

Prospects for lignite mining in Poland and CO<sub>2</sub> emission cutbacks

# Coal Has a Future



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**As one Polish saying goes, “coal keeps Poland on its feet.” The country is indeed particularly rich in lignite deposits – a domestic fuel of relatively low production cost, ensuring relatively inexpensive power production. Should such an energy source be abandoned?**



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Poland currently generates its electric power almost exclusively from coal. Coal accounts for around 94% of all power generated in the country, with lignite representing 32–35%. Poland possesses extensive

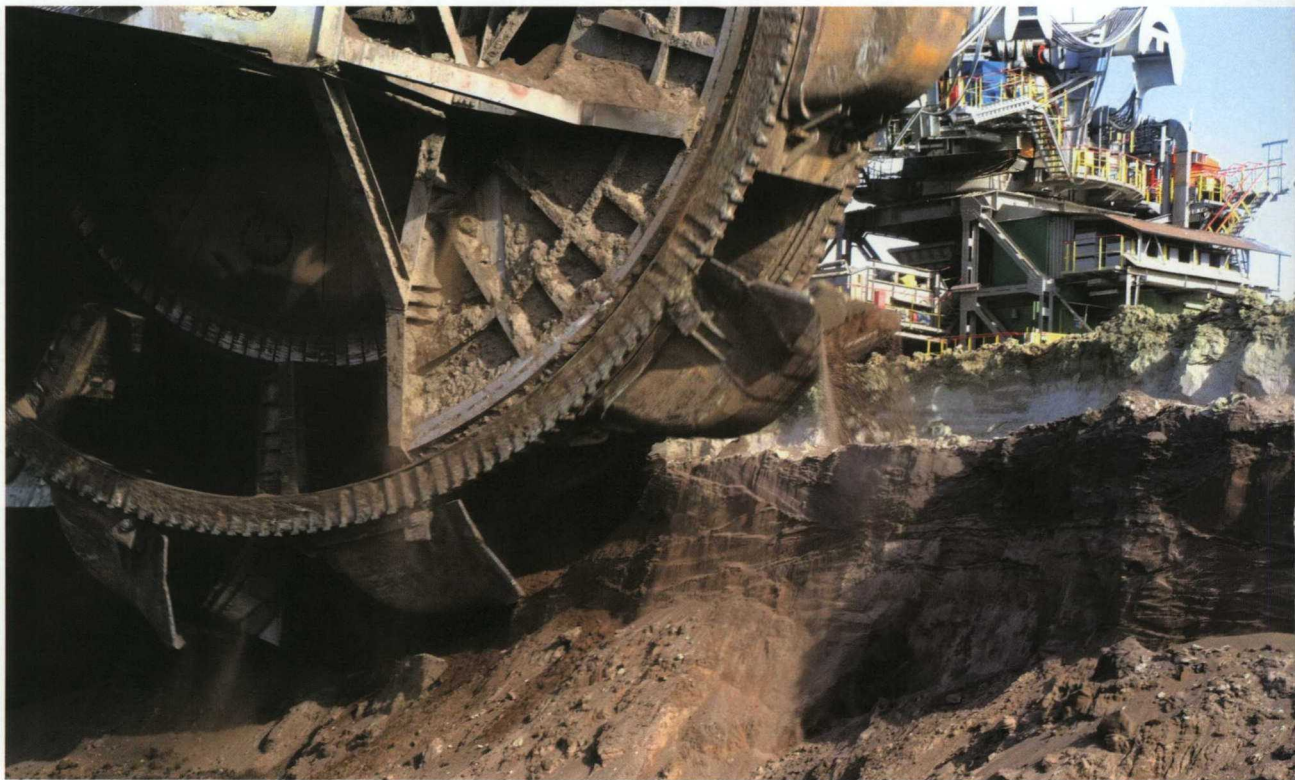
reserves of lignite, estimated at 13 billion tons, only 14% of which are now being developed at 11 separate deposits.

