

35 United Kingdom



35.1 Summary of Coal Industry

35.1.1 ROLE OF COAL IN THE UNITED KINGDOM

Coal use in the United Kingdom (UK) has fallen by about one quarter in recent years due to a combination of relatively low natural gas prices and higher carbon dioxide (CO₂) emission allowance prices (EURACOAL, 2014). Coal still accounts for 19.9 percent of the UK's total energy needs (DECC, 2014a). The bulk of coal use goes toward power generation, supplying approximately 36 percent of UK's power needs (EIA, 2014a). UK is the seventh largest coal importer worldwide (WCI, 2014). Its primary importer is Russia, with Colombia and the United States contributing significant portions (EIA, 2014a).

Coal production in the UK has declined steadily and dramatically since the early 1990s, falling to its record low of 16.3 million tonnes (Mmt) in 2012, while holding proved reserves of 228 Mmt (Table 35-1; EIA, 2014b). Coal is located in a number of regions in the UK, as shown in Table 35-2 and Figure 35-1. A more detailed map is provided by the [Confederation of UK Coal Producers](#) (UKCoalPro, nda).

Table 35-1. United Kingdom'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)	228	0	228	45 (0.03%)
Annual Coal Production (2012)	16.3	0	16.3	24 (0.2%)

Source: EIA (2014b)

Table 35-2. United Kingdom's Coal Fields

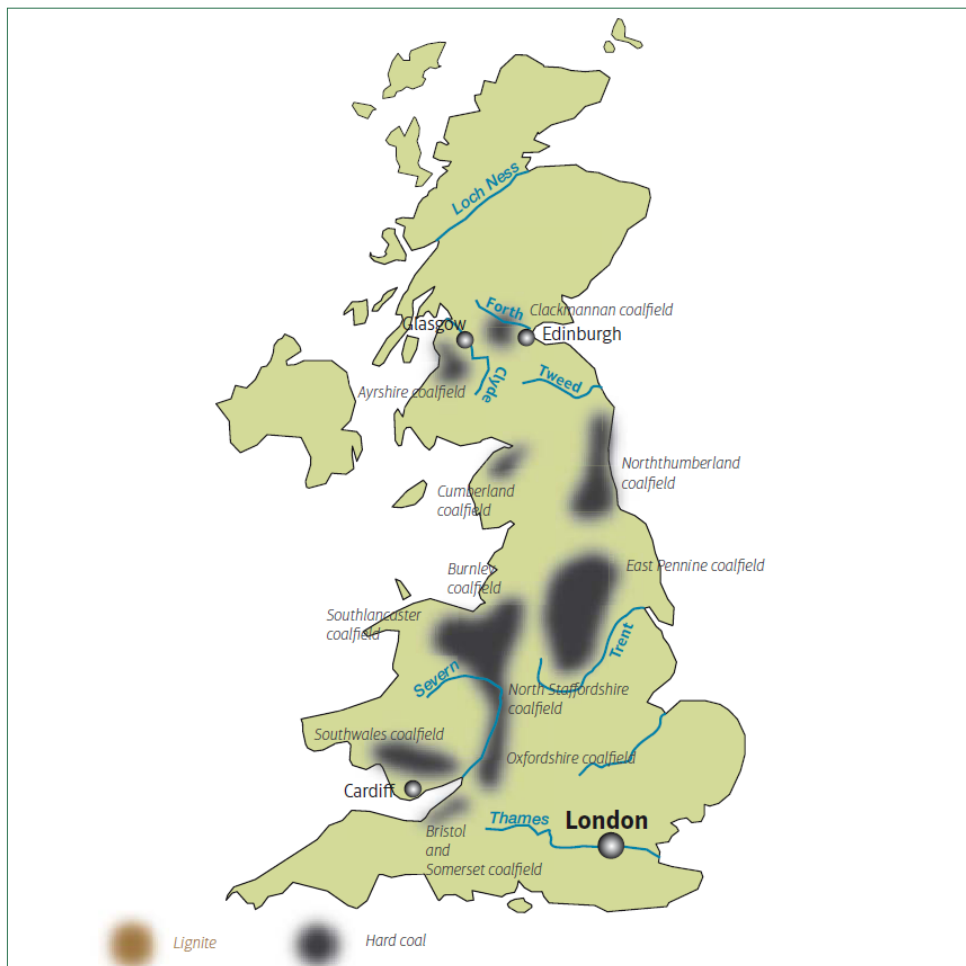
Basin / Location	Coal Field	
Midland Valley, Southern Scotland	<ul style="list-style-type: none"> ▪ Fife ▪ Central ▪ Lothians ▪ Firth of Forth 	<ul style="list-style-type: none"> ▪ Ayrshire ▪ Douglas ▪ Sanquhar ▪ Machrihanish
Northern England, between the Southern Uplands and Craven	<ul style="list-style-type: none"> ▪ Canonbie ▪ Cumberland ▪ Northwest Northumberland ▪ Midgeholme 	<ul style="list-style-type: none"> ▪ Northeastern (Durham) ▪ Ballycastle ▪ Ingleton
East Pennine Basin Central England, north of the Wales	<ul style="list-style-type: none"> ▪ Nottinghamshire ▪ Yorkshire 	<ul style="list-style-type: none"> ▪ East Lincolnshire ▪ Scarborough

