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journal homepage: www.elsevier.com/locate/enpol

Lignite mining and electricity generation in Poland: The current state and future prospects

Marek Widera^{a,*}, Zbigniew Kasztelewicz^b, Miranda Ptak^c^a Institute of Geology, Adam Mickiewicz University, Maków Polnych 16, 61-606 Poznań, Poland^b Department of Surface Mining, AGH University of Science and Technology, Al. Mickiewicza 30, 30-059 Kraków, Poland^c Regional Mining Council, Kotlarska 41, 50-151 Wrocław, Poland

HIGHLIGHTS

- Poland is one of the leaders in lignite production in the European Union.
- Energy policy in Poland assumes a key role of lignite in energy mix.
- Almost one-third of Polish electricity is currently generated from lignite.
- For Polish lignite mining exist pessimistic, realistic and optimistic scenarios.
- Extraction of lignite in Poland will gradually decrease in the coming decades.

ARTICLE INFO

Article history:

Received 17 October 2015

Received in revised form

29 January 2016

Accepted 2 February 2016

Keywords:

Lignite mining

Electricity generation

Poland

ABSTRACT

This opinion paper presents the current state and future scenarios of Polish lignite mining. For many years, over 1/3 of domestic electricity, that is about 53–55 TWh, has been generated by lignite-fired power plants. Currently, with 63–66 million tons of extraction, Poland is the fourth lignite producer worldwide and the second in the European Union. There are three possible scenarios for the development of lignite mining in Poland by 2050. Unfortunately, despite the huge lignite resources, amounting to more than 23.5 billion tons, and great potential of the mining industry, the future of Polish lignite mining does not look optimistic from the economic point of view. This is associated with social and environmental problems, including the European Union's climate and energy policy. However, this may change in the event of a global economic crisis and unstable geopolitical conditions. Therefore, a new energy doctrine for Poland at least by 2050 is urgently needed.

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1. Introduction

Hard coal and lignite still play a major role in the production of electricity in the world. They provided around 30.1% of global primary energy and generated more than 40% of the world's electricity in 2013 (WCA, 2014). However, the importance of lignite in many countries is very high, sometimes even higher than hard coal. Therefore, the lignite share in electricity production is characterized not only with hard coal (e.g. Ediger et al. (2014), Jovančić et al. (2011), Kaldellis et al. (2009), Kavouridis (2008), Pregger et al. (2013), and Yilmaz and Uslu (2007)).

Both, hard coal and lignite generate more than 56% of primary energy and over 85% of electricity production in Poland. On the other hand, lignite covers about one-third of Poland's electricity

(e.g. Kasztelewicz (2014a), Pietraszewski (2015) and PSE S.A. (2015)). Thus, lignite plays a key role and occupies second place in electricity production in Poland.

For many years Poland has been one of the most significant lignite producers in the world. According to WCA (2014) data, Poland, with lignite extraction about 66 Mt in 2013, took fourth place around the world after Germany (~183 Mt), Russia (~73 Mt) and the USA (~70 Mt), and ahead of Turkey (~63 Mt), Australia (~63 Mt), Greece (~54 Mt), India (~45 Mt), the Czech Republic (~40 Mt) and Serbia (~40 Mt). However, Poland (63.7 Mt in 2014), both among the EURACOAL members and in the European Union, is the second lignite producer after Germany (178.2 Mt in 2014).

Poland is characterized by the presence of more than 150 small to large lignite deposits, of which a few tens have economic value (e.g. Ciuk and Piwocki (1990), Kasiński (2010), Kasiński and Piwocki (2002), Kasiński et al. (2006), Kasztelewicz (2008), Kasztelewicz and Ptak (2009) and Tajduś et al. (2014)). These deposits are

* Corresponding author.

E-mail address: widera@amu.edu.pl (M. Widera).