Due to the lower calorific value of lignite as compared to crude oil, natural gas, and hard coal, and also in view of its high moisture content (around 50%), its transportation over longer distances is not economically feasible. Lignite is therefore put to industrial use in close proximity to the deposits from which it is mined, with lignite-fired power plants usually situated adjacent to the mine that acts as their sole fuel supplier.

Lignite is mined in three areas in Poland: two of them, Bełchatów and Konin-Adamów, in central Poland and a third, Turoszów, on the country’s southwestern corner. All told, four large opencast mines supply lignite to five power plants.

The Adamów mine has been producing since 1964. It is a triple-pit mine with pro-

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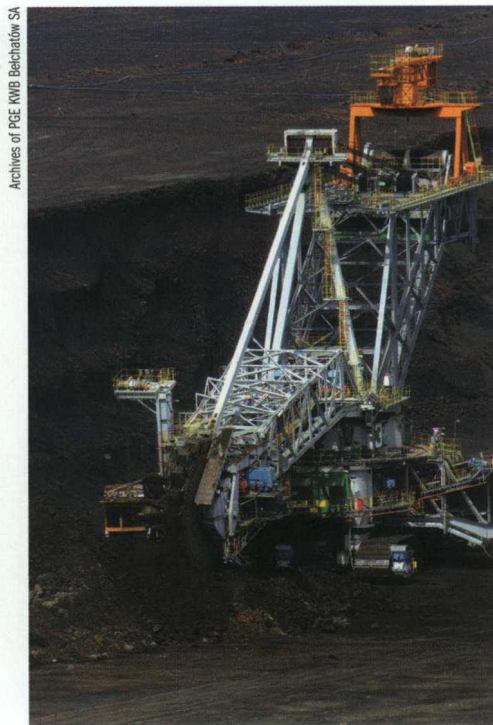
The Bełchatów power plant is situated adjacent to its mine, enabling wheeled transport costs to be eliminated and continual supplies to be maintained. For lignite, this arrangement is the only feasible option

duction capacity of around 5 million tons per year. The reserves in developed areas contain 62 million tons, plus there are a further 101 million tons in deposits slated for mining in the future. The mine supplies lignite via a conveyor system to the nearby Adamów power plant, which has 5 generator units each of 120 MW capacity (a total of 600 MW).

The Bełchatów mine, operational since 1980, is Europe's largest open-pit mine, able to extract 39 million tons of lignite per year from the Bełchatów and Szczerców deposits. Reserves in these deposits contain 898 million tons, plus there are a further 402 million tons in the Kamieńsk deposit slated for future mining. The coal from this mine is supplied by a conveyor system to the nearby Bełchatów power plant, the world's largest lignite-fired plant, which has a total capacity of 4440 MW (12 generator units of 360 MW each) and generates around 20% of Poland's electric power.

The Turów mine, in turn, is one of the oldest lignite mines in Poland, operational since 1947. It is a single-pit mine with production capacity of 15 million tons per year. Reserves in developed deposits contain 415 million tons of lignite, with a further 100 million tons lying in other deposits slated for mining. The mine supplies lignite on a continuous basis to the adjacent Turów power plant, with overall capacity of 2106 MW (currently operating at 1929 MW). The station has six newly-launched fluidized bed combustion units plus three pulverized fuel firing units.

The Konin mine, like Turów, has been operational since 1947. Its four open pits have an overall extraction capacity of around 15 million tons per year. Its reserves in developed deposits contain 101 million tons, while its deposits slated for future mining contain a further 235 million tons. The mine supplies coal by rail transport to two power stations in the vicinity, Konin and Pątnów. Konin is Poland's oldest lignite-fired power plant, generating 488 MW (with 8 generator units). The Pątnów plant, in turn, consists of two separate units: Pątnów I with generating capacity of 1200 MW and Pątnów II with 464 MW. Brought online in late 2007, Pątnów II is Poland's first electric power plant unit with supercritical parameters,



The open-pit method of coal mining does cause the degradation of land and the drainage of groundwater over a large area, but reclamation returns such land to nature

including a high-performance wet flue-gas desulphurisation system.