Table 35-2. United Kingdom’s Coal Fields

Basin / Location	Coal Field	
West Pennine Basin Central England, north of the Wales	<ul style="list-style-type: none"> ▪ Lancashire ▪ Chester Plains ▪ Anglesey ▪ North and South Staffordshire ▪ South Derbyshire ▪ Leicestershire ▪ Warwickshire 	<ul style="list-style-type: none"> ▪ Shropshire ▪ Cannock ▪ Coalbrookdale ▪ Wyre Forest ▪ Oxfordshire ▪ Flintshire ▪ Denbighshire
Southern England, between the Wales-London-Brabant Massif and Variscan Tectonic Front	<ul style="list-style-type: none"> ▪ Pembrokeshire 	
Southern England, between the Wales	<ul style="list-style-type: none"> ▪ South Wales ▪ Forest of Dean ▪ Bristol 	<ul style="list-style-type: none"> ▪ Somerset (Nailsea and Avonmouth), ▪ Berkshire ▪ Kent

Source: Schwochow (1997)

Figure 35-1. United Kingdom’s Coal Fields



Source: EURACOAL (2014)

35.1.2 STAKEHOLDERS

Table 35-3 identifies potential key stakeholders in the UK’s coal mine methane (CMM) development industry.

Table 35-3. Key Stakeholders in the United Kingdom’s CMM Industry

Stakeholder Category	Stakeholder	Role
Mining companies	<ul style="list-style-type: none"> ▪ ATH Resources Limited ▪ Celtic Energy ▪ Energybuild ▪ Goitre Tower Anthracite ▪ H J Banks & Company Limited ▪ H R M Resources Limited ▪ Hall Construction Services Ltd ▪ Hargreaves Services ▪ J D Flack & Sons Ltd ▪ Land Engineering Services Ltd ▪ Maltby Colliery Ltd ▪ Powerfuel Plc ▪ Recycoal Ltd ▪ Scottish Coal Company Ltd ▪ Scottish Resources Group ▪ The Kier Group - Kier Mining ▪ The Miller Group - Miller Argent (South Wales) Limited ▪ UK Coal Production Limited 	Project hosts
Equipment manufacturers	<ul style="list-style-type: none"> ▪ MAN B&W Diesel ▪ Hamworthy Combustion Engineering ▪ ALSTOM Power UK ▪ Peter Brotherhood ▪ EDECO Petroleum Services 	Methane treatment and utilization equipment
Developers	<ul style="list-style-type: none"> ▪ Abmec ▪ Alkane Energy plc ▪ Arevon Energy Ltd ▪ Clarke Energy Ltd. ▪ Coalbed Methane Ltd. ▪ Coastal Oil and Gas Ltd. ▪ Db Schenker ▪ DEUTZ UK Ltd. ▪ Edinburgh Oil & Gas plc ▪ Energy Developments (UK) Ltd. ▪ Evergreen Resources UK Ltd. ▪ Federation Of Independent Mines ▪ First Energy Ltd. ▪ GeoMet UK Ltd. ▪ Harworth Power Generation Ltd. ▪ HEL-East Ltd ▪ Mines Rescue Service Ltd ▪ Octagon Energy Ltd. ▪ R J Blasting (Scotland) Ltd ▪ Renewable Power Systems ▪ Rolls-Royce Power Ventures Ltd. ▪ Scottish and Southern Energy plc 	Project opportunity identification and planning

