

Vale S.A.
Form 20-F
April 11, 2017

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As filed with the Securities and Exchange Commission on April 10, 2017

UNITED STATES SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

Form 20-F

**ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d)
OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended: December 31, 2016
Commission file number: 001-15030

VALE S.A.

(Exact name of Registrant as specified in its charter)

Federative Republic of Brazil

(Jurisdiction of incorporation or organization)

Luciano Siani Pires, Chief Financial Officer
phone: +55 21 3814 8888
fax: +55 21 3814 8820

Avenida das Américas, 700 Bloco 8 Loja 318
22640-100 Rio de Janeiro, RJ, Brazil
(Address of principal executive offices)

Securities registered or to be registered pursuant to Section 12(b) of the Act:

Title of Each Class

Preferred class A shares of Vale, no par value per share
American Depositary Shares (evidenced by American Depositary Receipts), each representing one preferred class A share of Vale
Common shares of Vale, no par value per share

American Depositary Shares (evidenced by American Depositary Receipts), each representing one common share of Vale
5.625% Guaranteed Notes due 2019, issued by Vale Overseas
4.625% Guaranteed Notes due 2020, issued by Vale Overseas

**Name of Each Exchange on
Which Registered**

New York Stock Exchange*
New York
Stock Exchange
New York
Stock
Exchange*
New York
Stock Exchange
New York
Stock Exchange
New York
Stock Exchange

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5.875% Guaranteed Notes due 2021, issued by Vale Overseas	New York Stock Exchange
4.375% Guaranteed Notes due 2022, issued by Vale Overseas	New York Stock Exchange
6.250% Guaranteed Notes due 2026, issued by Vale Overseas	New York Stock Exchange
8.250% Guaranteed Notes due 2034, issued by Vale Overseas	New York Stock Exchange
6.875% Guaranteed Notes due 2036, issued by Vale Overseas	New York Stock Exchange
6.875% Guaranteed Notes due 2039, issued by Vale Overseas	New York Stock Exchange
5.625% Notes due 2042, issued by Vale S.A.	New York Stock Exchange

*

Shares are not listed for trading, but only in connection with the registration of American Depositary Shares pursuant to the requirements of the New York Stock Exchange.

Securities registered or to be registered pursuant to Section 12(g) of the Act: None
Securities for which there is a reporting obligation pursuant to Section 15(d) of the Act: None
The number of outstanding shares of each class of stock of Vale as of December 31, 2016 was:

3,185,653,000 common shares, no par value per share
1,967,721,914 preferred class A shares, no par value per share
12 golden shares, no par value per share

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act.

Yes No

If this report is an annual or transition report, indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934.

Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports) and (2) has been subject to such filing requirements for the past 90 days.

Yes No

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate website, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files).

Yes No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, or a non-accelerated filer. See definition of "accelerated filer" and "large accelerated filer" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer Accelerated filer Non-accelerated filer

Indicate by check mark which basis of accounting the registrant has used to prepare the financial statements included in this filing:

U.S. GAAP International Financial Reporting Standards as issued by the International Accounting Standards Board Other

If "Other" has been checked in response to the previous question, indicate by check mark which financial statement item the registrant has elected to follow.

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If this is an annual report, indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act).

Yes No

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FORWARD-LOOKING STATEMENTS

This annual report contains statements that may constitute forward-looking statements within the meaning of the safe harbor provisions of the U.S. Private Securities Litigation Reform Act of 1995. Many of those forward-looking statements can be identified by the use of forward-looking words such as "anticipate," "believe," "could," "expect," "should," "plan," "intend," "estimate" and "potential," among others. Those statements appear in a number of places and include statements regarding our intent, belief or current expectations with respect to:

- our direction and future operation;
- the implementation of our principal operating strategies, including our potential participation in acquisition, divestiture or joint venture transactions or other investment opportunities;
- the implementation of our financing strategy and capital expenditure plans;
- the exploration of mineral reserves and development of mining facilities;
- the depletion and exhaustion of mines and mineral reserves;
- trends in commodity prices, supply and demand for commodities;
- the future impact of competition and regulation;
- the payment of dividends or interest on shareholders' equity;
- compliance with financial covenants;
- industry trends, including the direction of prices and expected levels of supply and demand;
- the outcome of the various regulatory, governmental and legal proceedings in which we are involved;
- other factors or trends affecting our financial condition or results of operations; and
- the factors discussed under *Risk factors*.

We caution you that forward-looking statements are not guarantees of future performance and involve risks and uncertainties. Actual results may differ materially from those in forward-looking statements as a result of various factors. These risks and uncertainties include factors relating to (a) economic, political and social issues in the countries in which we operate, (b) the global economy, (c) commodity prices, (d) financial and capital markets, (e) the mining and metals businesses, which are cyclical in nature, and their dependence upon global industrial production, which is also cyclical, (f) regulation and taxation, (g) operational incidents or accidents, and (h) the high degree of global competition in the markets in which we operate. For additional information on factors that could cause our actual results to differ from expectations reflected in forward-looking statements, see *Risk factors*. Forward-looking statements speak only as of the date they are made, and we do not undertake any obligation to update them in light of new information or future developments. All forward-looking statements attributed

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to us or a person acting on our behalf are expressly qualified in their entirety by this cautionary statement, and you should not place undue reliance on any forward-looking statement.

Vale S.A. is a stock corporation, or sociedade por ações, that was organized on January 11, 1943 under the laws of the Federative Republic of Brazil for an unlimited period of time. Its head office is located at Avenida das Américas, 700 - bloco 8 - loja 318 - Barra da Tijuca, Rio de Janeiro, RJ, Brazil, and its telephone number is 55-21-3485-5000.

In this report, references to "Vale" are to Vale S.A. References to "we," "us" or the "Company" are to Vale and, except where the context otherwise requires, its consolidated subsidiaries. References to our "preferred shares" are to our preferred class A shares. References to our "ADSs" or "American Depositary Shares" include both our common American Depositary Shares (our "common ADSs"), each of which represents one common share of Vale, and our preferred class A American Depositary Shares (our "preferred ADSs"), each of which represents one class A preferred share of Vale. American Depositary Shares are represented by American Depositary Receipts ("ADRs") issued by the depositary.

Unless otherwise specified, we use metric units.

References to "real," "reais" or "R\$" are to the official currency of Brazil, the real (singular) or reais (plural). References to "U.S. dollars" or "US\$" are to United States dollars. References to "A\$" are to Australian dollars. References to "€" are to Euros.

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RISK FACTORS

External risks

Our business is exposed to the cyclicity of global economic activity and requires significant investments of capital.

As a mining company, we are a supplier of industrial raw materials. Industrial production tends to be the most cyclical and volatile component of global economic activity, which affects demand for minerals and metals. At the same time, investment in mining requires a substantial amount of funds in order to replenish reserves, expand and maintain production capacity, build infrastructure, preserve the environment and minimize social impacts. Sensitivity to industrial production, together with the need for significant long-term capital investments, are important sources of risk for our financial performance and growth prospects.

Adverse economic developments in China could have a negative impact on our revenues, cash flow and profitability.

China has been the main driver of global demand for minerals and metals over the last few years. In 2016, Chinese demand represented 72% of global demand for seaborne iron ore, 52% of global demand for nickel and 48% of global demand for copper. The percentage of our net operating revenues attributable to sales to customers in China was 46.4% in 2016. Therefore, any contraction of China's economic growth could result in lower demand for our products, leading to lower revenues, cash flow and profitability. Poor performance in the Chinese real estate sector, the largest consumer of carbon steel in China, would also negatively impact our results.

Our business may be adversely affected by declines in demand for and prices of the products our customers produce.

Demand for our iron ore, coal and nickel products depends on global demand for steel. Iron ore and iron ore pellets, which together accounted for 71.5% of our 2016 net operating revenues, are used to produce carbon steel. Nickel, which accounted for 11.1% of our 2016 net operating revenues, is used mainly to produce stainless and alloy steels. Demand for steel depends heavily on global economic conditions, but it also depends on a variety of regional and sectorial factors. The prices of different steels and the performance of the global steel industry are highly cyclical and volatile, and these business cycles in the steel industry affect demand and prices for our products. In addition, vertical backward integration of the steel and stainless steel industries and the use of scrap could reduce the global seaborne trade of iron ore and primary nickel. The demand for copper is affected by the demand for copper wire, and a sustained decline in the construction industry could have a negative impact on our copper business.

The prices we charge, including prices for iron ore, nickel, copper and coal, are subject to volatility.

Global prices for metals are subject to significant fluctuations and are affected by many factors, including actual and expected global macroeconomic and political conditions, levels of supply and demand, the availability and cost of substitutes, inventory levels, technological developments, regulatory and international trade matters, investments by commodity funds and others and actions of participants in the commodity markets. Sustained low market prices for the products we sell may result in the suspension of certain of our projects and operations, decrease in our mineral reserves, impairment of assets, and may adversely affect our cash flows, financial position and results of operations.

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We are mostly affected by movements in iron ore prices. For example, a price reduction of US\$1 per dry metric ton unit ("dmt") in the average iron ore price would have reduced our operating income for the year ended December 31, 2016 by approximately US\$325 million. Average iron ore prices significantly changed in the last four years, from US\$135 per dmt in 2013 to US\$97 per dmt in 2014, US\$55.5 per dmt in 2015 and US\$58.5 per dmt in 2016, according to the average Platts IODEX (62% Fe CFR China). On February 28, 2017 the year to date average Platts IODEX iron ore price was US\$84.8 per dmt. In addition to reduced demand for iron ore, an excess in supply has adversely affected our prices since 2014 and supply may grow with the expected conclusion of certain iron ore projects in coming years.

World nickel prices were adversely affected by lower demand in the first half of 2016, but benefited from increased demand, especially from the Chinese stainless steel sector, in the second half of 2016. Nickel refining in China, primarily using imported nickel ores and related raw materials, increased significantly between 2006 and 2015, with Chinese nickel pig iron production representing 19% of global nickel output. Since 2014, Chinese nickel pig iron production has been adversely affected by export restrictions in feed-producing countries, but the revocation or relaxation of export restrictions in feed producing countries, such as Indonesia, may benefit the production of nickel pig iron in China, which may in turn adversely affect global nickel prices. In January 2017, the Indonesian government issued a ministerial decree allowing for the controlled recommencement of nickel ore exports from Indonesia. For additional information about the average realized prices for the products we sell, see *Operating and financial review and prospects Overview Major factors affecting prices*.

We may not be able to adjust production volume in a timely or cost-efficient manner in response to changes in demand.

Lower utilization of capacity during periods of weak demand may expose us to higher unit production costs since a significant portion of our cost structure is fixed in the short-term due to the high capital intensity of mining operations. In addition, efforts to reduce costs during periods of weak demand could be limited by labor regulations or previous labor or government agreements.

Conversely, during periods of high demand, our ability to rapidly increase production capacity is limited, which could prevent us from meeting demand for our products. Moreover, we may be unable to complete expansions and greenfield projects in time to take advantage of rising demand for iron ore, nickel or other products. When demand exceeds our production capacity, we may meet excess customer demand by purchasing iron ore, iron ore pellets or nickel from joint ventures or unrelated parties and reselling it, which would increase our costs and narrow our operating margins. If we are unable to satisfy excess customer demand in this way, we may lose customers. In addition, operating close to full capacity may expose us to higher costs, including demurrage fees due to capacity restraints in our logistics systems.

Changes in exchange rates for the currencies in which we conduct operations could adversely affect our financial condition and results of operations.

A substantial portion of our revenues and our debt is denominated in U.S. dollars, and given that our functional currency is the Brazilian *real*, changes in exchange rates may result in (i) losses or gains on our net U.S. dollar-denominated indebtedness and accounts receivable and (ii) fair value losses or gains on currency derivatives we use to stabilize our cash flow in U.S. dollars. In 2016, we had foreign exchange gains of US\$3.3 billion, while in 2015 and 2014 we had foreign exchange losses of US\$7.0 billion and US\$2.1 billion, respectively. In addition, changing values of the Brazilian *real*, the Canadian dollar, the Australian dollar, the Indonesian rupiah and other currencies against the U.S. dollar affects our results since most of our costs of goods sold is denominated in currencies other than the U.S. dollar, principally the *real* (55% in 2016) and the Canadian dollar (12% in 2016), while our revenues are mostly U.S. dollar-denominated. We expect currency fluctuations to continue to affect our financial income, expense and cash flow generation.

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Significant volatility in currency prices may also result in disruption of foreign exchange markets, which could limit our ability to transfer or to convert certain currencies into U.S. dollars and other currencies for the purpose of making timely payments of interest and principal on our indebtedness. The central banks and governments of the countries in which we operate may institute restrictive exchange rate policies in the future and impose taxes on foreign exchange transactions.

Financial risks

Lower cash flows, resulting from decreased prices of our products, have adversely affected our credit ratings and the cost and availability of financing.

Lower prices of our products may adversely affect our future cash flows, credit ratings and our ability to secure financing at attractive rates. It may also negatively affect our ability to fund our capital investments, pay dividends and comply with the financial covenants in some of our long-term debt instruments.

Also, certain Canadian provinces where we operate require us to provide financial assurances, such as letters of credit, surety bonds or cash collateral, to cover certain closure and remediation costs after we conclude our operations. We may be required to increase the amount of these financial assurances if our credit ratings are downgraded below certain levels. If we are unable to provide these financial assurances, we would need to have discussions with the relevant jurisdictions about other options and ultimately it could affect our ability to operate in these jurisdictions.

We may not be able to implement our strategy with respect to divestments and strategic partnerships.

In the past few years, we have entered into agreements to dispose of assets and to make strategic partnerships, in order to optimize our business portfolio and implement our financing strategy and capital expenditure plans. We may continue to seek opportunities for divestments and strategic partnerships in the future. We are exposed to a number of risks in connection with these transactions, including imposition of regulatory conditions, inability to satisfy conditions for completion or for receipt of additional payments, and negative market reactions. If we are unable to complete our dispositions or strategic partnerships, particularly the sale of our fertilizer business or our partnership in our coal assets in Mozambique, we may have to revise our business and financing strategy and incur additional costs, which could in turn adversely affect our results of operations, financial conditions or reputation.

Risks relating to legal proceedings and Samarco dam failure

We are involved in legal proceedings that could have a material adverse effect on our business in the event of unfavorable outcomes.

We are involved in legal proceedings in which adverse parties have claimed substantial amounts, including several legal proceedings and investigations relating to the failure of Samarco's Fundão tailings dam. Although we are vigorously contesting them, the outcomes of these proceedings are uncertain and may result in obligations that could materially adversely affect our business and the value of the securities issued by Vale and its subsidiaries. For additional information, see *Additional information Legal proceedings*.

Our obligations and potential liabilities arising from the failure of a tailings dam owned by Samarco Mineração S.A. ("Samarco") in Minas Gerais could negatively impact our business, our financial conditions and our reputation.

In November 2015, the Fundão tailings dam owned by Samarco failed, causing environmental damage in the surrounding area. The failure of Samarco's tailings dam has adversely affected and will continue to affect our business, but the full impact is still uncertain and cannot be estimated. Below is a discussion of the main effects of the dam failure on our business.

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- *Legal proceedings.* We are involved in multiple legal proceedings and investigations relating to the failure of the Fundão tailings dam, and other proceedings and investigations may arise in the future. These proceedings include purported securities class actions in the United States against us and some of our officers, a criminal proceeding in Brazil, public civil actions brought by Brazilian authorities and multiple proceedings involving claims for significant amounts of damages and remediation measures. Adverse results in these proceedings may adversely impact our liquidity and our financial condition. See *Additional information* *Legal proceedings*.
- *Reparation obligations and other undertakings.* In March 2016, Samarco and its shareholders, Vale and BHP Billiton Brasil Ltda. ("BHPB"), a Brazilian subsidiary of BHP Billiton plc, entered into a framework agreement (the "Framework Agreement") with certain governmental authorities, pursuant to which Samarco, Vale and BHPB agreed to create a foundation to develop and implement long-term remediation and compensation programs. Also, in January 2017, Samarco, Vale and BHPB entered into preliminary agreements with the federal prosecution office (the "MPF") providing for, among other things, the appointment of experts selected by the MPF to review and monitor the remediation programs provided under the Framework Agreement, the provision of collateral to secure certain remediation obligations, and a timetable for negotiation of a final agreement. See *Business overview* *Failure of Samarco's tailings dam in Minas Gerais*. As Samarco is currently unable to resume its activities, we and BHPB have been funding the foundation and also providing funds directly to Samarco, to preserve its operations and to support certain remediation measures undertaken by Samarco. If Samarco is unable to resume operations or to generate sufficient cash flows to fund the remediation measures required under these agreements, we will be required to continue funding these remediation measures, which in turn may adversely affect our financial conditions and results of operations.
- *Risk of additional environmental damages.* Samarco continues to reinforce and improve its dams to contain the remaining tailings. Failure to contain the remaining tailings could cause additional environmental damages, additional impacts on our operations, and additional claims, fines and proceedings against Samarco and against us. Failure to contain the remaining tailings could also impact the feasibility and timing for the restart of Samarco's operations.
- *Other impacts.* We may encounter delays in the receipt of environmental operating license for other tailings dams, and Brazilian authorities may impose more stringent conditions in connection with the licensing process of our projects and operations. Also, as one of Samarco's shareholders, our reputation has been adversely affected by the failure of Samarco's tailings dam.

Political, economic, social and regulatory risks

Political, economic and social conditions in the countries in which we have operations or projects could adversely impact our business.

Our financial performance may be negatively affected by regulatory, political, economic and social conditions in countries in which we have significant operations or projects. In many of these jurisdictions, we are exposed to various risks such as political instability, bribery, extortion, corruption, robbery, sabotage, kidnapping, civil strife, acts of war, guerilla activities, piracy in international shipping routes and terrorism. These issues may adversely affect the economic and other conditions under which we operate in ways that could have a materially negative effect on our business. As an example, sections of our Carajás railroad (EFC) in the Brazilian state of Pará and other railways worldwide are subject to interruptions that can harm our operations and adversely affect our business.

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Political and economic instability in Brazil could adversely impact our business and the market price of our securities.

The Brazilian federal government's economic policies may have important effects on Brazilian companies, including us, and on market conditions and prices of securities of Brazilian companies. Our financial condition and results of operations may be adversely affected by the following factors and the Brazilian federal government's response to these factors:

- exchange rate movements and volatility;
- inflation and high interest rates;
- financing of the current account deficit;
- liquidity of domestic capital and lending markets;
- tax policy;
- political instability resulting from allegations of corruption involving political parties, elected officials or other public officials; and
- other political, diplomatic, social and economic developments in or affecting Brazil.

Historically, the country's political situation has influenced the performance of the Brazilian economy, and political crises have affected the confidence of investors and the general public, which resulted in economic deceleration and heightened volatility in the securities issued abroad by Brazilian companies. In August 2016, the Brazilian Congress approved the impeachment of the Brazilian president. Also, ongoing corruption investigations have led to charges against public officials, members of several political parties and directors and officers of many Brazilian companies. Political instability may aggravate economic uncertainties in Brazil and increase volatility of securities of Brazilian issuers.

In 2015 and 2016, Brazil faced an economic recession, adverse fiscal developments and political instability, which may continue in 2017. Brazilian GDP declined by 3.6% in 2016 and by 3.85% in 2015, while unemployment increased to 11.5% in 2016 from 6.9% in 2015. Inflation, as reported by the consumer price index (IPCA), was 6.29% in 2016, 10.67% in 2015 and 6.41% in 2014. The Brazilian Central Bank's base interest rate (SELIC) was 13.75% on December 31, 2016, 14.25% on December 31, 2015 and 11.75% on December 31, 2014. Future economic, social and political developments in Brazil may impair our business, financial condition or results of operations, or cause the market value of our securities to decline.

