



To Embrace a Profitable Energy Future, Poland's PGE Must Abandon Plans for a New Lignite Mine

Executive Summary

This report reviews past, present and future strategies at PGE, Poland's biggest electric utility, one of the most coal- and carbon-intensive energy companies in Europe. PGE is presently preparing a new strategy through 2030. We especially focus on the company's iconic Bełchatów power plant, the world's largest lignite power plant, Europe's biggest power plant of any kind, and the continent's biggest single source of carbon emissions. We consider PGE's plans to develop a new lignite mine by 2030, at Żłoczew, to fuel the Bełchatów power plant until the mid-2050s.

The context for this report is the extremely adverse and worsening environment facing coal and lignite power generation in Europe.¹ Headwinds include EU climate targets and a Paris climate agreement that imply coal phaseout by around 2030 in developed countries; declining investor sentiment; falling costs of renewables; rising carbon prices; diminishing scope for financing and insuring coal; stricter EU air quality standards; and a trend toward mandated coal phaseouts. We expect utilities in Europe will cease coal and lignite power generation in the 2030s at the latest, either by mandate or market forces. The questions thus arise for PGE, why is it developing a new lignite mine, and what alternative businesses should it develop instead to replace falling conventional generation earnings going forward.

PGE is a 57% majority state-owned company in a country whose governments have been traditionally pro-coal. Coal and lignite in Poland are partly a social issue, employing more than 100,000 people. But the greater profitability of renewables, as illustrated in this report, shows that even in the near term there are no winners from doubling down on coal and lignite. Transitioning to renewables will mean a short-term cash outflow, but massive EU modernisation funds have been allocated to Poland so that the country does not have to bear this cost alone. We recommend that PGE actively pursue a stepwise retirement of lignite units at the Bełchatów power plant in favour of alternative electricity sources and industries. Scrapping its plans for the Żłoczew mine is only the first step required in a new energy strategy that would also include accelerated investments in renewables.

Main Findings:

- PGE's record PLN 37 billion (€8.5 billion) investments under its 2015-2020 strategy to date has damaged the company's financial performance.

¹ In this briefing we distinguish between lignite, a soft brown form of coal with a high moisture and low energy content, typically mined in open pit mines next to a power plant, and hard coal, which can be mined locally or transported by ship or rail

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- Coal and lignite have accounted for 76% of this capex and acquisition investment. Renewables accounted for 3%. Coal and lignite earnings earnings before interest, tax and depreciation (EBITDA) have fallen year-on-year in the same period, while renewables EBITDA has risen. But we note that the introduction of Poland's capacity market will boost the conventional segment from 2021-2025.
 - PGE's cost of equity has exceeded return on equity for at least the last four years, indicating that PGE has destroyed shareholder capital
 - PGE has performed terribly compared with selected European electric utilities that have tilted toward renewables
 - Since Denmark's Ørsted listed in July 2016, after remodelling itself as a renewable energy company, PGE's share price has trailed Ørsted by 197%, RWE by 157%, ENEL by 105%, and Iberdrola by 91%
 - Germany's RWE and Britain's Drax provide case studies for how PGE might diversify into renewables. At present, PGE's strategy beyond 2020 focuses on extending lignite and building new gas, while major renewables targets refer to 2025 and beyond.
 - PGE has ample future land for ground-mounted solar at recultivated lignite mines. We analysed the cash flow impact of closing Bełchatów power plant's three oldest units, cleaning up their share of the power plant and lignite mine, and developing ground-mounted solar and warehouse rental businesses, versus the alternative of continuing lignite generation for another five years.
 - Lignite generation has a positive net present value (NPV) on a five-year time horizon through 2025, at these three units. In this case, we ignore future PLN 1 billion (€230 million, \$249 million)² lignite generation and mine decommissioning liabilities, tightening EU air quality standards, rising carbon prices, the end of capacity market payments and the vast expense of opening a new lignite mine at Złoczew. Five years is the investment horizon of distressed asset specialists presently buying ageing coal plants in Europe. PGE must look further into the future, for the sake of its multiple stakeholders.
 - Our alternatives of ground-mounted solar and warehouse rental achieve similar earnings (EBITDA) as lignite, with zero subsidies, for decades into the future rather than a handful of years.
 - Our alternatives also achieved a positive NPV, even after including the clean-up cost of the legacy of lignite mining and power generation, but only if PGE exploits grants available via the EU's Modernisation Fund to develop low-carbon energy. The purpose of the fund is to help carbon-

² In this report, we assume a PLN/euro exchange rate of 4.35.

intensive regions diversify, and Poland will be by far the biggest beneficiary. We urge PGE to exploit it, to make this urgent change.

Table of Contents

Executive Summary	1
PGE's 2015-2020 Strategy: A Woeful Performance	5
Coal Investments Squeeze Out Renewables	5
Earnings Collapse.....	6
Key Financial Metrics.....	8
PGE Share Price: Underperformance.....	9
Learning From Its Peers	10
In Poland, Tauron's Strategic Shift.....	10
In Germany, RWE's Acquisition of E.ON and Innogy Renewables Assets.....	10
In the UK, Drax's Conversion to Gas and Biomass, and Acquisition of Downstream Businesses	11
PGE Risks.....	11
Carbon Price Risk.....	12
Energy Demand Risk	13
Regulatory Risk.....	13
Financing Risk.....	13
Climate Risk.....	14
Civil Society Opposition	14
Beyond 2020: A New-Old Strategy.....	14
Złoczew Mine: Extending Coal Generation Into the 2050s.....	15
Switch to Gas Power	17
Delayed Investment in Renewables.....	17
An Alternative Path: Bełchatów Case Study.....	18
Value From Lignite Generation	18
Value From Alternative Uses.....	19
Conclusion.....	21
About the Authors.....	22