Table 35-3. Key Stakeholders in the United Kingdom's CMM Industry

Stakeholder Category	Stakeholder	Role			
Engineering, consultancy, and related services	<ul style="list-style-type: none"> ▪ Terex Distribution Ltd ▪ The Solid Fuel Association ▪ UK Coal Mining Ltd. ▪ UK Gas Ltd. ▪ Warwick Energy Ltd. ▪ Workington Gas & Light Ltd. ▪ See http://www.epa.gov/coalbed/networkcontacts.html 	Technical assistance			
	<ul style="list-style-type: none"> ▪ ACA Howe International Ltd. ▪ AEA Technology Environment ▪ Cadogan Consultants Ltd. ▪ Celtic Energy Ltd. ▪ EDECO Petroleum Services Ltd. ▪ Farley Engineering Ltd. ▪ HEL-East Ltd ▪ International Mining Consultants ▪ Knight Energy Services Ltd. ▪ PR Marriott Drilling Ltd. ▪ Pipeline Services Ltd. ▪ Reeves Wireline Services Ltd. ▪ Schlumberger Oilfield Services Ltd. ▪ Scientific Analysis Ltd. ▪ StrataGas plc ▪ Wardell Armstrong ▪ WS Atkins Consultants Ltd. ▪ See http://www.epa.gov/coalbed/networkcontacts.html 				
	Universities, Research Establishments		<ul style="list-style-type: none"> ▪ British Geological Survey ▪ Cranfield University ▪ Imperial College of Science, Technology, and Medicine (ICSTM) ▪ Loughborough University ▪ University of Cardiff ▪ University of Nottingham 	Technical assistance	
			<ul style="list-style-type: none"> ▪ UK Coal Authority ▪ UK Department for Business, Innovation and Skills (BIS) ▪ Department of Energy and Climate Change 		Regulation of methane rights
			<ul style="list-style-type: none"> ▪ European CO₂ Network ▪ CoalPro, Confederation of UK Coal Producers ▪ The Association of Coal Mine Methane Operators (ACMMO) (defunct) 		
			Regulatory Agencies and other Government Groups		
			Other		

Source: UKCoalPro (ndb); BERR/DTI (2001a); UK Nat Stats (nd)

There have been several pilot drilling schemes in the UK during the last few years but as of October 2010 there is only limited commercial production of coal bed methane (CBM) and this is being used to generate electricity rather than feeding the national gas distribution network. However, companies are now utilizing directional drilling techniques from the oil industry to try and make the exploitation of CBM a viable prospect in the UK (Coal Authority, 2014). Table 35-4 lists current licenses or agreements for CBM sites.

