Global and Middle Eastern iron ore pellet market development through the prism of a global market leader in metals and minerals processing

Tobias Stefan
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Outotec – a process technology company

• Outotec provides leading technologies and services for the sustainable use of Earth’s natural resources.

• As the global leader in minerals and metals processing technology, we have developed many breakthrough technologies over the decades for our customers in mining and metals industries.

• We also provide innovative solutions for industrial water treatment, the utilization of alternative energy sources and the chemical industry.

• Outotec shares are listed on NASDAQ Helsinki.
Local operations, global presence

- 4,146 employees
- Deliveries to more than 80 countries
- Experts of over 60 nationalities
- Sales MEUR 1,139 in 2017
- R&D, sales and service centers in 36 countries
- Sales split:
  - Metals related solutions, 81%
  - Energy & environment solutions, 7%
  - Other materials, 12%

Wide supplier network with established long-term relationships
Outotec has a rich heritage in the sintering and pelletizing since the very beginning of this technology

- Sintering plants were built by Metallurgische Gesellschaft since 1910
- First Lurgi iron ore sintering plant delivered in 1928
- More than 60 pelletizing plants since 1970
- The world’s largest pellet furnace with 816 m² and a capacity of 9.25 mtpy, designed and delivered to Samarco, Brazil in 2013, Lately repeated in India.
Outotec’s Pelletizing References

>70 Mio t/a Capacity Contracted in the last 10 years (+50% OT Installed Base)

- 2008
  - Caofeidian, China: 4.0 mtpy
  - Tata, India: 6.0 mtpy

- 2009
  - BPSL, India: 3.85 mtpy

- 2010
  - S-Gok, Russia: 6.0 mtpy

- 2011
  - GolGohar II, Iran: 5.0 mtpy
  - Samarco 4, Brazil: 9.25 mtpy

- 2012
  - Gohar Zamin, Iran: 5.0 mtpy

- 2013
  - Baotou, China: 5.0 mtpy

- 2015
  - B-Misco, Iran: 5.0 mtpy
  - SAIL, India: 4.0 mtpy

- 2017/18
  - China: 8.6 mtpy
  - India: 8 mtpy

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Supported by tighter environmental regulation, China prefers higher quality iron ore – strong business driver for pelletizing

Why this happened:
1) Reduce air pollution: higher grade requires less coking coal
2) Government-mandated rationalization of the steel industry -> capacity closures -> remaining steel mills making more money

Positive impact on pelletizing: more pellets will be needed (apart from environmental reasons, using pellets there is better recovery, lower energy consumption, improved furnace operations)

Source: SNL, HSBC
Tighter environmental regulations and sintering cuts will support the pellet demand likely satisfied through new plants

- Pellet premium remains supportive for investments
- Change in operating practice (for improved emissions, more hot metal per ton burden) in Indian and Chinese Blast Furnaces: they increase from max 20% pellets of the charge
- Sintering cuts in China opens the pellet market to new opportunities: In China polluting sintering plants are expected to be closed and replaced by pelletizing plants.
- Domestic steel production increase envisaged in Iran, India

**Pellet consumption outlook**

**Pellet cost curve**

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**Source:** CRU, JSW Steel, Internal analysis

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**IRAN**

20 Mtpa steel growth = ca 30-35 Mtpa more pellets needed

**INDIA**

+10% points of pellet use in BF = ca 8-10 Mtpa more pellets needed

**CHINA**

+10% point of pellet use = ca 80-120Mtpa more pellets needed

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25.04.2018

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Source: CRU, JSW Steel, Internal analysis
In addition to new investments into pelletizing plants, modernizations of assets is a must for many producers.

**Focus of modernizations**

- Environmental upgrades
- Capacity increase
- Raw material changes
- Mechanical upgrades
Operational Challenges for existing and future pellet plants

- Stability of operation
  - Stable operation beyond 100% capacity
  - Maintaining/Improving product quality

- Cost savings and increase of operational efficiency
  - Energy savings
  - Optimization of maintenance

- Flexibility
  - Capacity: Inbuilt extra capacity, fast ramp up
  - Raw material: frequent changes in recipe, and feed material

- Go into the details
  - Calculation
  - Measurement
  - Automation
Outotec’s Praetium plant optimizer is supporting operators in consistent plant operation. In a zinc roasting plant throughput and emissions were optimized significantly.

Increased throughput based on best average performance by 2.3 t/h (+ 5.8 %)
SO2 Emissions reduced by 25% based on yearly average.
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**Timeline**

**Best Manual Operation - October 2017**

- MLO OFF
- Average 55.6 t/h

**Optimizer OFF**

**Praetium Roaster Optimizer – January 2018**

- MLO ON
- Average 57.9 t/h

**Optimizer ON**

**Time Period**

- January 2017 & January 2018
- SO2 Emissions: 237 ppm

Both: www.autobild.de
Environmental challenges

• Emissions
  • China:
    - New emission directive put into effect starting from Oct 2017: Dust 20mg/m3, SO2 is 50mg/m3 and NOx is 100mg/m3.
  • USA:
    - NOx reduction by 70%
  • EU:
    - IED directive mandated (<10mg dust)

• Water scarcity
  • Trend to dry grinding, dry comminution (HPGR circuits)
    - Impact on raw material quality

• Tailings!

Source: www.industrialboiler.com
Source: NewSteel S.A.
Source: Maschinenfabrik Köppern GmbH
Outotec has been successfully developing solutions to counter emission restriction in coming years. Latest example: Low NOx burner technology.

- Standard burners: NOx: 650 ..1200 mg/Nm³
- Outotec Low NOx burner: 10…100 mg/Nm³
- Outotec Low NOx burner with only slightly increased opex

Target is to balance OPEX increase through De-NOx technology (fuel penalty) with achievable emission reduction.
Outlook

• Pellet capacity will be faster growing than other iron ore products, however boundary conditions are becoming increasingly challenging.

• Fight for high quality input between DR-Grade and BF pellets – most new plants are built captive and coking coal price remains high.

• Automation – Digital/ Autonomous Plants will become the norm.

• Tight environmental control – License to operate is critical for plants.
For more information: tobias.stefan@outotec.com or contact us right here during the conference.
Outotec’s unique approach to improve plant performance –Combining tests and research with industrial experience

Our comprehensive range of research and test services support you for the entire plant lifecycle.

• Metallurgical testing of feed materials
• Flowsheet development,
• Experimental research and fluid dynamics, including modeling and simulation.

Industrial experience from different phases of the plant life cycle:

• Erection
• Commissioning
• Operation
• Modernizations