Disagreements with local communities in which we operate could adversely impact our business and reputation.

Disputes with communities where we operate may arise from time to time. In some instances, our operations and mineral reserves are located on or near lands owned or used by indigenous people or other groups of stakeholders. Some of our mining and other operations are located in territories where title may be subject to disputes or uncertainties, or in areas claimed for agriculture or land reform purposes, which may lead to disagreements with landowners, organized social movements, local communities and the government. We may be required to consult and negotiate with these groups as part of the process to obtain licenses required to operate, to mitigate impact on our operations or to obtain access to their lands.

Disagreements or disputes with local groups, including indigenous groups, organized social movements and local communities, could cause delays or interruptions to our operations, adversely affect our reputation or otherwise hamper our ability to develop our reserves and conduct our operations. Protesters have taken actions to disrupt our operations and projects, and they may continue to do so in the future, which may harm our operations and could adversely affect our business.

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We could be adversely affected by changes in government policies or by trends such as resource nationalism, including the imposition of new taxes or royalties on mining activities.

Mining is subject to government regulation, including taxes and royalties, which can have a significant financial impact on our operations. In the countries where we are present, we are subject to potential renegotiation, nullification or forced modification of existing contracts and licenses, expropriation or nationalization of property, foreign exchange controls, changes in local laws and regulations and policies. We are also subject to new taxes or raising of existing taxes and royalty rates, reduction of tax exemptions and benefits, renegotiation of tax stabilization agreements or changes on the basis on which taxes are calculated in a manner that is unfavorable to us. Governments that have committed to provide a stable taxation or regulatory environment may alter those commitments or shorten their duration. We also face the risk of having to submit to the jurisdiction of a foreign court or arbitration panel or having to enforce a judgment against a sovereign nation within its own territory.

We are also required to meet domestic beneficiation requirements in certain countries, such as local processing rules, export taxes or restrictions or charges on unprocessed ores. The imposition of or increase in such requirements, taxes or charges can significantly increase the risk profile and costs of operations in those jurisdictions. We and the mining industry are subject to rising trends of resource nationalism in certain countries in which we operate that can result in constraints on our operations, increased taxation or even expropriations and nationalizations.

Concessions, authorizations, licenses and permits are subject to expiration, limitation on renewal and various other risks and uncertainties.

Our operations depend on authorizations and concessions from governmental regulatory agencies in the countries in which we operate. We are subject to laws and regulations in many jurisdictions that can change at any time, and changes in laws and regulations may require modifications to our technologies and operations and result in unanticipated capital expenditures.

Some of our mining concessions are subject to fixed expiration dates and might only be renewed a limited number of times for a limited period of time. Apart from mining concessions, we may need to obtain various authorizations, licenses and permits from governmental or other regulatory bodies in connection with the planning, maintenance, operation and closure of our mines and related logistics infrastructure, which may be subject to fixed expiration dates or periodic review or renewal. There is no assurance that renewals will be granted as and when sought, and there is no assurance that new conditions will not be imposed in connection with renewal. Fees for mining concessions might increase substantially due to the passage of time from the original issuance of each individual exploration license. If so, the costs of holding or renewing our mining concessions may render our business objectives not viable. Accordingly, we need to continually assess the mineral potential of each mining concession, particularly at the time of renewal, to determine if the costs of maintaining the concession are justified by the results of operations to date, and we might elect to let some of our concessions lapse. There can be no assurance that concessions will be obtained on terms favorable to us, or at all, for our future intended mining or exploration targets.

In a number of jurisdictions where we have exploration projects, we may be required to retrocede to the state a certain portion of the area covered by the exploration license as a condition to renewing the license or obtaining a mining concession. This requirement can lead to a substantial loss of part of the mineral deposit originally identified in our feasibility studies. For more information on mining concessions and other similar rights, see *Information on the Company Regulatory matters*.

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Operational risks

Our projects are subject to risks that may result in increased costs or delay in their implementation

We are investing to maintain and further increase our production capacity and logistics capabilities. We regularly review the economic viability of our projects. As a result of this review, we may decide to postpone, suspend or interrupt the implementation of certain projects. Our projects are also subject to a number of risks that may adversely affect our growth prospects and profitability, including the following:

- We may not be able to obtain financing at attractive rates.
- We may encounter delays or higher than expected costs in obtaining the necessary equipment or services and in implementing new technologies to build and operate a project.
- Our efforts to develop projects on schedule may be hampered by a lack of infrastructure, including reliable telecommunications services and power supply.
- Suppliers and contractors may fail to meet their contractual obligations to us.
- We may face unexpected weather conditions or other force majeure events.
- We may fail to obtain or renew the required permits and licenses to build a project, or we may experience delays or higher than expected costs in obtaining or renewing them.
- Changes in market conditions or regulations may make a project less profitable than expected at the time we initiated work on it.
- There may be accidents or incidents during project implementation.
- We may face shortages of skilled personnel.

Operational problems could materially and adversely affect our business and financial performance.

Ineffective project management and operational breakdowns might require us to suspend or curtail operations, which could generally reduce our productivity. Operational breakdowns could entail failure of critical plant and machinery. There can be no assurance that ineffective project management or other operational problems will not occur. Any damages to our projects or delays in our operations caused by ineffective project management or operational breakdowns could materially and adversely affect our business and results of operations. Our business is subject to a number of operational risks that may adversely affect our results of operations, such as:

- Unexpected weather conditions or other force majeure events.
- Adverse mining conditions delaying or hampering our ability to produce the expected quantity of minerals and to meet specifications required by customers, which can trigger price adjustments.
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Accidents or incidents involving our mines, industrial facilities and related infrastructure, such as dams, plants, railway and railway bridges, ports and ships.

- Delays or interruptions in the transportation of our products, including with railroads, ports and ships.
- Tropical diseases, HIV/AIDS and other contagious diseases in regions where some of our operations or projects are located, which pose health and safety risks to our employees.
- Labor disputes that may disrupt our operations from time to time.

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- Changes in market conditions or regulations may affect the economic prospects of an operation and make it inconsistent with our business strategy.
- Failure to obtain the renewal of required permits and licenses, or delays or higher than expected costs in obtaining them.
- Disruptions to or unavailability of critical information technology systems or services resulting from accidents or malicious acts.

Our business could be adversely affected by the failure of our counterparties to perform their obligations.

Customers, suppliers, contractors, financial institutions, joint venture partners and other counterparties may fail to perform existing contracts and obligations, which may unfavorably impact our operations and financial results. The ability of suppliers and customers to perform their obligations may be adversely affected in times of financial stress and economic downturn.

We currently operate important parts of our iron ore, pelletizing, nickel, coal, copper, fertilizers, bauxite and steel businesses through joint ventures. Important parts of our electricity investments and projects are operated through consortia or joint ventures. Our forecasts and plans for these joint ventures and consortia assume that our partners will observe their obligations to make capital contributions, purchase products and, in some cases, provide skilled and competent managerial personnel. If any of our partners fails to observe its commitments, the affected joint venture or consortium may not be able to operate in accordance with its business plans, or we may have to increase the level of our investment to implement these plans.

Some of our investments are controlled by partners or have separate and independent management. These investments may not fully comply with our standards, controls and procedures, including our health, safety, environment and community standards. Failure by any of our partners or joint ventures to adopt adequate standards, controls and procedures could lead to higher costs, reduced production or environmental, health and safety incidents or accidents, which could adversely affect our results and reputation.

We may not have adequate insurance coverage for some business risks.

Our businesses are generally subject to a number of risks and hazards, which could result in damage to, or destruction of, properties, facilities and equipment. The insurance we maintain against risks that are typical in our business may not provide adequate coverage. Insurance against some risks (including liabilities for environmental pollution or certain hazards or interruption of certain business activities) may not be available at a reasonable cost, or at all. Even when it is available, we may self-insure where we determine that is more cost-effective to do so. As a result, accidents or other negative developments involving our mining, production or transportation facilities could have a material adverse effect on our operations.

Labor disputes may disrupt our operations from time to time.

A substantial number of our employees, and some of the employees of our subcontractors, are represented by labor unions and are covered by collective bargaining or other labor agreements, which are subject to periodic negotiation. Strikes and other labor disruptions at any of our operations could adversely affect the operation of facilities and the timing of completion and cost of our capital projects. For more information about labor relations, see *Management and employees Employees*. Moreover, we could be adversely affected by labor disruptions involving unrelated parties that may provide us with goods or services.

Higher energy costs or energy shortages would adversely affect our business.

Costs of fuel oil, gas and electricity are a significant component of our cost of production, representing 10.9% of our total cost of goods sold in 2016. To fulfill our energy needs, we depend on the following sources: oil byproducts, which represented 36% of total energy needs in 2016, electricity (32%), natural gas (15%), coal (15%) and other energy sources (2%).

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Electricity costs represented 3.9% of our total cost of goods sold in 2016. If we are unable to secure reliable access to electricity at acceptable prices, we may be forced to curtail production or may experience higher production costs, either of which would adversely affect our results of operations. We face the risk of energy shortages in the countries where we have operations and projects, especially Brazil, due to lack of infrastructure or weather conditions, such as floods or droughts. Future shortages, and government efforts to respond to or prevent shortages, may adversely impact the cost or supply of electricity for our operations.

Failures in our information technology systems or difficulties in integrating new enterprise resource planning software may interfere with the normal functioning of our business.

We rely on information technology ("IT") systems for the operation of many of our business processes. Failures in our IT systems, whether caused by accident or malicious acts, may result in the disclosure or theft of sensible information, misappropriation of funds and disruptions to our business operations.

Health, safety and environmental risks

Our business is subject to environmental, health and safety incidents.

Our operations involve the use, handling, storage, discharge and disposal of hazardous substances into the environment and the use of natural resources, and the mining industry is generally subject to significant risks and hazards, including fire, explosion, toxic gas leaks, spilling of polluting substances or other hazardous materials, rockfalls, incidents involving dams, failure of other operational structures and incidents involving mobile equipment, vehicles or machinery. This could occur by accident or by breach of operating and maintenance standards, and could result in a significant environmental and social impacts, damage to or destruction of mineral properties or production facilities, personal injury, illness or death of employees, contractors or community members close to operations, environmental damage, delays in production, monetary losses and possible legal liability. Additionally, in remote localities, our employees may be exposed to tropical and contagious diseases that may affect their health and safety. Notwithstanding our standards, policies and controls, our operations remain subject to incidents or accidents that could adversely affect our business, stakeholders or reputation.

Our business may be adversely affected by environmental and health and safety regulation, including regulations pertaining to climate change.

Nearly all aspects of our activities, products, services and projects around the world are subject to environmental regulations and health and safety regulations, which may expose us to increased liability or increased costs. These regulations require us to have environmental licenses, permits and authorizations for our operations and projects, and to conduct environmental and social impact assessments in order to get approval for our projects and permission for initiating construction. Significant changes to existing operations are also subject to these requirements. Difficulties in obtaining or renewing permits may lead to construction delays, cost increases, and may adversely impact our production volumes. Environmental and health and safety regulations also impose standards and controls on activities relating to mineral research, mining, pelletizing activities, railway and marine services, ports, decommissioning, refining, distribution and marketing of our products. Such regulation may give rise to significant costs and liabilities. Litigation relating to these or other matters may adversely affect our financial condition or cause harm to our reputation.

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Environmental and health and safety regulation in many countries in which we operate has become stricter in recent years, and it is possible that more regulation or more aggressive enforcement of existing regulations will adversely affect us by imposing restrictions on our activities and products, creating new requirements for the issuance or renewal of environmental licenses, raising our costs or requiring us to engage in expensive reclamation efforts. For example, changes in Brazilian legislation for the protection of caves have required us to conduct extensive technical studies and to negotiate compensatory measures with Brazilian environmental regulators in order to continue to operate in certain sites. It is possible that in certain of our iron ore mining operations or projects, we may be required to limit or modify our mining plans or to incur additional costs to preserve caves or to compensate for the impact on them, with potential consequences for production volumes, costs or reserves in our iron ore business. For more information about Brazilian environmental regulations related to caves, see *Information on the Company Regulatory matters Environmental regulations*.

In response to the failure of Samarco's tailings dam in Minas Gerais, additional environmental and health and safety laws and regulations may be forthcoming in Brazil and authorities may impose more stringent conditions in connection with the licensing process of our projects and operations. Also, we may encounter delays in the receipt of environmental operating license for other tailings dams.

National policies and international regulations regarding climate change may affect a number of our businesses in various countries. The ratification of the Paris Agreement in 2016 increased international pressure for the establishment of a global carbon price, and on companies to adopt carbon pricing strategies. The pricing of greenhouse gas emissions may impact our operational costs, mainly through higher price for fossil fuels as mining is an energy intensive industry. Consumption of coal, one of the products we sell, in particular, is facing pressure from international institutions due to its carbon intensity.

Regulatory initiatives at the national and international levels that affect our shipping practices could increase our costs or require us to make new capital expenditures.

Natural disasters may cause severe damage to our operations and projects in the countries where we operate and may have a negative impact on our sales to countries affected by such disasters.

Natural disasters, such as wind storms, droughts, floods, earthquakes and tsunamis may adversely affect our operations and projects in the countries where we operate, and may cause a contraction in sales to countries adversely affected due to, among other factors, power outages and the destruction of industrial facilities and infrastructure. The physical impact of climate change on our business remains uncertain, but we are likely to experience changes in rainfall patterns, increased temperatures, water shortages, rising sea levels, increased storm frequency and intensity as a result of climate change, which may adversely affect our operations. On some occasions in recent years, we have determined that *force majeure* events have occurred due to effect of severe weather on our mining and logistics activities.

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Risks relating to our mining reserves

Our reserve estimates may materially differ from mineral quantities that we are actually able to recover; our estimates of mine life may prove inaccurate; and market price fluctuations and changes in operating and capital costs may render certain ore reserves uneconomical to mine.

Our reported reserves are estimated quantities of ore and minerals that we have determined can be economically mined and processed under present and assumed future conditions. There are numerous uncertainties inherent in estimating quantities of reserves and in projecting potential future rates of mineral production, including factors beyond our control. Reserve reporting involves estimating deposits of minerals that cannot be measured in an exact manner, and the accuracy of any reserve estimate is a function of the quality of available data, engineering and geological interpretation and judgment. As a result, no assurance can be given that the indicated amount of ore will be recovered or that it will be recovered at the rates we anticipate. Reserve estimates and estimates of mine life may require revisions based on actual production experience, projects, updated exploration drilling data and other factors. For example, lower market prices of minerals and metals, reduced recovery rates or increased operating and capital costs due to inflation, exchange rates, changes in regulatory requirements or other factors may render proven and probable reserves uneconomic to exploit and may ultimately result in a reduction of reserves. Such a reduction could affect depreciation and amortization rates and have an adverse effect on our financial performance.

We may not be able to replenish our reserves, which could adversely affect our mining prospects.

We engage in mineral exploration, which is highly uncertain in nature, involves many risks and frequently is non-productive. Our exploration programs, which involve significant expenditures, may fail to result in the expansion or replacement of reserves depleted by current production. If we do not develop new reserves, we will not be able to sustain our current level of production beyond the remaining lives of our existing mines.

The feasibility of new mineral projects may change over time.

Once mineral deposits are discovered, it can take a number of years from the initial phases of drilling until production is possible, during which the economic feasibility of production may change. Substantial time and expenditures are required to:

- establish mineral reserves through drilling;
- determine appropriate mining and metallurgical processes for optimizing the recovery of metal contained in ore;
- obtain environmental and other licenses;
- construct mining, processing facilities and infrastructure required for greenfield properties; and
- obtain the ore or extract the minerals from the ore.

If a project proves not to be economically feasible by the time we are able to exploit it, we may incur substantial losses and be obliged to take write-downs. In addition, potential changes or complications involving metallurgical and other technological processes arising during the life of a project may result in delays and cost overruns that may render the project not economically feasible.

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We face rising extraction costs or investment requirements over time as reserves deplete.

Reserves are gradually depleted in the ordinary course of a given open pit or underground mining operation. As mining progresses, distances to the primary crusher and to waste deposits become longer, pits become steeper, mines may move from being open pit to underground, and underground operations become deeper. In addition, for some types of reserves, mineralization grade decreases and hardness increases at greater depths. As a result, over time, we usually experience rising unit extraction costs with respect to each mine, or we may need to make additional investments, including adaptation or construction of processing plants and expansion or construction of tailings dams. Several of our mines have been operating for long periods, and we will likely experience rising extraction costs per unit in the future at these operations in particular.

Risks relating to our corporate structure

Our controlling shareholder has significant influence over Vale and the Brazilian Government has certain veto rights.

As of March 31, 2017, Valepar S.A. ("Valepar") owned 53.9% of our outstanding common stock and 33.7% of our total outstanding capital. As a result of its share ownership, Valepar can elect the majority of our board of directors and control the outcome of some actions that require shareholder approval. The shareholders of Valepar are party to a shareholders' agreement that governs Valepar's actions in its capacity as a shareholder of Vale. The existing shareholders' agreement will expire on May 9, 2017, and certain Valepar shareholders have entered into a new shareholders' agreement that will become effective on May 10, 2017, for a period of six months or until the merger of Valepar into Vale. The new shareholders' agreement contemplates a proposal to change our governance structure and the execution of a shareholders' agreement at the Vale level, binding with respect to 20% of our common shares, which will continue to give significant influence to these shareholders. For a description of our ownership structure and of the shareholders' agreements, see *Share ownership and trading Major shareholders*.

The Brazilian government owns 12 golden shares of Vale, granting it limited veto power over certain company actions, such as changes to our name, the location of our headquarters and our corporate purpose as it relates to mining activities. For a detailed description of the Brazilian government's veto powers, see *Additional information Memorandum and articles of association Common shares and preferred shares*.

The implementation of a change in our capital structure and governance, and any potential benefits, are subject to uncertainty and may not lead to the benefits that we expect.

Pursuant to the new shareholder's agreement of Valepar, which will become effective on May 10, 2017, Valepar is expected to submit a proposal to simplify our shareholding structure and corporate governance, with the purpose of eventually enabling Vale to be listed on BM&FBOVESPA's *Novo Mercado* special segment and making Vale a company without defined control. For a description of our ownership structure and the proposed changes to the Valepar shareholders' agreements pursuant to the Proposal, see *Share ownership and trading Major shareholders*.

The implementation of the proposal to simplify our shareholding structure is subject to, among other requirements, (i) the approval of the proposal, including the merger of Valepar into Vale, by our shareholders and the executive officers and board of directors of Vale and Valepar, and (ii) the acceptance by at least 54.09% of class A preferred shares of the voluntary conversion into common shares, within 45 days from the shareholders' meeting decision on the matter. We cannot predict how long it will take to implement all the necessary steps or whether they will be successfully implemented at all. Finally, we cannot predict whether or when we will migrate to the *Novo Mercado* segment of the BM&FBOVESPA, as the listing is subject to conversion of all of our preferred shares into common shares.

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The uncertainty in the timing and effective implementation may delay or limit our ability to achieve certain benefits that might derive from the simplified corporate ownership structure and eventual migration to the *Novo Mercado*, such as increased liquidity for shareholders. We cannot guarantee that these benefits will be fully realized, and any failure to achieve those benefits may affect the value of our shares and ADSs.