Table 35-4. United Kingdom's Current CBM Licenses/Agreements

Licensee	Name	Authority
Alkane Energy UK Ltd.	Glasshoughton Methane	Wakefield
	Old Mill Lane Industrial Estate	Nottinghamshire
	PPG Industries Site	Wigan
	Rexam Glassworks Site	Barnsley
Coal Bed Methane Ltd.	Arns Farm Development	Clackmannanshire
	River Forth Valley	Fife
Evergreen Resources (UK) Ltd.	Bersham (South Dee)	Wrexham
	Cronton	Knowsley
	Halewood	Knowsley
	Knowle Basin	Solihul
	Mersey Sealand	Cheshire
	Mersey Sealand Supplemental	Flintshire
	North Ouse	York
	Rhuddlan No. 1 Borehole	Denbighshire
	South Dee	Wrexham
	South Staffs	Staffordshire
Nexen	Vale of Clwyd	Denbighshire
	West Lancs	Cheshire
	Doe Green	NA
	Potteries	NA
Octagon (CBM) Ltd.	Old Boston	St. Helens
	Taff Merthyr – Penallta Project	Caerphilly

35.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

Coal production in the UK is declining because of falling consumption, relatively cheap natural gas that competes with coal for power generation, and a surge of low-cost imports (EIA, 2014a). UK's production shrunk roughly 40 percent over the last decade (DECC, 2013a).

Table 35-5. UK's Recent Coal Mine Statistics (2012)

Type of Mine	Coal Production (million tonnes)	Number of Mines
Underground (active) mines - total	6.2 (2012)	10
Surface (active) mines - total	10.1 (2012)	34

Source: (DECC, 2013b)

The UK coal mining industry is private, but subsidized by the government's Coal Investment Aid program that was launched in June 2003. As of 2006, UK's Department of Energy and Climate Change (DECC) reported that £162 million had been paid out to 26 different organizations (DECC, 2006).

Tables 35-6 and 35-7 provide information on major operating coal mines in the UK as of 2012.

Table 35-6. UK's Major Underground Mines in Production as of 2012

Licensee	Site Name	Location
Ayle Colliery Company Ltd	Ayle Colliery	Northumberland
Eckington Colliery Partnerships	Eckington Colliery	Derbyshire
Grimebridge Colliery Company Ltd	Hill Top Colliery	Lancashire
Maltby Colliery Ltd	Maltby Colliery	Rotherham
Hatfield Colliery Ltd	Hatfield Colliery	Doncaster
Ray Ashly, Richard Daniels and Neil Jones	Monument Colliery	Gloucestershire
UK Coal Operations Ltd	Daw Mill Colliery	Warwickshire
	Kellingley Colliery	North Yorkshire
	Thoresby Colliery	Nottinghamshire
Unity Mine Ltd	Unity Mine	Neath Port Talbot

Source: DECC (2013b)

Table 35-7. UK's Surface Mines in Production as of 2012

Licensee	Site Name	Location
Aardvark TMC Ltd (trading as ATH Resources)	Glenmuckloch	Dumfries & Galloway
	Glenmuckloch Samsiston Area	Dumfries & Galloway
	Laigh Glenmuir Site	East Ayrshire
	Muir Dean	Fife
	Netherton	East Ayrshire
Benhar Developments Ltd	Mossband Farm Quarry	North Lanarkshire
Bryn Bach Coal Ltd	Glan Lash	Carmarthenshire
Celtic Energy Ltd	East Pit	Neath Port Talbot
	Nant Helen	Powys
	Selar	Neath Port Talbot
Energybuild Ltd	Nant-y-Mynydd Site	Neath Port Talbot
H J Banks & Company Ltd	Brenkley Lane	Newcastle upon Tyne
	Shotton	Northumberland
Hall Construction Services Ltd	Earlseat	Fife
	Wilsontown	South Lanarkshire
Kier Minerals Ltd	Greenburn Project	East Ayrshire
Land Engineering Services Ltd	Comrie Colliery Site	Fife
Miller Argent (South Wales) Ltd	Ffos-y-Fran Land Reclamation Scheme	Merthyr Tydfil
Newcastle Science Central LLP	Science Central	Newcastle upon Tyne
The Scottish Coal Company Ltd	Blair House	Fife
	Broken Cross	South Lanarkshire
	Dalfad	East Ayrshire
	Dunstonhill	East Ayrshire
	House of Water	East Ayrshire
	Mainshill	South Lanarkshire
	Spireslack Complex (Airdsgreen)	East Ayrshire
	St Ninians	Fife