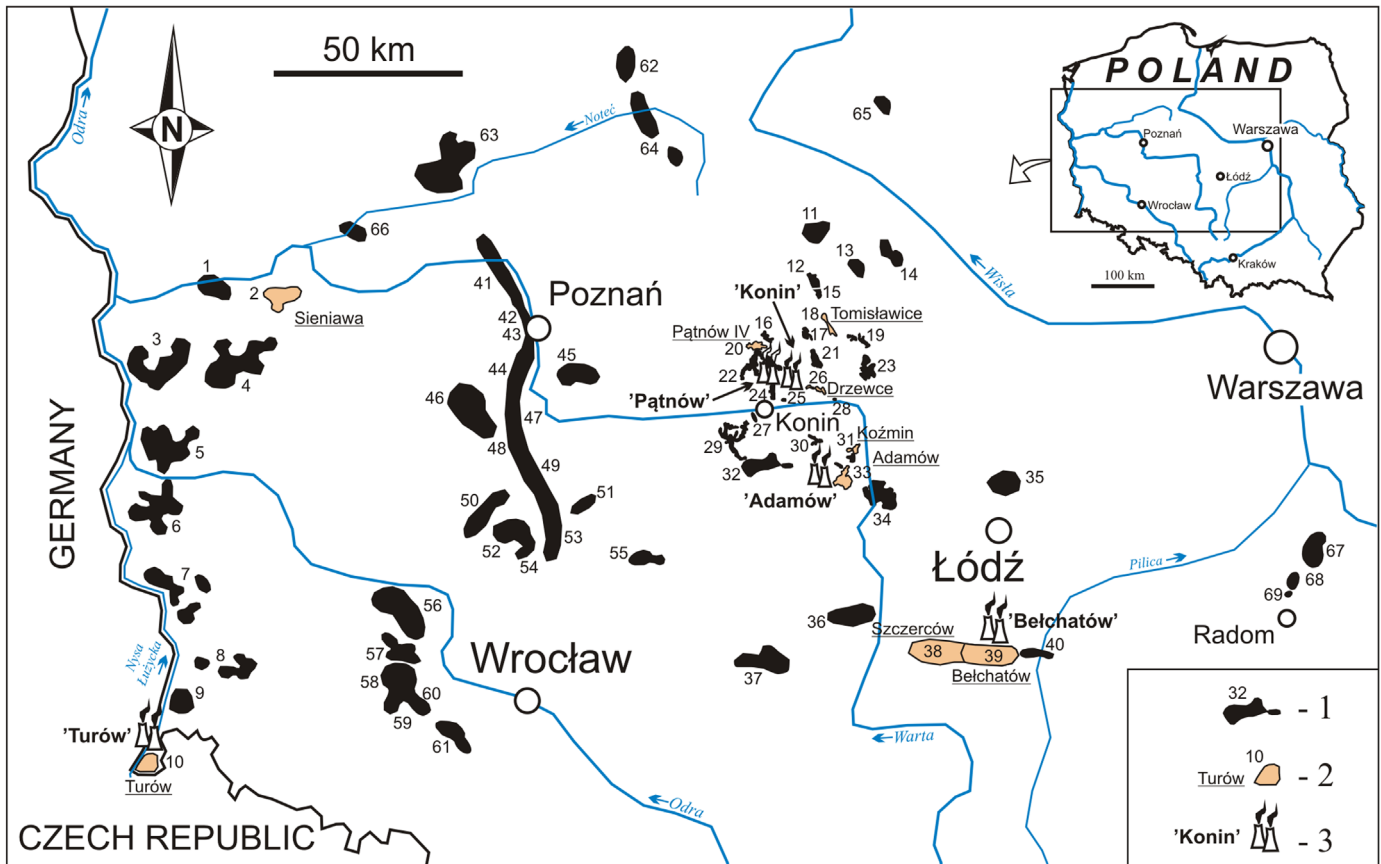


Fig. 1. Location map of major lignite deposits and lignite-fired power plants in Poland. 1 – lignite deposits, 2 – currently exploited lignite deposits, 3 – lignite-fired power plants (Source: Ciuk and Piwocki (1990), Kasiński (2010), Kasiński and Piwocki (2002) and Piwocki (1992); modified). For names of lignite deposits see Table 1.

predominantly of the Miocene age and they are located in central-western Poland (Fig. 1). The lignite-bearing areas cover more than one-third of the Polish territory, that is, about 70,000 km² (Ciuk and Piwocki, 1990; Piwocki, 1992). The geological resources of Polish lignite deposits are among the largest in the world. At the end of 2014 they amounted to more than 23.5 Gt in 90 deposits

(Szufflicki et al., 2015).

The primary objective of this opinion paper is to present the opportunities and risks for Polish lignite mining. Thus, different scenarios for lignite mining and its current and future role in the Polish energy sector will be discussed. Obviously, the socio-environmental risks as well as external geopolitical and energy

Table 1
Names of major Polish lignite deposits shown in Fig. 1.

Deposit number	Deposit name	Deposit number	Deposit name	Deposit number	Deposit name
1	Rogi–Rudnica	24	Niesłusz–Gostawice	47	Czempiń Town
2	Sieniawa	25	Morzysław	48	Czempiń
3	Rzepin	26	Drzewce	49	Krzywiń
4	Torzyn	27	Rumin	50	Góra
5	Cybinka–Sądów	28	Ochle	51	Pogorzela
6	Gubin–Zasieki–Brody	29	Piaski	52	Poniec–Krobia
7	Mosty	30	Władysławów	53	Gostyń
8	Parowa–Ruszków–Węgliniec	31	Koźmin	54	Oczkowice
9	Radomierzyce	32	Siąszyce–Grochowy	55	Sulmierzyce
10	Turów	33	Adamów	56	Ścinawa–Głogów
11	Radojewice	34	Uniejów	57	Ścinawa
12	Chełmce	35	Rogóżno	58	Legnica North
13	Radziejów	36	Złoczew	59	Legnica West
14	Włocławek	37	Wieruszów	60	Legnica East
15	Piotrków Kujawski	38	Szczerców	61	Ruja
16	Ościsłowo	39	Bełchatów	62	Więcbork
17	Morzyczyn	40	Bełchatów	63	Trzcianka
18	Tomislawice	41	Szamotoły	64	Nakło
19	Mąkoszyn–Grochowska	42	Naramowice	65	Wąbrzeźno
20	Pątnów IV	43	Poznań Town	66	Drezdenko
21	Lubstów	44	Mosina	67	Głowaczów
22	Pątnów I–III	45	Środa Wlkp.	68	Wola Owadowska
23	Dęby Szlacheckie–Izbica Kujawska	46	Cykowo–Sepno–Racot	69	Owadów

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