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What Role Can Coal Play in the United States' Energy Future?

A wider collaboration framework among the various value chain actors may provide a technology advancement pathway. However, for this collaboration to occur, lead coal companies need to expand their business model beyond coal mining into the downstream coal conversion business to include higher-value coal products and by-products.

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I. Introduction

Coal is a key fuel in power generation in the United States and in Asia and Africa, where it continues to power developing economies (Keith & Bhattaharya, 2011). Its popularity depends on a number of factors: the relative cost and availability of alternative fuels; environmental regulations; rate of economic growth; and the power generation technologies already in use (Coal Industry Advisory Board, 2006). The fuel draws considerable criticism, particularly for its contribution to soil erosion, loss of biodiversity and high carbon dioxide emissions across the value chain.[1] Nevertheless, improvements in technology in coal mining and coal use can significantly lower its negative environmental effects.

In the U.S., the coal industry is coping with declining demand as the nation burns less coal to generate electricity (**Figure 1**). Electric power is the largest single source of coal consumption, accounting for 90 percent of overall use, but increasing production costs and the availability of cheap natural gas is hurting coal's competitiveness. Leading companies are hoping to compensate for sluggish U.S. demand by sending more coal to

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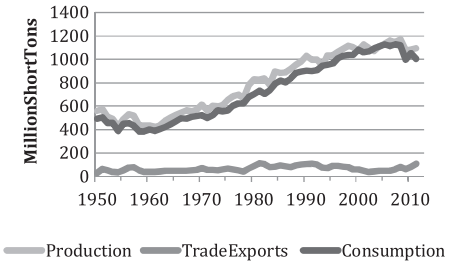

Figure 1: Coal Production, Consumption and Exports, 1950–2011

Asia; however, only 10 percent of U.S. production is currently exported overseas, and the capacity of U.S. ports is limited. These trends are driving new trading patterns, fuel switching, technology development, and price shifts that coal buyers and suppliers must consider.

The decreasing share of coal in power generation implies that the future of coal depends on technologies that change the way we manage and use coal. In particular, advances such as carbon capture and utilization, coal gasification, and coal liquefaction technologies hold promise. Clean energy technologies (or ''clean tech'') grew in recent years because of private innovation, entrepreneurship and critical public sector support in the form of tax credits, grants, and loan guarantees (Jenkins et al., 2012). However, nearly all clean technologies in the U.S. remain reliant on subsidies or other supportive policies to expand their foothold in energy markets. Many of these incentives are poised to expire, with total federal clean technology spending in the U.S. projected to fall from $44.9 billion in 2009 to $11 billion in 2014.

II. Overview of the U.S. Coal Industry

A. U.S. coal production and consumption

The United States holds the world's largest estimated recoverable reserves and is the second-largest producer and consumer of coal after China (EIA, 2011a,b,c,d). In 2011, total revenues for the U.S. coal market reached $57.7 billion (MarketLine, 2012). Historically, coal was the largest and least expensive source of electric power generation in the U.S. for more than 60 years; however, in April 2012, coal's share of electric power generation dropped to 32 percent, putting it level with natural gas as the most popular source of electric power generation.

B. Coal supply regions

There are three primary coal regions in the U.S.: the Appalachian region, the Interior region, and the Western region, with several subregions located within each (Gluskoter et al., 2009). Coal regions may differ in the types and quality of coal and mines (EIA, 2011a,b,c,d). For example, Northern Appalachia coal, rated at 13,000 Btu per pound, is the highest quality, while Powder River Basin coal (from Wyoming and other Rocky Mountain states) is the lowest quality, with a rating of just 8,800 Btu per pound.

Over the last couple of decades, much of the country's coal production has shifted from underground mining in the Appalachian region to surface mining in Western states. There are a number of reasons behind this move, including rising underground mining costs, thinning coals seams in Appalachia, as well as the boom in shale gas in the region. As a result of these changes, the Western region is now the single largest source of inexpensive coal in the U.S., accounting for more than half of total supply. Buoyed by the mammoth Powder River Basin (PRB), Wyoming is the largest single coal-producing state in the nation. Back east, coal remains an important part of the Appalachian economy—more than one-third of U.S. coal still comes from the region. Coal mined in Appalachia is primarily used for steam generation to produce electricity, metal production and exports.

III. Coal Value Chain

A. Value chain overview

The value chain (VC) framework maps industry and firm-level activities and supply networks that bring a product

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