

# 16 INDIA



## 16.1 Summary of Coal Industry

India is the fourth-largest coal producer in the world and holds over 319 billion tonnes of coal reserves. Over 56 percent of India's primary power production is supplied by coal and this number is expected to grow with India's population and increasing energy needs. With the recent liberalization of government regulations and completion of vital pipeline infrastructure, conditions are more favorable for coal mine methane (CMM) and coalbed methane (CBM) to become economically viable sources of natural gas for the country. Bharat Coking Coal Ltd. (BCCL), a state-owned coal producing company, is already exploring opportunities in the Jharia Coalfield for CMM/CBM capture and utilization. However, technical, regulatory, and logistical hurdles still remain as deterrents to the widespread capture and use of CMM/CBM resources. India's current 3-Year-Action-Agenda has acknowledged the positive impact CMM/CBM projects might have on the country, but future policy incentives will likely be necessary before any large-scale development commences.

### 16.1.1 ROLE OF COAL IN INDIA

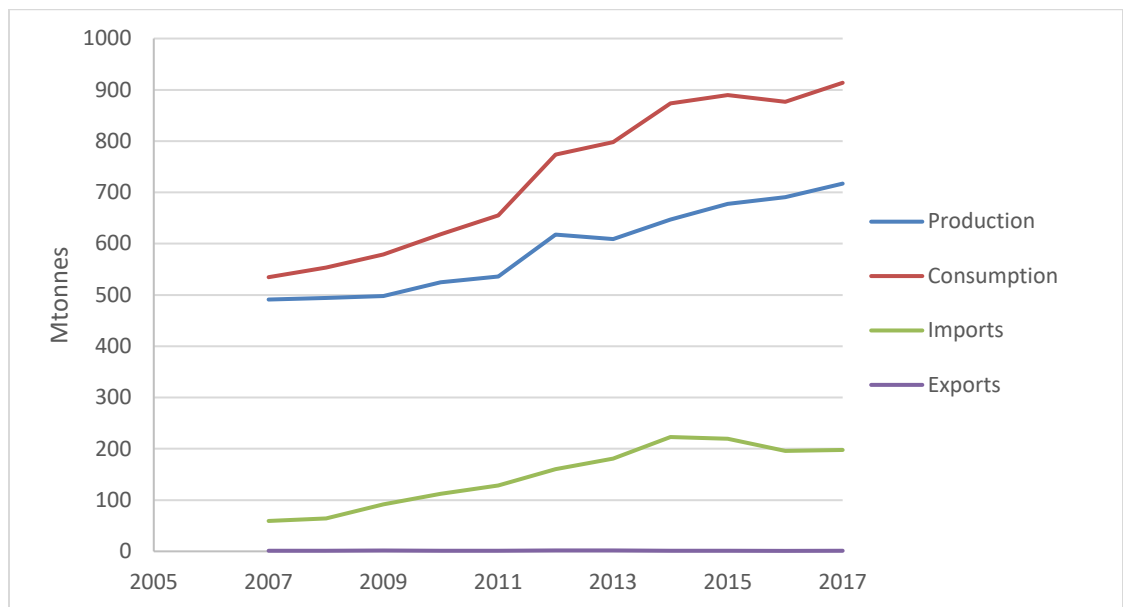
- India ranks sixth in total coal reserves, with more than 300 billion metric tonnes (Table 16-1). The country's primary coal fields are identified in Figure 16-2.
- Coal accounts for 56.3 percent of India's total primary energy consumption.
- Coal production increased by 44.1 percent between 2009 (497.64 million metric tons) and 2017 (717.18 million metric tonnes), and coal consumption increased 76.7 percent over the same period (Figure 16-1) (EIA, 2019).
- Natural gas production decreased by 33 percent between 2009 (32.85 billion cubic meters, BCM) and 2018 (21.94 BCM), and natural gas consumption increased by 39.6 percent during the same period.
- Indian electricity generation in 2017 was 56.3 percent coal and lignite, 29.5 percent oil, 6.1 percent natural gas, 4.1 percent hydroelectric, 2.9 percent renewables, and 0.1 percent nuclear (BP, 2018).

