Vale: a Long term Supplier of DR Pellets to the Market

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1. Vale: Operations and Integrated Supply Chain
2. Market Overview: a strong demand for high grade products
3. Vale: a Global Leader in pellet production
4. R&D at Vale: how Vale is positioned to support technically its clients
5. Vale Oman Pelletizing Plant: Consolidating a successful trajectory since 2011
6. Final Remarks
1

Vale – Integrated Supply Chain
The complexity of its integrated supply chain makes Vale an unique and truly global iron ore supplier.

4 integrated iron ore production systems in Brazil (mine – railway – port)

22 operating mines - total production of 366.5 Mt in 2017

13 pelletizing plants in 4 complexes

5 railways and waterway connecting mines to ports

4 Ports for iron ore loading in Brazil

2 Ports for blending and distribution in Malaysia and Oman

12 Ports for blending and distribution in China
Summary of Vale's iron ore operational performance in its integrated systems

**Northern System**
- Reserves (Bi t): 6.8
- Grade (% Fe): 65.7
- 2016 production (Mt): 148.1
- 2017 production (Mt): 148.1

**Southern and Southeastern Systems**
- Reserves (Bi t): 5.6, 6.0
- Grade (% Fe): 46.9, 46.0
- 2016 production (Mt): 95.7, 102.7
- 2017 production (Mt): 86.4, 108.5

**Western System**
- Reserves (Bi t): -
- Grade (% Fe): -
- 2016 production (Mt): 2.3
- 2017 production (Mt): 2.4

**Other Data**
- 2016 production (Mt): 348.8
- 2017 production (Mt): 366.5
Vale’s Distribution Centers have flexibility to deliver BRBF to fulfill demand from customers in a timely manner.

- **Oman**
  - Pellets: 9 Mty
  - DC Installed capacity: 20 Mtpy
  - Targets the Middle East

- **Malaysia**
  - Installed capacity: 30 Mtpy
  - Delivery to Asia ranging from 1 to 10 days

- **China (Dalian)**
  - Vale is using blending facilities in 12 ports in China to deliver BRBF

**Brazilian blend fines → better stability!**
Update on S11D – A landmark in Vale’s history

- Commissioned. As planned, the ramp-up will be a progressive and responsible production increase campaign reaching full capacity at 90 Mtpy.
- 2017, year to now: milestones accomplished as planned, from mine to port.

- High-Grade hematite ore type
  ~ 66% Fe content
- Premium product: less coking coal consumption on steel mills
- Truckless operation, generating less CO2 emissions
- Dry processing

First commercial IOCJ consignment with S11D shipped onto a seagoing vessel on the 13th January, 2017
Vale achieved annual records in iron ore, pellets, Salobo, gold and coal

Production highlights 2017

<table>
<thead>
<tr>
<th></th>
<th>Fe</th>
<th>Pellets</th>
<th>Ni</th>
<th>Cu</th>
<th>Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="icon" alt="Award" /></td>
<td><img src="icon" alt="Award" /></td>
<td><img src="icon" alt="Award" /></td>
<td><img src="icon" alt="Award" /></td>
<td><img src="icon" alt="Award" /></td>
</tr>
<tr>
<td>Total:</td>
<td>366.5 Mt</td>
<td>50.3 Mt</td>
<td>288.2 kt</td>
<td>438.5 kt</td>
<td>11.3 Mt</td>
</tr>
<tr>
<td>N. System:</td>
<td>169.2 Mt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VNC:</td>
<td></td>
<td></td>
<td>40.3 kt</td>
<td></td>
<td>193.4 kt</td>
</tr>
<tr>
<td>Onça Puma:</td>
<td></td>
<td></td>
<td></td>
<td>24.7 kt</td>
<td></td>
</tr>
</tbody>
</table>
Market Overview:

strong demand for high grade products
High grade iron ore continue in high demand

Healthy demand for high grade fines…

Iron ore spread:
65% Fe and 58% Fe vs. 62% Fe, USD/dmt

Pellet inventory at Chinese ports, Mt

And low Pellets stock…

Source: Metal Bulletin, Mystee, WSA
BF Pellet to Increase Productivity

Mills increased the volume of BF Pellets in the burden instead of lump. Good demand, tougher environmental controls and good steel price led to the increase in productivity.