Table 35-7. UK's Surface Mines in Production as of 2012

Licensee	Site Name	Location
Tower Regeneration Ltd	Tower Colliery Surface Mining Site	Rhondaa Cyon Taff
UK Coal Mining Ltd	Butterwell Disposal Point	Northumberland
	Huntington Lane	Telford & Wrekin
	Lodge House	Derbyshire
	Minorca	Leicestershire
	Park Wall North	Durham
	Potland Burn	Northumberland

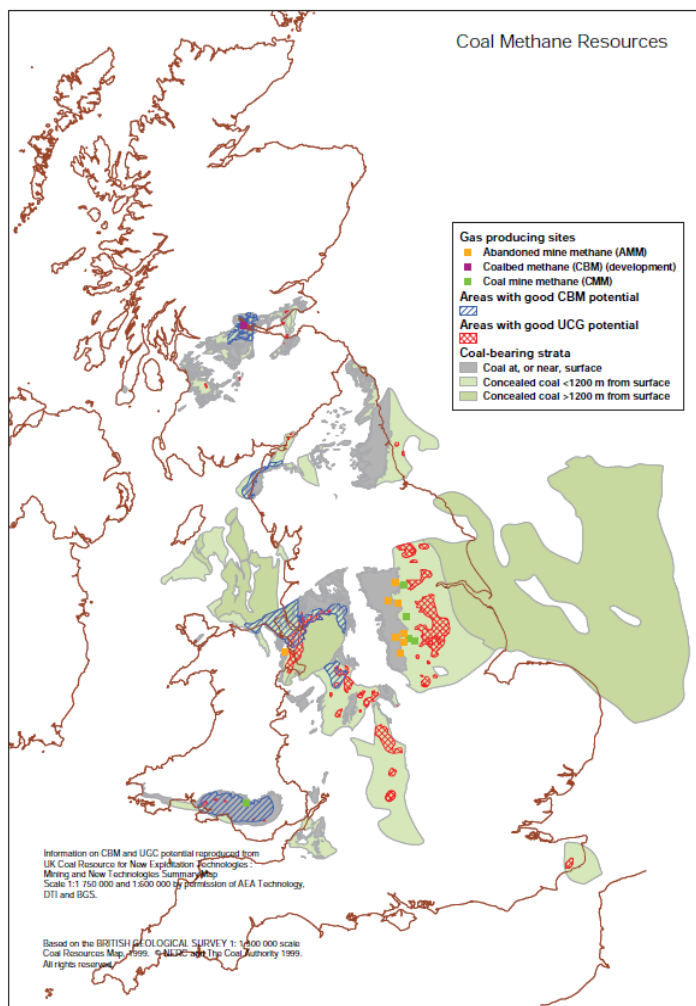
Source: DECC (2013b)

35.2 Overview of CMM Emissions and Development Potential

The Global Methane Initiative (GMI) International CMM Projects Database currently identifies 46 projects in the United Kingdom (GMI, 2014). Of these 46, 23 are in place in abandoned mines, another 23 are located at active underground mines, and the remaining project is in place at an active surface mine. Of the 46 projects, 26 are for power generation, nine involve flaring, five use methane for boiler fuel, two involve heating and cooling, two are for industrial use, and two destroy ventilation air methane (VAM). Updates on future CMM projects in the UK can be found at <https://www.globalmethane.org/coal-mines/cmm/index.aspx>. There are no active CMM flaring projects or VAM projects operating – all were decommissioned as there are no incentives in the UK for CMM or VAM destruction following the end of the UK ETS in 2005.

