Lars Schernikau, HMS Bergbau AG, Germany, considers the potential development of the steam coal trade.

The renaissance of steam coal

The world primary energy used today depends on the fossil fuels oil, coal and gas, in that order, to supply over 80% of demand (Figure 6). Previously, wood or biomass had been the primary energy source, since humans tamed fire. During the Industrial Revolution, coal took over the leading role from biomass and accounted for over 60% of world primary energy in the early 1900s (Figure 1). Today's age is often referred to as the Oil Age, which is somewhat appropriate considering that about 35% of the world's primary energy depends on oil. However, about 25% of world primary energy, and more than 40% of the world's electricity, comes from coal. In addition, about 66% of the world's steel is produced using coal. Coal is again gaining in importance, a trend that will continue until solar-based energy can fill the world's energy needs. Consequently, the author terms the 'interim period' between now and a solar-based future the "Renaissance of Steam Coal".

Before the late 1970s, steam coal was consumed near its site of production. If international trade occurred, it did so across green borders, i.e. in Europe or between Canada and the US. After the oil crises, coal trade picked up. In 1980, only about 150 million t of seaborne steam coal was traded globally. In 2008, this number grew to 632 million t (Figure 2). This translates into an annualised growth rate of above 5%.

The future of coal trade

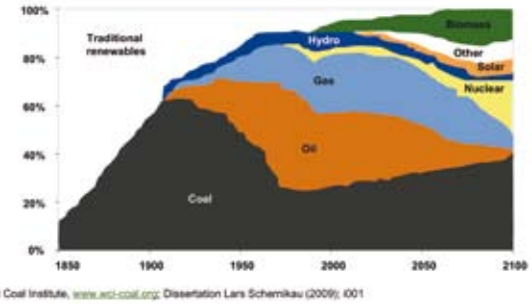
The trade of steam coal is expected to continue growing above coal demand as globalisation continues to translate into increased trade. It is the belief of this author that the resulting higher trade volumes will continue to professionalise the coal market, attract new and well-educated talent and increase transparency. It is expected that demand increase will continue to be driven by the Pacific market, specifically India and China.

The five main export regions (Australia, Indonesia, South Africa, Russia and Colombia/Venezuela) will not benefit equally from increased export volumes. Logistical constraints and domestic coal demand will keep a lid on exports, especially from South Africa, Indonesia and, to some extent, Russia. China is the wildcard for global coal

supply since it plays a special role as a fringe supplier. Historically, the country has been an important supplier to Japan, South Korea and Taiwan. More recently, China has turned into a net importer, but uncertainty remains about future coal export volumes that may disrupt the global market and thus add to volatility.

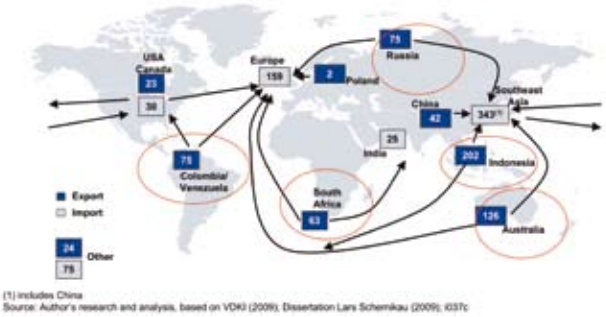
Consolidation in the supply market makes economic sense for producers' shareholders as it leads to higher profits (EBITDA) and total shareholder return (TSR). Figure 3 illustrates consolidation effects of related industries. However, from a macro-perspective, perfectly competitive markets are desirable. Thus, there are two trends, one driven by economics and one driven by politics. Policy will develop to manage coal supply consolidation more closely. As much as policy will allow, more and larger merger attempts in the coal supply arena will continue. Market participants will invest more in logistics and upstream assets as coal remains a scarce resource market. This is also supported by the fact that pure mining costs account for only 10 – 20% of delivered coal prices; the remainder are logistics-related costs. Even of FOB costs, only 40% are pure mining costs (Figure 4).

New market participants, including but not limited to banks, will continue to appear on the physical coal market. Default risk will increase credit risk requirements and make trading more expensive. Trade risks will increase and the same coal cargo will be traded through more and more companies. This author expects that exchange-based coal trading will continue to develop in the next decades but will be limited to larger standardised coal volumes. This will include the standard RB- ARA and NEWC-ARA route. At least 50% of coal volume will continue to be traded over-the-counter in the long-term, driven by coal quality and fragmented trading routes. Coal derivatives will continue to grow. The recent financial crisis will curb growth but, in the long-term, new financial traders will continue to influence the market and strive for more index-based pricing.