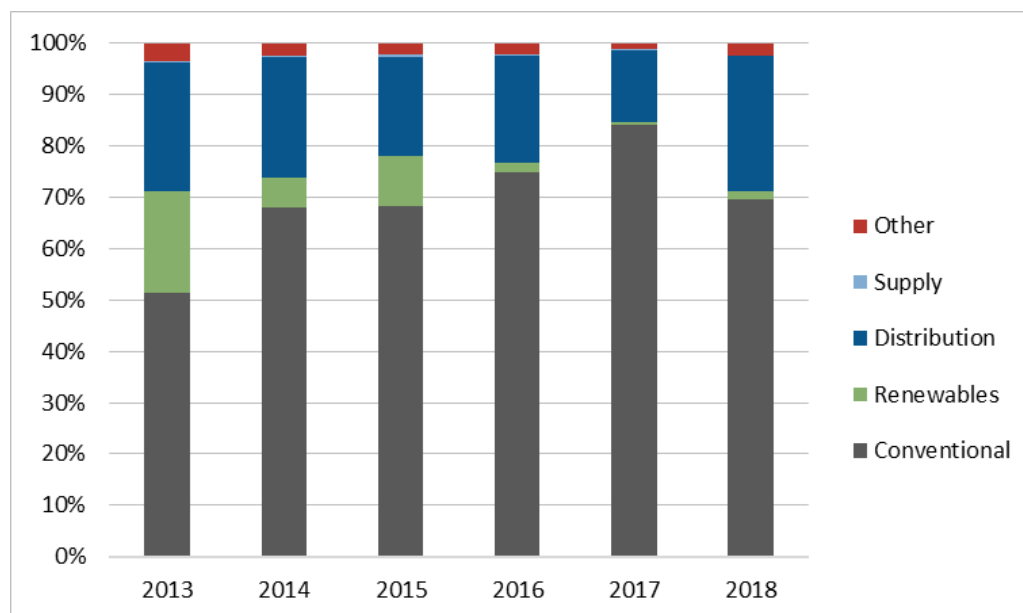
PGE's 2015-2020 Strategy: A Woeful Performance

In this section, we briefly review PGE's performance to date under its core 2015-2020 strategy. In a nutshell, this strategy was to invest in coal and lignite by building new coal power plants, modernising existing ones (to extend their operating life) and buying the Polish coal fleet of the French utility EDF. In the process, PGE has made record investments in conventional generation. But the company has seen profits from this business fall dramatically, with EBITDA (earnings before interest tax and depreciation) slumping more than a quarter. Meanwhile earnings at PGE's renewables business, starved of investment, have risen. The performance of coal and lignite has dragged down PGE's return on equity (ROE) to unacceptably low levels, consistent with its massive share price underperformance. The financial performance of the company is unsustainable. There may be a short-term return to earnings growth, as PGE's recent investments in new, more efficient, lower cost coal and lignite power units pay off as these units come online this year and next. And the introduction of Poland's capacity market will boost the conventional segment from 2021-2025. But earnings would have to bounce back enormously for PGE once more to achieve reasonable returns.

Coal Investments Squeeze Out Renewables

PGE's capital expenditures and acquisition investments have focused almost exclusively on coal and lignite (its conventional business) during the 2015-2018 period. More than three-quarters of the total PLN 37 billion invested to date went to coal and lignite (see Figure 1), mostly at the expense of renewables, which received just 3% of the total. Total capital expenditures (capex) have soared, and remain high. Inevitably, this growth in capex has driven growth in the asset base. For example, installed electrical generating capacity has grown by nearly a third since 2013, but the vast majority of this growth has been in coal and lignite. Looking ahead, PGE is laying plans for new renewables. But its big targets are for 2025 and 2030. Before then, it will bring online more coal, gas and lignite, net of retirements.

Figure 1: PGE Capital and Acquisition Expenditures, % of Total, by Business Segment, 2013-2018



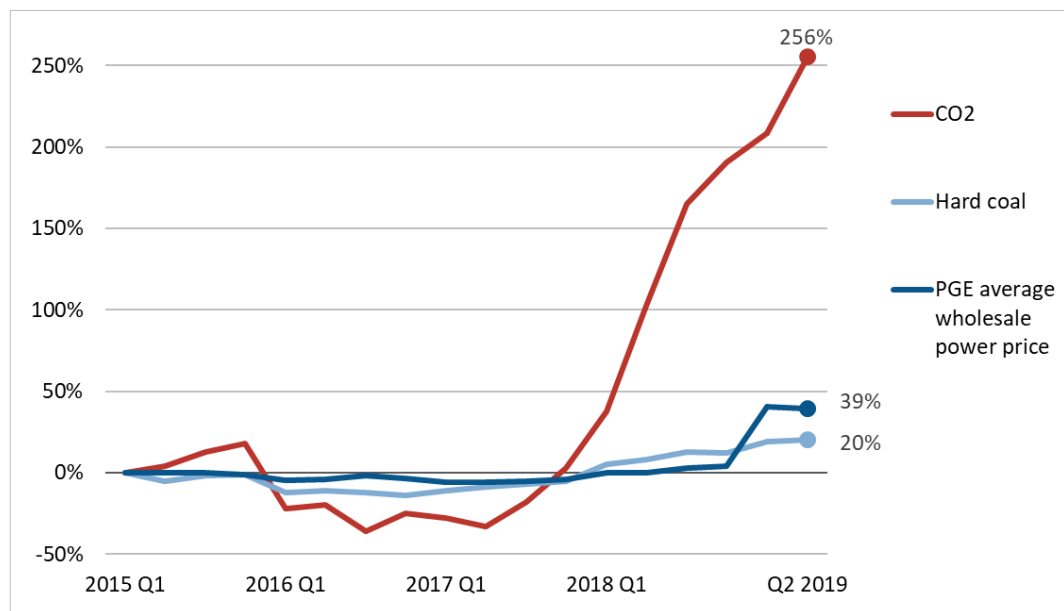
Source: IEEFA interpretation of PGE annual reports.

Earnings Collapse

The timing of PGE's investment in coal and lignite has been disastrous. The company's problem is not with output, which it has successfully increased, but costs. From the first quarter of 2015 to the second quarter of 2019, the price of carbon emissions permits rose 250% and the price of hard coal (Polish steam coal index) by 20%. These higher costs have only partially been offset by a 40% rise in PGE realised power prices (Figure 2). In addition, PGE has received a shrinking allocation of free carbon emissions allowances (EUAs), and has had to meet new air quality regulations (called BREF), which have forced upgrades and maintenance downtime at its coal and lignite power plants, developments that have left the company dangerously exposed. PGE has no control over these EU regulations on carbon emissions and air quality. The ratings agency Moody's states that the company's state backing cannot disguise the risks posed by its "significant thermal generation assets with a high carbon intensity and shrinking margins as free allowances decline and carbon prices have increased; the group's high exposure to market price volatility given the largely fixed-cost nature of its generation fleet; and the company's substantial capital spending programme".³

³ Moody's, 2019. [Moody's announces completion of a periodic review of ratings of PGE Polska Grupa Energetyczna S.A.](#)