**Table 16-1. India's Coal Reserves and Production**

Indicator	Coking (million tonnes)	Non- Coking (million tonnes)	Tertiary Coal (million tonnes)	Total (million tonnes)	Global Rank
Total Coal Reserve	34,522.46	282,910.19	1,587.68	319,020.33	6
Estimated Proved Coal Reserves (2018)	19,081.96	129,111.66	593.81	148,787.43	
Annual Coal Production (2018)				703.35	3

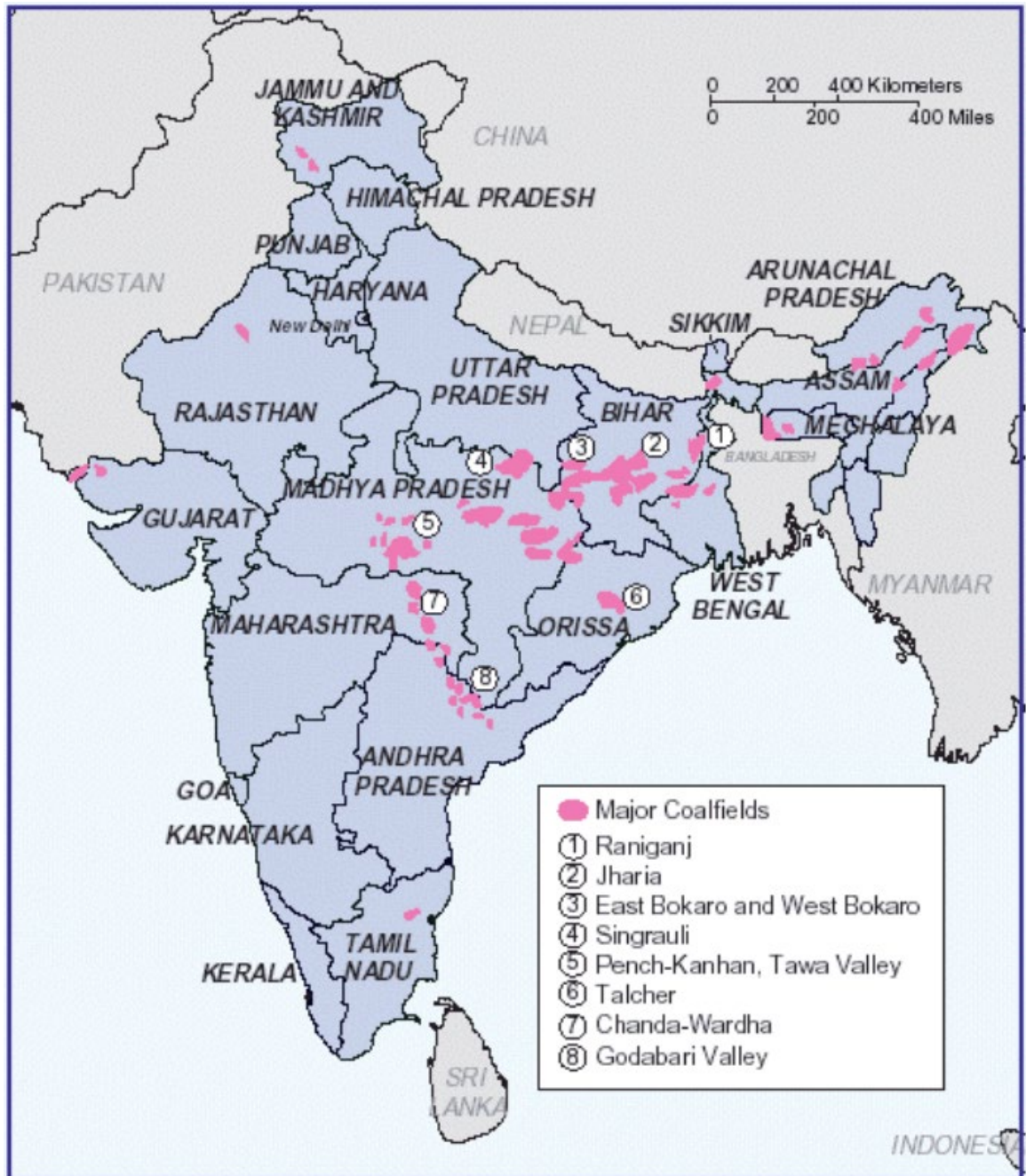
Source: GoI (2019).

- Coal demand averaged a growth rate of 6.3 percent per year over the past decade, while coal production fell behind with an average of only a 3.5 percent growth rate over the same period, leading to a significant reliance on coal imports (USEPA, 2019a; BP, 2018) (Figure 16-1).