Figure 35-2 depicts coal methane reserves in the UK.

Figure 35-2. United Kingdom’s Coal Methane Resources



Source: BGS (2006)

35.2.1 CMM EMISSIONS FROM OPERATING MINES

Methane emissions in the United Kingdom were estimated at 489.5 million cubic meters (m³) in 2000, but are expected to decrease by nearly two-thirds to 183.5 million m³ by 2015, and then anticipated to decrease slightly more to 176.5 million m³ by 2030 (see Table 35-8). As permeability is low, mines always use post drainage methods for extraction of CMM, resulting in CMM quality in the range of 25 to 60 percent methane.

Table 35-8. United Kingdom’s CMM Emissions (million cubic meters)

Emissions	2000	2005	2010	2015 (projected)
Total CH ₄ Emitted	489.5	285.7	191.2	183.5

Source: USEPA (2012)

35.2.2 CMM EMISSIONS FROM ABANDONED COAL MINES

There are more than 900 former deep mines in the UK, which offer differing degrees of potential for exploitation of methane. Projects can be developed using the existing mine shafts, where these remain open, or by drilling from the surface into the abandoned workings (Coal Authority, 2014). In 2012, the country produced and consumed 703 GWh of CMM, down from 775 GWh in 2009 (DECC, 2013c). It is estimated that 31,000 tonnes of methane have been recovered and used annually from abandoned mines (BERR/DTI, 2004b). Table 35-9 identifies abandoned mine methane (AMM) projects in the UK.

Table 35-9. United Kingdom's AMM Projects

Stakeholder	Site	Extracted Methane Flow (liter per second)	Project Operating Dates	Use of Methane (type)	Electric Generation (MW)	Global Warming Potential Avoided (tonnes CO ₂ e)
Alkane Energy Plc.	Bevercotes, North Nottinghamshire	N/A	2006-present	N/A	4.05	138,155
Alkane Energy Plc.	Whitwell, North Derbyshire	N/A	2006-present	N/A	1.35	46,052
Alkane Energy Plc.	Warsop, North Nottinghamshire	N/A	2006-present	N/A	1.35	46,052
Alkane Energy Plc.	Wheldale, West Yorkshire	^e 409	^a 2001-present	Electric generation	4.5 (^b 10.3) (^e 5.8)	153,054 (^e 184,000)
Alkane Energy Plc.	Mansfield, North Nottinghamshire	N/A	pre-2006-present	N/A	3.7	126,216
Alkane Energy Plc.	Sherwood, North Nottinghamshire	N/A	pre-2006-present	N/A	0.66	20,467
^e Green Gas Power Ltd.	Silverdale, North Staffordshire	200	1999-	Burner tip use and electric generation via pipeline	^d 9	90,000
^e Green Park Energy	Hickleton, South Yorkshire	250	^a 2000-	Electric generation	3.6 (^b 5.4)	112,500
^c Green Park Energy	Grimethorpe Brodsworth Frickley Bentley Houghton Main	N/A	N/A	N/A	4MWe per site	N/A
^e Warwick Energy	Annersley Bentinck, Nottinghamshire	140	^a 2000-	Electric generation	2.0 (^b 10.5)	63,000

