

Coal and Virginia's Energy Future

In the coming years, energy issues will profoundly impact economies at global and local levels. Increasing demand and limited resources are adding to the pressure for new energy alternatives. Further increased pressures are likely. Coal is expected to be a major factor in these coming developments and Virginia will be impacted as both a major coal producer and consumer.

Coal Mining in Virginia

Coal mining has figured prominently in Virginia's history. The first commercial coal mining in the United States occurred near Richmond in 1709. Today, coal is Virginia's top export. Coal accounted for \$836 million in exports in 2005, a 28% increase over the prior year.

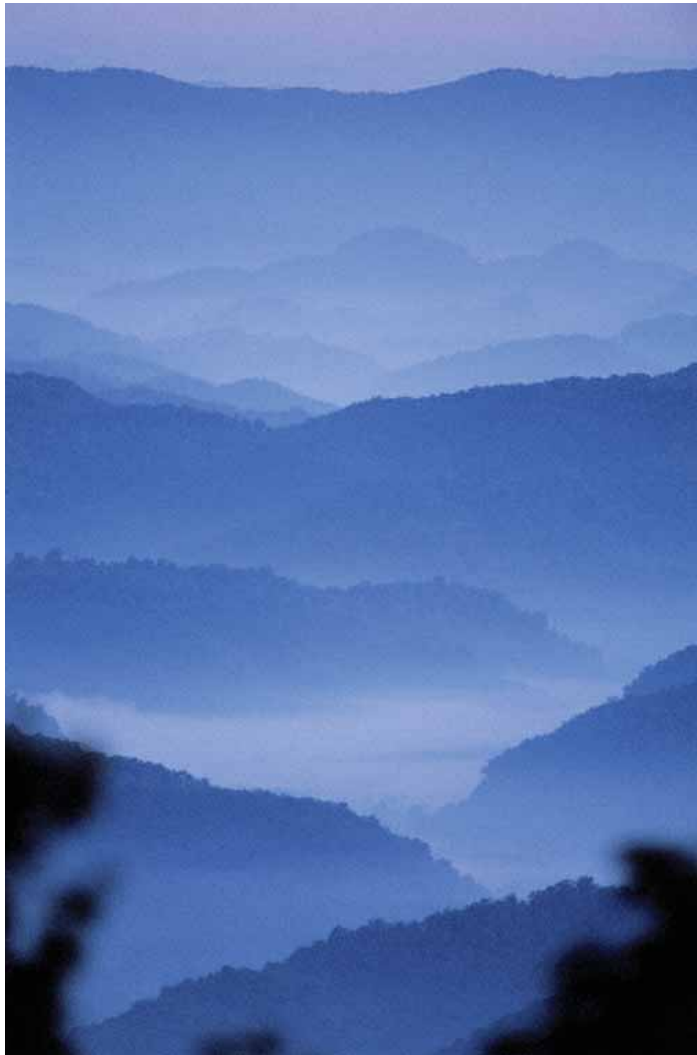
Most of Virginia's coal is among the highest quality produced—high in energy content and generally low in sulphur. Because of these qualities, it is particularly attractive in the export market. Virginia coal is used for electricity generation and as metallurgical coal in the production of

steel. The vast majority of the coal is produced in Southwest Virginia,¹ and, in particular, in the three counties of Buchanan, Dickenson, and Wise.