**Figure 16-1. India Coal Statistics**

Source: EIA (2019).

Figure 16-2. India's Coal Fields



Source: Bhattacharya (2015).

## 16.1.2 STAKEHOLDERS

Table 16-2 presents a summary of key stakeholders in India's CMM industry.

**Table 16-2. Key Stakeholders in India's CMM/CBM Industry**

Stakeholder Category	Stakeholder	Role
Mining companies	State-owned coal companies: <ul style="list-style-type: none"> <li>Coal India Limited (CIL) and its eight regional subsidiaries</li> <li>Singareni Collieries Company Limited</li> </ul>	Project hosts
Equipment manufacturers	<ul style="list-style-type: none"> <li>EES Tech</li> <li>Caterpillar India Limited</li> <li>Combustion Technologies Private, Limited</li> </ul>	Methane treatment and utilization equipment
Developers	<ul style="list-style-type: none"> <li>Deep Industries Ltd.</li> <li>Oil and Natural Gas Corporation Ltd.</li> <li>Essar Oil and Gas</li> <li>Reliance Industries</li> </ul>	Potential project partners
Engineering, consultancy, and related services	<ul style="list-style-type: none"> <li>Total CBM Solutions</li> <li>Central Mine Planning and Design Institute Ltd. (CMPDI)</li> </ul>	Technical assistance
Universities, research establishments	<ul style="list-style-type: none"> <li>Indian School of Mining, Dhanbad</li> <li>Central Institute of Mining and Fuel Research</li> <li>Central Mine Planning and Design Institute</li> <li>School of Petroleum Technology Gandhinagar</li> <li>University of Hyderabad</li> </ul>	Research institutions
Regulatory agencies and government groups	<ul style="list-style-type: none"> <li>Director General of Hydrocarbons</li> <li>Ministry of Coal</li> <li>Ministry of Petroleum and Natural Gas</li> </ul>	Drafting of legislation, implementation of laws, government oversight

Source: USEPA (2019b); for a full list of Global Methane Initiative Project Network contacts, please visit:

<https://www.globalmethane.org/partners/country.aspx?country=india>.

## 16.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

- Indian coal production is almost entirely controlled by the government, with 84 percent of all coal produced by the state-owned company CIL (CIL, 2018). A further 10 percent of coal production is mined by Singareni Collieries Company Limited, which is also state-owned (EIA, 2016).

- As of 2016, there were 493 coal mines in operation in India, a decrease from 539 coal mines in 2015. This is likely due to India's continuing efforts to shut down small, unprofitable mines (GoI, 2017); of these 493 mines, 430 belonged to CIL (CIL, 2015).
- 62 percent of India's installed power capacity is dependent on coal and 61.8 percent of the overall coal production went toward power production in 2016 (EIA, 2016; MOSPI, 2018).
- Coal production from underground mines represented only 7 percent of output in 2017, down from 16 percent in 2005 due to CIL's growing dependence on opencast mines to meet government-set production goals (GoI, 2017).
- In 2018 there were 204 commercial coal mine blocks with 97,728 million metric tons of coal reserves available in India (BP, 2018; PIB, 2018).

## 16.2 Overview of CMM Emissions and Development Potential

- There are no certified CMM projects currently operating in India; however, CIL has expressed interest in developing projects in some of its gassier mines (ARI, 2019a).
- CIL/CMPDI, through its subsidiary companies, has planned two projects in the Jharia Coalfield under the BCCL leasehold and one project in the Raniganj Coalfield under an Eastern Coalfields Ltd. leasehold for development of CBM in CIL leasehold areas.
- The Global Environment Facility, the United Nations Development Programme, and the Government of India funded a demonstration project on CBM recovery and its commercial utilization was successfully completed in 2008, proving the efficacy of the technology in Indian geo-mining conditions (Singh, 2010).
- A pre-drainage project for CMM at BCCL's Moonidih underground mine with an envisaged project life of 10 years is currently under development. The Moonidih Mine is a highly gassy mine and the project has been planned to keep coal miners safe from methane outbursts, enhance coal production, and lower the cost of coking coal production. It will also reduce greenhouse gas (GHG) emissions. This will represent the first CMM production and utilization project in India.
- Under the auspices of the Global Methane Initiative (GMI), the U.S. Environmental Protection Agency conducted three pre-feasibility studies for the Chinakuri, Sawang, and Pootkee-Bullinary Collieries in the Damodar Valley coalfields. Through these studies, US EPA evaluated site-specific conditions for an initial assessment of potential technical and economic viability for coal mine methane project recovery and use (US EPA 2015, US EPA 2016, US EPA 2019c).
- India has a classification system for mine gassiness that is dependent on the amount of methane emissions per tonne of coal mined (Table 16-3); most mines are degree I and II mines (DGMS, 2015).