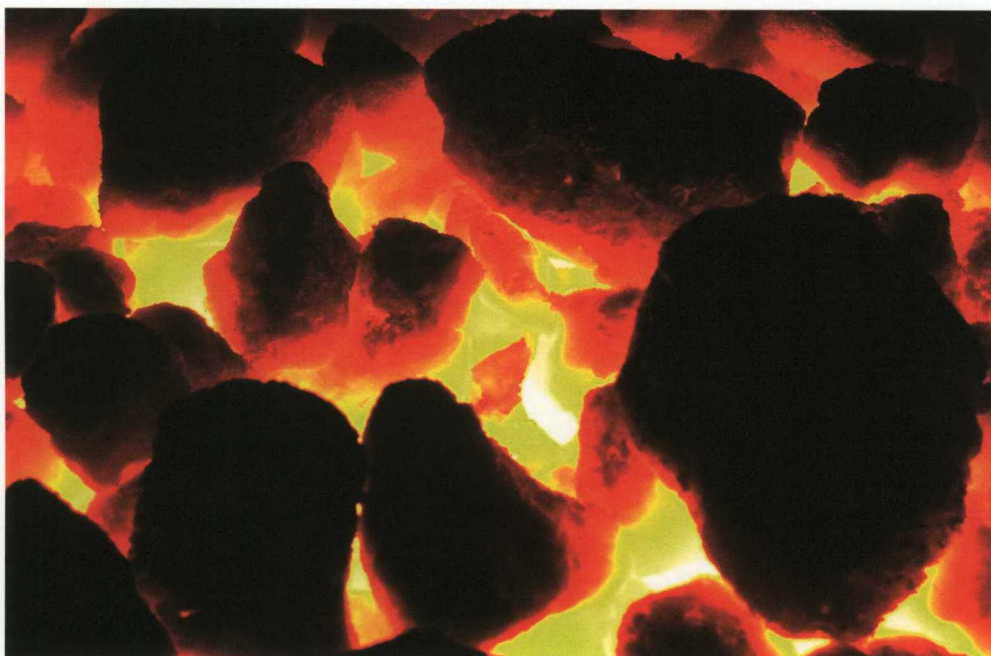
### Untapped deposits

After the various deposits now slated for future mining are tapped, Poland's currently operational lignite mines will be able to maintain extraction at around 60 million tons per year through 2020, after which there will be a systematic decline in production from these mines. The Adamów mine is expected to cease production in 2024, while activity at the Bełchatów and Szczerców pits will continue until 2038. The launching of new pits at the Konin mine will enable its production to stabilize at around 10-11 million tons through 2026, after which it will see an inevitable decline in production until its complete cessation in 2040. The Turów mine, as well, will see a downturn in its production after 2030 until its closure in 2048.

In the longer-term perspective, therefore, Poland's supply of lignite should be expected to wane unless new deposits are brought into use. The most well-suited site for future mining is Legnica, not only in view of its large deposits (5.4 billion tons) but also because of its location in an industrialized copper mining region. The gradual exhaustion of copper ore deposits will trigger significant unemployment, and lignite

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94% of all power generation in Poland is based on coal, with lignite accounting for 35% of that figure



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mining and lignite-based power production could offer the region a chance for continued development. If exploited, this deposit could supply a power station the size of the Bełchatów plant and sustain Poland's lignite-fired power production on a level comparable to the present for many years to come. Around mid-century, the Legnica mine would be Poland's sole source of lignite, possibly yielding around 50 million tons per year.

This potential mine in Legnica is not the only opportunity for lignite extraction – Poland in fact has 76 documented but as-yet undeveloped deposits containing in excess of 13 billion tons. Even at the current rate of mining, these sources would suffice for many years. As a low-cost and domestic source of electric power, they would help boost Poland's national energy security.

