



executive summary

Low quality coals – key commercial, environmental and plant considerations

Around half of the world's estimated recoverable coal reserves comprise coals of low quality or value. These are predominantly subbituminous and high-ash bituminous coals, and various grades of lignite. Anthracite and bituminous coals account for 51% of the world's reserves, subbituminous coal 32%, and lignite 18%. Each coal type brings its own combination of advantages and disadvantages. For various economic and environmental reasons, a number of countries have turned increasingly to the use of lower quality coals.



Lignite mining, West Macedonia, Greece

Various combinations of the three types of lower grade coals are used in a number of major economies. For example, China produces all three, whereas the USA, Russia, Kazakhstan and Canada only produce subbituminous coal and lignite. Lignite is used widely for power generation in countries such as India, Germany, Poland, Turkey and Greece, whereas high-ash bituminous coals are of particular importance in China, India, and South Africa.

Lower quality coals can be used in most conventional and clean coal utilisation technologies. In some cases, they can be used directly, whereas in others, a degree of pre-treatment is required. Some are used widely in considerable quantities and in a number of processes; others hold potential for the future. The biggest market by far is for power generation. Around the world, there are many conventional pulverised coal combustion (PCC) plants based on subcritical steam conditions that fire these types of coal. However, supercritical (SC) and ultrasupercritical (USC) systems are being deployed in growing numbers. In particular, recent years have seen their widespread adoption in the burgeoning economies of China and India.

Alongside PCC, the fuel-flexible nature of circulating fluidised bed combustion (CFBC) technology makes it well suited to burning low grade coals. Deployment of CFBC has grown in countries such as China, India, Turkey and Poland where various types of low grade coals are used to generate electricity or produce heat. The average capacity of

CFBC units is increasing and supercritical steam conditions are being adopted for some larger projects – supercritical CFBC boilers up to 800 MWe are now offered commercially.

IEA Clean Coal Centre is a collaborative project of member countries of the International Energy Agency (IEA) to provide information about and analysis of coal technology, supply and use. IEA Clean Coal Centre has contracting parties and sponsors from: Australia, China, the European Commission, Germany, India, Italy, Japan, Poland, Russia, South Africa, Thailand, the UK and the USA.

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Low quality coals – key commercial, environmental and plant considerations

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Fuel flexibility has been a major driving force behind many recent projects, giving utilities the option to easily change fuel supply.

Low quality coals are also gasified to produce synthetic natural gas (SNG) or used in Integrated Gasification Combined Cycle (IGCC) plants. Coals containing high levels of ash and/or moisture are routinely gasified in commercial operations, successfully producing a number of end-products. Plant size and configuration varies widely. Large SNG plants are operating in China and the USA. However, China has the largest number of individual projects (more than 100) and development continues through government support of R&D programmes. Various coal types, including subbituminous coals, washery residues and high-ash lignite are used to produce a range of products. Around the world, there are several IGCC projects, based on a number of technology variants, that rely on low quality coals as feedstock. These include projects in China, the USA, South Korea, the Czech Republic and India. Coals used include subbituminous and various types of lignite.

Low grade coals are also used in commercial coal-to-liquids (CTL) operations. CTL is particularly attractive to countries that rely heavily on oil imports but have large domestic coal reserves. The process is of particular importance in South Africa, where SASOL gasifies 40 Mt/y of high-ash bituminous coal to produce a range of liquids and other products. CTL is also of significance in China where a number of projects use several types of low grade coal that include high-ash subbituminous coals and lignite. In other parts of the world, CTL projects using these types of coal show promise and have been proposed in countries such as Indonesia, India and Mozambique.

In recent years, the supply and demand situation for coal has been evolving. Subbituminous coals and coals with higher ash content have been introduced into the market and traded in increasing quantities. Similarly, a number of major economies have increased their reliance on indigenous reserves of lower grade coals. In some cases, these are the only significant energy resource available. Such coals are often mined inexpensively via large-scale opencast techniques. They provide a secure supply of energy and help minimise dependence on imported supplies. In the longer term, the future of coal-derived energy supplies is expected to include the greater use of lower grade coals, a trend that is already evident in various markets around the world. Such coals are often of strategic importance, providing a secure source of energy and helping minimise dependence on imported supplies. Although some major economies are currently pursuing policies designed to eliminate or at least reduce coal consumption, in others, it will continue to be used as a major provider of electricity.



Subbituminous coal production, Wyoming, USA



Coal exports from Richards Bay, South Africa