POLAND METS WEBINAR

30 May 2019
Opportunities for Australian METS companies to engage with the Polish Mining Industry

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OVERVIEW – POLAND & CENTRAL EUROPE AS A REGION

WHY CENTRAL EUROPE SHOULD MATTER TO AUSTRALIAN COMPANIES?

• CE is a A$2.6 trillion economy with a population in excess of 130 million people

• Strong growth over the last two decades and good forward trajectory

• Strong governance – fiscally conservative

• Strong flow of FDI and EU structural funds

• CE is well connected to the EU – market of 500 million people
OVERVIEW - POLAND

WHY POLAND?

• Fastest growing and 10th largest economy in Europe

• 6th largest population in Europe: 38 million

• Current GDP growth - 4.6%

• Over 25 consecutive years of economic growth

• Inflation - 1.8%

• Unemployment rate - 3.4%

• Poland is referred to as the economic “growth island” of Europe

• In 2018 Poland earned Developed Market status

• Highly skilled labour force
OVERVIEW

• Poland is the second largest coal producing country in Europe and ninth in the world

• The nation’s exploitable coal reserves are estimated at 191 billion tonnes.

• There are currently 18 operating mines in Poland and two Australian investors engaged in developing mining projects in Poland.

• The coal industry remains an important employer with nearly 85,000 people in 2018,

• The major commodities mined are: hard coal, lignite, copper, zinc, lead, silver and sulphur,

• In order to secure energy independency, the current government is introducing measures to sustain and boost the efficiency of the mining sector
OVERVIEW

• Major players on the Polish mining market:
  › JSW (coking coal)
  › PGG (thermal coal)
  › LW Bogdanka (thermal coal)
  › KGHM (copper)
  › Belchatow (lignite)

• Most Polish mining companies are state controlled

• The mining sector is supported by large mining equipment, technology and services industry and specialist education, research and development organisations.

• There is a steady flow of Australian METS companies visiting Poland and the region looking at new opportunities not only in coal but metal mining and mineral processing as well.
**Statistics 2018**

- **Hard coal** - total production: 63 million tonnes
  - 80,8% thermal coal
  - 19,2% coking coal
- Imports: 18 million tonnes
  - 70% from Russia
  - 30% from Columbia, USA and Australia combined
- Exports: 3,6 million tonnes
  - Main buyers: Czech Republic, Slovakia, Hungary, Austria and Germany
- **Lignite**: total production: 32 million tonnes – destined mainly for domestic energy production.
- **Copper**: total production: 657 thousand tonnes
  - Exports: 257 thousand tonnes (copper ore), 207 thousand tonnes (copper products)

Sources: ARP; Gazeta Prawna; Energetyka24
OPPORTUNITIES FOR AUSTRALIA

- Improving operational efficiency
- Mine planning and deposit assessment
- Coal-bed methane extraction, collection and utilization
- Introduction of roof bolting (strata control) expertise, technologies and equipment
- Mine safety including efficient, safe mining practices,
- Specialised underground communication systems
- Personnel management, including individual worker/staff tracking systems, work cycle management and payroll systems
- Environmental remediation of closed mine sites
Webinar
30.05.2019
Brisbane, MelbourneWarsaw, Jastrzębie-Zdrój
Agenda

• JSW Group overview
• JSW mining assets
• Coking coal production and CRM list
• Demand for Coking coal
• Research and Innovations
• Areas of focus in innovation and technology for JSW
• Polish-Australian cooperation in case of JSW
COKING COAL
STRATEGIC FOR
INNOVATIVE
INDUSTRY
JSW Group Overview

Located in the industrial heartland of Europe
- 4 existing coal mines in Poland
- 3 coking plants
- headquartered in Jastrzębie-Zdrój, Poland
- located 100% in OECD nations

Coking coal focused
- #1 independent, not integrated coking company in EU
- Holds 14% of the global coke trade market

Long mine life
- 30–40 years expected life of mines

Strong share price performance in FY 2017
- JSW share price up by 43.9%
- FTSE 350 mining Index up by 27.8%

Solid total resources and reserves
- Total resources of approx. 5.497 billion tonnes
- Reserves of 0.952 billion tonnes

<table>
<thead>
<tr>
<th>JSW Group Key Financials</th>
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</thead>
<tbody>
<tr>
<td>EURm</td>
</tr>
<tr>
<td>Revenue</td>
</tr>
<tr>
<td>EBITDA</td>
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<tr>
<td>EBITDA margin</td>
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<tr>
<td>Net Income</td>
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# JSW mining assets