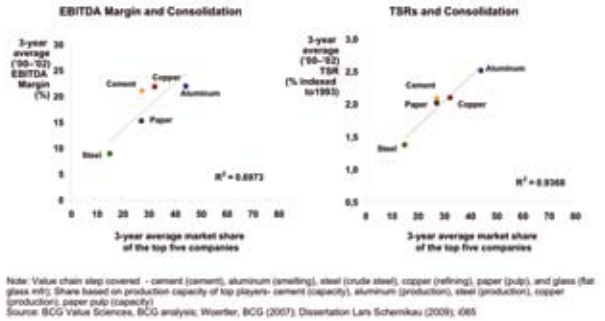
Source: World Coal Institute, www.wci-coal.org; Dissertation Lars Schernikau (2009); i001

Figure 1. World primary energy mix - scenario 2010. The Oil and Gas Age will be over soon, leaving room for a second small Coal Age.



(1) includes China
Source: Author's research and analysis, based on VDKI (2009); Dissertation Lars Schernikau (2009); i037c

Figure 2. Coal trade flow 2008: 632 million t of steam coal were traded. Where will future export growth come from?



Note: Value chain step covered - cement (cement), aluminum (smelting), steel (crude steel), copper (refining), paper (pulp), and glass (flat glass mfr); Share based on production capacity of top players- cement (capacity), aluminum (production), steel (production), copper (production), paper pulp (capacity)
Source: BCG Value Sciences, BCG analysis; Woerter, BCG (2007); Dissertation Lars Schernikau (2009); i065

Figure 3. Industry consolidation increases performance and returns to shareholders.

Future steam coal price trends

Future steam coal prices point towards higher prices driven by the following:

- Increasing electricity demand.
- Increasing share of coal in electricity generation.
- Increased domestic coal demand in major coal-exporting countries.
- FOB cost increases due to labour, fuel, machinery and equipment.
- Coal asset price increases because relative coal investments will slowly catch up with oil and gas investments.
- Producer consolidation.

For global commodities, as well as for coal, 2008 was an extraordinary year, with CIF prices peaking at US$ 210/t in July 2008. Overall, 2009 prices will be far below 2008 but still above 2005, 2006 and 2007 price levels (Figure 5). Longer-term, coal prices will continue to go up, starting again in 2010. Coal price volatility will also increase, but relatively should remain below gas and oil price volatility.

The author predicts that coal prices will be above marginal cost of production in the long run because producers have enough market power to keep average coal prices above perfectly competitive market price levels. Short-term price fluctuations may, however, cause the coal price to go below marginal FOB costs for brief periods of time. Coal prices are also expected to slowly catch up with gas prices because the basic economic principle of making a CO_2-friendly fuel less expensive than a non-CO_2-friendly fuel, such as coal, will win support from politics and policy.

As an aside, assuming power plant efficiency of 38%, 1 MWh of coal power generation emits 0.89 t of CO_2. As such, coal is about twice as CO_2-intensive as gas-fired electricity generation. However, the European CO_2 trading scheme is more likely to increase global CO_2 emissions rather than reduce them. The reasoning is that higher CO_2 prices will, relatively, push coal prices down and gas prices up, thus increasing the price spread between gas and coal. At first glance, this seems to make sense. But countries with no CO_2 avoidance obligations and, most often, less-efficient power plants can now buy coal

relatively cheaper than gas, thus they have an incentive to use CO_2-emitting coal rather than the cleaner gas.

Future sources of energy and coal

What role will coal play in the global power mix? The short answer is that coal will become even more important than it already is for both primary energy and even more so for electricity. The Renaissance of Steam Coal is just about to begin.

World primary energy consumption grows at an average annual rate (1990 – 2030) of about 1.7% (CAGR). Electricity, on the other hand, has always grown much faster and will continue to do so at an average annual rate (2005 – 2030) of 2.6%. Growth is fuelled by non-OECD countries, most importantly China and India. As such, electricity generation will grow at a CAGR (2005 – 2030) of 4.0% in non-OECD countries, but only 1.3% in OECD countries. The author's study shows that coal is expected to increase its electricity share to 46% by 2030 from 41% in 2005. Thus, it is expected that almost half of all global electricity will be generated using coal by 2030.

More interesting is the fact that renewable energy sources will retreat in relative terms at least until 2030 (Figure 6). Renewable electricity generation can simply not keep up with the increased demand until technology is ready to exploit solar energy in an efficient and economic way.