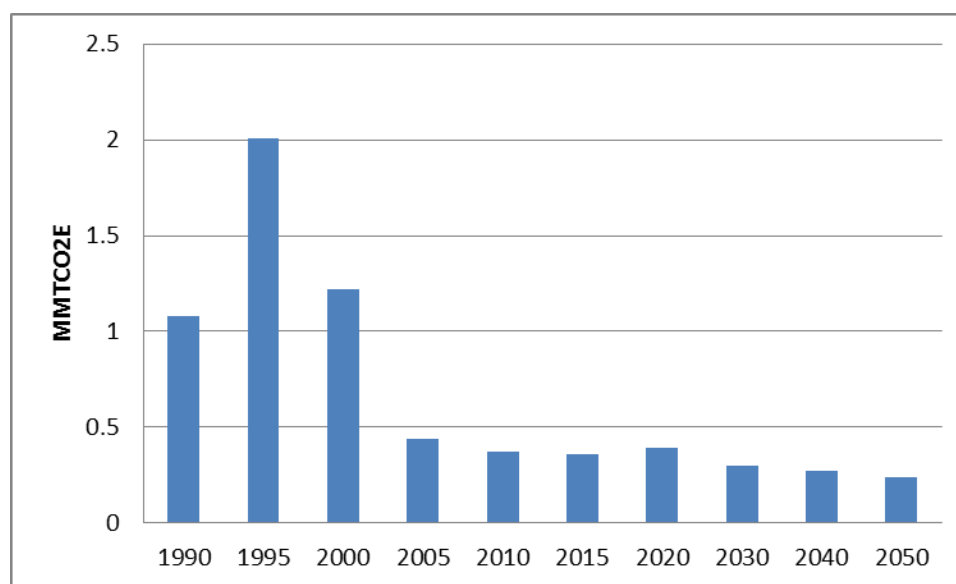
Table 35-9. United Kingdom’s AMM Projects

Stakeholder	Site	Extracted Methane Flow (liter per second)	Project Operating Dates	Use of Methane (type)	Electric Generation (MW)	Global Warming Potential Avoided (tonnes CO ₂ e)
Likely Inactive						
^e Alkane Energy Plc.	Markham, North Derbyshire	51	^a 1999-	Via pipeline to boilers	^d 6 (^b 3)	23,000
^d Alkane Energy Plc.	Steetley, North Nottinghamshire	NA	^a 1999-	^d Electric generation	^d 3	NA
^e Alkane Energy Plc.	Shirebrook, North Derbyshire	372	^a 2000-	Electric generation	5.3 (^b 9.5)	167,400
^e Alkane Energy Plc.	Monk Bretton, West Yorkshire	33	N/A	Burner tip use	^b 2 (^c 5)	14,900

Sources cover entire row unless otherwise noted: a) Alkane (2003); b) BERR/DTI (2004a); c) Coal Authority (2008); d) BERR/DTI (2001b); e) BERR/DTI (2004b)

Figure 35-3 shows net emissions from current and future abandoned mines through 2050.

Figure 35-3. Abandoned Mine Net Emissions



Source: DECC (2011)

35.2.3 CBM FROM VIRGIN COAL SEAMS

There is a very substantial technical resource of virgin CBM in the UK totaling 2.45 trillion m³. This would give the UK a 24-year supply under 2008 consumption levels. A 2001 estimate suggested that only 30 billion m³ would be economically recoverable (BERR/DTI, 2001b). However, given that the natural gas price in the UK was roughly \$2.80 per million Btu in 2001 and the current EU

average price has risen to nearly \$10 per million Btu, the economic viability for CBM recovery would be far more favorable now (YCharts, 2014). Recent technological advancements associated with hydraulic fracturing would also likely further expand recoverable reserves. The highest gas contents of more than 20 m³ per metric ton can be found in South Wales and is the focus of most commercial interest (ACMMO, nd).

It is worth noting U.K. coal seams are generally of low permeability; therefore, hydraulic fracking and directional drilling techniques are likely to be necessary to recover commercial volumes.

35.3 Opportunities and Challenges to Greater CMM Recovery and Use

The UK is a signatory to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (Table 35-10). As an Annex I Party to the Kyoto Protocol, its emissions target is 20 percent below 1990 levels by 2020.