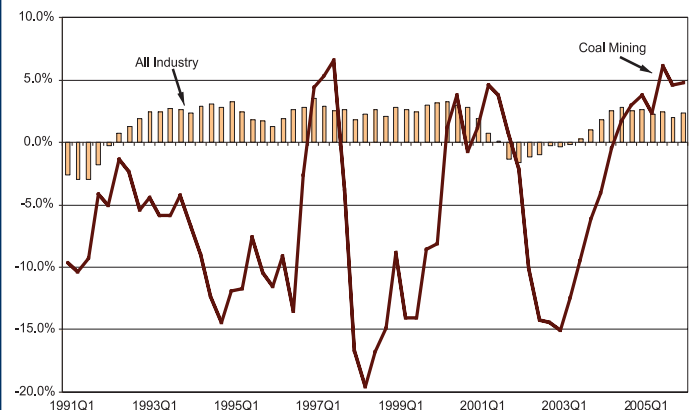
In 2005, coal mining directly accounted for 5,134 jobs in Virginia.² Approximately 70% of those jobs were related to underground mining and the rest to surface mining. About 95% of coal mining employment in Virginia can be found in Southwest Virginia. The heaviest concentration is found in Buchanan, Dickenson, and Wise Counties which together account for 77% of Virginia's coal mining employment.³

Coal mining employment in Virginia declined, for the most part, from 1991 through 2003. Since the second half of 2004, however, the industry has been expanding. The number of jobs in coal mining increased nearly 9% over the two years ending with the first quarter of 2006. To put these figures in a wider context, declining employment in coal mining has been the trend in U.S. history. In 1923, the United States had over 700,000 miners but only 81,000 in 1998. While employment declined, however, productivity soared and total production increased. Between 1988 and 1998 for example, employment dropped 40% while coal production increased 18%.⁴

The economic impact of coal mining extends beyond its direct employment. The coal mining industry also influences Southwest Virginia and the entire state through ripple effects, purchases made by the firms and employees and employment subsequently generated. The total impact of coal mining in Southwest Virginia is equal to over double the amount of jobs directly attributed to mining and an annual spending impact of over \$2 billion. In the state, wider employment gains are induced with approximately two and a



Employment Growth: Virginia Percentage Change From A Year Ago



Source: Chmura Economics & Analytics and Virginia Employment Commission

¹ Southwest Virginia is defined as Workforce Investment Area One: the counties of Buchanan, Dickenson, Lee, Russell, Scott, Tazewell, and Wise and the city of Norton.

² U.S. Department of Labor, Mine Safety and Health Administration, Form 7000-2, "Quarterly Mine Employment and Coal Production Report."

³ In 1990, these three counties' share of mining employment was 84%.

⁴ *Coal Mining Outlook*, Virginia Tech, November 2000.

Economic Impact of the Coal Mining Industry (2006)

Virginia

	Direct	Ripple Effects	Total
Spending	\$1,612,256,000	\$783,840,457	\$2,396,096,439
Employment	4,478	6,604	11,082

Southwest Virginia

	Direct	Ripple Effects	Total
Spending	\$1,522,255,360	\$575,941,915	\$2,098,197,158
Employment	4,269	4,615	8,884

Source: IMPLAN Pro

half times as many jobs created as are directly attributed to coal mining. The total annual spending impact of coal mining in Virginia is nearly \$2.4 billion annually.

Other important impacts from coal mining that are not included in the above figures should also be noted. For one, these calculations do not include savings in reduced transportation costs from which coal-consuming industries within Virginia benefit. In 2000, for example, approximately one-quarter of Virginia's distributed coal was shipped to destinations within the state. Another consideration is the critical importance of coal mining to local economies. For Buchanan, Dickenson, and Wise Counties in 2004, between a quarter and a third of their revenue was derived from mineral extraction.⁵

Virginia Coal Production

Coal production in Virginia peaked in 1990. Since then, production has generally trended downward. Virginia produced a low of 27.7 million short tons⁶ of coal in 2005. This production was equal to two and a half percent of the total U.S. output. It also ranked Virginia twelfth among coal producing states, a lower ranking compared with prior years.⁷ Coal production through the first half of 2006, however, was up 17.6% in Virginia compared with the same period in 2005.