Our governance and compliance processes may fail to prevent regulatory penalties and reputational harm.

We operate in a global environment, and our activities extend over multiple jurisdictions and complex regulatory frameworks with increased enforcement activities worldwide. Our governance and compliance processes, which include the review of internal control over financial reporting, may not prevent future breaches of legal, accounting or governance standards. We may be subject to breaches of our Code of Ethics and Conduct, anti-corruption policies and business conduct protocols and to instances of fraudulent behavior, corrupt practices and dishonesty by our employees, contractors or other agents. Our failure to comply with applicable laws and other standards could subject us to fines, loss of operating licenses and reputational harm.

It could be difficult for investors to enforce any judgment obtained outside Brazil against us or any of our associates.

Our investors may be located in jurisdictions outside Brazil and could seek to bring actions against us or our directors or officers in the courts of their home jurisdictions. We are a Brazilian company, and the majority of our officers and directors are residents of Brazil. The vast majority of our assets and the assets of our officers and directors are likely to be located in jurisdictions other than the home jurisdictions of our foreign investors. It might not be possible for investors outside Brazil to effect service of process within their home jurisdictions on us or on our officers or directors who reside outside their home jurisdictions. In addition, a final conclusive foreign judgment will be enforceable in the courts of Brazil without a re-examination of the merits only if previously confirmed by the Brazilian Superior Court of Justice (STJ *Superior Tribunal de Justiça*), and confirmation will only be granted if the foreign judgment: (a) fulfills all formalities required for its enforceability under the laws of the country where it was issued; (b) was issued by a competent court after due service of process on the defendant, as required under applicable law; (c) is not subject to appeal; (d) does not conflict with a final and unappealable decision issued by a Brazilian court; (e) was authenticated by a Brazilian consulate in the country in which it was issued or is duly apostilled in accordance with the Convention for Abolishing the Requirement of Legalization for Foreign Public Documents and is accompanied by a sworn translation into Portuguese, unless this procedure was exempted by an international treaty entered into by Brazil; (f) it does not cover matters subject to the exclusive jurisdiction of the Brazilian courts; and (g) is not contrary to Brazilian national sovereignty, public policy or good morals. Therefore, investors might not be able to recover against us or our directors and officers on judgments of the courts of their home jurisdictions predicated upon the laws of such jurisdictions.

Risks relating to our depositary shares

If ADR holders exchange ADSs for the underlying shares, they risk losing the ability to remit foreign currency abroad.

The custodian for the shares underlying our ADSs maintains a registration with the Central Bank of Brazil entitling it to remit U.S. dollars outside Brazil for payments of dividends and other distributions relating to the shares underlying our ADSs or upon the disposition of the underlying shares. If an ADR holder exchanges its ADSs for the underlying shares, it will be entitled to rely on the custodian's registration for only five business days from the date of exchange. Thereafter, an ADR holder may not be able to obtain and remit foreign currency abroad upon the disposition of, or distributions relating to, the underlying shares unless it obtains its own registration under applicable regulation, which permits qualifying institutional foreign investors to buy and sell securities on the BM&FBOVESPA. For more information regarding these exchange controls, see *Additional information Exchange controls and other limitations affecting security holders*. If an ADR holder attempts to obtain its own registration, it may incur expenses or suffer delays in the application process, which could delay the receipt of dividends or other distributions relating to the underlying shares or the return of capital in a timely manner.

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The custodian's registration or any registration obtained could be affected by future legislative changes, and additional restrictions applicable to ADR holders, the disposition of the underlying shares or the repatriation of the proceeds from disposition could be imposed in the future.

ADR holders may be unable to exercise preemptive rights relating to the shares underlying their ADSs.

The ability of ADR holders to exercise preemptive rights is not assured, particularly if the applicable law in the holder's jurisdiction (for example, the Securities Act in the United States) requires that either a registration statement be effective or an exemption from registration be available with respect to those rights, as is in the case in the United States. We are not obligated to extend the offer of preemptive rights to holders of ADRs, to file a registration statement in the United States, or to make any other similar filing in any other jurisdiction, relating to preemptive rights or to undertake steps that may be needed to make exemptions from registration available, and we cannot assure holders that we will file any registration statement or take such steps.

ADR holders may encounter difficulties in the exercise of voting rights.

ADR holders do not have the rights of shareholders. They have only the contractual rights set forth for their benefit under the deposit agreements. ADR holders are not permitted to attend shareholders' meetings, and they may only vote by providing instructions to the depository. In practice, the ability of a holder of ADRs to instruct the depository as to voting will depend on the timing and procedures for providing instructions to the depository either directly or through the holder's custodian and clearing system. With respect to ADSs for which instructions are not received, the depository may, subject to certain limitations, grant a proxy to a person designated by us.

The legal protections for holders of our securities differ from one jurisdiction to another and may be inconsistent, unfamiliar or less effective than investors anticipate.

We are a global company with securities traded in several different markets and investors located in many different countries. The legal regime for the protection of investors varies around the world, sometimes in important ways, and investors in our securities should recognize that the protections and remedies available to them may be different from those to which they are accustomed in their home markets. We are subject to securities legislation in several countries, which have different rules, supervision and enforcement practices. The only corporate law applicable to our parent company is the law of Brazil, with its specific substantive rules and judicial procedures. We are subject to corporate governance rules in several jurisdictions where our securities are listed, but as a foreign private issuer, we are not required to follow many of the corporate governance rules that apply to U.S. domestic issuers with securities listed on the New York Stock Exchange, and we are not subject to the U.S. proxy rules.

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The tables below present selected consolidated financial information as of and for the periods indicated. You should read this information together with our consolidated financial statements in this annual report. The comparative information for 2012 to 2015 has been re-presented to report our fertilizers segment as discontinued operations.

Consolidated statement of income data

	For the year ended December 31,				
	2012	2013	2014	2015	2016
	(US\$ million)				
Net operating revenues	42,983	43,953	35,124	23,384	27,488
Cost of goods sold and services rendered	(22,407)	(21,668)	(22,790)	(18,751)	(17,650)
Selling, general, administrative and other operating expenses, net	(1,954)	(1,101)	(2,059)	(819)	(774)
Research and evaluation expenses	(1,356)	(748)	(662)	(395)	(319)
Pre-operating and operational stoppage	(3,495)	(2,375)	(975)	(942)	(453)
Impairment of non-current assets and onerous contracts	(4,023)	(182)	(99)	(8,769)	(1,174)
Results on measurement or sales of non-current assets	(377)	(215)	(167)	61	(66)
Operating income (loss)	9,371	17,664	8,372	(6,231)	7,052
Non-operating income (expenses):					
Financial income (expenses), net	(3,976)	(8,314)	(6,018)	(10,654)	1,843
Equity results in associates and joint ventures	645	469	501	(445)	309
Impairment and other results in associates and joint ventures	(1,941)	14	(61)	(349)	(1,220)
Net income (loss) before income taxes	4,099	9,833	2,794	(17,679)	7,984
Income taxes	(32)	(6,889)	(1,603)	5,249	(2,781)
Net income (loss) from continuing operations	4,067	2,944	1,191	(12,430)	5,203
Loss attributable to non-controlling interests	(311)	(191)	(308)	(501)	(8)
Net income (loss) from continuing operations attributable to Vale's stockholders	4,378	3,135	1,499	(11,929)	5,211
Net income (loss) from discontinued operations attributable to Vale's stockholders	1,076	(2,551)	(842)	(200)	(1,229)
Net income (loss) attributable to Vale's stockholders	5,454	584	657	(12,129)	3,982
Loss attributable to non-controlling interests	(257)	(178)	(304)	(491)	(6)
Net income (loss)	5,197	406	353	(12,620)	3,976
Total cash paid to stockholders ⁽¹⁾	6,000	4,500	4,200	1,500	250

(1) Consists of total cash paid to stockholders during the period, whether classified as dividends or interest on stockholders' equity.

Earnings (loss) per share

	For the year ended December 31,				
	2012	2013	2014	2015	2016
	(US\$, except as noted)				
Earnings (loss) per share from continuing operations:					
Per common share	0.86	0.61	0.29	(2.31)	1.01
Per preferred share	0.86	0.61	0.29	(2.31)	1.01

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Earnings (loss) per share from discontinued operations:					
Per common share	0.20	(0.50)	(0.16)	(0.04)	(0.24)
Per preferred share	0.20	(0.50)	(0.16)	(0.04)	(0.24)
Earnings (loss) per share:					
Per common share	1.06	0.11	0.13	(2.35)	0.77
Per preferred share	1.06	0.11	0.13	(2.35)	0.77
Weighted average number of shares outstanding (in thousands)(1):					
Common shares	3,172,179	1,185,653	1,185,653	1,185,653	1,185,653
Preferred shares	1,933,491	1,967,722	1,967,722	1,967,722	1,967,722
Total	5,105,670	3,153,375	3,153,375	3,153,375	3,153,375

Distributions to stockholders per share(2):					
Expressed in US\$	1.17	0.87	0.81	0.29	0.05
Expressed in R\$	2.26	1.81	1.89	0.98	0.17

(1) Each common ADS represents one common share and each preferred ADS represents one preferred share.

(2) Our distributions to shareholders may be classified as either dividends or interest on shareholders' equity. In many years, part of each distribution has been classified as interest on shareholders' equity and part has been classified as dividends. For information about distributions paid to shareholders, see *Share ownership and trading Distributions*.

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	As of December 31,				
	2012	2013	2014	2015	2016
	(US\$ million)				
Current assets	22,069	20,611	16,594	11,429	13,978
Non-current assets held for sale	457	3,766	3,640	4,044	8,589
Property, plant and equipment, net and intangible assets	94,093	88,536	84,942	59,426	62,290
Investments in associated companies and joint ventures	6,384	3,584	4,133	2,940	3,696
Non-current assets	7,574	8,100	7,180	10,653	10,461
Total assets	130,577	124,597	116,489	88,492	99,014
Current liabilities	12,402	9,164	10,626	10,438	10,142
Liabilities associated with non-current assets held for sale	169	448	111	107	1,090
Long-term liabilities(1)	16,380	22,379	22,043	15,896	19,096
Long-term debt(2)	26,799	27,670	27,388	26,347	27,662
Total liabilities	55,750	59,661	60,168	52,788	57,990
Stockholders' equity:					
Capital stock	60,578	60,578	61,614	61,614	61,614
Additional paid-in capital	(552)	(552)	(601)	(854)	(851)
Retained earnings and revenue reserves	13,213	3,299	(5,891)	(27,171)	(21,721)
Total Vale shareholders' equity	73,239	63,325	55,122	33,589	39,042
Non-controlling interests	1,588	1,611	1,199	2,115	1,982
Total stockholders' equity	74,827	64,936	56,321	35,704	41,024
Total liabilities and stockholders' equity	130,577	124,597	116,489	88,492	99,014

(1) Excludes long-term debt.

(2) Excludes current portion of long-term debt.

Table of Contents**I. INFORMATION ON THE COMPANY****BUSINESS OVERVIEW****Summary**

We are one of the largest metals and mining companies in the world, based on market capitalization. We are the world's largest producer of iron ore and iron ore pellets and the world's largest producer of nickel. We also produce manganese ore, ferroalloys, metallurgical and thermal coal, copper, platinum group metals (PGMs), gold, silver and cobalt. We are engaged in greenfield mineral exploration in six countries around the globe. We operate large logistics systems in Brazil and other regions of the world, including railroads, maritime terminals and ports, which are integrated with our mining operations. In addition, we have a portfolio of maritime freight assets, floating transfer stations and distribution centers to support the delivery of iron ore worldwide. Directly and through affiliates and joint ventures, we also have investments in energy and steel businesses.

The following table presents the breakdown of total net operating revenues attributable to each of our lines of business of continuing operations.

	Year ended December 31,					
	2014		2015		2016	
	US\$ million	% of total	US\$ million	% of total	US\$ million	% of total
Ferrous minerals:						
Iron ore	19,301	55.0%	12,330	52.7%	15,784	57.4%
Pellets	5,263	15.0	3,600	15.4	3,827	13.9
Ferroalloys and manganese	392	1.1	162	0.7	302	1.1
Other ferrous products and services	741	2.1	470	2.0	438	1.6
Subtotal	25,697	73.2	16,562	70.8	20,351	74.0
Coal	739	2.1	526	2.3	839	3.1
Base metals: Nickel and other products(1)	6,241	17.8	4,693	20.1	4,472	16.3
Copper(2)	1,451	4.1	1,470	6.3	1,667	6.0
Subtotal	7,692	21.9	6,163	26.4	6,139	22.3
Other(3)	996	2.8	133	0.5	159	0.6
Total net operating revenues from continuing operations	35,124	100.0%	23,384	100.0%	27,488	100.0%

(1) Includes nickel coproducts (copper) and byproducts (precious metals, cobalt and others).

(2) Does not include copper produced in our nickel operations.

(3) Includes energy.

Ferrous minerals:

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Iron ore and iron ore pellets. We operate four systems in Brazil for producing and distributing iron ore, which we refer to as the Northern, Southeastern, Southern and Midwestern Systems. The Northern and the Southeastern Systems are fully integrated, consisting of mines, railroads, maritime terminals and a port. The Southern System consists of three mining complexes and two maritime terminals. We also have iron ore pellet operations in several locations, some of which are conducted through joint ventures. We operate 11 pellet plants in Brazil and two in Oman. The operations of three of our

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pellet plants in Brazil have been suspended since 2012 in response to market conditions, and their capacity was partially replaced by Tubarão VIII, a more efficient plant. In response to market conditions, we plan to re-start operations at one of our pellet plants in 2018. We also have a 50% stake in Samarco and 25% stakes in two pellet companies in China.

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- *Ferrous alloys and manganese.* We conduct our manganese mining operations through Vale S.A. and subsidiaries in Brazil, and we produce several types of manganese ferrous alloys through a wholly-owned subsidiary in Brazil.

Base metals:

- *Nickel.* Our principal nickel mines and processing operations are conducted by our wholly-owned subsidiary Vale Canada Limited ("Vale Canada"), which has operations in Canada, Indonesia and New Caledonia. We also have nickel operations in Onça Puma, in the Brazilian state of Pará. We also own and operate, or have interests in, nickel refining facilities in the United Kingdom, Japan, Taiwan, China and South Korea.
- *Copper.* In Brazil, we produce copper concentrates at Sossego and Salobo, in Carajás, in the Brazilian state of Pará. In Canada, we produce copper concentrates, copper anodes and copper cathodes in conjunction with our nickel mining operations at Sudbury and Voisey's Bay. We will discontinue the production of copper anode in 2017, as a result of changes in our production process in Sudbury, which is part of our efforts to reduce air emissions. In Zambia, our joint venture produces copper concentrates in Lubambe, located in the Zambian Copperbelt.
- *Cobalt, PGMs and other precious metals.* We produce cobalt as a byproduct of our nickel mining and processing operations in Canada and refine it at our Port Colborne facilities, in the Province of Ontario, Canada. We started to produce refined cobalt in our Long Harbour facilities in Newfoundland and Labrador in 2017. We also produce cobalt as a byproduct of our nickel operations in New Caledonia. We produce PGMs as byproducts of our nickel mining and processing operations in Canada. The PGMs are concentrated at our Port Colborne facilities and refined at our precious metals refinery in Acton, England. We produce gold and silver as byproducts of our nickel mining and processing operations in Canada, and gold as a byproduct of our copper mining at Sossego and Salobo in Brazil.

Coal:

- We conduct our coal operations primarily in Mozambique, through Vale Moçambique S.A. ("Vale Moçambique"), where we are ramping up our metallurgical and thermal coal operations. We also have minority interests in a Chinese coal and coke producer.

Logistics infrastructure:

- We are a leading operator of logistics services in Brazil and other regions of the world, with railroads, maritime terminals, distribution centers and ports. Two of our four iron ore systems include an integrated railroad network linked to port and terminal facilities. We also have an interest in MRS Logística S.A. ("MRS"), which transports our iron ore products from the Southern System mines to our maritime terminals, and VLI S.A. ("VLI"), which provides integrated logistics solutions to general cargo through railroads, inland and maritime terminals in Brazil. We are ramping up the logistics infrastructure to support our coal operations in Southeastern Africa. We own and charter dry bulk vessels to transport the products that we sell on a cost and freight ("CFR") basis to customers.

In December 2016, we agreed to sell a substantial part of our fertilizer business to The Mosaic Company ("Mosaic"), subject to certain conditions precedent. As a result, this segment is reported as discontinued operations. Until closing of the transaction, which is expected by the end of 2017, we continue to conduct potash and phosphate operations in Brazil and to hold a 51% voting interest in a joint venture that operates a phosphate rock mine in Peru. See *Discontinued Operations*.

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Business strategy

Our mission is to transform natural resources into prosperity and sustainable development. In all of our lines of business, we are committed to:

- Prioritizing risk and impact management, seeking to achieve zero harm to our employees and surrounding communities and establishing a positive social, economic and environmental legacy in the places where we operate.
- Investing mainly in world-class assets, with long life, low cost, potential to expand and high quality output, capable of creating value through different economic cycles.
- Maintaining a lean management organization, with teamwork and accountability, excellence in project execution and firm commitment to transparency and shareholder value creation.

Below are the highlights of our major business strategies.

Commitment to sustainability

We are committed to promoting sustainable development, which means generating value for our shareholders and other stakeholders, and simultaneously improving health and safety of our workers, enhancing the well-being of the communities surrounding our operations and protecting the environment. This can be achieved through conscious and responsible management, corporate voluntary actions and cross-sectorial partnerships. Below is a list of measures illustrating our commitment to sustainability:

- Since 2013, environmental and social actions are directly incorporated into our strategic planning. In 2016, we revised our Global Sustainability Policy to reflect health, safety, environment and community management improvement. We also follow standards for social action and principles on business and human rights, which are based on the Guiding Principles on Business and Human Rights of the United Nations Human Rights Council.
- We are committed to reducing greenhouse gas emissions, by investing in energy efficiency, process improvements, control systems and the use of clean fuels. In 2016, our operations (including discontinued operations) generated 910 thousand tons of non-mineral waste, 96% non-hazardous and 4% hazardous. From the total amount of waste disposal, 65.2% was sent to recycling processes.
- We are also committed to reducing water use in our activities by investing in technologies and initiatives to control total water withdrawal, especially by promoting water reuse. In 2016, we withdrew a total of 426.3 million cubic meters of water, and used 394.3 million cubic meters in our operations (including discontinued operations), with the balance being allocated to third parties. From the total volume of water used in 2016, 80% or 1.6 billion cubic meters was reused.

Disciplined capital management

In all of our lines of businesses, we are committed to investing in world-class assets, with long life, low cost, potential to expand and high quality output, capable of creating value through different economic cycles. We exercise disciplined capital management and maintaining a low cost structure. The preservation of our credit ratings and reduction of our debt leverage are also among our key commitments. In the past years, we suspended operations of assets in response to market conditions and disposed of assets that we have determined to be non-strategic or in order to optimize the structure of our business portfolio. The divestiture of assets improves capital allocation and unlocks funds to finance the execution of top priority projects and to manage our liquidity.

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Improving our competitiveness in the global iron ore market

We are committed to improving our competitiveness in the global iron ore market, by focusing our product line to capture industry trends, improving quality and productivity, controlling costs, strengthening our logistics infrastructure of railroads, ports, shipping and distribution centers, and strengthening relationships with customers. Our diversified portfolio of high quality products, strong technical marketing strategy, efficient logistics and long-standing relationships with major customers will help us achieve this goal.