**Table 16-3. India's Classification System and Estimates of Mine Gassiness**

<b>Class</b>	<b>Specific Emissions</b> (volume of flammable gas/tonne of coal produced)	<b>Number of</b> <b>Underground Mines</b> (as of 2015)
Degree I	> 0.01 and $\leq$ 1 cubic meters (m <sup>3</sup> )	260
Degree II	> 1 and $\leq$ 10 m <sup>3</sup>	70
Degree III	> 10 m <sup>3</sup>	7

Source: DGMS (2015).

### 16.2.1 CMM EMISSIONS FROM OPERATING MINES

- The India CMM Clearinghouse, a nonprofit, nongovernment-run organization, was created in 2006 in Ranchi, Jharkhand State, India, to facilitate CMM information exchange and support the development of CMM projects in India (India CMM/CBM Clearinghouse, 2019).
- Methane emissions from coal mining grew from 555 kilotonnes in 1991 to 765 kilotonnes in 2012 (Singh and Kumar, 2016).

### 16.2.2 CBM FROM VIRGIN COAL SEAMS

- India has CBM reserves estimated at 2.6 trillion cubic meters spread across 11 states (DGH, 2019). CBM is classified as gas existing in coal seams below 300 meters (m) and up to 1,500 m in depth, with an average depth of 907 m (Jadhav, 2016).
- The Ministry of Coal has designated 33 CBM blocks for commercial exploration and production that cover 16,613 square kilometers (km<sup>2</sup>) and carry 1.767 trillion cubic meters of India's CBM reserves. These blocks were auctioned off between 2001 and 2008 (DGH, 2019).
- As of February 2019, three of these blocks were commercially producing CBM; CBM production of the country is 2 million cubic meters (m<sup>3</sup>) of gas per day (DGH, 2019).
- Over 600 CBM wells have been drilled in India, and this number is expected to double in the next several years due to the recent development of natural gas production and the transportation infrastructure (ARI, 2019b).
- India's CBM production jumped to 2.0 million metric standard cubic meters per day in 2018 from 0.77 million metric standard cubic meters per day in 2015.
- Recent legislation in India has allowed CIL to develop CBM/CMM within its own lease blocks without the permission of the Directorate General of Hydrocarbons. The two main blocks slated for development in the near future are:
  - **Jharia Coalfield.** The Jharia CBM Block-I is about 24 km<sup>2</sup> in size and has over 25 BCM of methane resources—the planned project has an envisaged project life of 39 years (CMPDI, 2019).

- **Raniganj Coalfield:** A planned project in the Raniganj coalfield targets a 57 km<sup>2</sup> block housing 3.93 BCM of methane resources (2.92 BCM in a targeted area of 40 km<sup>2</sup>), and has an envisaged project life of 25 years. However, the identified area may be technologically challenging for CBM/CMM extraction.
- The delineation of additional CBM/CMM blocks in CIL areas has also been undertaken to encourage the exploitation of gassy coal seams in different coalfields. Deeper virgin coal seams below developed mining areas in CIL-owned territory are also to be delineated for prospective CMM/CBM blocks (CMPDI, 2019).