One forecast of future production in Virginia is of gradual decline. As Secretary of Natural Resources Preston Bryant summarized,

We've seen a steady decline in coal production over the last fifteen years and we will see a continuing steady decline over the next fifty to eight-five years upcoming. We're going to see production get down to about twenty million tons a year in the next fifteen years. Beyond that it's going to drop to ten million tons a year or lower over the succeeding twenty-five years.... [Between] the middle part of this century and toward the end of this century, you're going to see Virginia's coal production really peter out.⁸

To forecast future production, a popular model used assumes that the production history of a natural resource follows a bell-shaped curve.⁹ Such a model predicts the pattern that Secretary Bryant outlined. However, this model assumes that



(1) a relatively large area is being analyzed as smaller area production does not necessarily follow a bell-shaped curve, and (2) the definition of reserves does not change appreciably. Reserves are not only defined by a region's geology but can change in response to changes in technologies, economics, and legislative restrictions. From 2004 to 2005, for example, Virginia's recoverable coal reserves increased 18.0%.¹⁰

Regarding future coal production in Virginia, Dr. Michael Karmis—Stonie Barker Professor, Department of Mining Engineering and Director, Virginia Center for Coal and Energy Research, Virginia Tech—points out the importance of price in any forecast. "Reserves are directly related to the price of material. I would suggest Virginia has capacity to sustain thirty to thirty-five [million tons] for a long time." Specifically, when the price of coal is higher, it becomes more profitable to mine coal that previously was too expensive to extract.

The Virginia Department of Mines, Minerals and Energy (DMME) is preparing for robust activity. In its *2007 Service Area Plan*, the department noted that "Significant volumes of minerals are exported from Virginia. The volume of these exports may increase as Asian markets demand more mineral and energy commodities to meet their economic growth. Additionally, DMME has seen an increase in the number of

⁵ *Advancing the Commonwealth's Energy Agenda*, a presentation by Secretary of Natural Resources, L. Preston Bryant, Jr. and Secretary of Commerce and Trade, Patrick O. Gottschalk at the Energy Virginia Symposium, October 18, 2006, Lexington, Virginia.

⁶ A short ton is a unit of weight equal to 2,000 pounds.

⁷ U.S. Department of Labor, Mine Safety and Health Administration, Form 7000-2, "Quarterly Mine Employment and Coal Production Report."

⁸ WINA's "Charlottesville - Right Now" radio program, October 19, 2006. Recording is available at <http://www.cvillepodcast.com>.

⁹ For further details, see *Estimation of Southwest Virginia Coal Reserves*, E.C. Westman et al. Text is available at <http://www.ext.vt.edu/pubs/mines/460-139/460-139.html>.

¹⁰ Energy Information Administration.



domestic mining companies contacting the Division of Mineral Resources for information on deposits of industrial minerals. These factors are expected to continue and will increase the number of companies exploring for mineral deposits in Virginia." In its *2007 Agency Strategic Plan*, the DMME reported that it "expects the number of coal mines to remain relatively stable and the tonnage produced to be stable or slightly increase as long as the price of coal remains above \$40/ton." If prices remain high, the DMME further "expects the total number of coal miners to remain stable or increase slightly."¹¹

National Coal Outlook

In the short-term outlook, U.S. coal production is expected to grow 2.4% through 2006 but recede 0.4% in 2007. Demand is expected to be flat in 2006 but increase 1.9% in 2007.¹² (U.S. production and demand do not exactly match in part because the nation exports as well as imports coal.) The long-term outlook for coal production in the United States is an annual average 1.1% increase from 2004 to 2015 and an average 2.0% annual increase from 2015 to 2030. Most of the increased production is expected to come from the West, especially in the Powder River Basin in Wyoming and Montana. Appalachian coal production is expected to remain nearly flat.¹³

Increasing use of coal for electricity generation at existing and new plants is expected to drive demand for coal higher. As demand increases, price pressures will help shift production toward mines with higher labor productivity. This favors the large surface mines in the Powder River Basin. In the "reference case" analysis of the Energy Information Administration, 27,000 additional mining jobs are forecast to be created nationally between 2004 and 2030 and Appalachia mining employment is expected to be relatively flat overall with job losses expected in Central Appalachia: "Although producers in Central Appalachia are well situated geographically to supply coal to new generating capacity in the Southeast, the Appalachian basin has been mined extensively, and production costs have been increasing more rapidly than in other regions."¹⁴ In further developments, U.S.

coal imports are expected to increase 367% between 2004 and 2030. These imports are expected to be in direct competition with Appalachian and Virginian coal to fuel the new coal-fired generating capacity expected in the U.S. East and Southeast.