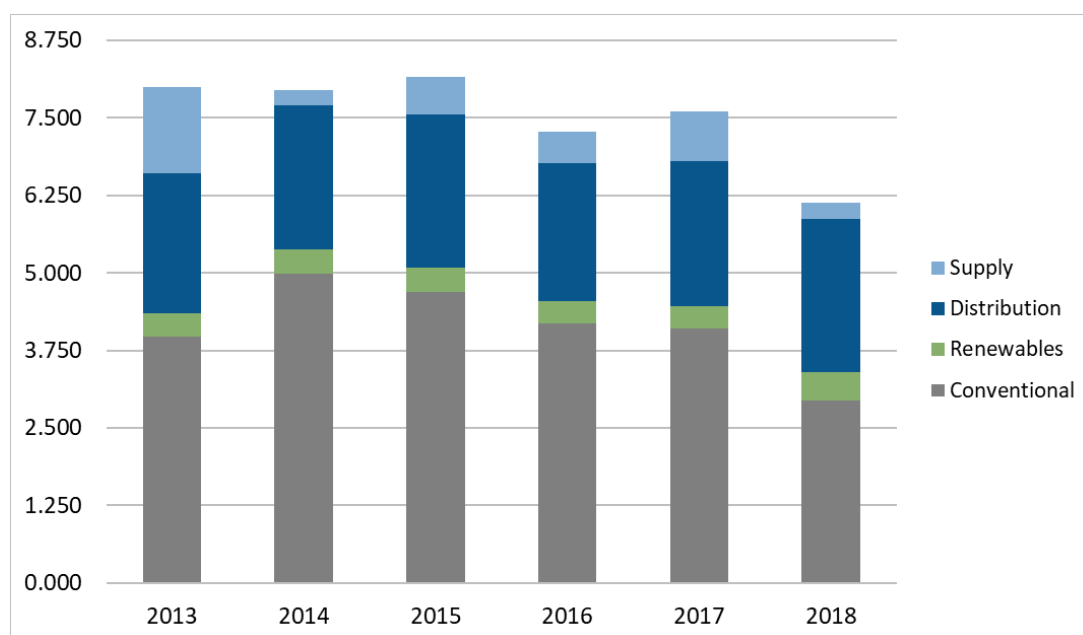
Figure 2: Higher Power Prices Have Failed to Offset Higher Coal and Substantially Higher Carbon Prices, 2015-2018



Source: PGE data for spot carbon prices, spot Polish coal steam index and PGE average wholesale price of electricity.

The result of commodity prices moving against PGE has been sharply lower EBITDA in its coal and lignite business (Figure 3). Conventional EBITDA has fallen year on year for the past four years, and is down 26% since 2013, to PLN 2.9 billion from PLN 4.5 billion. By contrast, renewables EBITDA is up 20%. The company's first half results in 2019 confirmed the downward trend in EBITDA, mostly because of a PLN 1.2 billion increase in carbon costs.

Figure 3: PGE EBITDA By Business Segment, PLN bln, 2013-2018



Source: IEEFA interpretation of PGE annual reports.

Key Financial Metrics

Return on equity (ROE) – ROE measures net income divided by shareholder equity and is a key metric of a company’s performance. Net income records profit after tax. Equity measures the money it has cumulatively made from profits, after dividends, and issuing shares. PGE’s ROE has fallen from a reasonable 10% in 2013, to minus 7% in 2015, 6.0% in 2016, and 3% last year.

Cost of equity – Cost of equity is a financial calculation that allows a comparison of different investments of similar risk. Clearly, shareholders would prefer to beat the cost of equity, i.e. to add value compared with the most equivalent, alternative investment. Equity analysts canvassed for this report indicated that a company with PGE’s profile would traditionally have had a cost of equity in the 8-10% range. We conclude that PGE’s cost of equity has exceeded returns on equity since at least 2015, and the company has been destroying shareholder capital for several years.

Return on assets (ROA) – ROA measures EBIT divided by a company’s total assets, which in this case will be mostly the value of PGE’s power plants. PGE’s ROA has fallen from 7% in 2013 to just 2% last year.

Net debt to EBITDA – PGE has borrowed to implement its strategy, with its net debt to EBITDA multiple rising to 1.5 times at the end of 2018, from minus 0.4 in 2013. This rise is a result both of a 22% drop in EBITDA, and 132% rise in net debt. PGE management has stated that this ratio could rise to as high as 3. This is still a relatively low value, compared to some other utilities.

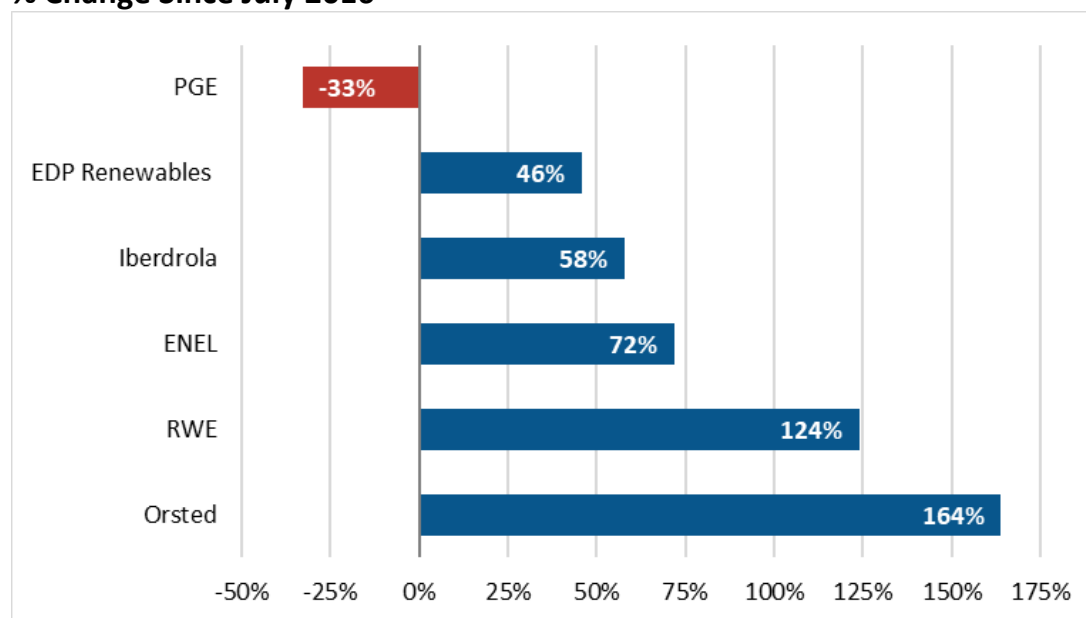
PGE Share Price: Underperformance

Since PGE affirmed its commitment to its 2015-2020 strategy, on September 8 2016, shares have fallen by more than one-third. In the same period, two important benchmarks, the MSCI index of European electric utilities, and the WIG20 index of large-cap Polish companies, are both up by more than one-fifth. PGE has only narrowly underperformed the Polish energy index (WIG-Energia), however.