## JSW Coal Mining

<table>
<thead>
<tr>
<th>Location</th>
<th>Resources (mt)</th>
<th>Reserves (mt)</th>
<th>Coal Type in Resources</th>
<th>Expected Life of Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budryk</td>
<td>996.6</td>
<td>222.3</td>
<td>63% HCC 37% Semi-soft</td>
<td>60 years</td>
</tr>
<tr>
<td>Pniówek</td>
<td>889.4</td>
<td>188.3</td>
<td>90% HCC 10% Semi-soft</td>
<td>34 years</td>
</tr>
<tr>
<td>Borynia-Zofiówka-Jastrzębie</td>
<td>1,869.5</td>
<td>219.2</td>
<td>79% HCC 1% Semi-soft 20% type 36-37</td>
<td>Zof.: 34 years Jas-Mos: 5 years</td>
</tr>
<tr>
<td>Knurów-Szczygłowice</td>
<td>1,741.8</td>
<td>323.0</td>
<td>36% HCC 60% Semi-soft 4% Thermal</td>
<td>Knurów: 54 years Szczyt: 60 years</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,497.3</strong></td>
<td><strong>952.8</strong></td>
<td></td>
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</tr>
</tbody>
</table>

- **Expected Life of Mine**:
  - Budryk: 60 years
  - Pniówek: 34 years
  - Borynia-Zofiówka-Jastrzębie: 34 years
  - Knurów-Szczygłowice: 54 years
  - Szczyt: 60 years
Key supplier of a strategic raw material to the Steel Industry
EU Coking Coal Production

75% of the EU’s domestic coking coal production is from JSW.

EU demand

The estimated EU’s import of coking coal in 2017 was 36mt.

Total number of jobs created in the EU:* 2.5 million

Value of production:* 123.5 billion EUR

*Source: Oxford Economics
Coking Coal

- *Coking coal* (*metallurgical coal*) is used to make coke, which is an indispensable ingredient in steel production. Currently 75% of steel is produced with coke in the blast furnace-basic oxygen furnace (BF-BOF).

- Characteristics:
  - low sulphur
  - low ash level
  - low phosphorous content

- Major producers & exporters: Australia, Canada, United States

- Securing reliable, sustainable and undistorted access to coking coal is essential to sustaining the EU’s economy, growth and jobs.
Coking coal production

Steel production process

- JSW is the largest producer of high quality coking coal and a major coke producer in the European Union (4 million tonnes annually)
- JSW aims to increase coal output to above 18 m tons and raise the percentage of produced coking coal to 85% of total production.
Coking coal production and revenues

Coking coal production (mt)
- 2013: 3.8
- 2014: 9.9
- 2015: 11.1
- 2016: 11.6
- 2017: 10.7

Steam coal production (mt)
- 2013: 13.6
- 2014: 13.9
- 2015: 5.2
- 2016: 5.2
- 2017: 4.1

Production (% Coking Coal)
- 2013: 9.8
- 2014: 9.9
- 2015: 11.1
- 2016: 11.6
- 2017: 10.7

Coking coal revenues (PLNm)
- 2013: 5,164
- 2014: 4,492
- 2015: 4,573
- 2016: 4,604
- 2017: 6,805

Coking coal revenue 85.8%

Steam coal revenue 14.2%
EU demand for coking coal

- JSW is the largest producer of high quality coking coal and a major merchant coke producer in the European Union (4 million tonnes annually)
- Raw steel production is rising at 5.3% globally and 4.1% in the EU on a yoy basis (in 2017)
- The global demand for steel was up 7% in 2017 while in the EU it rose 2.5% (according to the World Steel Association)
- The stable demand for coke will be driven by robust steel production in the EU
- JSW aims to increase coal output to above 18 m tons and raise the percentage of produced coking coal to 85% of total production.

EU Coking Coal import in 2017

- Canada 3 mt
- Russia 5 mt
- USA 11 mt
- Mozambique 1 mt
- Australia 14 mt

Total imports to the EU 36 mt

Others: 2 mt
Demand for coke in the EU steel production

- The conventional technology for steel production in a blast furnace process, i.e. using coke and thus coking coal is prevalent across the globe and in the EU.
- On average, 350 kg of blast furnace coke is used, and thereby 490 kg of coking coal, to produce 1 ton of pig iron in the EU.
- Steel mills in the EU consume approximately 37 mt of coke in the blast furnace process (blast furnaces + sintering), whose production consumes roughly 53 mt of coking coal per annum (excluding PCI).
- The European steel industry depends on coking coal. It accounts for nearly 2% of the European Union’s total production and employs almost 2.5 million people with the annual value of production over EUR 120 billion.
- In 2017 the European Union imported 38 million tonnes of coking coal, which is twice as much as the domestic production (17 million tonnes).
- In the upcoming years the European transformation towards a low-emission industry will drive up the demand for environmentally-friendly products, i.e. electric vehicles and windmills.
Research & Innovations
Establishment of R&D Centre

1962 - 1986
Development of several mines in JSW Group

1993
Merger of 7 independent mines into the JSW Group

2008
Construction and development of the Coal-Coke group

2011
IPO on Warsaw Stock Exchange (6 July 2011 r.)

2014
Acquisition of new mining asset: Knurów-Szczągłowice

2017
Establishment of R&D Centre (JSW Innovations)
JSW new ongoing Projects – coal segment

The Autonomus Longwall Project as the part of JSW 4.0 Smart Mine Program

The Rooof Bolting Technology Project

Cooperation with the leading mining equipment suppliers on the market

Cooperation with Polish and international research institutes
The most efficient technologies

