol	July 15, 1998	December 13, 2002

Source: UNFCCC (2014)

27.3.1 Market and Infrastructure Factors

Polish companies have been very innovative at utilizing CMM at mine sites in a variety of ways including heat, power, LNG, and coal drying. Poland is also working toward ventilation air methane (VAM) utilization and recovery through the use of advanced technologies and creating market conditions that can spur VAM project development. The Central Mining Institute of Katowice is researching VAM emissions from 10 gassy hard coal mines in Poland and their potential end use (Skiba, 2009) and Kompania Weglowa is exploring the use of VAM as well.

The transmission network of the Polish Oil and Gas Company (PGNiG) could also play a favorable role for CMM. It is extensive, with 17.9 thousand km of pipes covering almost all of Poland. PGNiG has two main gas transmission networks – one for low-methane gas and another for high-methane gas. The distribution networks include approximately 105 thousand km of gas pipelines that cover the urban areas of the country. PGNiG also has seven underground gas storage facilities (PGNiG, 2006). PGNiG is thus well-situated to make use of CMM projects.

27.3.2 Regulatory Information

The *Geological and Mining Law of February 4, 1994* regulates the ownership of natural resources, including the right to explore for and extract them. The *Energy Law* requires energy enterprises to supply and connect customers, meet demands, and initiate actions for reducing consumption. There are 27 licenses for exploration fields reported in the USB and 68 licenses for coal mines.

Poland is currently providing support for methane use by promoting the use of Combined Heat and Power (CHP) systems through the "CHP Certificates" mechanism and is also providing excise tax exemptions for electricity generation (Skiba, 2009).

27.4 Profiles of Individual Mines

Detailed profiles of gassy Polish mines are available through the GMI website at https://www.globalmethane.org/partners/poland.aspx.

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