We find serious PGE share price underperformance compared with other, selected European utilities. In July 2016, Ørsted (formally DONG – Danish Oil and Natural Gas) listed on the Copenhagen stock exchange, after having transformed itself into a renewable energy company. As recently as 2008, Ørsted had 84% of its assets in fossil fuel-related business. Today, it has some 94% of its assets in renewables (largely offshore wind) and has become the fifth largest renewable generator outside China. Since its listing, Ørsted's share price has risen by more than 160%, making it one of the top-20 large cap stock performers across all European bourses. Ørsted has achieved an ROE in excess of 25% for the past three years (PGE averaged 5%).

Figure 4 compares PGE's stock performance, at the time of writing (September 27 2019), since July 2016 against selected European utilities that have tilted toward renewables. PGE has been making record investments in conventional generation but has seen profits from this business fall. That has dragged its ROE and ROA down to unacceptably low levels. Figure 4 makes a devastating comparison with utilities that have made big, successful bets on renewables.

Figure 4: PGE Share Price Performance vs. European Electricity Utilities, % Change Since July 2016



Source: FT markets data.

Learning From Its Peers

PGE's conventional business accounted for 46% of total EBITDA last year, down from 57% in 2015. The company needs to find a new growth engine beyond coal and lignite. Renewables accounted for 7% of EBITDA in 2018, and so PGE would have to grow this business more than six-fold to replace its conventional generation, a giant undertaking that would need to start immediately. A brief review follows of the approaches taken by some of PGE's peers in Poland and across Europe.

In Poland, Tauron's Strategic Shift

Tauron is a significant electric utility in Poland, 30% owned by the Polish state. As of end-2018, it was the biggest distributor of electricity by volume; second behind PGE in sales of electricity to final off-takers; and third in Poland by electric capacity and generation. In May 2019, Tauron management announced a "strategic direction update," signalling a dramatic shift away from coal toward renewables.⁴ Specifically, coal would fall to one-third of Tauron's generating capacity in 2030, from 90% today, and renewables would rise in the opposite direction, to two-thirds of capacity, from 10%. The strategy would entail the sale of some heating and mining assets, and a greater focus on retail services. Tauron summarised the drivers for this strategic shift as follows: EU air quality standards ("further tightening of environmental standards"); reduction of support for coal after 2025 (under EU capacity market rules); pressure from investors ("reducing the financing of coal investment projects"); rising carbon prices; and a change in customer behaviour, including the rise of renewable energy prosumers.

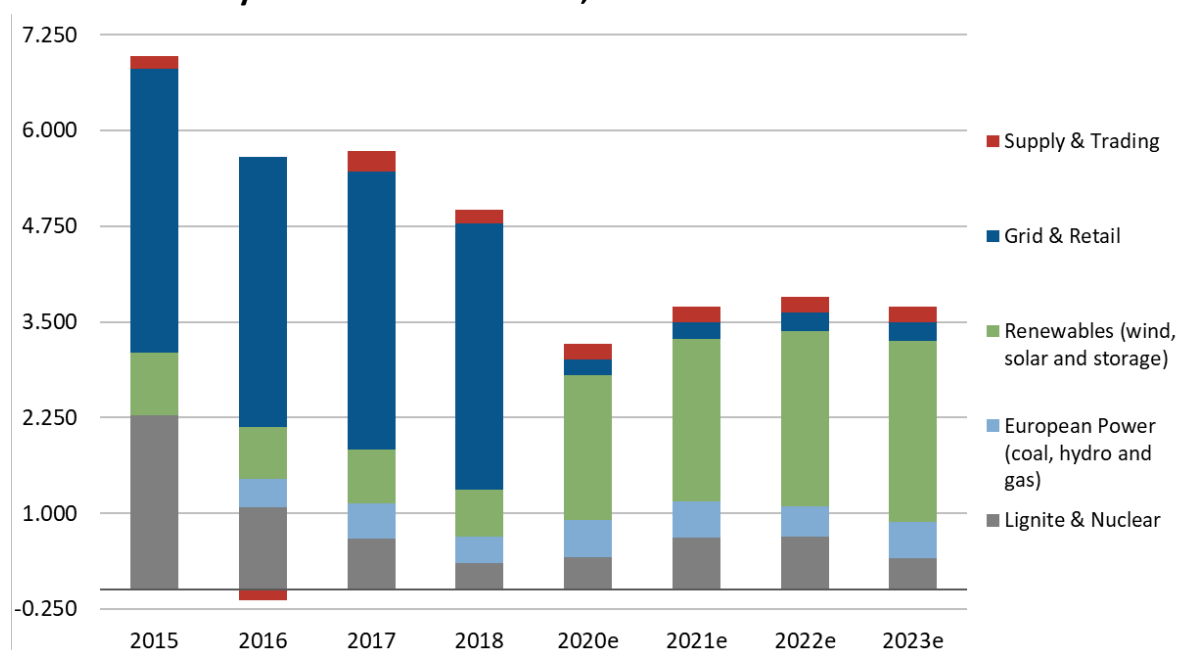
In Germany, RWE's Acquisition of E.ON and Innogy Renewables Assets

One of Europe's biggest utilities, RWE is transitioning from being one of Europe's largest coal and lignite generators, to the third biggest generator of renewable power. We should note that RWE is still Europe's biggest carbon emitter, even after accounting for the asset swap, so their transition is far from complete.

The business structure of RWE was similar to that of PGE until very recently, with both dependent on conventional lignite and coal as a major source of earnings. Figure 5 below shows how RWE's combined conventional earnings (European Power and Lignite and Nuclear) have fallen year on year from 2015-2018, in the same way as PGE's conventional segment (see Figure 3 above). Last year, RWE took the strategic decision to replace this lost EBITDA with renewables, announcing that it would acquire the renewables assets of E.ON and Innogy, in an asset swap for its own retail and grid businesses. RWE's renewables business will be its growth and earnings engine going forward.

⁴ Tauron, 2019. [Tauron Group's Strategy for 2016-2025: Update of Strategic Directions](#).

Figure 5: RWE EBITDA By Business Segment, Actual to 2018, and Consensus Analyst Forecasts 2020-2023, € Million



Source: RWE investor relations.