We will continue to promote the Brazilian blend fines (BRBF), a product resulting from blending fines from Carajás, which contain a higher concentration of iron and a lower concentration of silica in the ore, with fines from the Southern and Southeastern Systems, which contain a lower concentration of iron in the ore. The resulting blend offers strong performance in any kind of sintering operation. It is blended and sold in our Teluk Rubiah Maritime Terminal in Malaysia and in five distribution centers in China, which reduces the time to reach Asian markets and increases our distribution capillarity by allowing the use of smaller vessels. The blending strategy also permits the use of iron ore with lower concentration, particularly from the Southern System, allowing more efficient mining plans and increases use of dry processing methods, which in turn reduce capital expenditures, expand the life of our mines and reduce the use of water in our operations.

Enhancing our logistics capacity to support our iron ore and coal businesses

We have been expanding the capacity of our railroads and ports, entering into long term affreightment agreements and developing distribution centers in Asia to meet the logistics needs of our iron ore and coal businesses.

- We are increasing the logistics capacity of our Northern System to support the iron ore production of the S11D project. We believe that the quality of our logistics assets, our extensive experience as a railroad and port operator, and our stakes in MRS and VLI position us as a leader in the logistics business in Brazil.
- Our strategy with respect to maritime shipping of iron ore consists of securing long-term shipping capacity and protecting against volatility in spot freight rates, without incurring the costs relating to building and owning the vessels. We transport a large amount of our iron ore products from Brazil to Asia through long-term contracts of affreightment with owners of very large ore carriers of 400,000 deadweight tons ("DWT").
- We also ramped up our distribution center in Malaysia, and we are developing port service contracts in several ports in China to capture the benefits of being closer to iron ore customers. This downstream management of the supply chain plays an important role in our commercial strategy as it reduces the time to market and increases our distribution capillarity in the Asian market, by allowing the sale of smaller lots at competitive costs
- In order to position ourselves for the future expansion of our coal production in Mozambique and leverage our presence in Africa, we are currently ramping up the expansion of the local railroad capacity after the rehabilitation of the existing network and after building new railroad tracks to develop the logistics corridor from our mine to the newly constructed port at Nacala-à-Velha, in Mozambique.

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Maximizing value in the nickel and copper businesses

We are the world's largest nickel producer, with large-scale, long-life and low-cost operations, a substantial resource base and diversified mining operations that produce nickel from nickel sulfides and laterites using advanced technology. We have processing facilities in North America, Europe, Asia, Brazil, New Caledonia and Indonesia, which produce an array of products for use in most nickel applications. We are a leading producer of high-quality nickel products for non-stainless steel applications, such as plating, alloy steels, high nickel alloys and batteries, which represented 58% of our refined nickel sales in 2016. Our goal is to strengthen our competitiveness in the nickel business. In the long-term, the battery segment shows an important upside potential as electric vehicle production continues to attract significant investments, which could positively impact nickel price and our nickel premiums. We continue to optimize our operations and to review our asset utilization aiming to increase productivity and improve returns.

We produce copper concentrates from our Sossego and Salobo facilities located in the Carajás region. These copper mines benefit from our infrastructure facilities serving the Northern System. The gold we produce at Sossego and Salobo increases the total aggregated value of those operations. A key aspect of our strategy for our copper assets in the Carajás region is to improve our efficiency and asset utilization while evaluating opportunities to extend our operations at Sossego and expand Salobo. We also produce copper as a coproduct in our nickel operations, principally at Sudbury and Voisey's Bay, in Canada.

Improving the coal business

We have coal operations in Moatize (Mozambique), and we hold a minority interest in a joint venture in China. We intend to increase our coal production, mainly through the expansion of a new coal handling processing plant (CHPP) of coal in the Moatize operations in Mozambique and the ramp-up of the Nacala Logistics Corridor in Mozambique and Malawi, where we have entered into a strategic partnership with Mitsui. As we complete the ramp-up of our new CHPP in Moatize and the Nacala Logistics Corridor, our costs are expected to reduce, enhancing the competitiveness of our coal operations.

Developing our resource base

We are taking advantage of our global presence to develop mineral exploration initiatives. We conduct brownfield exploration to maximize results from existing mining areas and to support both projects and operations. We conduct our greenfield exploration activities in six countries, which are Brazil, Peru, Chile, Canada, Australia and Indonesia. In particular, we seek to identify opportunities and develop deposits with the potential for large scale production at low cost. Our exploration activities are focused on iron ore, nickel and copper.

Optimizing our energy matrix

As a large consumer of electricity, we have invested in power generation projects to support our operations and to reduce our exposure to the volatility of energy prices and regulatory uncertainties. Accordingly, we have developed hydroelectric power generation plants in Brazil, Canada and Indonesia, and 50% of our worldwide electricity needs come from our own plants. We are seeking to develop a clean energy mix by focusing on reducing our carbon footprint.

Significant changes in our business

We summarize below major events related to our organic growth, divestitures, acquisitions and other significant developments in our business since the beginning of 2016.

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Organic growth

We have an extensive program of investments in the organic growth of our businesses. Our main investment projects are summarized under *Capital expenditures*. The most significant projects that have come on stream since the beginning of 2016 are summarized below:

- *Carajás Serra Sul S11D*. In the fourth quarter of 2016, we started up the mine and processing plant in the southern range of Carajás, in the Brazilian state of Pará. The nominal capacity is 90 Mtpy.
- *Moatize II*. In the third quarter of 2016, we completed the construction of a new pit and the expansion of a new coal handling processing plant ("CHPP") located in Tete, Mozambique, as well as related infrastructure. The nominal capacity is 11 Mtpy of coal, expanding the complex capacity to 22 Mtpy.
- *Companhia Siderúrgica do Pecém*. In the second quarter of 2016, we concluded the construction of an integrated steel slab plant in the Brazilian state of Ceará, in partnership with Dongkuk Steel Mill Co. ("Dongkuk") and Posco. We own 50% of the joint venture, while Dongkuk owns 30% and Posco owns 20%. The nominal capacity is 3.0 Mtpy.

Dispositions and asset sales

We are always seeking to optimize the structure of our portfolio of businesses in order to achieve the most efficient allocation of capital. We summarize below our most significant dispositions since the beginning of 2016.

- *Sale of Fertilizer Business* In December 2016, we entered into an agreement with Mosaic for the sale of a substantial part of our fertilizer business, which includes (i) our phosphate assets in Brazil; (ii) our stake in the joint venture that operates the phosphate rock mine in Bayóvar, Peru; (iii) our potash assets located in Brazil; and (iv) our potash project based in Canada (Kronau). Only our nitrogen and phosphate assets, located in Cubatão, were not included in this sale agreement. We expect to receive consideration from Mosaic totaling approximately US\$2.5 billion, consisting of US\$1.25 billion in cash and approximately 42.3 million shares of Mosaic's common stock, which corresponds to approximately 11% (on a post-issuance basis) of Mosaic's outstanding common stock. Subject to limited exceptions, the Mosaic shares to be issued to us cannot be transferred for two years following closing, after which time we will have customary registration rights. Following closing of the transaction, we will also have the right to appoint two members of Mosaic's board of directors for so long as we hold at least 90% of the Mosaic shares received at closing, or one member of Mosaic's board for so long as we hold at least 50% of the Mosaic shares received at closing. Mosaic has also agreed to pay additional amounts of up to US\$260 million if the market price of certain products, and the exchange rate between the Brazilian *real* and the U.S. dollar exceed certain thresholds during each of the two 12-month periods following completion of the transaction. Closing of the sale is subject to certain conditions precedent, including approvals by the Brazilian and other antitrust authorities, certain other operational and regulatory milestones and the completion of a carve-out of our assets located in Cubatão from Vale Fertilizantes. We expect to complete the sale to Mosaic in late 2017. The Rio Colorado potash project in Argentina may also be sold to Mosaic, subject to Mosaic's agreement following appropriate diligence. We intend to seek buyers for the Cubatão assets in 2017.

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- *Sale of gold stream from Salobo copper mine* In August 2016, we sold to Silver Wheaton (Caymans) Ltd. ("Silver Wheaton") an additional 25% of the gold produced as a byproduct at our Salobo copper mine, in Brazil, for the life of that mine. We had previously sold an aggregate volume of 50% of such gold in 2013 and 2015. In consideration for the August 2016 sale, we (i) received an initial cash payment of US\$800 million, (ii) received an option value of approximately US\$23 million from a reduction of the exercise price of the Silver Wheaton warrants held by us since 2013 and maturing in 2023, and (iii) ongoing payments of the lesser of US\$400 per ounce (subject to a 1% annual inflation adjustment starting January 1, 2019) and the prevailing market price, for each ounce of gold that we deliver under the agreement. We may receive an additional cash payment if we expand our capacity to process Salobo copper ores to more than 28 Mtpy before 2036. The additional cash payment may range from US\$113 million to US\$953 million, depending on ore grade, timing and size of the expansion.
- *Sale of very large ore carriers* In June 2016, we concluded the sale of three very large ore carriers of 400,000 DWT for an aggregate amount of US\$269 million to a subsidiary of the ICBC International Finance Limited. In September 2016, we signed an agreement for the sale of four capesize vessels to Polaris Shipping Co. Ltd. for US\$35 million per vessel. Two of these vessels were delivered in December 2016 and the other two in January 2017. See *Restructuring our investments in iron ore shipping*.
- *Sale of Mineração Paragominas* In December 2016, we concluded the sale of our remaining 13.63% indirect interest in Mineração Paragominas S.A., a bauxite mining business located in Brazil, to Hydro Paragominas B.V., a subsidiary of Norsk Hydro ASA ("Hydro"), for US\$113 million. The transaction is the final step of the sale of our aluminum business to Hydro, which was initially announced in February 2011.
- *Sale of coal assets in Australia* In November 2016, we sold to a subsidiary of AMCI Euro-holdings BV ("AMCI") our interests in certain coal assets in Australia, including Carborough Downs operations, Broadlea operation, which is currently suspended, and the undeveloped deposits of Ellensfield and Red Hill. AMCI assumed all existing rights and obligations associated with the assets, including all existing take or pay agreements, employment related obligations and any future environmental rehabilitation requirements. The transaction does not provide for upfront payments, but contemplates potential future payments to us of up to A\$30 million in production bonuses upon the production of first coal in certain tenements, as well as royalties of up to US\$4 per ton of any coal sold from these assets. As part of the same transaction, we also agreed to sell certain additional surface land and ancillary tenements surrounding these assets, and closing of this additional sale is subject to regulatory approvals in Australia.

Partnership in coal assets in Mozambique

In September 2016, we agreed with Mitsui the new terms of our partnership in coal assets in Mozambique. Under these new terms, Mitsui agreed to pay us an amount of up to US\$450 million, consisting of: (i) a fixed payment of US\$255 million for 15% of our 95% stake in the Moatize coal mine and (ii) an additional amount of up to US\$195 million, subject to certain conditions, including mine performance. Mitsui will also contribute an amount of approximately US\$348 million for 50% of our 70% stake in the Nacala Logistics Corridor and extend a long-term facility of US\$165 million to Nacala Logistics Corridor. We completed the equity transaction with Mitsui on March 27, 2017. The total value of the transaction will be approximately US\$770 million, including all amounts mentioned above except the additional amount of up to US\$195 million, which is subject to certain conditions still to be satisfied. From these US\$770 million, we received US\$733 million upon completion of the equity transaction on March 27, 2017, and expect to receive the remainder upon closing of the project financing, which is expected to occur during 2017. If the project financing is not signed before the end of 2017, Mitsui has certain rights to transfer its participation in the Moatize coal mine and the Nacala Logistics Corridor back to us. See *Lines of Business Infrastructure Railroads*.

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Obtaining environmental licenses for the S11D project in Carajás

In December 2016, we obtained the operational environmental license for the S11D project located in Carajás, Brazil. This license is a key step in the process of expanding our iron ore production and improving our competitiveness in the iron ore business.

Optimizing our base metals operations in Canada

We plan to optimize our nickel operations across Canada, as part of an overall strategy to reduce our atmospheric emissions and comply with local regulations. Our goal is to concentrate our refining and smelting activities in Sudbury, where we will focus on the production of copper concentrate, copper matte and refined nickel. In Long Harbour we will produce nickel rounds, copper cathode and cobalt metal. We will phase out our smelting and refining activities in Thompson, where we will focus on nickel concentrate production.

- *Sudbury, Ontario* In the second half of 2017, we will convert our two-furnace operation in Sudbury into a single furnace. As a result of this change, we expect to increase the proportion of production of copper concentrate to total copper production from the current rate of 45% to 70% in 2017 and to 80% in 2018, maximizing the smelter capacity for nickel. In addition, we plan to cease production of copper anode and increase production of copper matte. By 2018, we expect that about 10% of our copper production will be sold in the form of copper matte. We plan to renovate one of the operational furnaces from March 2017 to June 2017, followed by the immediate decommissioning of the other furnace. The rebuilt furnace will have its capacity increased, but due to the single furnace operation, the overall production of refined nickel and copper in the long term will decrease by approximately 30%.
- *Thompson, Manitoba* We intend to change our operations in Thompson, Manitoba, from an integrated operation to a mine-mill operation. We intend to decommission one of the two furnaces at the site, beginning in 2017, and we expect to decommission the other furnace in 2018, therefore closing the remaining smelting and refining activities to focus the operation solely on nickel concentrate production. We plan to send the majority of the feed from Thompson to be refined in Long Harbour and Sudbury.
- *Voisey's Bay and Long Harbour, Newfoundland and Labrador* We plan to ship a greater proportion of Voisey's Bay nickel concentrate to our Long Harbour processing facility in 2017, reducing concentrate shipments to our Sudbury and Manitoba operations. By the end of 2017, we plan on shipping all Voisey's Bay nickel concentrate to our Long Harbour refinery. Our Long Harbour processing facilities will produce nickel rounds, copper cathode and cobalt metal from the Voisey's Bay concentrate.

Failure of Samarco's tailings dam in Minas Gerais

Samarco's dam failure

On November 5, 2015, the Fundão tailings dams owned by Samarco failed, releasing tailings downstream, reaching and flooding certain communities and causing impacts on communities and the environment along the Rio Doce river. The failure resulted in 19 fatalities, and caused property and environmental damage to the affected areas.

After the dam failure, Samarco, together with the public authorities, provided first aid, food, water, housing, social assistance and financial aid to the affected families and individuals, and both Vale and BHPB, Samarco's shareholders, have been actively involved in supporting Samarco during this period. In addition to these emergency actions, Samarco has been monitoring the affected area, performing emergency work to contain any movement of tailings, reinforcing the structures of its dams and dikes to ensure the safety of the region and mitigating the environmental and social impacts of the event. Samarco continues to reinforce and improve the structures of its dams to contain the remaining tailings.

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Impact of dam failure on our and Samarco's operations

Our operation in the Mariana mining complex, near Samarco's mining area, was also negatively impacted by the failure of Samarco's tailings dam. A major conveyor belt connecting our Fábrica Nova mine to our Timbopeba beneficiation plant was damaged, and the Alegria mine is operating with a dry beneficiation process.

Following the dam failure, governmental authorities ordered the suspension of Samarco's operations. With the exception of the Fundão tailings dam and the Santarém water dam, which was impacted by the overflow of tailings from the Fundão dam, all other production assets owned by Samarco were undamaged. Samarco's management is working on a plan that would permit it to resume operations and provide a long-term solution for the disposal of tailings. The feasibility, timing and scope of measures necessary to resume Samarco's operations remain uncertain.

In December 2016, we entered into a non-binding term sheet outlining the general terms and conditions to permit Samarco, upon its eventual resumption of operations, to deposit its tailings in our Timbopeba pit. A definitive agreement is being negotiated and is subject to due diligence and governmental approvals. The use of the Timbopeba pit may allow Samarco to operate for several years without a new tailings structure.

The Framework Agreement and the agreements with the MPF

In March 2016, Samarco and its shareholders, Vale S.A. and BHPB entered into the Framework Agreement with the Brazilian federal government, the two Brazilian states affected by the failure (Espírito Santo and Minas Gerais) and other governmental authorities in order to implement programs for remediation and compensation of the areas and communities affected by Samarco's dam failure. The Framework Agreement has a 15-year term, renewable for successive one-year periods until all the obligations under the Framework Agreement have been performed. The Framework Agreement does not provide for admission of civil, criminal or administrative liability for the Fundão dam failure.

In June 2016, Samarco, Vale S.A. and BHPB created the Renova Foundation to develop and implement social and economic remediation and compensation pursuant to the Framework Agreement. The foundation must be funded by Samarco according to the following schedule: R\$2.0 billion (US\$614 million) in 2016, R\$1.2 billion (US\$368 million) in 2017 and R\$1.2 billion (US\$368 million) in 2018. From 2019 to 2021, Samarco agreed to provide funding based on the amounts needed to implement the projects approved for the relevant year, subject to an annual minimum of R\$800 million (US\$245 million) and an annual maximum of R\$1.6 billion (US\$491 million). Starting in 2022, Samarco will provide the necessary funding in order to complete remaining programs approved for each year. The foundation will allocate an annual amount of R\$240 million (US\$74 million) over 15 years to the implementation of compensation programs, and these annual amounts are included in the annual contributions described above for the first six years. Through the end of 2018, R\$500 million (US\$153 million) will be provided for sewage collection and treatment and solid waste disposal under the terms of the Framework Agreement.

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In January 2017, Samarco, Vale and BHPB entered into two preliminary agreements with the MPF in connection with the pending public civil actions brought by the Brazilian Government and others and the public civil action brought by the MPF, which are described under *Additional information Legal proceedings*.

- The first agreement, which was approved by the 12th federal court in Belo Horizonte on March 16, 2017, consists of an initial transitory agreement, which will be effective until the parties agree on the terms of a final agreement, and provides for (i) a process and timetable for the resolution of the public civil action brought by the Brazilian government and others and the public civil action brought by the MPF, (ii) the appointment of experts selected by the MPF to analyze and monitor the remediation programs provided under the Framework Agreement, (iii) the holding of public hearings in different communities in the states of Minas Gerais and Espírito Santo and in the indigenous territories of Krenak, Comboios and Caieiras Velhas, (iv) the obligation of Samarco, Vale and BHPB to provide collateral to secure the payment of the socio-environmental and socio-economic remediation measures, in the amount of R\$2.2 billion. The required collateral will consist of R\$100 million in financial investments, R\$1.3 billion in insurance bonds and R\$800 million in assets of Samarco.
- The second agreement provides for a timetable to make funds available for remediation measures in the municipalities of Barra Longa, Rio Doce, Santa Cruz do Escalvado and Ponte Nova, in the total amount of R\$200 million.

In March 2017, the court partially ratified the first agreement, pending the appointment of an expert and conclusion of the final agreement. We expect the Framework Agreement and the agreements with the MPF to be a first step towards the settlement of these actions. Any final settlement of these actions is subject to approval by the court.

Impact of the failure of Samarco's tailings dam in our financial statements

For a discussion of the impact of the failure of Samarco's tailings dam in our financial statements, see *Operating and financial review and prospects Failure of Samarco's tailing dams*.