Energy Crisis?

A potential huge influence on the future of coal is looming on the global stage—the peaking of oil production. A report by Robert L. Hirsch et al. begins, "The peaking of world oil production presents the U.S. and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel prices and price volatility will increase dramatically, and, without timely mitigation, the economic, social, and political costs will be unprecedented."¹⁵

Compounding the oil production problem is the recent and potential economic growth in Asia, especially China and India. In a report by the National Coal Council prepared for the U.S. Department of Energy, the situation is described thus: "Simply put, there is no precedent in human history for the magnitude of change that Asia and its rapid economic growth and industrialization will stimulate."¹⁶ By 2025, oil consumption in China is expected to be 189% higher than its 2001 level and to be approaching the production capacity of Saudi Arabia. India's impact is expected to be immense as well; by 2030, India's population is expected to exceed that of China.¹⁷

Some of the conclusions reached in the Hirsh report call to be repeated:

- The problems associated with world oil production peaking will not be temporary, and past "energy crisis" experience will provide relatively little guidance.
- Oil peaking will create a severe liquid fuels problem for the transportation sector, not an "energy crisis" in the usual sense that term has been used.
- Timely, aggressive mitigation initiatives addressing both the supply and demand sides of the issue will be required.
- Mitigation will require a minimum of a decade of intense, expensive effort, because the scale of liquid fuels mitigation is inherently extremely large.

¹¹ Two asides that may be of interest to some readers: The DMME reported in the same 2007 Strategic Plan that "a large percentage of working coal miners will be reaching retirement age over the next five years. Mining companies already are facing difficulties replacing these miners with new employees. This need for new miners is causing an increasing demand for coal miner certification training and other new miner services." The DMME also "expects there will be additional people affected by mineral extraction operations in the coming years." Trends including suburban and exurban sprawl as well as surface coal mining operations locating closer to built-up areas is expected to increase the proximity between extraction operations and the public. This is "expected to result in increased opposition to the locations of both existing and new operations."

¹² Short-term forecasts are from the *Short-Term Energy Outlook*, November 2006, Energy Information Administration.

¹³ Long-term forecasts are from the *Annual Energy Outlook 2006*, Energy Information Administration.

¹⁴ Note that the "reference case" analysis of the EIA assumes "as is" conditions: no legislative changes or behavioral changes beyond what has been observed in the past.

¹⁵ *Peaking of World Oil Production: Impacts, Mitigation, & Risk Management*, Robert L. Hirsch et al., February 2005.

¹⁶ *Coal: America's Energy Future*, The National Coal Council. It is labeled as "DRAFT 3/22/06" and is available at <http://www.easterncoalcouncil.org>.

¹⁷ *Ibid.*

- Increased efficiency alone will be neither sufficient nor timely enough to solve the problem. Production of large amounts of substitute liquid fuels will be required.
- Intervention by governments will be required, because the economic and social implications of oil peaking would otherwise be chaotic.

Specific mitigation options were researched in a follow-up report¹⁸ sponsored by the U.S. Department of Energy. The option researched that produced the largest production impact was coal liquefaction (coal to liquids or CTL). CTL is not a hypothetical technology, but has already been developed and put into practice—in Germany during World War II and subsequently in South Africa. The Sasol Company in South Africa, the world's major commercial user of CTL technology, has current capacity capable of meeting about 40% of South Africa's oil requirements.