In the UK, Drax's Conversion to Gas and Biomass, and Acquisition of Downstream Businesses

UK-based Drax Group was once best known as the owner of the largest coal power plant in western Europe. Drax power plant was western Europe's closest equivalent to PGE's Bełchatów. Drax is now diversifying into multiple alternatives, in advance of the UK's total coal phaseout by 2025. In particular, Drax has converted four of six units to burn biomass, and has acquired gas and hydropower generation. We note that the sustainability of burning biomass at scale is disputed by environmental groups. Other diversification measures made by Drax include the acquisition of two business-to-business supply companies, Haven Power and Opus Energy, to provide a more efficient route to market for Drax generation. We note that Drax has announced plans to build new gas generation, but that this has not yet come to pass, since it requires a successful bid in Britain's capacity market, which is presently suspended. Drax ended plans several years ago to bid for funds for a major carbon capture and storage project ("White Rose"), which it deemed uncompetitive.

PGE Risks

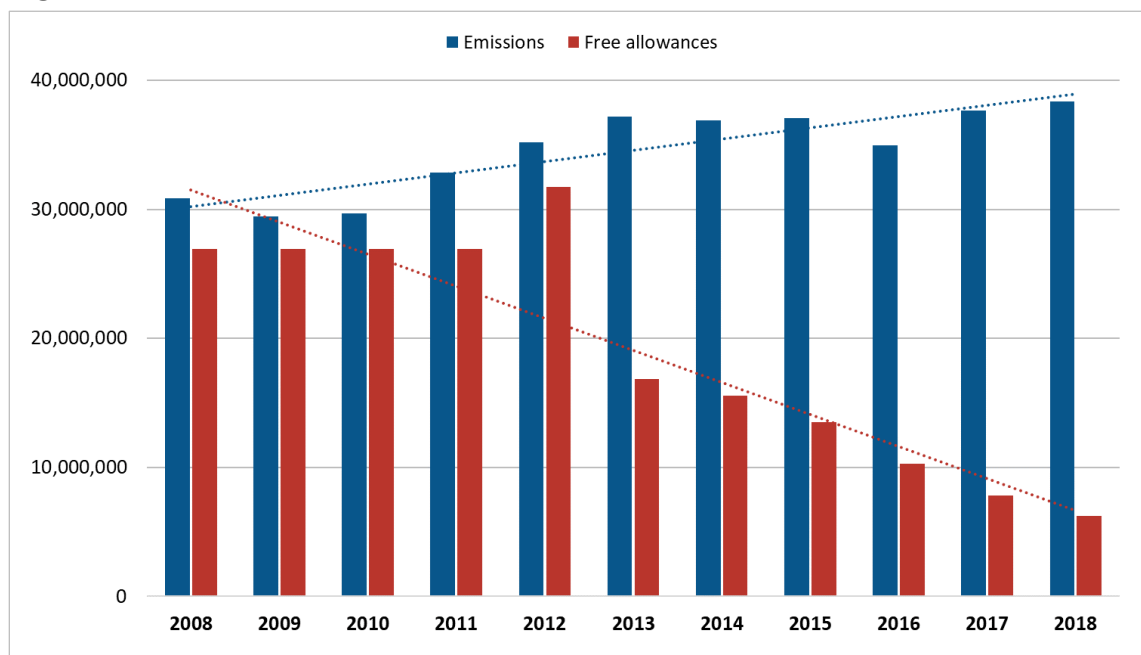
In the past four years, PGE has invested capital in highly uncertain future revenues. PGE's various sources of risk stem from fundamentally independent drivers and

timescales, such as capacity market revenues and carbon prices, and as such they are largely additive.⁵

Carbon Price Risk

Under the EU emissions trading scheme (EU ETS), owners of large industrial facilities including fossil fuel power plants have to submit an EU allowance (EUA) for every tonne of carbon dioxide (CO₂) emissions. PGE is the third-highest carbon emitting company in the EU ETS, behind RWE and EPH.⁶ Higher carbon prices have especially impacted PGE's lignite business. Burning lignite typically emits around 1.1 tonnes of CO₂ per megawatt hour of electricity production, compared with about 0.9 tonnes from burning coal, and 0.3 tonnes from burning gas. In other words, PGE's lignite carbon costs rise disproportionately if carbon prices go up. Compounding the impact of rising carbon prices, utilities in Poland have received a falling quota of free EUAs (Figure 6). In 2018, carbon costs at PGE rose by PLN 389 million to PLN 1.6 billion. Some market participants see carbon prices rising much faster than implied by the forward curve today, to as high as €50 per tonne in three years (compared with around €25 at the time of writing), a level that would hugely benefit utilities with a greater exposure to renewables.⁷ PGE now acknowledges that: "We are learning our lessons with respect to CO₂ prices which we don't expect to fall."⁸

Figure 6: Bełchatów's Emissions vs. Quota of Free EUAs (tonnes)



Source: PGE annual Report data, IEEFA calculations.

⁵ IEEFA, 2018. *Decision time at Poland's PGE*. p. 15.

⁶ Carbon Market Data, 2019. *EU ETS Company Rankings 2018*.

⁷ FT, 2019. *Hedge fund forecasts demise of coal in Europe within 3 years*.

⁸ PGE, 2019. *Webcast: Consolidated half-year report for H1 2019*. September 25.

Coal-fired combined heat and power plants (CHP) emit CO₂ from burning coal, in the same way as coal and lignite power plants, and they also have to buy EUAs to cover these emissions. PGE recently expanded its heat business, by buying EDF's CHP units in Poland. At the time, PGE trumpeted the addition of CHP plants, which receive a regulated income from sales of heat, because the acquisition reduced PGE's exposure to volatile power prices. However, this has turned out to be a double-edged sword: Unfortunately, regulated heat tariffs do not pass through the costs of EUAs as directly as power prices, and rising carbon prices have thus cut earnings at this newly acquired CHP business.

Energy Demand Risk

PGE's goal to open a new lignite mine, and several combined cycle gas turbine (CCGT) power plants, is built on an assumption of rising power demand, which may be flawed. First, there is a trend for a decoupling of energy demand with economic growth, as a result of advances in energy efficiency, growth in the less energy-intensive service economy, and growth in renewable energy with near-zero energy conversion losses. The consultancy McKinsey warned this year that "we're beginning to see a decoupling between the rates of economic growth and energy demand, which in the decades ahead will become even more pronounced".⁹ Second, Poland's recent clip of economic growth is forecast to slow, The World Bank forecasts growth of 4% in 2019 (down from 5% in 2018), falling to 3.6% in 2020 and 3.3% in 2021.¹⁰

Regulatory Risk

The EU has set energy and climate goals, for lower greenhouse gas emissions, higher energy efficiency, and for more renewables, which all imply a curtailed future for coal. Meanwhile, the global Paris Agreement sets climate change targets that imply a coal phaseout by around 2030 in developed countries. As Poland's biggest electric utility and a majority state-owned company, PGE's energy strategy is embedded in the strategy of the Polish government. Should Poland fall short, PGE may have to plug the gap. Under EU action on climate change, member states have agreed to develop National Energy and Climate Plans (NECPs), to show their plans meet EU 2030 goals for renewable energy and energy efficiency. Commenting on Poland's draft plans, the European Commission found that Poland's transition to renewables was slower than required by an EU-wide target, which implied a share of 25% renewables in all energy demand in Poland by 2030 (not Poland's target of 21%). The Commission also noted that Poland's energy efficiency goals were modest and said that the country was lagging a binding 2020 goal for a 15% share of renewables (actual 2017: 11%).