Reorganization of our shareholding structure and share ownership by controlling shareholders

Pursuant to the new shareholders' agreement entered into by certain shareholders of Valepar, our controlling shareholder, on February 19, 2017, Valepar is expected to make a proposal to simplify our shareholding structure and corporate governance, with the purpose of eventually enabling Vale to be listed on BM&FBOVESPA's *Novo Mercado* special segment and making Vale a company without defined control. This proposal is composed of a series of indivisible and interdependent steps, and is subject to approval by our shareholders and the executive officers and board of directors of Vale and Valepar. The proposal contemplates (i) the voluntary conversion of at least 54.09% of our class A preferred shares into common shares, (ii) the amendment of our bylaws to adjust them, to the extent possible, to *Novo Mercado* rules, and (iii) the merger of Valepar into Vale. Subsequently, certain former shareholders of Valepar will enter into a new shareholders' agreement at the Vale level. Our eventual migration to the *Novo Mercado* segment of the BM&FBOVESPA is also subject to conversion of all of our preferred shares into common shares. For a description of our ownership structure and the proposed changes to the Valepar shareholders' agreements pursuant to the Proposal, see *Share ownership and trading Major shareholders*.

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LINES OF BUSINESS

Our principal lines of business consist of mining and related logistics. This section presents information about operations, production, sales and competition and is organized as follows.

1. Ferrous minerals

- 1.1 Iron ore and iron ore pellets
 - 1.1.1 Iron ore operations
 - 1.1.2 Iron ore production
 - 1.1.3 Iron ore pellets operations
 - 1.1.4 Iron ore pellets production
 - 1.1.5 Customers, sales and marketing
 - 1.1.6 Competition
- 1.2 Manganese ore and ferroalloys and production
 - 1.2.1 Manganese ore operations and production
 - 1.2.2 Ferroalloys operations and production
 - 1.2.3 Manganese ore and ferroalloys: sales and competition

2. Base metals

- 2.1 Nickel
 - 2.1.1 Operations
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Table of Contents**1. Ferrous minerals**

Our ferrous minerals business includes iron ore mining, iron ore pellet production, manganese ore mining and ferroalloy production. Each of these activities is described below.

1.1 Iron ore and iron ore pellets**1.1.1 Iron ore operations**

We conduct our iron ore business in Brazil primarily at the parent-company level, through our subsidiaries, Mineração Corumbaense Reunida S.A. ("MCR") and Minerações Brasileiras Reunidas S.A. MBR ("MBR"). Our mines, all of which are open pit, and their related operations are mainly concentrated in three systems: the Southeastern, Southern and Northern Systems, each with its own transportation capabilities. We also conduct mining operations in the Midwestern System and we have a 50% stake in Samarco. Samarco's operations have been suspended following the failure of one of its tailings dams located in Minas Gerais in November 2015 (see *Business overview Failure of Samarco's tailings dam in Minas Gerais*). We conduct each of our iron ore operations in Brazil under concessions from the federal government granted for an indefinite period, subject to the life of the mines.

Company/Mining System Vale	Location	Description/History	Mineralization	Operations	Power source	Access/Transportation
<i>Northern System</i>	Carajás, state of Pará	Divided into Serra Norte, Serra Sul and Serra Leste (Northern, Southern and Eastern ranges). Since 1984, we have been conducting mining activities in the northern range, which is divided into three main mining areas (N4W, N4E and N5) and two major beneficiation plants. In 2014, we started a new mine and beneficiation plant in Serra Leste. Our operations in Serra Sul, where our S11D project is located, started in 2016.	High-grade hematite ore type (iron grade of more than 65% on average).	Open-pit mining operations. In Serra Norte, one of the major plants applies the natural moisture beneficiation process, consisting of crushing and screening, and the other applies both the natural moisture and the wet beneficiation process in distinct lines. The wet beneficiation process consists simply of sizing operations, including screening, hydrocycloning, crushing and filtration. Output from this site consists of sinter feed, pellet feed and lump ore. Serra Leste and Serra Sul natural moisture beneficiation process consists of crushing and screening. Serra Sul produces only sinter feed and Serra Leste produces lump and sinter feed.	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	EFC railroad transports the iron ore to the Ponta da Madeira maritime terminal in the Brazilian state of Maranhão. Serra Leste iron ore is transported by trucks from the mine site to EFC railroad. The Serra Sul ore is shipped via the Carajás railroad (EFC) via the new 101-kilometers long railroad branch
<i>Southeastern System</i>	Iron Quadrangle, state of	Three mining complexes: Itabira (two mines, with three major beneficiation	Ore reserves with high ratios of itabirite ore relative to hematite ore	Open-pit mining operations. We generally process	Supplied through the national electricity grid.	EFVM railroad connects these mines to the Tubarão port.

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Minas Gerais	plants), Minas Centrais (two mines, with two major beneficiation plants and one secondary plant) and Mariana (three mines, with two major beneficiation plants).	type. Itabirite ore type has iron grade of 35-60%. Part of the ore is concentrated to achieve shipping grade and part is shipped and blended in Asia with the high grade ore from our Northern System.	the run-of-mine by means of standard crushing, classification and concentration steps, producing sinter feed, lump ore and pellet feed in the beneficiation plants located at the mining complexes.	Produced directly by Vale or acquired through power purchase agreements.
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Company/Mining System	Location	Description/History	Mineralization	Operations	Power source	Access/Transportation
<i>Southern System</i>	Iron Quadrangle, state of Minas Gerais	Three major mining complexes: Minas Itabirito (four mines and three major beneficiation plants); Vargem Grande (three mines and two major beneficiation plants); and Paraopeba (five mines and two major beneficiation plants).	Ore reserves with high ratios of itabirite ore type relative to hematite ore type. Itabirite ore has iron grade of 35-60%. Part of the ore is concentrated to achieve shipping grade and part is shipped and blended in Asia with the high grade ore from our Northern System.	Open-pit mining operations. We generally process the run-of-mine by means of standard crushing, classification and concentration steps, producing sinter feed, lump ore and pellet feed in the beneficiation plants located at the mining complexes.	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	MRS transports our iron ore products from the mines to our Guaíba Island and Itaguaí maritime terminals in the Brazilian state of Rio de Janeiro. EFVM railroad connects certain mines to the Tubarão port.
<i>Midwestern System</i>	State of Mato Grosso do Sul	Two mines and two plants located in the city of Corumbá.	Hematite ore type, which generates lump ore predominantly. Iron grade of 62% on average.	Open-pit mining operations. The beneficiation process for the run-of-mine consists of standard crushing and classification steps, producing lump and sinter feed.	Supplied through the national electricity grid. Acquired from regional utility companies.	Part of the sales are transported through barges traveling along the Paraguay river to the ports in Argentina, moving to Europe and Asia markets from there. Another part of the sales is delivered to customers in the ports of Corumbá.
Samarco	Iron Quadrangle, state of Minas Gerais	Integrated system comprised of two mines, three beneficiation plants, three pipelines, four pellet plants and a port. The mines and the beneficiation plants are located in the state of Minas Gerais and the pellet plants and port are located in the state of Espírito Santo. From Minas Gerais to Espírito Santo state production flows through the three pipelines which extend for approximately 400 Km.	Itabirite ore type.	Open-pit mining operations. The three beneficiation plants, located at the site, process the run-of-mine by means of standard crushing, milling and concentration steps, producing pellet feed and sinter feed. Samarco's mining operations have been suspended following the failure of one of its tailings dams located in Minas Gerais in November 2015 (see <i>Business overview Failure of Samarco's tailings dam in Minas Gerais</i>).	Supplied through the national electricity grid. Acquired from regional utility companies or produced directly by Samarco.	Samarco's mines supply Samarco's pellet plants using three pipelines extending approximately 400 kilometers. These pipelines transport the iron ore from the beneficiation plants to the pelletizing plants. From the pelletizing plants to the Ubu port in the Brazilian state of Espírito Santo pellets are transported by conveyor belts of approximately 1 kilometer.

Table of Contents**1.1.2 Iron ore production**

The following table sets forth information about our iron ore production.

Mine/Plant	Type	Production for the year ended December 31(2),			2016 process recovery(4) (%)
		2014	2015	2016	
		(million metric tons)			
Southeastern System					
Itabira	Open pit	35.8	35.6	33.4	49.6
Minas Centrais(1)	Open pit	33.7	41.3	40.9	67.6
Mariana	Open pit	39.4	36.1	28.4	89.4
Total Southeastern System		108.9	113.0	102.7	
Southern System					
Minas Itabirito	Open pit	41.0	41.4	40.1	71.7
Vargem Grande	Open pit	25.0	29.3	29.2	64.9
Paraopeba	Open pit	31.2	28.1	26.4	95.9
Total Southern System		97.2	98.8	95.7	
Northern System					
Serra Norte	Open pit	117.5	127.6	143.6	95.5
Serra Leste	Open pit	2.2	2.0	4.2	98.9
Serra Sul	Open pit			0.4	100.0
Total Northern System		119.7	129.6	148.1	
Midwestern System					
Corumbá	Open pit	3.8	2.8	1.9	73.9
Urucum	Open pit	2.1	1.7	0.4	65.8
Total Midwestern System		5.8	4.5	2.3	
Total Vale Systems(2)		331.6	345.9	348.8	
Samarco(3)	Open pit	13.1	12.7	0.0	
Total		344.7	358.6	348.8	

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- (1) Agua Limpa mine and plants are part of the Minas Centrais operations and are owned by Baovale Mineração S.A. ("Baovale"). We own 100% of the voting shares and 50% of the total shares of Baovale. Production figures for Água Limpa have not been adjusted to reflect our ownership interest.
- (2) Production figures represent the mass obtained after beneficiation process, with minor contribution of run-of-mine production and third-party ore purchases.
- (3) Production figures for Samarco, in which we have a 50% interest, have been adjusted to reflect our ownership interest.
- (4) Process recovery figures do not include third-party ore purchases.

1.1.3 Iron ore pellets operations

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We produce iron ore pellets in Brazil and Oman, directly and through joint ventures, as set forth in the table below. We also have a 25% interest in two iron ore pelletizing plants in China, Zhuhai YPM Pellet Co., Ltd. ("Zhuhai YPM") and Anyang Yu Vale Yongtong Pellet Co., Ltd. ("Anyang"). Our total estimated nominal capacity is 64.7 Mtpy, including the full capacity of our pelletizing plants in Oman, but not including our joint ventures Samarco, Zhuhai YPM and Anyang. We supply all of the iron ore requirements of our wholly-owned pellet plants and part of the iron ore requirements for Samarco and Zhuhai YPM. In 2016, we sold 1.08 million metric tons of pellet feed to Zhuhai YPM and 0.33 million metric tons to Anyang YVY. We suspended our sales of run-of-mine to Samarco following the failure of Samarco's tailings dam in November 2015.

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Company/Plant	Description/History	Nominal capacity (Mtpy)	Power source	Other information	Vale's share (%)	Partners
Brazil:						
Vale						
<i>Tubarão (state of Espírito Santo)</i>	Three wholly-owned pellet plants (Tubarão I, II and VIII) and five leased plants (Itabasco, Hispanobras, Kobrasco and two Nibrasco plants). These plants receive iron ore primarily from our Southeastern System mines and distribution is made through our logistics infrastructure.	36.7(1)	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	Operations at the Tubarão I and II pellet plants have been suspended since November 13, 2012 in response to changes in steel industry demand for raw materials, and replaced by Tubarão VIII, a newer and more efficient plant.	100.0	
<i>Fábrica (state of Minas Gerais)</i>	Part of the Southern System. Receives iron ore from Minas Itabirito mining complex, more specifically from João Pereira and Segredo mines. Production is mostly transported by MRS and EFVM.	4.5	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.		100.0	
<i>Vargem Grande (state of Minas Gerais)</i>	Part of the Southern System. Receives iron ore from Minas Itabirito and Vargem Grande mining complexes, more specifically from Sapecado, Galinheiro, Capitão do Mato and Tamanduá mines and the production is mostly transported by MRS.	7.0	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.		100.0	
<i>São Luís (state of Maranhão)</i>	Part of the Northern System. Receives iron ore from the Carajás mines and production is shipped to customers through our Ponta da Madeira maritime terminal.	7.5		On October 8, 2012, we suspended operations at the São Luís pellet plant in response to changes in steel industry demand for raw materials. We plan to re-start the São Luís pellet plant in the beginning of 2018, after the renewal of its operational license, the revamp of the plant and the upgrade of its automation system.	100.0	

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Company/Plant	Description/History	Nominal capacity (Mtpy)	Power source	Other information	Vale's share (%)	Partners
Samarco	Four pellet plants, with aggregate nominal capacity of 30.5 Mtpy, located in the Ponta Ubu unit, in Anchieta, state of Espírito Santo.	30.5(2)	Supplied through the national electricity grid. Acquired from regional utility companies or produced directly by Samarco.	In January 2016, Samarco suspended its pelletizing operations as pelletizing feed became unavailable as a result of the suspension of its mining operations in November 2015.	50.0	BHP Billiton Brasil Ltda.
<i>Oman:</i>						
Vale Oman Pelletizing Company LLC	Vale's industrial complex. Two pellet plants with a total nominal capacity of 9.0 Mtpy. The pelletizing plants are integrated with our distribution center that has a nominal capacity to handle 40.0 Mtpy.	9.0	Supplied through the national electricity grid.	Oman plants are supplied by iron ore from the Iron Quadrangle state of Minas Gerais through the Tubarão Port (80%) and by iron ore from Carajás through the Ponta de Madeira Port (20%).	70.0	Oman Oil Company S.A.O.C.

- (1) Our environmental operating licenses for the Tubarão pellet plants provide for a capacity of 36.2 Mtpy.
- (2) The actual capacity will be revised based on the conditions under which Samarco resumes operations.

Table of Contents**1.1.4 Iron ore pellets production**

The following table sets forth information about our main iron ore pellet production.

Company	Production for the year ended December 31,		
	2014	2015	2016
	(million metric tons)		
Vale(1)	43.0	46.2	46.2
Samarco	12.1	12.3	0.0
Total	55.1	58.5	46.2

(1)

Figure indicates actual production, including full production from our pellet plants in Oman and the five pellet plants we lease in Brazil. The operating leases for Itabasco, Kobraco and Hispanobras' pellet plants expire in 2018, and the operating leases for the two Nibraco's pellet plants expire in 2019.

1.1.5 Customers, sales and marketing

We supply all of our iron ore and iron ore pellets (including our share of joint-venture pellet production) to the steel industry. Prevailing and expected levels of demand for steel products affect demand for our iron ore and iron ore pellets. Demand for steel products is influenced by many factors, such as global manufacturing production, civil construction and infrastructure spending. For further information about demand and prices, see *Operating and financial review and prospects Major factors affecting prices*.

In 2016, China accounted for 58% of our iron ore and iron ore pellet shipments, and Asia as a whole accounted for 71%. Europe accounted for 14%, followed by Brazil with 8%. Our 10 largest customers collectively purchased 130 million metric tons of iron ore and iron ore pellets from us, representing 38% of our 2016 iron ore and iron ore pellet sales volumes and 36% of our total iron ore and iron ore pellet revenues. In 2016, no individual customer accounted for more than 10% of our iron ore and iron ore pellet shipments.

Of our total 2016 pellet production, including the production of our joint ventures, 62.9% was blast furnace pellets and 37.1% was direct reduction pellets. Blast furnace and direct reduction are different technologies employed by steel mills to produce steels, each using different types of pellets. In 2016, the Asian market (mainly Japan, South Korea and Taiwan), the European market and the Brazilian market were the primary markets for our blast furnace pellets, while the Middle East, North America and North Africa were the primary markets for our direct reduction pellets.

We invest in customer service in order to improve our competitiveness. We work with our customers to understand their objectives and to provide them with iron ore solutions to meet specific customer needs. Using our expertise in mining, agglomeration and iron-making processes, we search for technical solutions that will balance the best use of our world-class mining assets and the satisfaction of our customers. We believe that our ability to provide customers with a total iron ore solution and the quality of our products are both very important advantages helping us improve our competitiveness in relation to competitors that may be more conveniently located geographically. In addition to offering technical assistance to our customers, we have sales offices in St. Prex (Switzerland), Tokyo (Japan), Seoul (South Korea), Singapore, Dubai (UAE) and Shanghai (China), which support the global sales by Vale International, and an office in Brazil, which supports sales to South America. These offices also allow us to stay in close contact with our customers, monitor their requirements and our contract performance, and ensure that our customers receive timely deliveries.

We sell iron ore and iron ore pellets under different arrangements, including long-term contracts with customers and on a spot basis through tenders and trading platforms. Our pricing is generally linked to market price indexes and uses a variety of mechanisms, including current spot prices and average prices over specified periods. In cases where the products are priced before the final price is determinable at delivery, we recognize the sale based on a provisional price with a subsequent adjustment reflecting the final price.

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In 2015 and 2016, we hedged part of our total exposure to bunker oil prices relating to our owned fleet and long-term contracts of affreightment connected to our FOB, CFR and domestic sales. The 2015 hedge program was settled in 2015 and 2016. We expect the 2016 hedge program to be settled in 2017.

1.1.6 Competition

The global iron ore and iron ore pellet markets are highly competitive. The main factors affecting competition are price, quality and range of products offered, reliability, operating costs and shipping costs.

- *Asia* Our main competitors in the Asian market are located in Australia and include subsidiaries and affiliates of BHP Billiton, Rio Tinto Ltd ("Rio Tinto") and Fortescue Metals Group Ltd.

We are competitive in the Asian market for two main reasons. First, steel companies generally seek to obtain the types (or blends) of iron ore and iron ore pellets that can produce the intended final product in the most economic and efficient manner. Our iron ore has low impurity levels and other properties that generally lead to lower processing costs. For example, in addition to its high grade, the alumina content of our iron ore is very low compared to Australian ores, reducing consumption of coke and increasing productivity in blast furnaces, which is particularly important during periods of high demand. When market demand is strong, our quality differential generally becomes more valuable to customers. Second, steel companies often develop sales relationships based on a reliable supply of a specific mix of iron ore and iron ore pellets. Our ownership and operation of logistics facilities in the Northern and Southeastern Systems help us ensure that our products are delivered on time and at a relatively low cost. We rely on long-term contracts of affreightment to enhance our ability to offer our products in the Asian market at competitive prices on a CFR basis, despite higher transportation costs compared to Australian producers. To support our commercial strategy for our iron ore business, we operate two distribution centers, one in Malaysia and one in Oman and we have long-term agreements with five ports in China, which also serve as distribution centers.

In 2015, we launched the Brazilian blend fines (BRBF), a product resulting from blending fines from Carajás, which contain a higher concentration of iron and a lower concentration of silica in the ore, with fines from the Southern and Southeastern Systems, which contain a lower concentration of iron in the ore. The resulting blend offers strong performance in any kind of sintering operation. It is blended and sold in our Teluk Rubiah Maritime Terminal in Malaysia and in five distribution centers in China, which reduces the time to reach Asian markets and increases our distribution capillarity by using smaller vessels.

- *Europe* Our main competitors in the European market are Luossavaara Kiirunavaara AB ("LKAB"), ArcelorMittal Mines Canada Inc., Iron Ore Company of Canada ("IOC"), a subsidiary of Rio Tinto., Kumba Iron Ore Limited and Société Nationale Industrielle et Minière ("SNIM"). We are competitive in the European market for the same reasons as in Asia, but also due to the proximity of our port facilities to European customers.

- *Brazil* The Brazilian iron ore market is also competitive, and includes several small iron ore producers. Some steel companies, including Gerdau S.A. ("Gerdau"), Companhia Siderúrgica Nacional ("CSN"), Vallourec Tubos do Brasil S.A., Usiminas and Arcelor Mittal, also have iron ore mining operations. Although pricing is relevant, quality and reliability are important competitive factors as well. We believe that our integrated transportation systems, high-quality ore and technical services make us a strong competitor in the Brazilian market.

