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Lignite power provides bargain-priced pollution ^[1]



Bełchatów in Poland is the largest point source of CO₂ in the EU. Photo: Greenpeace Polska/flickr.com/ CC BY-ND

Combustion of lignite is one of the environmentally worst ways to generate energy. Even so, there is a continued increase in many parts of Europe.

Lignite is a low-quality carbonaceous fuel in geological transition from peat to hard coal. Vast accessible deposits have made lignite, or brown coal, a preferred energy source in Central Europe, the eastern Mediterranean region, and Australia.

Burning a tonne of lignite produces only about a tonne of carbon dioxide (CO₂), since the mined fuel contains two-thirds water and impurities. However, correspondingly greater quantities of waterlogged lignite are required for electricity generation, emitting over twice the carbon dioxide of hydrogen-rich natural gas.

The high water content makes transport to distant power stations uneconomical. However, mined lignite can be delivered directly by conveyor belt to nearby power plants for less than €6 per MWh (megawatt-hour) of thermal energy, half the price of natural gas in North America, and less than a third of high-grade imported coal landed at European seaports. Delivered natural gas may be ten times as expensive.

The German Öko-Institut has calculated that the cost of domestic lignite is so low that even a CO₂ emissions penalty of €40 per tonne – six times recent EU ETS trading prices – might not

be sufficient to eliminate the competitive advantage of an older, fully paid lignite power plant.

The economist Dieter Helm has criticised lignite power generation as “about as dirty as you can get”. The enormous scope of lignite extraction and generation testifies to the ongoing industrialised imperilment of natural environments.

Lignite is employed to achieve CO₂-intensive energy security even in regions availed of abundant solar and wind resources. On the basis of population, Greece burns more lignite than any other country in the world – over six tonnes per inhabitant.

Turkey is currently planning dozens of additional coal and lignite plants to reduce dependency on Russian gas imports. An 8,000 MW lignite power station in the Afsin-Elbistan mining region may be erected with Chinese financing, equivalent to the capacity of eight modern nuclear reactors.

In Poland, domestic lignite deposits would be adequate for another two to three centuries of power generation. With only limited reserves of gas and oil, the economy ministry has noted that “lignite coal has to be perceived as the stabilising factor for Poland’s energy safety”. Long-term predictable mining costs contribute to make lignite “Poland’s *raison d’état*” according to Zbigniew Bryja of ZE PAK, the country’s second-largest lignite power corporation.

Germany leads the world in lignite production, with 183 million tonnes mined in 2013 sustaining one quarter of electricity generation. Renewable energies contributed another 24.6 per cent, but remained insufficient to compensate for nuclear power phase-out begun in 2011. Lignite usage instead increased by 8 per cent during the same period to a half-million tonnes per day. Two newly approved Vattenfall mine expansions at Nochten and Welzow near the Polish border will require the resettlement of 2,500 residents from traditional Lusatian communities fated for destruction. Future projects could impact over 4,000 additional inhabitants in this region alone. An additional 349-million-tonne MIBRAG mining site at Lützen would deface the landscape near the city of Leipzig and possibly involve the destruction of eight additional villages. In the western Rhineland, on the other hand, the RWE Garzweiler II mine was recently re-zoned to protect the homesteads of 1,400 inhabitants. Overall, however, the German government’s intention to reduce CO₂ emissions by 40 per cent between 1990 and 2020 cannot be realized on present coal and lignite trajectories.

In the Czech Republic, lignite extraction in Northern Bohemia was limited in 1991 to existing licensed boundaries. Despite mining termination foreseen after 2022, however, the state energy corporation ČEZ modernised its lignite power plant at Pruněřov for operation until 2040. The eastern German MIBRAG mining corporation was purchased in 2009 to facilitate trans-border lignite deliveries. MIBRAG was later sold by ČEZ to the Czech consortium EPH, after which lignite was shipped regularly to the Opatovice and Most-Komořany power plants. The Czech coalition government is now considering lifting particular mining restrictions, possibly by referendum, since two additional nuclear reactors originally planned at Temelin will likely not be built. However, the Czech Mining Act was revised in 2012 to prohibit expropriations of private property for maximising lignite extraction. In contrast with Germany, the preservation of essential human rights has thus become integral to mining policy.

Lignite qualifies as the least expensive of all fossil fuels only when its spurious effects are ignored. Preparing a mining site generally entails the destruction of homes, farms, cultural heritage sites, and nature refuges. In earlier industrial epochs, landscape disfigurement and human resettlement were integral to economic development. Lignite production today, however, sacrifices regional diversity to mechanised rationalisation.

Lignite deposits of relatively recent geological origin are accessible by surface mining. Shovel-wheel excavators often as heavy as the Eiffel Tower (100 t) remove overlying layers of topsoil from several square kilometres of land, while groundwater is pumped into nearby waterways or abandoned mines. In Germany, lignite extraction amounts to excavating the original 1869 Suez Canal 16 times per year.

Groundwater depletion extends in a subterranean funnel far beyond the mining boundaries. Fresh water is often piped in from other regions to replenish surface losses.