Financing Risk

While PGE is majority state-owned, it is still reliant on international shareholders and creditors. Regarding shareholders, there is clearly a move by some investors away from fossil fuels. While there may always be some investors willing to buy

⁹ McKinsey, 2019. [The decoupling of GDP and energy growth: a CEO guide.](#)

¹⁰ World Bank, 2019. [Polish economy to slow slightly, fiscal deficit to grow, says World Bank.](#)

such shares, a shrinking pool of potential shareholders would inevitably lower valuations on the back of reduced demand. Regarding creditors, the world's biggest development bank, the European Investment Bank, has published a new draft energy policy to end financing of all fossil fuel projects, including gas. In its draft policy, published end-July, the EIB said:

"The Bank will phase out support to energy projects reliant on fossil fuels: oil and gas production, infrastructure primarily dedicated to natural gas, power generation or heat based on fossil fuels. These types of projects will not be presented for approval to the EIB Board beyond the end of 2020."

In its existing borrowing from the EIB, PGE has a PLN 2 billion credit facility, of which PLN 490 million is proposed to be used to finance and refinance the construction of cogeneration units, predominantly gas-fired. This sum appears at risk under the draft EIB policy.

Climate Risk

Climate change will lead to wetter, milder winters in north European countries, and hotter, drier summers, according to some scientists. The European Commission has stated that Poland's National Energy and Climate Plan (NECP) "mentions neither climate change impacts as risks for energy security (e.g. for electricity supply from thermal power plants), nor potential adaptation measures to address these risks." The first quarter of 2019 was an example of a winter as might be expected under future climate change. PGE reported that the first quarter of 2019 was 3 degrees Celsius warmer than average, and in particular, the month of March was 10C warmer. Coupled with good wind conditions, the result was lower power generation by coal and lignite power plants, down 28% and 10% respectively, compared with the first three months of 2018. In addition, total PGE heat production was down 11%.

Civil Society Opposition

Grassroots organisations and environmental groups are becoming more active in their protests against high-carbon assets. One recent example relevant to PGE and Bełchatów is a legal procedure brought by the environmental lawyers, ClientEarth, against Bełchatów to reduce its impact on climate change. ClientEarth is demanding that PGE either stop burning lignite, or take measures to eliminate its CO2 emissions, by 2035 at the latest.¹¹

Beyond 2020: A New-Old Strategy

We review PGE's plans for a successor strategy, which the company is expected to announce formally in the coming weeks or months.

¹¹ Washington Post, 2019. [Environmentalists sue Poland's major coal power plant](#). September 26, 2019.

Złoczew Mine: Extending Coal Generation Into the 2050s

Most fossil fuel utilities understand that they cannot run their businesses as they used to, replacing old coal with new coal. However, one of PGE's core strategies is to replace old lignite mines with a new mine at Złoczew, to fuel its flagship coal power plant Bełchatów into the 2050s (see Table 1).¹² PGE explains that this is a precautionary strategy, "in the event that climate policy is substantially relaxed".¹³ This is a bizarre interpretation of trends in the European electricity sector, given the EU energy and climate regulatory context described above, and the scientific view that climate change is accelerating, implying only more ambitious action.¹⁴ It also contradicts the position of almost all other EU countries, including heavy users of lignite power. For example, in September 2019, Greece announced that it would phase out lignite power in 2028. There appears to be zero prospect that climate policy or regulations might be eased in Europe, much more likely that they are tightened, where PGE would be more exposed than its peers.

Table 1: Sources of Fuel for Bełchatów Power Plant

Mine	Area ha	Economic resource (2017) mln tonnes	Annual capacity mln t/ year	Actual output (2018) mln t/ year	Start date year	Expected depletion year	Max Depth of mine m	Distance from power plant km
Bełchatów	3870	28.244	N/A	11.23	1981	2020-2025	246	4
Szczerców	2480	558.816	36.5	33.08	2009	2035-2040	352	12
Złoczew (proposed)	1350	465.096	18	N/A	2030?	2050-2060	354	42

Sources: IEEFA; Acousmatics; PGE Management reports (2015-19).¹⁵

There is an economic logic in the sequence of PGE's exploitation of lignite fields, starting with the Bełchatów field, which is shallower and closer to the power plant than Szczerców, which in turn is shallower and much closer to the power plant than Złoczew (Table 1). The distance of Złoczew from Bełchatów power plant implies massive infrastructure investment, in particular a dedicated railway. We note that there is no prospect for EU funds to support such expanded lignite production, in contrast to significant funds available for transitioning to low-carbon generation and other alternative economic uses, at up to 100% of capital expenditure.

¹² In its 2018 annual report, PGE lists three long-term strategic options for maintaining a "leading position in the generation segment": construction of offshore wind; building a nuclear power plant; and/ or the development of new lignite deposits"

¹³ PGE, 2019. [Management Board's report on activities of PGE S.A. and PGE Capita Group for year 2018](#).

¹⁴ Climate Analytics, 2019. [Global and regional coal phaseout requirements of the Paris Agreement](#).

¹⁵ Mine areas and distances are estimated by the report authors from Google Maps and a range of sources. Mine output is taken from PGE's 2018 annual report. Mine capacity and resource are taken from Wilczyński (2019). Mine maximum depths are taken from Wilczyński (2019) and from Geoland, 2008, *Reclamation and development of brown coal post-mining areas*.

It seems likely that PGE, a majority state-owned company, is being encouraged in its plans for Żłoczew by a pro-coal Polish government. In advance of a general election on October 13, the government prepared a draft bill to fast-track Żłoczew authorisation by introducing the notion of “special purpose areas” that would bypass local planning authorities on the location of new mines, and reduce the opportunity for community consultation.¹⁶ These special powers were attributed to the “primary importance for the national economy” and energy security of developing new coal and lignite deposits. This view that new lignite is vital for Poland’s energy security rests on an assumption that a low-carbon transition is a decades-long process, which is not the case. For example, Britain in six years has reduced coal generation to 5% of its electricity mix from 39% (2012-2018), while wind and solar have risen to 21% from 6%. Poland’s wholesale power prices have risen largely because of the pass-through of European carbon prices, which have climbed several hundred percent over the past few years.¹⁷ Polish electricity prices are more exposed than most to rising carbon prices, because of a high coal intensity of power generation, with knock-on impacts on costs and inflation across Poland’s economy.