With respect to pellets, our major competitors are LKAB, Iron Ore Company of Canada (IOC), Ferrexpo, Arcelor Mittal Mines Canada (former Quebec Cartier Mining Co.) and Bahrain Steel (former Gulf Industrial Investment Co.).

Table of Contents**1.2 Manganese ore and ferroalloys****1.2.1 Manganese ore operations and production**

We conduct our manganese mining operations in Brazil through Vale S.A. and our wholly-owned subsidiaries Vale Manganês S.A. ("Vale Manganês") and MCR. Our mining operations are carried out under concessions from the federal government granted for an indefinite period. Our mines produce metallurgical ore, used primarily for the production of manganese ferroalloys, raw material to produce carbon and stainless steel.

Mining complex	Company	Location	Description/History	Mineralization	Operations	Power source	Access/ Transportation
Azul	Vale S.A.	State of Pará	Open-pit mining operations and on-site beneficiation plant.	High and medium-grade ores (22-53% manganese grade).	Crushing and classification steps, producing lumps and fines.	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	Manganese ore is transported by truck and EFC railroad to the Ponta da Madeira maritime terminal.
Morro da Mina	Vale Manganês	State of Minas Gerais	Open-pit mining operations and one major beneficiation plant. In January 2015, we suspended operations due to market conditions. In October 2016, we resumed operations to provide manganese ore to the Barbacena ferroalloy plant.	Medium and low-grade ores (an average content of 31% manganese grade).	Crushing, screening and dense-heavy medium separation DMS / HMS process producing lumps to the Barbacena ferroalloy plant.	Supplied through the national electricity grid. Acquired from regional utility companies.	Manganese ore is transported by trucks to the Barbacena ferroalloy plant.
Urucum	MCR	State of Mato Grosso do Sul	Underground mining operations and on-site beneficiation plant.	High-grade ores (an average content of 46% manganese grade).	Crushing and classification steps, producing lumps and fines.	Supplied through the national electricity grid. Acquired from regional utility companies.	Manganese ore is transported by barges traveling along the Paraguay and Paraná rivers to transhipper.

The following table sets forth information about our manganese ore production, obtained after beneficiation process, and mass recovery for the year of 2016.

Mine	Type	Production for the year ended December 31, 2016 process			recovery (%)
		2014	2015	2016	
		(million metric tons)			
Azul	Open pit	1.7	1.7	1.7	51.2
Morro da Mina(1)	Open pit	0.1		0.0	70.0
Urucum	Underground	0.6	0.7	0.7	82.0
Total		2.4	2.4	2.4	

(1)

We suspended operations at Morro da Mina Mine in 2015 due to market conditions. We resumed operations in October 2016 to provide manganese ore to the Barbacena ferroalloy plant.

Table of Contents**1.2.2 Manganese ferroalloys operations and production**

We conduct our manganese ferroalloys business through our wholly-owned subsidiary Vale Manganês. The production of manganese ferroalloys consumes significant amounts of electricity, which is provided through power purchase agreements. For information on the risks associated with potential energy shortages, see *Risk factors*.

We produce several types of manganese ferroalloys, such as high carbon and medium carbon ferro-manganese and ferro-silicon manganese.

Plant	Location	Description/History	Nominal capacity	Power source
Minas Gerais Plants	Cities of Barbacena and Ouro Preto	Barbacena has six furnaces, two of which are refining furnaces and a briquetting plant. Ouro Preto has three furnaces which are currently not operating.	Barbacena: 66,000 tons per year (54,000 tons per year of ferro-silicon manganese and 12,000 tons per year of ferro-manganese medium carbon). Ouro Preto: 64,000 tons per year of ferro-silicon manganese.	Supplied through the national electricity grid. Acquired through power purchase agreements.
Bahia Plant	City of Simões Filho	Four furnaces, two converters and a sintering plant.	135,000 tons per year (42,000 tons per year of ferro-silicon manganese and 93,000 tons per year of high carbon ferro-manganese). The plant has a capacity to refine until 40,000 tons per year of ferro-manganese high carbon to produce ferro-manganese medium carbon alloy, according to market demand.	Supplied through the national electricity grid. Energy acquired from CHESF or through power purchase agreements.

The following table sets forth information about our manganese ferroalloys production.

Plant	Production for the year ended December 31(1),		
	2014	2015	2016
	(thousand metric tons)		
Barbacena	50	6	48
Ouro Preto	8	1	
Simões Filho	113	92	77
Total	171	99	124

(1) Production figures reflect unfinished material, which is further processed by a crushing and screening facility. Average mass recovery in this process is 85%.

We suspended operations at the Ouro Preto plant in February 2014, due to market conditions. In January 2015, the power purchase agreement pursuant to which we acquire energy for our Barbacena and Ouro Preto plants expired, and we also suspended operations in our Barbacena plant. The Barbacena plant resumed operations in February 2016. We are considering power supply alternatives to these plants, taking into consideration the energy prices and current market conditions for manganese ferroalloys.

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1.2.3 Manganese ore and ferroalloys: sales and competition

The markets for manganese ore and ferroalloys are highly competitive. Competition in the manganese ore market takes place in two segments. High and medium-grade manganese ore competes on a global seaborne basis, while low-grade ore competes on a regional basis. For some manganese ferroalloys, high and medium-grade ore is mandatory, while for other ores are complementary. The main suppliers of high-grade ores are located in South Africa, Gabon, Australia and Brazil. The main producers of low-grade ores are located in the Ukraine, China, Ghana, Kazakhstan, India and Mexico.

We compete in the seaborne market with both high- and medium-grade ores from Azul and Urucum mines, where we benefit from extensive synergies with our iron ore operations, from mine to rail to port to vessels operations. Our main competitors in this segment are South32 (Australia and South Africa) and Eramet (Gabon). Our low-grade ores are consumed internally in our ferroalloy smelters.

The manganese ferroalloy market is characterized by a large number of participants who compete primarily on the basis of price. Our competitors are located principally in countries that produce manganese ore or carbon steel. Potential entrants and substitutes come from silicon or chrome ferroalloys, who can occasionally shift to manganese, and from electrolytic manganese producers. Competitors may be either integrated smelters like us, who feed manganese ore from their own mines, or non-integrated smelters. The principal competitive factors in this market are the costs of manganese ore, electricity, logistics and reductants such as coke, coal and charcoal. We compete with both stand-alone producers and integrated producers that also mine their own ore.

Focusing mainly in the Brazilian and South American steelmaking customers, our ferroalloys operations also benefit from synergies with our iron ore sales, marketing, procurement and logistics activities. We buy our energy and coke supplies at reasonable market prices both through medium- and long-term contracts. Competitors in the Brazilian market are about a dozen smelters with capacities from five to 90 thousand tons per year, most non-integrated ones and some of them are customers of our manganese ores. We have a distinctive advantage in comparison to them in producing higher manganese content ferroalloys.

Table of Contents**2. Base metals****2.1 Nickel****2.1.1 Operations**

We conduct our nickel operations primarily through our wholly-owned subsidiary Vale Canada, which operates two nickel production systems, one in the North Atlantic region and the other in the Asia Pacific region. We also produce copper as a coproduct in our nickel operations in Canada and, through Vale S.A., operate a third nickel production system, Onça Puma, in the South Atlantic region. Our nickel operations are set forth in the following table.

Company/Mining System	Location	Description/History	Operations	Mining title	Power source	Access/Transportation
<i>North Atlantic:</i>						
Vale Canada	Canada Ontario	Sudbury, Integrated mining, milling, smelting and refining operations to process ore into finished nickel with a nominal capacity of 66,000 metric tons of refined nickel per year and additional nickel oxide feed for the refinery in Wales and our nickel plants in Asia. Mining operations in Sudbury began in 1885. We acquired the Sudbury operations in 2006.	<i>Nickel.</i> Primarily underground mining operations with nickel sulfide ore bodies, which also contain some copper, cobalt, PGMs, gold and silver. We also process external feeds from third parties and from our Voisey's Bay operation. We plan to cease processing Voisey's Bay feed in Sudbury during the year of 2017. In addition to producing finished nickel in Sudbury, we ship a nickel oxide intermediate product to our nickel refinery in Wales for processing to final products. We also have capabilities to ship nickel oxide to our Asian refineries. As part of our efforts to reduce sulfur dioxide and other air emissions to meet regulatory changes in Ontario and Manitoba, and to rationalize our smelting and refining assets across Canada, we will modify our processes including switching to a single flash furnace in Sudbury in 2017.	Patented mineral rights with no expiration date; mineral leases expiring between 2017 and 2037; and mining licenses of occupation with indefinite expiration date(1).	Supplied by Ontario's provincial electricity grid and produced directly by Vale.	Located by the Trans-Canada highway and the two major railways that pass through the Sudbury area. Finished products are delivered to the North American market by truck. For overseas customers, the products are loaded into containers and travel intermodally (truck/rail/containership) through both east and west coast Canadian ports.

Copper. We produce two intermediate copper products, copper concentrate and copper anode, and we also produce a finished copper product, electrowon copper cathode. We will switch to a single flash furnace in Sudbury in 2017 and as a result, we will cease copper anode production resulting in increased production of copper concentrate and copper matte.

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Company/Mining System	Location	Description/History	Operations	Mining title	Power source	Access/Transportation
Vale Canada	Canada Thompson, Manitoba	Integrated mining, milling, smelting and refining operations to process ore into finished nickel with a nominal capacity of 38,000 metric tons of refined nickel per year. We intend to phase out smelting and refining activities in Thompson by 2018. Thompson mineralization was discovered in 1956, and Thompson operations were acquired by us in 2006.	<i>Nickel</i> . Primarily underground mining operations with nickel sulfide ore bodies, which also contain some copper and cobalt. Local concentrate is combined with nickel concentrate from our Voisey's Bay operations for smelting and refining to high quality nickel plate product. We expect to decommission one of the two furnaces in Thompson in 2017 and the other in 2018. We also expect to cease processing Voisey's Bay feed in Thompson during the year of 2017. We plan to send the majority of the feed from Thompson to be refined in Long Harbour and Sudbury. We intend to phase out smelting and refining activities in Thompson by 2018, due primarily to the capital costs associated with the federal sulfur dioxide emission limits defined under the pollution prevention plan under the Canadian Environmental Protection Act (CEPA), as well as to declining feed availability. We have secured an extension for implementation of our current sulfur dioxide emission reduction plan, which permits smelting and refining through 2018, subject to negotiated emission limits.	Order in Council leases expiring between 2020 and 2025; mineral leases expiring in 2034.	Supplied by Manitoba's provincial utility company.	Finished products are delivered to market by truck in North America. For overseas customers, the products are loaded into containers and travel intermodally (truck/rail/containership) to final destination through both west coast and east coast Canadian ports.

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Company/Mining System	Location	Description/History	Operations	Mining title	Power source	Access/Transportation
Vale Newfoundland & Labrador Limited	Canada Voisey's Bay and Long Harbour, Newfoundland and Labrador	Integrated open-pit mining and milling operation at Voisey's Bay producing nickel and copper concentrates with refining of nickel concentrate at Long Harbour into finished metal products with an expected nominal capacity of approximately 50,000 metric tons of refined nickel per year upon ramp-up. Voisey's Bay's operations started in 2005 and was purchased by us in 2006.	Comprised of the Ovoid open pit mine, and deposits for underground operations at a later stage. We mine nickel sulfide ore bodies, which also contain copper and cobalt. The Long Harbour facility continued to ramp up in 2016. In 2016, Long Harbour facility only processed Voisey's Bay high-grade nickel concentrates and no longer nickel in matte from PTVI. In 2017, as a result of the continuing ramp-up of the Long Harbour nickel refinery, copper cathode and cobalt metal will be produced for the first time. The portion of mid-grade and high-grade concentrate not shipped to Long Harbour in 2017 will be shipped to our Sudbury and Thompson operations for final processing (smelting and refining) while copper concentrate will be sold to the market. Shipments of nickel concentrate to Sudbury and Thompson are expected to cease by the end of 2017. We expect the ramp-up to continue at Long Harbour until the end of 2018.	Mining lease expiring in 2027, with a right of further renewals for 10-year periods.	Power at Voisey's Bay is 100% supplied through Vale owned diesel generators. Power at the Long Harbour refinery is supplied by the Newfoundland and Labrador provincial utility company.	The nickel and copper concentrates from Voisey's Bay are transported to the port by haulage trucks and then shipped by drybulk vessels to either overseas markets or to our Long Harbour and other Canadian operations for further refining.
Vale Europe Limited	U.K. Clydach, Wales	Stand-alone nickel refinery (producer of finished nickel), with nominal capacity of 40,000 metric tons per year. The Clydach refinery commenced operations in 1902 and was acquired by us in 2006.	Processes a nickel intermediate product, nickel oxide, supplied from our Sudbury and Matsuzaka operations to produce finished nickel in the form of powders and pellets.		Supplied through the national electricity grid.	Transported to final customer in the UK and continental Europe by truck. Products for overseas customers are trucked to the ports of Southampton and Liverpool and shipped by ocean container.

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Company/Mining System	Location	Description/History	Operations	Mining title	Power source	Access/Transportation
<i>Asia Pacific</i>						
PT Vale Indonesia Tbk ("PTVI")	Indonesia Sulawesi	Sorowako, Open cast mining area and related processing facility (producer of nickel matte, an intermediate product) with a nominal capacity of approximately 80,000 metric tons of nickel in matte per year. PTVI's shares are traded on the Indonesia Stock Exchange. We indirectly hold 59.2% of PTVI's share capital, Sumitomo Metal Mining Co., Ltd ("Sumitomo") holds 20.2%, Sumitomo Corporation holds 0.1% and the public holds 20.5%. PTVI was established in 1968, commenced its commercial operations in 1978 and was acquired by us in 2006.	PTVI mines nickel laterite ore and produces nickel matte, which is shipped primarily to our nickel refinery in Japan. Pursuant to life-of-mine off-take agreements, PTVI sells 80% of its production to our wholly-owned subsidiary Vale Canada and 20% of its production to Sumitomo.	Contract of work expiring in 2025, entitled to two consecutive ten-year extensions, subject to approval of the Indonesian government. See <i>Regulatory matters Mining rights and regulation of mining activities.</i>	Produced primarily by PTVI's low cost hydroelectric power plants on the Larona River (there are currently three facilities). PTVI has thermal generating facilities in order to supplement its hydroelectric power supply with a source of energy that is not subject to hydrological factors.	Trucked approximately 55 km to the river port at Malili and then loaded onto barges in order to load break-bulk vessels for onward shipment.
Vale Nouvelle-Calédonie S.A.S ("VNC")	New Caledonia Southern Province	Mining and processing operations (producer of nickel oxide, nickel hydroxide and cobalt carbonate). We hold 95% of VNC's shares and the remaining 5% is held by Société de Participation Minière du Sud Caledonien SAS ("SPMSC") SPMSC has an obligation to increase its stake in VNC to 10% within two years after the startup of commercial production.	We are currently ramping up our nickel operation in New Caledonia. VNC utilizes a High Pressure Acid Leach ("HPAL") process to treat limonitic laterite and saprolitic laterite ores. We expect to continue to ramp-up VNC over the next four years to reach nominal production capacity of 57,000 metric tons per year of nickel contained in nickel oxide, which will be further processed in our refineries in Asia, and hydroxide cake form (IPNM), and 4,500 metric tons of cobalt in carbonate form.	Mining concessions expiring between 2017 and 2051(3).	Supplied through the national electricity grid and by independent producers.	Products are packed into containers and are trucked approximately 4 km to Prony port and shipped by ocean container.

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Company/Mining System	Location	Description/History	Operations	Mining title	Power source	Access/Transportation
Vale Japan Limited	Japan Matsuzaka	Stand-alone nickel refinery (producer of intermediate and finished nickel), with a nominal capacity of 60,000 metric tons per year. We own 87.2% of the shares, and Sumitomo owns the remaining shares. The refinery was built in 1965 and was acquired by us in 2006.	Produces intermediate products for further processing in our refineries in Asia and the UK, and finished nickel products using nickel matte sourced from PTVI.		Supplied through the national electricity grid. Acquired from regional utility companies.	Products trucked over public roads to customers in Japan. For overseas customers, the product is loaded into containers at the plant and shipped from the ports of Yokkaichi and Nagoya.
Vale Taiwan Limited	Taiwan Kaoshiung	Stand-alone nickel refinery (producer of finished nickel), with nominal capacity of 18,000 metric tons per year. The refinery commenced production in 1983 and was acquired by us in 2006.	Produces finished nickel for the stainless steel industry, primarily using intermediate products from our Matsuzaka and New Caledonian operations.		Supplied through the national electricity grid. Acquired from regional utility companies.	Trucked over public roads to customers in Taiwan. For overseas customers, the product is loaded into containers at the plant and shipped from the port of Kaoshiung.
Vale Nickel (Dalian) Co., Ltd	China Dalian, Liaoning	Stand-alone nickel refinery (producer of finished nickel), with nominal capacity of 32,000 metric tons per year. We own 98.3% of the shares and Ningbo Sunhu Chemical Products Co., Ltd. owns the remaining 1.7%. The refinery commenced production in 2008.	Produces finished nickel for the stainless steel industry, primarily using intermediate products from our Matsuzaka and New Caledonian operations.		Supplied through the national electricity grid. Acquired from regional utility companies.	Product transported over public roads by truck and by railway to customers in China. It is also shipped in ocean containers to overseas and some domestic customers.
South Atlantic						
Vale/Onça Puma	Brazil Ourilândia do Norte, Pará	Mining and smelting operation producing a high quality ferronickel for application within the stainless steel industry.	The Onça Puma mine is built on lateritic nickel deposits of saprolitic laterite ore. The operation produces ferronickel via the rotary kiln-electric furnace process. We are currently operating with a single line, with nominal capacity estimated at 27,000 metric tons per year. We will evaluate opportunities to restart the second line operations in light of market conditions and the associated business case.	Mining concession for indefinite period.	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	The ferro-nickel is transported by truck to the Vila do Conde maritime terminal in the Brazilian state of Pará, and exported in ocean containers.

(1) In Sudbury, ten mining leases are scheduled to expire in 2017. We have submitted applications for renewal of these leases and the approval process is ongoing. We can continue to operate while the approval process is ongoing.

(2)

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In March 2016, Vale Canada purchased the entire equity interest in VNC held by Sumic, a joint venture between Sumitomo and Mitsui. In April 2017, Vale Canada will pay to Sumic the share purchase price of US\$135 million and repay a total amount of US\$225 million in debt funding provided by Sumic to VNC.

(3)

VNC has requested a renewal of concessions that were scheduled to expire in 2015 and 2016. We can continue to operate while the approval process is ongoing.

Table of Contents**2.1.2 Production**

The following table sets forth our annual mine production by operating mine (or, on an aggregate basis in the case of the Sulawesi operating areas operated by PTVI in Indonesia, because it is organized by mining areas rather than individual mines) and the average percentage grades of nickel and copper. The mine production at Sulawesi represents the product from PTVI's screening station delivered to PTVI's processing plant and does not include nickel losses due to drying and smelting. For our Sudbury, Thompson and Voisey's Bay operations, the production and average grades represent the mine product delivered to those operations' respective processing plants and do not include adjustments due to beneficiation, smelting or refining. For Onça Puma's operation, in Brazil and VNC's operation, in New Caledonia, the production and average grade represents in-place ore production and does not include losses due to processing.