Coal to liquid technology is already getting a lot of attention in China. The state-owned China Shenhua Group intends to build several CTL plants, including joint ventures with Sasol and Shell, to produce the equivalent of ten million tons of crude oil by 2010. Among other developments, the Yanzhou Coal Mining Company plans to complete construction of a two-million-ton CTL plant by 2008.¹⁹ In the United States, a small "demonstration" facility is planned near Gilberton, Pennsylvania. The Gilberton Coal-to-Clean Fuels and Power Plant will be going forward with sponsorship from the Department of Energy.

Virginia Energy Plan

Virginia's population is growing at a rate of nearly 14% per decade. Energy consumption increases with the growing population due to both industry and personal use. On the personal side, Virginia's fuel usage averages 504 gallons per capita compared with 471 gallons per capita in the United States. Transportation woes are partly to blame. Between 1986 and 2004, the number of registered vehicles in Virginia grew 56% while the number of VDOT-maintained lane miles grew just 8%.²⁰

Approximately 70% of Virginia's direct energy consumption is derived from fossil fuel sources—a little over 20% is derived from coal and about 39% is from petroleum.²¹ For electricity generation in Virginia, 47% is derived from coal, 38% from nuclear, and 10% from natural gas.²² As energy prices have increased—and have proved difficult to predict—and as natural resources are limited, the supply side of the state's energy situation is under stress. This, taken with increasing demand, has led the Commonwealth to look for solutions—as described by Secretary Bryant, market-based, creative, and cost-effective solutions.²³

The DMME is currently developing an energy plan for Virginia. The Virginia Energy Plan (VEP) will be a ten-year plan, due by June 30, 2007, to be updated every five years. The plan should help move Virginia on several fronts at once: conservation and efficiency, infrastructure as it applies to different energy sources, the environment, and research and

development. Several possible technologies may be supported at once: clean coal, waste-to-energy, tidal/in-stream water, wind, etc. The ultimate success of this plan, however, may not be in how well it is developed, but how well it is ultimately financed. As Dr. Michael Karmis commented on the VEP, "At the end of the day, Virginia needs to be willing to invest money to support the plan."



Going Forward

In the United States, there are currently 154 proposed new coal-fired power plants under consideration.²⁴ Two of these plants are proposed for Virginia: in Sussex and Wise Counties. The Wise County development was announced in May 2006 for a reclaimed surface coal mine site near St. Paul, Virginia. The plant would use a clean-coal technology that also allows using waste coal as well as wood waste. The project would create 800 jobs during construction plus 75 at the facility and 250 mining jobs once the plant is operational. Environmental permits and regulatory approvals, however, must be obtained before this project can move forward.

The Wise plant may be a sign of things to come in Virginia. Many variables, though, can alter the energy path the state follows. Price shifts in natural resources, changes in environmental regulations, and the degree of governmental support could all play vital roles. One thing that is almost certain, however, the impact will be large, not only for the coal mining regions in Southwest Virginia, but for the entire state.

¹⁸ *Economic Impacts of Liquid Fuel Mitigation Options*, Roger H. Bezdek, et al., February 2006.

¹⁹ Asia Times Online, May 23, 2006,

http://www.atimes.com/atimes/China_Business/HE23Cb06.html.

²⁰ Sources: Virginia Department of Transportation and *Advancing the Commonwealth's Energy Agenda*, Bryant and Gottschalk.

²¹ *Advancing the Commonwealth's Energy Agenda*, Bryant and Gottschalk.

²² Net generation figures based on year-to-date numbers through July 2006. *Coal and Energy Opportunities and Challenges for Virginia*, a presentation by Dr. Michael Karmis at the Energy Virginia Symposium, October 17, 2006.

²³ *Advancing the Commonwealth's Energy Agenda*, Bryant and Gottschalk.

²⁴ *Tracking New Coal-Fired Power Plants*, National Energy Technology Laboratory, September 29, 2006.