We note that Poland’s own draft energy plan for 2040 foresees just 1,500 MW of lignite remaining by then, which would make a new lignite mine at Żłoczew redundant.¹⁸ For PGE, this is a worrying contradiction in Polish energy policy, which appears both to favour such mine expansion, and also find it unnecessary.

**An expert review of Żłoczew
concluded that the field ‘is
associated with numerous
geological, environmental, social
and economic problems.’**

The international environmental law firm, Client Earth, recently commissioned Michał Wilczyński, the former chief national geologist at Poland’s Ministry of Environmental Protection, Natural Resources and Forestry, to review Żłoczew.¹⁹ He concluded that the field “is associated with numerous geological, environmental, social and economic problems,” and would be unprofitable. He based this conclusion on three critical factors. First, the biggest cost component is the removal of rock and soil (“overburden”) above the lignite seam. Wilczyński found that the Żłoczew field would be the deepest lignite pit mined to date in Poland, at up to 354 metres below sea level. Exploitation of the lignite would require the removal of 7 billion tonnes of rock and soil. The average thickness of the Żłoczew overburden is almost twice that of the Szczerców field, and nine times that of Bełchatów. The second biggest cost of output is drainage, again magnified by the greater depth of Żłoczew. Pumping of water would impact the hydrology of a surrounding area of up to 803 square

¹⁶ Parliament of Poland (SEJM), n.d. [Deputy’s draft act amending the act - Geological and mining law and the act on providing information on the environment and its protection, public participation in environmental protection and on environmental impact assessments.](#)

¹⁷ Sandbag, n.d. [EUA Price.](#)

¹⁸ Poland Energy Ministry, 2018. PEP2040: Conclusions from analysis of the energy sector. Table 1.2.

¹⁹ Michał Wilczyński, 2019, [What coal for Bełchatów power plant?](#)

kilometres. Third, the distance from Złoczew to the power plant would require the construction of a new, dedicated railway with annual traffic of 6,500 trains, Wilczyński estimated. EU-funded new rail projects in Poland indicate a lower estimate of around PLN 20 million per km, or PLN 850 million in total for a Złoczew-Belchatów line, before accounting for additional rolling stock, stations and the like. Regarding environmental problems at Złoczew, Wilczyński highlighted expected emissions, and hence added health costs, of toxins including mercury, cadmium and lead, and the greenhouse gas, methane. He did not estimate the expected annual CO₂ emissions.

Switch to Gas Power

PGE has indicated that in the near-term, the company's first diversification from coal and lignite will be into gas. The company is targeting imminent final investment decisions (FID) on three CCGT power plant units, with a combined capacity of 2.1GW, at Rybnik and Dolna Odra. PGE expects such construction to be supported by the country's newly introduced capacity market. PGE also plans to convert some of its coal-fired combined heat and power (CHP) plants to run on gas.

Delayed Investment in Renewables

PGE has been late to invest in renewables. PGE's onshore wind portfolio has taken 12 years to reach 550MW. So far, PGE and the Polish government have followed a similar approach to offshore wind investments in the Baltic Sea. In its National Energy and Climate Plan, the Polish government states that the tasks of developing adequate storage and transmission capacities will delay exploitation of offshore wind until 2025 at the earliest, with more significant growth after 2030.²⁰ The government anticipates around 5GW of offshore wind in 2030, and 10GW in 2040.

PGE ignores the current opportunities and threats coming from improving renewable generation economics and declining fossil-fuelled ones.

PGE follows this cautious line. In contrast to imminent final investment decisions for new CCGTs, the company is targeting FIDs for offshore wind in 2023, and plans to install some 2.5GW of capacity by 2030. We note that PGE has recently changed its tune somewhat in response to higher carbon prices, stating that these had triggered "our decision to adjust our assets to the situation we're facing." Here, PGE refers to a new ambition to install 1,300MW of solar by 2025, and 2,550MW by 2030, compared with 1MW today. PGE's new plan for 2030, for some

²⁰ Polish Energy Ministry, 2019. [National Energy and Climate Plan for the Years 2021-2030](#).

5GW of offshore wind and solar, is ambitious, but a long way off, and still a fraction of PGE's 14GW of coal and lignite generation installed today.

In delaying its renewables investment, PGE ignores the current opportunities and threats coming from improving renewable generation economics and declining fossil-fuelled ones, driven by both a high carbon price and growing capital flight from the sector. Regarding the improvement in renewables economics in Europe, the rating agency Fitch states: "the high CO₂-price environment will expedite higher wholesale electricity prices, which in turn will make renewable generation more competitive and profitable even without support mechanisms. We also assume that with completion of the coal phase-out in Germany, EU's decarbonisation policies will intensify, leading to more rapid reduction in electricity generation from coal in Poland."²¹

An Alternative Path: Bełchatów Case Study

In this section, we review two economic alternatives to lignite mining and generation at the site of Bełchatów power plant. We investigate the gradual, stepwise closure of its 12 generating units over time, starting with the three oldest units, B2, B3 and B4. First, we estimate the net present value (NPV) of cash flows from lignite generation at these three units over the next five years, from 2020 to 2025. Second, we estimate the NPV that would result from closing these three units, decommissioning them and recultivating (reclaiming) their pro rata share of the lignite mine from 2020-2024, and then putting that land to alternative use from 2024 to 2054. These alternative uses would be ground-mounted solar on their share of the recultivated lignite mine, and industrial warehousing at their share of Bełchatów power plant.

Value From Lignite Generation

In the case of lignite generation, we calculate cash flows from electricity generation and some limited heat production for five years. We very generously assume zero capital investment at the start of and during this period, and zero maintenance outages. We also conservatively assume actual carbon prices using the forward market through 2022, and then rising with inflation.

In this way, we calculate an NPV over the next five years of PLN 820 million, discounted at an assumed cost of equity of 10%. At the end of these five years, we assume a zero NPV going forward. We consider this to be a generous assumption, given the present market price for lignite generation and mining assets in Europe of around zero euros (e.g. the 2016 sale by Vattenfall to EPH), plus multiple decommissioning liabilities going forward beyond 2025, and the elimination of capacity market payments from 2026. In addition, we are ignoring the vast expense, in the billions of zloty, of opening a brand new lignite mine to continue generation at Bełchatów.