	2014(1)			2015(1)			2016(1)		
	Production	Copper Grade	Nickel Grade	Production	Copper Grade	Nickel Grade	Production	Copper Grade	Nickel Grade
<i>Ontario operating mines</i>									
Copper Cliff North	1,053	1.45	1.34	1,138	1.42	1.38	979	1.44	1.26
Creighton	903	1.81	2.47	774	2.00	2.33	832	2.17	2.76
Stobie	2,089	0.58	0.66	1,471	0.63	0.73	1,373	0.57	0.64
Garson	678	1.39	1.75	778	1.39	1.94	711	1.34	1.91
Coleman	1,385	3.10	1.52	1,309	2.95	1.56	1,209	3.76	1.47
Ellen	181	0.62	1.07	165	0.70	0.95	75	0.42	0.88
Totten	303	1.98	1.50	528	1.88	1.62	671	1.86	1.43
Total Ontario operations	6,591	1.57	1.36	6,164	1.64	1.46	5,850	1.84	1.47
<i>Manitoba operating mines</i>									
Thompson	1,184		1.95	1,163		1.82	1,140		1.97
Birchtree	545		1.39	564		1.47	503		1.36
Total Manitoba operations	1,729		1.78	1,727		1.71	1,643		1.78
<i>Voisey's Bay operating mines</i>									
Ovoid	2,243	1.54	2.58	2,328	1.51	2.57	2,392	1.44	2.62
<i>Sulawesi operating mining areas</i>									
Sorowako	4,391		1.99	4,694		1.99	4,708		1.93
<i>New Caledonia operating mines</i>									
VNC	2,134		1.44	2,561		1.41	2,919		1.53
<i>Brazil operating mines</i>									
Onça Puma	1,358		2.19	1,024		2.13	1,710		2.04

(1) Production is stated in thousands of metric tons. Grade is % of copper or nickel, respectively.

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The following table sets forth information about our nickel production, including: nickel refined through our facilities and intermediates designated for sale. The numbers below are reported on a contained nickel ore-source basis.

Mine	Type	Finished production by ore source for the year ended December 31,		
		2014	2015	2016
		(thousand metric tons contained nickel)		
Sudbury	Underground	64.3	54.4	80.4
Thompson	Underground	26.1	24.8	26.5
Voisey's Bay(1)	Open pit	48.3	53.0	49.0
Sorowako(2)	Open cast	78.7	79.5	81.1
Onça Puma	Open pit	21.4	24.4	24.1
New Caledonia(3)	Open pit	18.7	26.9	34.3
External(4)		17.5	27.6	15.6
Total(5)		274.9	290.6	311.0

-
- (1) Includes finished nickel produced at Long Harbour, Sudbury and Thompson.
- (2) These figures have not been adjusted to reflect our ownership. We have a 59.2% interest in PTVI, which owns the Sorowako mines.
- (3) These figures have not been adjusted to reflect our ownership. We have a 95.0% interest in VNC.
- (4) Finished nickel processed at our facilities using feeds purchased from unrelated parties.
- (5) These figures do not include tolling of feeds for unrelated parties.

2.1.3 Customers and sales

Our nickel customers are broadly distributed on a global basis. In 2016, 47% of our refined nickel sales were delivered to customers in Asia, 27% to Europe, 24% to North America and 1% to other markets. We have short-term fixed-volume contracts with customers for the majority of our expected annual nickel sales. These contracts generally provide stable demand for a significant portion of our annual production.

Nickel is an exchange-traded metal, listed on the London Metal Exchange ("LME") and Shanghai Futures Exchange ("SHFE"), and most nickel products are priced according to a discount or premium to the LME price, depending primarily on the nickel product's physical and technical characteristics. Our finished nickel products represent what is known in the industry as "primary" nickel, meaning nickel produced principally from nickel ores (as opposed to "secondary" nickel, which is recovered from recycled nickel-containing material). Finished primary nickel products are distinguishable in terms of the following characteristics, which determine the product price level and the suitability for various end-use applications:

- nickel content and purity level: (i) intermediates have various levels of nickel content, (ii) nickel pig iron has 1.5-15% nickel, (iii) ferro-nickel has 15-40% nickel, (iv) refined nickel with less than 99.8% nickel, including products such as Tonimet and Utility nickel, (v) standard LME grade nickel has a minimum of 99.8% nickel, and (vi) high purity nickel has a minimum of 99.9% nickel and does not contain specific elemental impurities;
- shape (such as pellets, discs, squares, and strips); and
- size (from sub-micron powder particles to large full sized cathodes)

In 2016, the principal end-use applications for nickel were:

- stainless steel (69% of global nickel consumption);
- non-ferrous alloys, alloy steels and foundry applications (18% of global nickel consumption);

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- nickel plating (7% of global nickel consumption); and
- specialty applications, such as batteries, chemicals and powder metallurgy (6% of global nickel consumption).

In 2016, 58% of our refined nickel sales were made into non-stainless steel applications, compared to the industry average for primary nickel producers of 30%. This brings more diversification and sales volume stability to our nickel revenues. As a result of our focus on such higher-value segments, our average realized nickel prices for refined nickel have typically exceeded LME cash nickel prices.

We offer sales and technical support to our customers on a global basis through an established marketing network headquartered at our head office in Toronto (Canada). We have a well-established global marketing network for finished nickel, based at our head office in Toronto (Canada). We also have sales and technical support distributed around the world with primary back offices in Singapore and Toronto (Canada) and have sales managers located in St.Prex (Switzerland), Saddle Brook, New Jersey (United States) and at several sites throughout Asia. For information about demand and prices, see *Operating and financial review and prospects Major factors affecting prices*.

2.1.4 Competition

The global nickel market is highly competitive. Our key competitive strengths include our long-life mines, our low cash costs of production relative to other nickel producers, sophisticated exploration and processing technologies, and a diversified portfolio of products. Our global marketing reach, diverse product mix, and technical support direct our products into applications and geographic regions that offer the highest margins for our products.

Our nickel deliveries represented 16% of global consumption for primary nickel in 2016. In addition to us, the largest mine-to-market integrated suppliers in the nickel industry (each with its own integrated facilities, including nickel mining, processing, refining and marketing operations) are Nornickel, Glencore, Jinchuan Nonferrous Metals Corporation and Sumitomo Metal Mining Co. Ltd. Together with us, these companies accounted for about 38% of global refined primary nickel production in 2016.

While stainless steel production is a major driver of global nickel demand, stainless steel producers can obtain nickel with a wide range of nickel content, including secondary nickel (scrap). The choice between primary and secondary nickel is largely based on their relative prices and availability. See *Operating and Financial Review and Prospects Major factors affecting prices Nickel*.

Competition in the nickel market is based primarily on quality and reliability of supply and price. We believe our operations are competitive in the nickel market because of the high quality of our nickel products and our relatively low production costs.

Table of Contents**2.2 Copper****2.2.1 Operations**

We conduct our copper operations at the parent-company level in Brazil and through our subsidiaries in Canada.

Mining complex/Location	Location	Description/History	Mineralization/Operations	Mining title	Power source	Access/Transportation
Brazil:						
Vale/Sossego	Carajás, state of Pará.	Two main copper ore bodies, Sossego and Sequeirinho, and a processing facility to concentrate the ore. Sossego was developed by Vale. Production started in 2004 and has a nominal capacity of 100,000 tpy of copper in concentrates.	The copper ore is mined using the open-pit method, and the run-of-mine is processed by means of standard primary crushing and conveying, SAG milling (a semi-autogenous mill that uses a large rotating drum filled with ore, water and steel grinding balls to transform the ore into a fine slurry), ball milling, copper concentrate flotation, tailings disposal, concentrate thickening, filtration and load out.	Mining concession for an indefinite period.	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	We truck the concentrate to a storage terminal in Parauapebas and then transport it via the EFC railroad to the Itaqui Port in São Luís, in the Brazilian state of Maranhão. We constructed an 85-kilometer road to link Sossego to Parauapebas.
Vale/Salobo	Carajás, state of Pará.	Salobo I processing plant started production in 2012 and has a total capacity of 100,000 tpy of copper in concentrates. The open pit mine and mill concluded their ramp up in the fourth quarter of 2016 to a capacity of 200,000 tpy of copper in concentrates with the full implementation of Salobo II expansion.	Our Salobo copper mine is mined using the open-pit method, and the run-of-mine is processed by means of standard primary and secondary crushing, conveying, roller press grinding, ball milling, copper concentrate flotation, tailings disposal, concentrate thickening, filtration and load out.	Mining concession for an indefinite period.	Supplied through the national electricity grid. Acquired through power purchase agreements.	We truck the concentrate to a storage terminal in Parauapebas and then transport it via the EFC railroad to the Itaqui Port in São Luís, in the Brazilian state of Maranhão. We constructed a 90-kilometer road to link Salobo to Parauapebas.

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Mining complex/Location	Location	Description/History	Mineralization/Operations	Mining title	Power source	Access/Transportation
Canada:						
Vale Canada	Canada Sudbury, Ontario		See <i>Base metals</i>	<i>Nickel Operations</i>		
Vale Canada/ Voisey's Bay	Canada Voisey's Bay, Newfoundland and Labrador		See <i>Base metals</i>	<i>Nickel Operations</i>		
Zambia:						
Lubambe	Zambian Copperbelt	Lubambe copper mine, which includes an underground mine, plant and related infrastructure. Teal Minerals ("TEAL") (our 50/50 joint venture with African Rainbow Minerals ("ARM")) has an 80% indirect stake in Lubambe. ZCCM Investments Holdings PLC holds the remaining (20%) stake.	Nominal production capacity of 45,000 metric tons per year of copper in concentrates. Production started in October 2012.	Mining concessions expiring in 2033.	Long-term energy supply contract with Zesco (Zambian state owned power supplier).	Copper concentrates are transported by truck to local smelters.

Table of Contents**2.2.2 Production**

The following table sets forth our annual mine production in our Salobo and Sossego mines and the average percentage grades of copper. The production and average grade represents in-place ore production and does not include losses due to processing. For the annual production of copper as a coproduct in our nickel operations, see *Base metals Nickel Production*.

	2014(1)		2015(1)		2016(1)	
	Production	Grade	Production	Grade	Production	Grade
<i>Brazil</i>						
Sossego	15,105	0.86	12,857	0.93	12,687	0.82
Salobo	18,644	0.84	44,296	0.62	57,279	0.62
Total	33,749	0.85	57,153	0.69	69,966	0.66

(1) Production is stated in thousands of metric tons. Grade is % of copper.

The following table sets forth information on our copper production.

Mine	Type	Finished production by ore source for the year ended December 31,		
		2014	2015	2016
		(thousand metric tons)		
<i>Brazil:</i>				
Salobo	Open pit	98	155	176
Sossego	Open pit	110	104	93
<i>Canada: (as coproduct of nickel operations)</i>				
Sudbury	Underground	98	98	122
Voisey's Bay	Open pit	33	32	32
Thompson	Underground	2	1	3
External(1)		29	23	21
<i>Zambia:</i>				
Lubambe(2)	Underground	10	10	8
Total		380	424	453

(1) We process copper at our facilities using feed purchased from unrelated parties.

(2) Vale's attributable production capacity of 40%, which represents 80% of indirect interest through our 50% participation.

2.2.3 Customers and sales

We sell copper concentrates from Sossego and Salobo under medium and long-term contracts to copper smelters in Europe, India and Asia. We have medium-term copper supply agreements with Glencore Canada Corporation for part of the copper concentrates produced in Sudbury, which are also sold under long-term contracts in Europe and Asia. We sell copper concentrates from Voisey's Bay under long-term contracts to customers in Europe and electrowon copper from Sudbury in North America under short-term sales agreements.

2.2.4 Competition

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The global refined copper market is highly competitive. Producers are integrated mining companies and custom smelters, covering all regions of the world, while consumers are principally wire rod and copper-alloy producers. Competition occurs mainly on a regional level and is based primarily on production costs, quality, reliability of supply and logistics costs. The world's largest copper cathode producers are Corporación Nacional del Cobre de Chile ("Codelco"), Freeport McMoRan Copper & Gold Inc. ("Freeport-McMoRan"), Aurubis AG, Jiangxi Copper Corporation Ltd. and Glencore, operating at the parent-company level or through subsidiaries. Our participation in the global refined copper cathodes market is marginal as we position ourselves more competitively in the copper concentrate market.

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Copper concentrate and copper anode are intermediate products in the copper production chain. Both the concentrate and anode markets are competitive, having numerous producers but fewer participants and smaller volumes than in the copper cathode market due to the high levels of integration by the major copper producers.

In the copper concentrate market, mining occurs on a global basis with a predominant share from South America, while consumers are custom smelters located mainly in Europe and Asia. Competition in the custom copper concentrate market occurs mainly on a global level and is based on production costs, quality, logistics costs and reliability of supply. The largest competitors in the copper concentrate market are Glencore, BHP Billiton, Freeport McMoRan, Codelco, Anglo American and Antofagasta plc operating at the parent-company level or through subsidiaries. Our market share in 2016 was about 4% of the total custom copper concentrate market.

The copper anode/blister market is very limited; generally, anodes are produced to supply each company's integrated refinery. The trade in anodes/blister is limited to those facilities that have more smelting capacity than refining capacity or to those situations where logistics cost savings provide an incentive to source anodes from outside smelters. The largest competitors in the copper anode market in 2016 included Glencore, First Quantum Minerals Ltd, Codelco, and China Nonferrous Metals, operating at the parent-company level or through subsidiaries.

2.3 PGMs and other precious metals

As byproducts of our Sudbury nickel operations in Canada, we recover significant quantities of PGMs, as well as small quantities of gold and silver. We operate a processing facility in Port Colborne, Ontario, which produces PGMs, gold and silver intermediate products using feed from our Sudbury operation. We have a refinery in Acton, England, where we process our intermediate products, as well as feeds purchased from unrelated parties and toll-refined materials. In 2016, PGM concentrates from our Canadian operations supplied about 88% of our PGM production, which also includes metals purchased from unrelated parties. Our base metals marketing department sells our own PGMs and other precious metals, as well as products from unrelated parties and toll-refined products, on a sales agency basis. Our copper concentrates from our Salobo and Sossego mines in Carajás, in the Brazilian state of Pará, also contain gold, the value of which we realize in the sale of those products.

In February 2013, we sold to Silver Wheaton 25% of the gold produced as a byproduct at our Salobo copper mine, in Brazil, for the life of that mine, and 70% of the gold produced as a byproduct at our Sudbury nickel mines, in Canada, for 20 years. In each of March 2015 and August 2016, we sold to Silver Wheaton an additional 25% of the gold produced as a byproduct at our Salobo copper mine. In consideration for the August 2016 sale, we received an initial cash payment of US\$800 million, an option value of approximately US\$23 million from a reduction of the exercise price of the warrants of Silver Wheaton held by Vale since 2013, and ongoing payments of the lesser of US\$400 per ounce (subject to a 1% annual inflation adjustment starting January 1, 2019) and the prevailing market price, for each ounce of gold that we deliver under the agreement. We may receive an additional cash payment if we expand our capacity to process Salobo copper ores to more than 28 Mtpy before 2036. The additional cash payment may range from US\$113 million to US\$953 million, depending on ore grade, timing and size of the expansion. See *Business overview Significant changes in our business*. Pursuant to the gold stream contract, Silver Wheaton received 247,287 oz. of gold in 2016.

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The following table sets forth information on the contained volume of precious metals as a byproduct of our production of nickel and copper concentrates.

Mine	Type	2014	2015	2016
		(thousand troy ounces of contained metal)		
Sudbury(1):				
Platinum	Underground	182	154	166
Palladium	Underground	398	341	322
Gold(2)	Underground	83	89	98
Salobo:				
Gold(2)	Open pit	160	251	317
Sossego:				
Gold	Open pit	78	80	67

(1) Includes metal produced from unrelated parties feed purchases. Includes Ontario (Canada) and Acton (England) production. Excludes tolling from unrelated parties.

(2) Figures represent 100% of Salobo and Sudbury contained volume of gold as a byproduct of our production of nickel and copper concentrates and do not deduct the portion of the gold sold to Silver Wheaton.

2.4 Cobalt

We recover significant quantities of cobalt as a byproduct of our nickel operations. In 2016, we produced 1,851 metric tons of refined cobalt metal at our Port Colborne refinery, 3,188 metric tons of cobalt in a cobalt-based intermediate product at our nickel operations in New Caledonia, and our remaining cobalt production consisted of 761 metric tons of cobalt contained in other intermediate products (such as nickel concentrates). As a result of the ramp-up of VNC operations in New Caledonia, our production of cobalt intermediate as a byproduct of our nickel production is increasing. We sell cobalt on a global basis. Our cobalt metal is electro-refined at our Port Colborne refinery and has very high purity levels (99.8%) meeting the LME contract specification. Cobalt metal is used in the production of various alloys, particularly for aerospace applications, as well as the manufacture of cobalt-based chemicals. In 2016, Long Harbour produced a cobalt intermediate with the operation expected to begin producing high quality cobalt metal in 2017.

The following table sets forth information on our cobalt production.

Mine	Type	Finished production by ore source for the year ended December 31,		
		2014	2015	2016
(contained metric tons)				
Sudbury	Underground	833	751	882
Thompson	Underground	489	365	700
Voisey's Bay	Open pit	952	849	887
New Caledonia	Open pit	1,384	2,391	3,188
Others(1)		84	177	143
Total		3,743	4,533	5,799

(1) These figures do not include tolling of feeds for unrelated parties. Includes cobalt processed at our facilities using feeds purchased from unrelated parties and, for 2016, also includes 24 tonnes of ore sourced by PTVI.

Table of Contents**3. Coal****3.1 Operations**

We produce metallurgical and thermal coal through our subsidiary Vale Moçambique, which operates the Moatize mine. We also have a minority interest in a Chinese company, Henan Longyu Energy Resources Co., Ltd. ("Longyu"). In November 2016, we sold our coal operation in Carborough Downs in Australia.

In September 2016, we agreed with Mitsui the new terms of our partnership in coal assets in Mozambique. Under the new terms, Mitsui agreed to pay us an amount of up to US\$450 million, consisting of: (i) an aggregate of US\$255 million for 15% of Vale's 95% stake in the Moatize coal mine and (ii) an additional amount of up to US\$195 million, subject to certain conditions, including mine performance. Mitsui will also contribute an amount of approximately US\$348million for a 50% stake of Nacala Logistics Corridor and extend a long-term facility of US\$165 million to Nacala Logistics Corridor. We completed the equity transaction with Mitsui on March 27, 2017. The total value of the transaction will be approximately US\$770 million, including all amounts mentioned above except the additional amount of up to US\$195 million, which is subject to certain conditions, such as mining performance, still to be satisfied. From these US\$770 million, we received US\$733 million upon completion of the equity transaction on March 27, 2017, and we expect to receive the remainder upon closing of the project financing, which is expected to occur during 2017. If the project financing is not signed before the end of 2017, Mitsui has certain rights to transfer its participation in the Moatize coal mine and the Nacala Logistics Corridor back to us.