Breakdown of blast furnace burden, %

Pellet Share in Chinese burden increased

Rebar price continues at a healthy level

Steel price in China and IODEX, USD/ton

Source: Platts, Mysteel
Lower steel imports into MENA and higher steel price are beneficial for local steel production

Chinese steel mills sell domestically to enjoy higher margins. The result is higher price worldwide and lower competition of cheap Chinese steel.

Steel imports into MENA, Mt

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>YoY %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>34.9</td>
<td>27.6</td>
<td>-21%</td>
</tr>
<tr>
<td>China</td>
<td>13.1</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>CIS</td>
<td>11.8</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td>EU28</td>
<td>7.3</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>2.7</td>
<td>4.8</td>
<td></td>
</tr>
</tbody>
</table>

HRC prices, USD/t

Source: ISSB, Bloomberg
DRI production in 2017 was 9% higher YoY and this trend will continue as projects kick-in

New projects in Algeria and in Sohar will also require DRP:

2 projects of 2.5Mty DRI each, an additional 7.45 Mty of DRP
And new projects being announced

Source: WSA, DRI production for the countries as reported by WSA
Vale: a Global Leader in Pellet Production
Vale - A Global Leader in pellet production
13 pellet plants and 5 types of pellets in our portfolio

64.2 Mt/year of Licensed Capacity

¹ Excluding:
JV Samarco (30.5 Mty);
JV Annyang & Zhuhai (2.4 Mty)
Increasing demand for DR Pellets has been supported by Vale

- **Restart of Tubarao I and II** idle for 5 years, located in the southeast of Brazil, in the Tubarão complex.
- Additional volume of **3.8 Mty of high grade DRP**.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Start-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant #1</td>
<td>Apr 2018</td>
</tr>
<tr>
<td>Plant #2</td>
<td>Running since Jan 2018</td>
</tr>
</tbody>
</table>

**Total Investment over 100 MUSD**

Source: Vale
Re-start of Sao Luis Pellet Plant – Using Vale operational flexibility to produce more DRP in Tubarao

- **Re-start** of Sao Luis Pellet Plant *idle for 5 years*, located in the north of Brazil in Maranhão State
- Production capacity of 7.0 Mty of BF pellets
- São Luis’s main **advantages**:
  - BF pellet with **high reducibility**
  - **Flexibility** of combining cargoes with IOCJ
  - Designed to **consume the existing tailings** of Carajas dams
  - Expected production in **2018: 2.5Mt**
  - **Will free up pellet plants in Tubarão to produce more DRP** *(free up capacity)*

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**Sao Luis Pellet - Specification**

<table>
<thead>
<tr>
<th>Pellet</th>
<th>Fe</th>
<th>S iO2 + Al2O3</th>
<th>P</th>
<th>B2</th>
<th>%-5mm</th>
<th>CCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF70</td>
<td>64,10</td>
<td>4,80</td>
<td>0,050</td>
<td>0,9</td>
<td>3,0</td>
<td>240</td>
</tr>
<tr>
<td>AF73</td>
<td>64,80</td>
<td>4,80</td>
<td>0,050</td>
<td>0,5</td>
<td>3,0</td>
<td>220</td>
</tr>
</tbody>
</table>

Source: Vale
A Strong Partner to DR Market

Consistency and reliability: Vale expect to reach accumulated 300 million tons of DRP production by the end of 2018.

Vale’s pellets annual and accumulated production

~300 M tons

High quality of Pellets saves in Energy Consumption, Electrodes and productivity.