However, long-term forecasts for power production in Poland do not take account of such lignite industry development. Instead, government plans envision that the country's rising energy demand will be met by imported natural gas and renewable energy sources. There is also increasing discussion about the inevitability of building nuclear power plants.

These forecasts call for increased consumption of hard coal, yet overlook the possibilities inherent in Poland's large deposits of lignite. This approach makes

it harder to find investors ready to finance the construction of mine-plus-power-station complexes, especially since the turnaround time for such construction projects is very long. Another obstacle is posed by the objection of local communities – lignite is frequently seen as a “dirty” fuel that harms the environment.

### Clean coal

Open-pit lignite mining techniques do cause the degradation of large tracts of land. Accessing underlying coal seams requires the removal of huge amounts of overburden. The result is a vast hole in the ground, which is not just an eyesore but can also drain water from nearby aquifers. These aspects are what sparks harsh protests by ecologists and local communities. However, it should be borne in mind that this state of affairs does not last forever – areas where mining has been completed are subsequently and systematically reclaimed. Lignite mining enterprises take careful measures to protect the ground, air, and water. Reclamation efforts proceed in parallel with exploitation, as mining work progresses. After such efforts living up to the best European practices are made, post-mine areas can be used for agricultural production, forestry, or for recreational purposes. One new trend in the field of reclaiming opencast mines involves leaving behind new large water-bodies acting as

both recreational centers and as reservoirs of fresh water, a commodity in short supply in many regions. Notably, modern projects for reclaiming post-mine areas call for the land to be given back to nature and the local community with even more enhanced value, in environmental and recreational terms, than before coal mining began.

One important factor that affects the perception of lignite as a fuel is the impact of its combustion on the environment. The Polish energy industry has to date done a very great deal to curb its emissions of sulfur, nitrogen oxides, and dust. But carbon dioxide emissions have not yet been successfully reduced to a significant degree, as is crucial for halting global climate change.

Meeting that challenge will require the construction of higher-performance, state-of-the-art power stations utilizing more advanced technologies. The newly-launched Pątnów II unit and the new unit now being built at Bełchatów, to have a capacity of 858 MW, are ushering in a new era for lignite-fired power generation. These facilities are characterized by supercritical steam parameters, enabling them to achieve efficiency of around 45% and to cut CO<sub>2</sub> emissions by around 20%. Still, the European Commission's stance is that this reduction does not suffice; it recommends striving to eliminate emissions of the gas entirely. Poland therefore needs to perfect and implement such advanced power gen-

eration technologies as burning coal in pure oxygen (oxy-fuel) and the integrated gasification combined cycle technique (IGCC), already in use in the world's first pilot projects. They can boost efficiency even to as much as 52%.

It seems that at present, the only way to resolve the problem of greenhouse gas emissions and to allow coal-fired power production to be maintained is through carbon capture and storage (CCS) technology. While it is clear that CCS lowers the efficiency of a power generation unit by more or less 10%, there is no other option. A first small-capacity power plant is already operating with this technology in Germany. All of Poland's coal-fired plants are also reckoning with the necessity to implement CCS technology in the not-too-distant future. Newly constructed facilities, such as at the Bełchatów power plant, will already be adapted for it.

In sum, lignite has been and should continue to be of fundamental significance for Poland's national energy security. Abandoning this low-cost source of energy in favor of expensive, imported energy sources would be an irrational decision, especially since all the technical, technological, and ecological problems are resolvable. ■

#### Further reading:

Kasztelewicz Z. (2007). Węgiel brunatny. Optymalna oferta energetyczna dla Polski [Lignite - Optimal Energy Offer for Poland]. *Górnictwo odkrywkowe*.

Archives of PGE KWIB Bełchatów SA



**Lignite is seen as a dirty source of energy, but with state-of-the-art technologies it can be clean**