## 16.3 Opportunities and Challenges to Greater CMM Recovery and Use

### 16.3.1 MARKET AND INFRASTRUCTURE FACTORS

- Natural gas consumption has increased 39.6 percent in the past decade despite a decrease in domestic production. The Indian government intends for natural gas to make up 15 percent of primary energy consumption by 2022—this increase, in the status quo, will largely be fed by imports (Kar, 2018).
- India is the fourth-largest importer of liquefied natural gas in the world and has invested heavily in the construction of new terminals for liquified natural gas imports to feed its growing gas demand (Riviera Newsdeck, 2018).
- Collaborating under the auspices of the Global Methane Initiative (GMI), US EPA assessed market opportunities for coal mine methane development in India (USEPA, 2019a).
- GAIL (India) Limited is expected to complete phase I of its Jagdishpur-Haldia and Bokaro-Dhamra Gas Pipeline project at the end of 2020 (Urja Ganga Gas Pipeline Project). This pipeline will connect the CBM fields of eastern India to the population centers of northern India, which will provide vital infrastructure for CMM to potentially be used in the 7 cities, 40 districts, and 2,600 villages that the pipeline runs through (HT, 2019).
- As of 2012, the Indian government opened coal mining to both private and public sectors; before this, private sectors could only mine and provide coal for a regional powerplant and could not sell the coal on the market, a practice called captive mining (PIB, 2012).
- In 2014, the Indian government voided 204 coal mining blocks and began a process of re-auctioning the blocks to increase competition in the coal sector, and increase the transparency and accountability of mining companies. As of 2019, auctioning was still occurring; however, foreign interest in the blocks has remained low (Das, 2019; PIB, 2018).
- A 2017 policy change now allows CBM producers to sell gas at market rates (as opposed to the rates previously mandated by the government for other sources of natural gas); however, if the producer sells at a price higher than the official rate, the producer will be required to pay dues

and royalties to the government (Reuters, 2017).

- Coal prices are primarily dictated by the government and are kept artificially low to improve domestic power development; however, these low prices have caused CIL to largely abandon underground mining in favor of opencast mining, which is cheaper because it requires less excavation and no degasification. As India becomes more familiar with methane drainage and utilization practices, the number of underground mines in operation is expected to increase (HBL, 2018).

### 16.3.2 GOVERNMENT POLICY AND REGULATORY INFORMATION

- India is the third-largest producer of GHGs in the world (Friedrich et al., 2017).
- India is a non-Annex I country under the United Nations Framework Convention on Climate Change and it is not obligated to reduce carbon and GHG emissions (see Table 16-4). As a non-Annex I party, India is eligible to receive financing for GHG mitigation projects such as CMM projects under the Clean Development Mechanism (CDM).
- As a non-Annex I party, India has hosted GHG mitigation projects such as CMM projects under the CDM, creating revenues through credit trading. As of 2019 India had 2,111 registered CDM projects (UNEP DTU, 2019).

**Table 16-4. India's Climate Change Mitigation Commitment**

Agreement	Signature	Ratification
United Nations Framework Convention on Climate Change*	June 10, 1992	November 1, 1993
Kyoto Protocol**	–	August 2002
Paris Agreement***	April 16, 2016	October 2, 2016

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

- India formulated its first CBM policy in 1997 and auctioned off 26 commercial CBM and 6 LBM blocks to public and private industries between 2001 and 2009.
- A policy modification in May 2018 now permits CIL and its subsidiaries to extract CBM from their lease-held areas under the administrative control of the Ministry of Coal. For other areas, companies will still be governed by the CBM policy stipulated in the original 1997 mineral statutes.
- Underground mines in India require surface area rights in addition to mineral rights (HBL, 2018).
- CBM projects are guaranteed a seven-year tax holiday, and government shares of profit are only based on average daily production levels. This is a smaller amount than the shares paid by conventional producers of natural gas, whose prices are determined by the ratio of cumulative revenue, net upfront payments, and operating expenditure over cumulative capital expenditure



(Energy Global, 2015).

### 16.3.3 TECHNOLOGICAL CHALLENGES RELATED TO OPTIMUM EXTRACTION OF CMM/CBM AND COAL

- A two-day International Workshop, “Optimum Utilization of CMM/CBM in India,” was held on April 24–25, 2019, in Ranchi (Jharkhand) India. The workshop was conducted under the aegis of the Government of India Ministry of Coal and was co-hosted by the CMPDI, CIL, and the Global Methane Initiative.
  - Critical problems faced by Indian coal mines due to methane emissions were discussed to better develop standardized methods for optimum utilization of CMM/CBM and coal in India.
  - Issues concerning hindrances that CBM projects may potentially pose to conventional coal mining, especially underground coal mining, were discussed in length and considered the impact casing would have on CBM well production.
  - Various methodologies were suggested to overcome these issues—it was agreed upon that CBM block decisions will follow a decision matrix developed by CBM operators and competent authorities. The matrix would provide a basis for decisions involving simultaneous coal and CBM extraction operations, sequential coal and CBM extraction operations, or only-coal/only-CBM extraction.
  - It was recommended that prospecting and mining licenses for all minerals, including CBM, should be given to one governing entity that is then given the prospecting and/or mining lease of the dominant mineral.

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