Source: Vale
... and the partnership has become stronger

Vale has supported the continued growth of DR market

Vale Pellet’s Sales Mix

Vale’s DRP Sales per region

Source: Vale
R&D at Vale
Ferrous Technology Center - a simulation center

Infrastructure

CTF – Infrastructure

- Sintering and Pelletizing Pilot Plants / Lab. of Metrology
- Samples Storage
- Chemical Laboratory
- Coal and Coke Laboratory
- Sewage Treatment Station
- Metallurgical Laboratory
- High Temperature Properties Laboratory
- Gas Distribution Center
- Health Center
- Ore Treatment Laboratory
- Samples Preparation Laboratory
- Materials Characterization Laboratory
Strategy to develop burden solutions – Technical Cooperation Agreement

Vale, through the coordination of Iron Ore & Coal Marketing Department and its Ferrous Technology Center is involved in knowledge construction with its customers, generating gains for both parties.

A TCA contract usually registers the purpose, the general view of the activities, and confidentiality clauses protecting both parties.

**Topics Covered in TCAs**

**TYPICAL TOPICS WHICH MAY BE DEALT WITH IN THIS KIND OF COOPERATION AGREEMENT:**

- Optimization of raw materials blend considering ore, pellets and coals properties.
- Forecast the performance of the ironmaking and refining stages, considering the impact on the quality of the raw-materials.
- Analysis of the behavior of the ores, pellets and coals in the steelmaking chain, verifying the adjustment on the quality of these products generate gain opportunities.
- Other possibilities which may arise from the opportunities identified between the parties.
Practical examples and support to clients – TCA Studies on DR Route

Coating efficiency evaluation based on perform a semi-automatic analysis of pellets

Application of briquetting and cold agglomeration for recovery of pellet oxide fines and DRI fines
Vale Oman - Consolidating a successful trajectory since 2011
Usage of Iron Ore Carajas (IOCJ) in Oman - Why do use it?

**IOCJ – Main attributes**

- Premium sinter feed (Fe > 65% with low impurities)
- Very soft material with excellent grinding properties
- It has been used with success in our Iron mix in Oman at 20%

**Main benefits**

- Blaine index showed an increase of 22-25%.
- Finer blaine has resulted in improved balling strength with higher performance and lesser fines generation..
- Lower pellet chips generation up to 15%.
- Bentonite consumption dropped drastically by around 15%.
- Reduction of chips, reduces the silica in pellets and increases the pellet production as recycling is reduced.
Since its start-up, Vale Oman has produced over 50 Mt of pellets to fulfill the growing demand in the region, delivering high premium quality.

### Typical Figures of Quality

<table>
<thead>
<tr>
<th></th>
<th>RM80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe</td>
<td>67.75%</td>
</tr>
<tr>
<td>SiO2 + Al2O3</td>
<td>2%</td>
</tr>
<tr>
<td>P</td>
<td>0.030%</td>
</tr>
<tr>
<td>Moisture</td>
<td>2.0%</td>
</tr>
<tr>
<td>-5,0mm</td>
<td>0.5%</td>
</tr>
<tr>
<td>-0,5mm</td>
<td>3.5%</td>
</tr>
<tr>
<td>CCS</td>
<td>300 daN/p</td>
</tr>
<tr>
<td>Metal.</td>
<td>94.0%</td>
</tr>
</tbody>
</table>

In addition to consistent quality:

- Safe sourcing
- Just-in-time
6

Final Remarks
The move towards a more efficient steel industry, should support the demand for high-quality ores that enable productivity and lower emission levels, like pellets and IOCJ.

Vale is aware of this trend and has invested to expand iron ore and pellet production, adjusting its product portfolio according to the customer’s needs.

With the decision to bring back Tubarao plants I and II and Sao Luis Pellet Plant, Vale evidences its commitment with the future of the DR market.

Vale Oman Pelletizing plant is a reliable supplier, delivering consistent quality and volumes as expected.
Shukran – Thank you!