²¹ Fitch Ratings, 2019. [EU's High CO₂ Prices to Accelerate Utilities' Transition](#).

When we add an estimated cost of decommissioning these three power plant units, and their share of lignite mine recultivation costs, the NPV falls dramatically. We base these costs, of PLN 1,042 million, on PGE's own discounted provisions against these liabilities.²² Adding these costs as an upfront capital expenditure cuts the NPV to PLN 186 million.

Table 2 below illustrates some of our assumptions, and how we calculate annual earnings (EBITDA), in a sample year 2021, when capacity payments become available. These capacity payments account for about 10% of revenues. Carbon costs account for more than half of total operating costs.

Table 2: Assumptions and Results in Our Modelling of Continued Lignite Generation at Bełchatów Units 2-4, 2020-2025 (Sample Year 2)

Assumptions		Revenues				Costs		Profit
Capacity factor %	Installed capacity MW	Power PLN mln	Heat PLN mln	Capacity Payments PLN mln	Total revenues PLN mln	Carbon PLN mln	Total costs PLN mln	EBITDA PLN mln
72%	1130	2008	24	231	2263	975	1823	440

Sources: IEEFA; Acousmatics; PGE Management reports (2015-19).

Value From Alternative Uses

In contrast to lignite, our alternatives case study assumes significant upfront capital investment, putting it at an immediate, obvious disadvantage in cash terms. These upfront costs include the decommissioning and site remediation of these three generation units, and recultivation of their pro rata share of the lignite mine. In addition, we add the capital investments required to develop our alternatives: a large industrial warehouse (available area: 115 hectares), and solar farm (available area 1,354 ha, capacity 423MW). We assume all these cash outflows are complete, i.e. the sites remediated, and new assets constructed and operational and generating cash flows, by year five.

Given that in this case, the cash flows extend over three decades (our assumed lifespan for the solar farm and warehouse), the NPV result is extremely sensitive to discount rate. Applying a discount rate of 6% to reflect the long-dated, infrastructure nature of these cash flows, and their stable nature, we calculate a negative NPV through year 35 of around minus PLN 800 million. The result is much lower than our lignite generation case because we now include substantial capital expenditures. In addition, the delay in any positive cash flows until year five damages the NPV. Nevertheless, our alternatives case study generates positive EBITDA from the first year of operation, for three decades, while the lignite case is strictly time-limited because of the headwinds as discussed in this report. In addition, the decommissioning liabilities remain in the lignite case, only they have

²² We note that PGE's quoted provisions for the decommissioning cost of their conventional power plants (i.e. excluding wind farms), at around \$8k/MW, are barely 10% of many published estimates for such costs.

been kicked down the road. In other words, lignite only works on a short-term horizon, the horizon of distressed asset investors presently acquiring cheap coal assets in Europe. It does not work for a public-facing utility with long-term commitments to shareholders, creditors, employees, local communities and customers. For PGE, it is better to make the investment today that safeguards their future.

Fortunately for PGE, the solar and warehouse case will benefit from EU funds, principally, in this case the EU Modernisation Fund. The goal of this fund is to support the modernisation of energy systems and a just energy transition in 10 east European countries. Priority investments will be: “the generation and use of renewable electricity, energy efficiency improvements, energy storage, modernisation of energy networks, and just transition in carbon-dependent regions,” which would qualify for up to 100% of relevant costs and receive at least 70% of the total value of the fund. The fund will be supplied by auction revenues in the EU ETS, worth around €8 billion, assuming an average carbon price of €29 from 2021-2030. Poland will be assigned 43% of the value of the fund, far ahead of second-placed Czech Republic (16%), implying a value available to Poland of €3.4 billion (PLN 15 billion). As Poland's biggest electric utility, with a bigger weighting to coal and lignite than the national average, PGE could be the EU's biggest individual recipient of Modernisation Fund support.

In our case study, applying a 100% grant to fund solar capital expenditure, we find a positive NPV for our alternatives case of PLN 450 million. This is more than double the value of continued lignite generation, where the latter also incorporates assumed decommissioning costs (PLN 186 million, see above).

Fortunately for PGE, the solar and warehouse case will benefit from EU funds, principally, the EU Modernisation Fund.

We conclude that PGE must urgently use the EU Modernisation Fund to make the investments that will reposition it, out of lignite, into a more stable, higher growth, renewables future. The Modernisation Fund is only one among many growing sources for climate finance from multilateral development banks.²³

²³ EBRD, 2019. [MDBs pledge. To join forces to raise annual climate finance to \\$175 billion by 2025.](#) September 22, 2019.

Table 3: Assumptions and Results in Our Modelling of New Solar and Warehouse Rental at Bełchatów Units 2-4, 2020-54 (Sample Year 5)

Assumptions			Revenues			Costs			Profit	
Solar capacity factor	Solar installed capacity	Warehouse area	Solar power generation	Warehouse rent	Total revenues	Total operating costs	Solar installed cost	Warehouse build cost	Pro rata share of decommissioning costs	EBITDA
%	MW	Hectares	PLN mln	PLN mln	PLN mln	PLN mln/ year	PLN mln	PLN mln	PLN mln	PLN mln/yr
12%	423	115	157	187	336	30	1663	2959	1042	307

Sources: IEEFA; Acousmatics.

Conclusion

The coal mining sector has significant social importance in Poland. In 2016, the coal mining industry in Poland employed, in aggregate, 113,500 people, of whom 23,500 were employed in lignite mining and 90,000 in coal mining.²⁴

In this report, we have shown that renewables are exposed to fewer risks and have higher profitability than conventional generation. Utilities that made large investments on renewables have performed better. We do not review the jobs impact of transitioning to renewables, but investment in such alternatives will help replace current mining and other coal jobs over time.

We show that EU funds are available to help PGE transition to alternative economic uses for its fossil fuel sites. New, co-located employment, whether in industrial warehousing and data centres and the like, or low-carbon electricity generation, has a long-term future, unlike coal and lignite generation.

Subsidising lignite, instead, by investing billions of zloty in a new lignite mine would not receive EU support, thus burdening Poland's balance sheet. The Złoczew mine seems very unlikely to achieve profitable returns, as it is overtaken by global energy sector trends which create a stranded asset, would impoverish PGE, and make related employment vulnerable.

Finally, investment in renewables more widely can stabilise Polish wholesale power prices, which have risen on the back of a higher EU carbon price. Stabilising and lowering power prices would be to the benefit of investment in Poland more generally.

²⁴ Polish Energy Ministry, 2019. [National Energy and Climate Plan for the Years 2021-2030](#).

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The Institute for Energy Economics and Financial Analysis conducts research and analyses on financial and economic issues related to energy and the environment. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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