In the mining aftermath, groundwater ascends to fracture building foundations and masonry, roadwork and sewage networks. Iron pyrites rising in water from mining strata can discolour waterways in iron oxide hues. In the Lusatian region, aquacultures and tourism have been disrupted. Costly programmes of remediation will be necessary for a half-century, or more. Particularly high aluminium concentrations have been measured in groundwater. Acidified lakes (as low as pH 2.5) and pulpwood trees characterise former lignite mining sites. Re-deposited soil is too unstable for building construction. Post-lignite renaturalised landscapes are largely unsuitable for subsequent commercial development, reducing the net regional economic value of surface mining.

Carbon-intensive lignite power generation is frequently criticised as a “climate killer”, but the worldwide combustion of about one billion tonnes per year accounts for only 3 per cent of total manmade CO₂ emissions.

In anticipation of future greenhouse gas regulations, the EU lignite industry originally supported carbon capture and storage (CCS) for reducing plant emissions. In 2006, German chancellor Angela Merkel named Vattenfall CEO Lars Josefsson as her personal climate advisor due to his advocacy of this technology.

A German parliamentary hearing on 6 June 2011, however, showed that CO₂-free lignite power generation could require 50 per cent more fuel and over 80 per cent more cooling water for the same grid power output. These added resource expenditures effectively eliminated any prospect of commercial viability, even before questions of geological CO₂ storage were examined.

Fossil fuels contain mercury and other heavy metals deposited by prehistoric volcanic activity. Due to its low energy content, particularly high quantities of lignite are burned, releasing the greatest amounts of contaminants. Without the Mercury and Air Toxics Standards (MATS) specified in the United States for flue gases, a European lignite power station emits up to a half-tonne of toxic mercury per year.

All 50 US states have issued health advisories on the threats of mercury contamination from fish consumption, particularly for pregnant women, nursing mothers, and children. In parts of Europe, however, far greater mercury effluents from power plants continue to accumulate in lakes open to fishing and recreation.

As lignite extraction disfigures landscapes and diminishes real estate valuations, it also promotes a fatalistic acceptance of any mining practices allowed by law. The wide latitude of potential human rights violations has been dramatically illustrated in eastern Germany.

Before 1990, state lignite combines were under the pervasive surveillance of the East German secret police (Stasi), who recruited informants from the workforce. After German reunification, some former agents falsified their biographies and became leading managers of the mining companies Vattenfall and MIBRAG. With their experience in undercover activity, they now directed the social destabilisation of communities resisting lignite resettlement. German politicians informed of this hideous practice have disclaimed any responsibility for

protecting the constitutional rights of citizens, which under German mining law can be compromised arbitrarily without legislated legal recourse.

Private security is imperilled by all mining projects. However, the means of commercial espionage and surveillance have been greatly advanced since mining laws were originally formulated at the beginning of modern industrial society.

After sulphur dioxide (SO₂) emissions responsible for acid rain were reduced in the 1990s, lignite power appeared less objectionable despite ongoing contradictions with EU climate policy. However, the mines are now increasingly surrounded by wind and solar farms, providing alternative zero-carbon generation for the power grid.

Renewable power generation in eastern Germany therefore contributes to superseding nuclear reactors in other parts of the country. Furthermore, the Bavarian government has rejected building any high-voltage power lines for electricity from lignite. A transmission corridor already under construction to the eastern mining regions must instead be extended to northern wind farms. In a further step, undersea cables would provide supplementary hydropower from Sweden and Norway.

While this strategy could ultimately circumvent the need for lignite generation altogether, existing power plants are also being modernised under the apparent assumption of hybrid strategies. The ongoing retrenchment of lignite throughout the former Black Triangle region (Germany, Poland, Czech Republic) may nevertheless challenge future EU climate policies.

According to Vattenfall corporate statements, profits from lignite extraction in eastern Germany are being devoted to financing the energy transition in Sweden. Electricity supplied in the future to Continental Europe could therefore help supplant the very lignite operations that have provided essential investment capital. Vattenfall is now erecting 72 North Sea wind turbines equal to the electricity needs of the Bavarian capital of Munich. The city's utility company is included as a 49 per cent project partner.

Such renewable energy transition projects are indispensable for limiting the progress of climate change. CO₂-induced ocean acidification is already causing pH values in seawater to decline 100 times more rapidly than at any time over the last 300 million years. The resulting loss of marine life could reach disastrous proportions by mid-century, disrupting fish protein supplies for billions of people. There is no way to avert this prospect except by drastically reducing fossil fuel emissions to a level that can be compensated by the natural environment, since the process of ocean acidification is irreversible.

Lignite-producing countries remain irresponsive to these prospects. According to data compiled by Greenpeace, the realisation of all currently planned European lignite power stations could account for 118 million tonnes of carbon dioxide per year. Total EU emissions would likely not increase under the ETS trading scheme. However, another generation of lignite power plants would impose an additional half-century of environmental degradation and monolithic economic development on the mining regions.

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