Modern roof bolting system at Budryk Mine

Current schedule:
2019, April 1st half – reception in USA, Lebanon, Kentucky
2019, IVQ – pilot installation commissioning at Budryk Mine

• 30% cost
• 40-60% progress
• 30% total efficiency

The Autonomous Longwall System (ALS)

Current schedule:
2019 - 2020 – TechTeam work for final arrangements
2022, IQ – pilot installation commissioning at Szczyciowice Site

The most advanced technologies for supporting safety, logistics and monitoring.
JSW and Polish - Australian cooperation

In June 2017, the JSW Company was the host of the International Mining Forum, whose honorary patron was the Embassy of Australia. That initiated an active bond with the Australian Trade & Investment Commission and the Embassy. Thanks to these contacts, a number of joint meetings and events took place, the main purpose of which was to search for the possibility of using the best Australian solutions in the conditions of JSW S.A.
From December 2017, representatives of JSW visited several times mines in Australia as well as scientific and research institutes and technical universities as well as leading suppliers of mining equipment. The result of these visits is establishing contacts and planned cooperation among others with:

**CSIRO** - the largest Research Institute for Industry in the Commonwealth with a huge reputation

**Palaris** - a mining consulting company in the technical area recognized on the Australian market

**Australian Drilling Systems** – one of the leading Australian drilling companies that provides directional drilling solutions

**Sedgman** – an expert recognized on the Australian and global market in the field of design and consultancy of mineral processing

At the same time, the Company has started cooperation with software suppliers supporting the planning process and geological modeling: **Deswik** and **MineScape**. Both of these solutions were created in Australia.
Technical trips of JSW to Australia

Mining assets of New South Wales and Queensland that have been visited by JSW in 2018

- Kestrel Mine
- Narrabri Mine
- Moolarben Mine
- Wambo Mine
- Integra Mine
JSW - Australian on-going Projects

One of the ways of implementation of the main JSW business target known as Increase of Effectiveness is the technological support of the coal and coke production process. There are good examples of excellent cooperation between JSW and the Australian partners.

Project of MineScape ABB geological modeling, along with mine planning and design with Deswik, during implementation in JSW from 2018 May and June, one of the largest implementations in today's world's mining.

Brisbane workshop

JSW workshops
JSW and Polish - Australian cooperation

Letter of Intent JSW, JSW Innovations and CSIRO, Polish-Australian Conference, 2018 August, Sydney
Main challenges in JSW 4.0

**quality**
- Processes automation and computerisation in Laboratories
- Coal quality measurement automation and computerisation during the extraction and processing, integration of the obtained data with model predictions

**safety**
- Development of the wireless connection and localisation systems with proactive functions
- Underground mining safety improvement, underground work station monitoring, hazards information system

**data analysis**
- Advanced Data Analysis Centre and Predictive Mining Maintenance
- Integration of all production stages into one data model updated by the constant data inflow, creation of analytical and data-mining models
Use of by-products
JSW Climate Action Plan

Methane utilization strategy 2018 – 2030

Carbon credits savings [mln t]

- 2004 r.: 0.27 CO₂
- 2018 r.: 1.2 CO₂
- 2030 r.: 2.2 CO₂

Energy self-sufficiency

- Starting at 2022

Energy self-sufficiency in 3 years

90 GWh → 490 GWh

500%
Hydrogen separation

Coke plant → Hydrogen → Zero-emission urban transport

JSW coking coal mine
Hydrogen separation technology from the coking gas
**JSW hydrogen for e-mobility**

Hydrogen potential in JSW coking plants

- Coking gas contains approx. 55% of hydrogen
- JSW works on implementing hydrogen separation technology from the coking gas with high purity i.e. 99,999% \( \text{H}_2 \)
- Superintendent for fuel cells

The planned hydrogen separation installation at JSW coking plant Przyjaźń will allow the production of approx. 8,000 tons of hydrogen per annum, which will cover the annual demand for:

- More than 900 buses
- More than 4000 cars

75 tys. ton \( \text{H}_2 \) per annum
Tar processing

Production of high value added products from coal tars – by products of coke production ie. carbon fiber, graphite electrodes, and nanostructures

- Carbon nanostructures are used in automotive industry, chemistry and electronics, mainly thus their weight-strength ratio
- Compounds made from carbon fibers have the best potential for lightweight constructions
- Graphite electrodes contain about 1-3% of carbon nanostructures for lithium-ion batteries
- Carbon fibers will take about 45% of future composite applications
- Demand for carbon fibre is predicted to increase significantly from 77,000 tons in 2018 to 117,000 tons in 2022 (according to Fraunhofer Institut)
THANK YOU!
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