Table 35-10. UK's Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC	June 12, 1992	December 8, 1993
Kyoto Protocol	April 29, 1998	May 31, 2002

Source: UNFCCC (2014)

The first and second phases (2005-8 and 2008-12, respectively) of the European Union Emissions Trading Scheme (EU ETS) did not include methane emissions (EC, 2013). The European Union Commission suggests that the EU ETS needs to be strengthened by taking measures that include extending the scheme to other gases such as methane (EU, 2007). Just recently, the UK called for major reforms to improve the EU ETS to tackle climate change, including provisions for additional activities and gases (DECC, 2014b). The Department of Food and Rural Affairs commissioned a study exploring CMM and incorporating it into the EU ETS, highlighting its challenges (DECC, 2005).

35.3.1 MARKET AND INFRASTRUCTURE FACTORS

British coal mining as a nationalized industry was self-sufficient with regards to research and development (R&D). Companies downsized when the British government privatized the industry in the mid-1990s, and emphasis moved away from long-term R&D to more immediate issues. The industry position has stabilized and some long-term mining-related R&D effort has been taken over by the universities and private businesses.

New CMM utilization projects have tended to be power generation projects. The technology is usually standard modules of 1 to 2 MW_e internal combustion engines as used in the landfill gas industry. Landfill gas is a strong and growing sector in the UK with more than 1,000MW_e installed capacity in 2012 (DECC, 2013d). Pipeline sales can occur if the infrastructure stays in place from previous mining enterprises. However, CMM gas is not of sufficient quality to enter the national natural gas network or even to be upgraded, so the economic viability of pipeline injection is impossible. In some cases, CBM may be of adequate quality to enter the public distribution system, but there is no evidence of this (Coal Authority, 2014).

35.3.2 REGULATORY INFORMATION

Ownership of the methane in coal rests with the UK government, but it passes to the licensee when the methane is captured. The rights to the methane gas are regulated by the Department of Business Enterprise & Regulatory Reform under the Petroleum Act of 1998 (Coal Authority, 2014). Petroleum Exploration and Development Licenses (PEDLs) are awarded in a series of “rounds,” the most recent being the 13th Landward Licensing round, which accepted applications on February 6, 2008 (Oil and Gas, 2008a). Methane Development Licenses (MDLs) are used primarily for operating mines. An MDL grants permission to get gas “in the course of operations for making and keeping safe mines whether or not disused.” It grants no exclusive rights, so it can overlap geographically with one or more PEDLs. MDLs generally cover much smaller areas than PEDLs; typically each covers one mine, although the Coal Authority holds a license that covers the whole country (Oil and Gas, 2008b). Coal licensing—and through it, the responsibility for environmental and safety standards—is handled by the Coal Authority.

The regulatory system for CMM/AMM/CBM ownership is straightforward and works well, subject to clear delineation of when a mine is open and closed.

CMM currently enjoys an exemption from the UK Climate Change Levy (CCL), a tax on fossil fuels that has not otherwise been taxed (as is the case with oil) (OPSI, 2003). When used for power generation, it currently represents an incentive of 4.41 £ per MW_e (Customs, 2007a). The CCL was indexed to inflation starting April 1, 2007 (Customs, 2007b). These savings are shared with the distribution company that accepts the power into its system; the net benefit to the generator is likely being closer to 3.0 £ per MW_e and is realized by the sale of CCL Certificates. With the exception of this benefit, power from CMM must compete equally with that from all other generators in the electricity market. This has proved difficult in recent times due to the low price of electricity on the wholesale market. Recently, however, prices have risen, generating increased interest in CMM projects.

CMM projects are normally developed by private capital. Recent natural gas price volatility has meant a downturn in activity due to poor projected returns.

CO₂ sequestration into the coal seam is often cited as a possible means of making CBM carbon neutral. CO₂ sequestration technology is immature at present and its potential application in the UK cannot be assessed. However, there are vast areas of coal at depths below 1,200 m that are possibly too deep for mining and thus may be suitable sites for sequestration.

35.4 Profiles of Individual Mines

The Coal Authority maintains coal mining data in an interactive national database (found at <http://mapapps2.bgs.ac.uk/coalauthority/home.html>), and provides information on past and present coal mining activities in UK.

35.5 References

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