Environmental concerns about the emission of CO_2 from increased coal burn will need to be addressed by the global community. It was discussed that there is hardly any way around coal as a source of electricity and energy in the coming decades. This author predicts that solar-based energy will only be able to reduce coal burn in the second half of this century. Thus, politicians and scientists should reconsider their negative evaluation of coal burn and focus on improving technology to more efficiently burn coal.

The best alternative fuel for energy is energy efficiency. The most CO_2 can be saved, and the increase in CO_2 emissions reduced most, through the following methords:

- More efficient power plants.
- More efficient production of energy resources.
- More efficient ways to transport energy resources and electricity.
- More efficient use of energy and electricity in general.

In order to support more gas-fired electricity – as gas-fired generation produces about 45% less CO_2/kWh than coal-fired generation – it is important to close the gap between coal and gas prices. CO_2 trading schemes that penalise coal, which results in relatively lower coal prices vs. gas prices, in fact do the opposite. From a macroeconomic and geopolitical perspective, gas, the CO_2-friendly fuel, should be priced below coal, the non-CO_2-friendly fuel, and worldwide at that.

CCS is a much-hoped-for technology to solve the big CO_2 problem of coal use. However, this author personally believes that CCS will come only for the long-term. The only long-term solution to all environmental problems caused by use of fossil fuels is the use of solar energy. The planet has access to enough energy in the form of solar radiation: the task for the future is not to develop new ways to release energy, but how the primary needs of humankind (food, heat, electricity and fuel/process energy) can be met with regenerative or renewable sources of energy. Although this study is about coal, it is perhaps appropriate to finish with the following *Brennstoffformel der Erde*, which illustrates that only solar energy is required to process CO_2 and water into a carbon-based fuel and oxygen:

$$solar\ energy + CO_2 + H_2O <-> CH_2 + 1.5\ O_2$$

Sources

Dissertation Schernikau (2009); Ritschel/Schiffer (2007); Wolf/Scheer (2005); IEA-Statistics (2005); VDKI (2006-2008). For a complete list of sources please refer to the author's study (see below). WC

Notes

This article forms part of the dissertation "The economics of the international seaborne steam coal trade" currently being concluded by the author at the Technical University of Berlin. The text and illustrations are part of this study and its executive summary. Please contact the author at lars@ schernikau.com for a complete copy of the study, which will be published later this year.

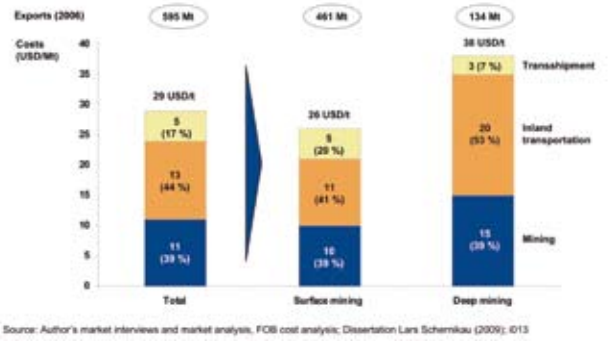


Figure 4. Global average marginal FOB costs (2006).

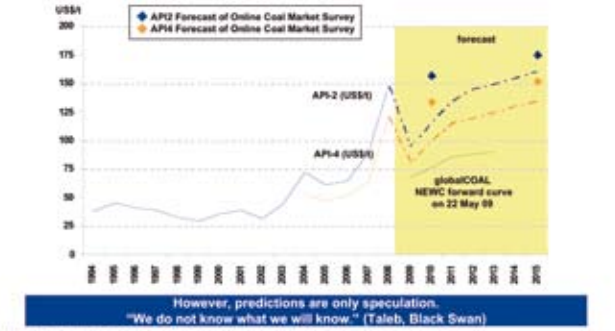


Figure 5. Steam coal price trend until 2015.

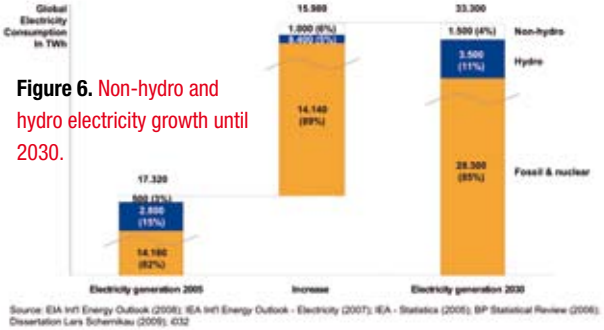


Figure 6. Non-hydro and hydro electricity growth until 2030.