Coal Mining and Logistics

HIGHLIGHTS

PROCESS AND TECHNOLOGY STATUS – Coal mining and logistics covers coal extraction from mines, coal preparation and coal transportation to the final users, such as power plants or industrial areas. As of January 1, 2009, total recoverable coal reserves were estimated at 858.3 billion metric tons, corresponding to a reserves/production ratio of 120 years [2]. Although coal reserves exist in 70 countries, they are concentrated in only few countries/regions - the United States (27%), Russia (18%), China (13%), non-OECD Europe and other Eurasia (1%), and Australia/New Zealand (9%) [2]. Total coal production reached about 7.2 billion metric tons in 2010) [2]. Global coal trade movements are small compared with global coal consumption: only 14% of the total coal consumed was imported in 2010 [2]. On the exporter's side, Indonesia made significant gains representing 50% of the additional coal exports between 2000 and 2011. China and India became major importers representing 57% of the incremental 2000-2011 coal imports.

PERFORMANCE AND COSTS – GHG emissions are a key issue in coal mining and logistics. Coal mining results in methane emissions of about 10-25 m3/tonne for underground mining and 0.3 –2.0 m3/tonne for surface mining. Post-mining operations also result into methane emissions of 0.4-4.0 m3/tonne for underground mining and 0-0.2 m3/tonne for surface mining. These emissions rates exclude recovered emissions. Emissions from coal transportation are same as the emissions involved in freight transportation, i.e. 62g CO2/tonne-km for road transport, 22g CO2/tonne-km for rail, 31g CO2/tonne-km for inland waterways, 16g CO2/tonne-km for short-sea shipping, 8.4 g CO2/tonne-km for deep-sea – container shipping and 5 g CO2/tonne-km for deep-sea tanker operations [14]. Total upstream emissions have been calculated in many life cycle analyses for coal power plant in the US, including methane releases from mines and fuel combustion during mining and transportation activities. Resulting emission factors are 5.1-10.1 kg CO2-eq/GJ for coal mining and processing, and 0.7-2.6 kg CO2-eq/GJ for coal transportation [11, 12, 13]. Data from main producing countries were used in order to estimate coal supply costs in various world regions [7]: 0.3 to 0.79 $/GJ for lignite reserves, and 1.0-3.7 $/GJ for hard coal reserves. Coal transportation can account for up to 70% of the total delivery cost. Transportation costs between world regions vary between 0.1-0.9 $/GJ, which include a coal handling fee in sea ports of about US$2/ton [7]. In Europe, inland water transportation involves different types of waterways, barges, and consequently, transportation costs vary accordingly: 1.8-3.1 €/t (from ARA-ports to the Ruhr), 9.7-11.3 €/t (on the Main-Danube canal to Austria), and 3.6-4.1 €/t (from Hamburg on the Elbe, the Elbe-Havel canal and the Havel to Berlin) [6]. As for port charges and handling costs, there is about 0.3 €/t for the pier tax, 3 €/t for railway loading in the port and 5 €/t as follow-up costs to the final destination [6]. As for coal transportation rates to the electric power sector in the US they also vary widely depending on the regions and the transportation mode. In 2010, the average was US$(2005)17.1/metric ton (38.6% of the total delivery cost), while the range was US$(2005) 11-21.5/metric tons. For barges, the average was US$(2005) 6.4/metric ton (11.4% of the total delivery cost); for trucks, the average was US$(2005) 6.2/metric (15.4% of the total delivery cost).

POTENTIAL AND BARRIERS – Coal will continue to play an important role in the future energy mix [5]. It is an affordable source of energy which plays an important role in terms of energy security. It is abundant in several countries and can be easily transported and stored at power plants. With the development of the coal-to-liquids industry, coal can also become a substitute to oil. Carbon capture and storage (CCS) can play an important role in the efforts to reduce CO2 emissions from coal combustion, though significant investments are required to implement cost-effective CCS technologies. Finally, technologies are currently being developed to capture and use the methane emitted from mining operations (coal mine methane, CMM), which currently accounts for 8% of the total anthropogenic methane emissions. More than 220 CMM projects are currently being developed in 14 countries with important coal reserves, e.g. Australia, China and the US [5].

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