Company/Mining complex	Location	Description/History	Mineralization/ Operations	Mining title	Power source	Access/ Transportation
<i>Vale Moçambique</i>						
Moatize	Tete, Mozambique	Open-cut mine, which was developed directly by Vale. Operations started in August 2011 and are expected to reach a nominal production capacity of 22 Mtpy, considering the Moatize expansion, comprised of metallurgical and thermal coal and the Nacala Logistics Corridor ramp up. Vale has an indirect 95.0% stake, and the remaining is owned by Empresa Moçambicana de Exploração Mineira, S.A. Upon conclusion of the partnership agreement, Mitsui will acquire 15% of our stake in Vale Moçambique.	Produces metallurgical and thermal coal. Moatize's main branded product is the Chipanga premium hard coking coal, but there is operational flexibility for multiple products. The optimal product portfolio will come as a result of market trials. Coal from the mines is currently processed at a CHPP with a capacity of 4,000 metric tons per hour. An additional CHPP began production in August 2016, which increased feed capacity by additional 4,000 metric tons per hour.	Mining concession expiring in 2032, renewable thereafter.	Supplied by local utility company. Back up supply on site.	The coal is transported from the mine to the Beira Port by the Linha do Sena railway and, since January 2016, to the port at Nacala-à-Velha via the Nacala Logistics Corridor.

Table of Contents**3.2 Production**

The following table sets forth information on our marketable coal production.

Operation	Mine type	Production for the year ended December 31,		
		2014	2015	2016
(thousand metric tons)				
Metallurgical coal:				
Moatize(1)	Open-cut	3,124	3,401	3,480
Thermal coal:				
Moatize(1)	Open-cut	1,784	1,559	2,012

(1) These figures correspond to 100% production at Moatize, and are not adjusted to reflect our ownership.

3.3 Customers and sales

Coal sales from our Moatize operations, in Mozambique, target global steel and energy markets, including Asia, Africa, Europe and the Americas. Our Chinese coal joint venture directs its sales into the Chinese domestic market.

3.4 Competition

The global coal industry comprises markets for black (metallurgical and thermal) and brown (lignite) coal, and is highly competitive.

The demand for steel, especially in Asia, underpins demand for metallurgical coal, while demand for electricity underpins demand for thermal coal. We expect some increase in coal supply from the United States, Canada and Australia, driven by increased prices in the second half of 2016, which would thus rebalance the market following the price increases caused by China intervention policies relating to domestic coal production.

Competitiveness in the coal industry is based primarily on the economics of production costs, coal quality, transportation costs and proximity to the market. Our key competitive strengths are completion of a new and competitive transportation corridor, the proximity to the Atlantic and Indian markets (as compared to our main competitors) and the size and quality of our reserves.

Major participants in the seaborne coal market are subsidiaries, affiliates and joint ventures of BHP Billiton, Glencore, Anglo American, Rio Tinto, Teck, Peabody, PT Adaro Energy and the Shenhua Group, among others.

Table of Contents**4. Infrastructure****4.1 Logistics**

We have developed our logistics business based on the transportation needs of our mining operations and we also provide transportation services for other customers. We conduct our logistics businesses at the parent-company level and through subsidiaries and joint ventures, as set forth in the table below.

Company	Business	Location	Our share of capital Voting Total (%)		Partners
Vale	Railroad (EFVM and EFC), port and maritime terminal operations	Brazil			
VLI(1)	Railroad, port, inland terminal and maritime terminal operations. Holding of certain general cargo logistics assets	Brazil	37.6	37.6	FI-FGTS, Mitsui and Brookfield
MRS	Railroad operations	Brazil	46.75	48.12	CSN, Congonhas Minérios, Usiminas Participações e Logísticas, Gerdau, Railvest Investments and public investors.
CPBS	Port and maritime terminal operations	Brazil	100	100	
PTVI	Port and maritime terminal operations	Indonesia	59.2	59.2	Sumitomo, public investors
Vale Logística Argentina	Port operations	Argentina	100	100	
CEAR(2)(4)	Railroad	Malawi	43.4	43.4	Portos e Caminhos de Ferro de Moçambique, E.P.
CDN(3)(4)	Railroad and maritime terminal operations	Mozambique	43.4	43.4	Portos e Caminhos de Ferro de Moçambique, E.P.
CLN(4)	Railroad and port operations	Mozambique	80.0	80.0	Portos e Caminhos de Ferro de Moçambique, E.P.
Vale Logistics Limited ("VLL")(4)	Railroad operations	Malawi	100	100	
Transbarge Navegación	Paraná and Paraguay Waterway System (Convoys)	Paraguay	100	100	
VNC	Port and maritime terminal operations	New Caledonia	95.0	95.0	SPMSC
VMM	Port and maritime terminal operations	Malaysia	100	100	
Vale Newfoundland & Labrador Limited	Port operations	Voisey's Bay and Long Harbour, in Newfoundland and Labrador	100	100	
Vale Oman Distribution Center LLC	Port and maritime terminal operations	Oman	100	100	

- (1) BNDES holds debentures issued by Vale that are exchangeable into part of Vale's stake in VLI. Vale's equity interests in VLI may be reduced by up to 8% if BNDES exercises its rights under those debentures.
- (2) Vale controls its interest in CEAR through an 85% interest in Sociedade de Desenvolvimento do Corredor de Nacala ("SDCN"), which owns 51% of CEAR.
- (3) Vale controls its interest in CDN through an 85% interest in SDCN, which owns 51% of CDN.
- (4) Upon completion of the transaction with Mitsui, we will hold indirectly 42.5% of the voting and total capital of CEAR, 42.5% of the voting and total capital of CDN, 50% of the voting and total capital of CLN and 50% of the voting and total capital of VLL.

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4.1.1 Railroads

Brazil

Vitória a Minas railroad ("EFVM"). The EFVM railroad links our Southeastern System mines in the Iron Quadrangle region in the Brazilian state of Minas Gerais to the Tubarão Port, in Vitória, in the Brazilian state of Espírito Santo. We operate this 905-kilometer railroad under a 30-year renewable concession, which expires in 2027. The EFVM railroad consists of two lines of track extending for a distance of 601 kilometers to permit continuous railroad travel in opposite directions, and single-track branches of 304 kilometers. Industrial manufacturers are located in this area and major agricultural regions are also accessible to it. VLI has rights to use railroad transportation capacity on our EFVM railroad. In 2016, the EFVM railroad transported a daily average of 329.3 thousand metric tons of iron ore and 61.1 thousand metric tons of other cargo. The EFVM railroad also carried one million passengers in 2016. In 2016, we had a fleet of 325 locomotives and 19,135 wagons at EFVM, which were operated by Vale and third parties.

Carajás railroad ("EFC"). The EFC railroad links our Northern System mines in the Carajás region in the Brazilian state of Pará to the Ponta da Madeira maritime terminal, in São Luis, in the Brazilian state of Maranhão. We operate the EFC railroad under a 30-year renewable concession, which expires in 2027. EFC extends for 997 kilometers from our Carajás mines to our Ponta da Madeira maritime terminal complex facilities located near the Itaqui Port. Its main cargo is iron ore, principally carried for us. VLI has rights to use railroad transportation capacity on our EFC railroad. In 2016, the EFC railroad transported a daily average of 419 thousand metric tons of iron ore and 22.8 thousand metric tons of other cargo. EFC also carried 293 thousand passengers in 2016. EFC supports the largest train, in terms of capacity, in Latin America, which measures 3.5 kilometers, weighs 42.01 thousand gross metric tons when loaded and has 330 cars. In 2016, EFC had a fleet of 289 locomotives and 18,135 wagons, which were operated by Vale and third parties.

The principal items of cargo of the EFVM and EFC railroads are:

- iron ore and iron ore pellets and manganese ore, carried for us and customers;
- steel, coal, pig iron, limestone and other raw materials carried for customers with steel mills located along the railroad;
- agricultural products, such as soybeans, soybean meal and fertilizers; and
- other general cargo, such as pulp, fuel and chemical products.

We charge market prices for customer freight, including iron ore pellets originating from joint ventures and other enterprises in which we do not have a 100% equity interest. Market prices vary based on the distance traveled, the type of product transported and the weight of the freight in question, and are regulated by the Brazilian transportation regulatory agency, ANTT (*Agência Nacional de Transportes Terrestres*).

VLI. VLI provides integrated logistics solutions through 7,935 kilometers of railroads in Brazil (FCA and FNS), eight inland terminals with a total storage capacity of 795,000 tons and three maritime terminals and ports operations. We hold a 37.6% stake in VLI, and are party to a shareholders' agreement with FI-FGTS, Mitsui and Brookfield, which hold the remaining equity interests in VLI. VLI's main assets are:

- *Ferrovias Centro-Atlântica ("FCA").* Central-east regional railway network of the Brazilian national railway system, held under a 30-year renewable concession, which expires in 2026. The central east network has 7,215 kilometers of track, extending into the states of Sergipe, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, Goiás and the Federal District of Brazil;

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- *Ferrovias Norte-Sul railroad ("FNS").* A 30-year renewable subconcession for the commercial operation of a 720-kilometer stretch of the North-South railroad in Brazil, between the cities Açailândia, in the Brazilian state of Maranhão, and Porto Nacional, in the Brazilian state of Tocantins. This railway is connected to EFC railroad, and creates a new corridor for the transportation of general cargo, mainly for the export of soybeans, rice and corn produced in the center-northern region of Brazil;
- Right to use capacity of our EFVM and EFC railroads for general cargo; and
- Right to use capacity of our Tubarão e Praia Mole terminals for general cargo.

In 2016, VLI transported a total of 31.98 billion ntk of general cargo, including 19.53 billion ntk from FCA and FNS and 12.45 billion ntk through operational agreements with Vale.

MRS Logística S.A. ("MRS"). The MRS railroad is 1,643 kilometers long and links the Brazilian states of Rio de Janeiro, São Paulo and Minas Gerais. In 2016, the MRS railroad transported a daily average of 338.8 thousand metric tons of iron ore and 122.0 thousand metric tons of other cargo.

Africa

We are concluding the ramp up of the Nacala Corridor, which connects the Moatize mine to the Nacala-à-Velha maritime terminal, located in Nacala, Mozambique, and which crosses into the Republic of Malawi. The Nacala Corridor consists of railway and port infrastructure, including greenfield and rehabilitation of existing railways in Mozambique and Malawi and a new coal port terminal in Mozambique. The Nacala Corridor will allow for the expansion of the Moatize mine and support our operations in Southeastern Africa. In Mozambique, we are operating under two concession agreements, one related to the Mozambican greenfield railway and another related to the newly constructed coal port, both held by our subsidiary Corredor Logístico Integrado de Nacala S.A. ("CLN"), which will expire in 2042, subject to renewal. We have also rehabilitated existing railroads under a concession held by our subsidiary Corredor de Desenvolvimento do Norte S.A. ("CDN"), which will expire in 2035. In Malawi, we are operating under a concession held by our subsidiary Vale Logistics Limited ("VLL"), which will expire in 2046, subject to renewal, and we have also rehabilitated existing railroads under a concession held by our subsidiary, Central East African Railway Company Limited ("CEAR"), which was extended in 2013 for a 30-year period from the commencement of rail services under VLL's greenfield railway concession.

In November 2016, we agreed the new terms of our partnership in coal assets in Mozambique with Mitsui. Under these new terms, Mitsui will contribute an amount of approximately US\$348 million for a 50% stake of Nacala Logistics Corridor and extend a long-term facility of US\$165 million to Nacala Logistics Corridor. The completion of the equity transaction is subject to certain conditions precedent, including certain conditions precedents relating to the completion of a project financing in the expected amount of US\$2.7 billion.

4.1.2 Ports and maritime terminals

Brazil

We operate a port and maritime terminals principally as a means to complete the delivery of our iron ore and iron ore pellets to bulk carrier vessels serving the seaborne market. See *Ferrous minerals Iron ore and iron ore pellets Iron ore operations*. We also use our port and terminals to handle customers' cargo.

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Tubarão and Praia Mole Ports. The Tubarão Port, which covers an area of 18 square kilometers, is located near the Vitória Port in the Brazilian state of Espírito Santo and contains the iron ore maritime terminal and the general cargo terminals (*Terminal de Granéis Líquidos* and the *Terminal de Produtos Diversos*). The Praia Mole port is also located near the Vitória Port.

- The iron ore maritime terminal has two piers. From this terminal in the Tubarão Port, we export mostly iron ore produced from our Southeastern system. Pier I can accommodate two vessels at a time, one of up to 170,000 DWT on the southern side and one of up to 210,000 DWT on the northern side. Pier II can accommodate one vessel of up to 405,000 DWT at a time, limited at 23 meters draft. In Pier I there are two ship loaders, which can load up to 13,500 metric tons per hour each. In Pier II there are two ship loaders that work alternately and can each load up to 16,000 metric tons per hour continuously. In 2016, 100.7 million metric tons of iron ore and iron ore pellets were shipped through the terminal for us. The iron ore maritime terminal has a storage yard with a capacity of 3.42 million metric tons.
- The *Terminal de Produtos Diversos* handled 7.0 million metric tons of grains and fertilizers in 2016. VLI has the right to use the capacity of the *Terminal de Produtos Diversos*.
- The *Terminal de Granéis Líquidos* handled 531 thousand metric tons of fuel in 2016. VLI has the right to use the capacity of the *Terminal de Granéis Líquidos*.
- The Praia Mole terminal is principally a coal terminal and handled 10.8 million metric tons of coal and other related cargo in 2016. VLI has the right to use the capacity of the Praia Mole terminal.

Ponta da Madeira maritime terminal. Our Ponta da Madeira maritime terminal is located near the Itaqui Port, in the Brazilian state of Maranhão. Pier I can accommodate vessels of up to 420,000 DWT and has a maximum loading rate of 16,000 tons per hour. Pier III, which has two berths and three shiploaders, can accommodate vessels of up to 210,000 DWT at the south berth and 180,000 DWT at the north berth (or two vessels of 180,000 DWT simultaneously), subject to tide conditions, and has a maximum loading rate of 8,000 metric tons per hour in each shiploader. Pier IV (south berth) is able to accommodate vessels of up to 420,000 DWT and have two ship loaders that work alternately with a maximum loading rate of 16,000 tons per hour. Pier IV (north berth) is able to accommodate vessels of up to 420,000 DWT and have two ship loaders that work alternately with a maximum loading rate of 16,000 tons per hour. In 2016, Pier IV (north berth) performed pre-tests for a subsequent request for the definitive authorization to operate. Cargo shipped through our Ponta da Madeira maritime terminal consists of the Northern system production of iron ore and manganese. In 2016, 149.0 million metric tons of iron ore were handled through the terminal. The Ponta da Madeira maritime terminal has a storage yard with a static capacity of 7.7 million tons, which will be expanded to 10.7 million tons. VLI currently handles and stores fertilizers, grain, pig iron and manganese ore, which are then shipped through the Itaqui Port.

Itaguaí maritime terminal Cia. Portuária Baía de Sepetiba ("CPBS"). From this terminal we mostly export iron ore from our Southern system. CPBS is a wholly-owned subsidiary that operates the Itaguaí terminal, at the Itaguaí Port, in Sepetiba in the Brazilian state of Rio de Janeiro, which is leased from Companhia Docas do Rio de Janeiro (CDRJ). The Itaguaí port terminal has a pier with one berth that allows the loading of ships up to 17.8 meters of draft and approximately 200,000 DWT of capacity. In 2016, the terminal loaded 21.4 million metric tons of iron ore.

Guaíba Island maritime terminal. From this terminal we also export mostly iron ore from our Southern system. We operate a maritime terminal on Guaíba Island in the Sepetiba Bay, in the Brazilian state of Rio de Janeiro. The iron ore terminal has a pier with two berths that allows the loading of ships of up to 350,000 DWT. In 2016, the terminal loaded 46.1 million metric tons of iron ore.

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VLI also operates Inácio Barbosa maritime terminal (TMIB), owned by Petrobras, in the Brazilian state of Sergipe; Santos maritime terminal (TIPLAM), in the Brazilian state of São Paulo, which is jointly owned by VLI and Vale Fertilizantes; and Pier II in the Itaqui Port, which can accommodate vessels of up to 155,000 DWT and has a maximum loading rate of 4,500 tons per hour for pig iron and of 3,000 tons per hour for grains.

Argentina

Vale Logística Argentina S.A. ("Vale Logística Argentina") contracts third party services to operate two terminals and a transhipper in Argentina. The terminals are located at Rosario port in the province of Santa Fé and at San Nicolas port in the province of Buenos Aires. The transhipper is also located in the province of Santa Fé. We handled 1.76 million metric tons of iron and manganese ore through these ports and transhipper in 2016, which came from Corumbá, Brazil, via the Paraguay and Paraná rivers, for shipment to Brazilian, Asian and European markets.

Canada

Vale Newfoundland and Labrador Limited operates a port as part of our mining operation at Voisey's Bay, Labrador and a port as part of our processing operation at Long Harbour, Newfoundland. The port at Voisey's Bay is used for shipping nickel, copper and re-supply. The port at Long Harbour is used to receive nickel concentrate from Voisey's Bay along with goods and materials required for the Long Harbour operation.

Oman

Vale Oman Distribution Center LLC operates a distribution center in Liwa, Sultanate of Oman. The maritime terminal has a large deep water jetty, a 600-meter long platform connected to the shore by means of a 700-meter long trestle, and is integrated with a storage yard that has a throughput capacity to handle 40 Mtpy of iron ore and iron ore pellets per year. The loading nominal capacity is 10,000 tons per hour and the nominal unloading capacity is 9,000 tons per hour.

Indonesia

PTVI owns and operates two ports in Indonesia to support its nickel mining activities.

- The Balantang Special Port is located in Balantang Village, South Sulawesi, and has two types of piers, with total capacity of 10,000 DWT, two barge slips for barges with capacity of up to 4,000 DWT each for dry bulk cargo, and a general cargo wharf for vessels of up to 2,000 DWT.
- The Tanjung Mangkasa Special Port is located in Lampia Village, South Sulawesi, with mooring buoys that can accommodate vessels with capacity of up to 20,000 DWT, and a terminal that can accommodate fuel tanker vessels with capacity of up to 5,000 DWT, totaling capacity of 25,000 DWT.

New Caledonia

We own and operate a port in Prony Bay, Province Sud, New Caledonia. This port has three terminals, including a passenger ferry terminal able to berth two ships up to 50m long, a dry bulk wharf where vessels of up to 55,000 DWT can unload at a rate of 8,000 tons per day and a general cargo wharf where vessels up to 200m long can berth. The general cargo wharf can move containers at a rate of seven per hour and liquid fuels (LPG, HFO, Diesel) at a rate of 350 cubic meters per hour, and break-bulk. The port's container yard, covering an area of approximately 13,000 square meters, can receive up to 1,000 units. A bulk storage yard is linked to the port by a conveyor and has a storage capacity of 94,000 tons of limestone, 95,000 tons of sulfur, and 60,000 tons of coal.

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Malaysia

Teluk Rubiah Maritime Terminal ("TRMT"). TRMT is located in the Malaysian state of Perak and has a pier with two berths that allows the unloading of vessels of approximately 400,000 DWT of capacity and the loading of vessels up to 220,000 DWT of capacity. In 2016, the terminal unloaded 21.4 million metric tons of iron ore and loaded 21.7 million metric tons of iron ore. In this terminal we produce and sell the Brazilian blend fines, by mixing iron ore produced in Carajás with iron ore produced in our Southern and Southeastern systems.

4.1.3 Shipping

Maritime shipping of iron ore and pellets

In 2016, we shipped approximately 202 million metric tons of iron ore and pellets pursuant to transactions in which we were responsible for freight (CFR or CIF basis), which corresponds to 59% of our total iron ore and pellets sales. We transport a large amount of our iron ore products from Brazil to Asia through long-term contracts of affreightment with owners of very large ore carriers of 400,000 deadweight tons ("DWT"). These vessels reduce energy consumption and greenhouse emissions by carrying an increased amount of cargo in a single trip, offering lower shipping costs. In 2016, approximately 48 million tons of iron ore products were transported by these vessels under long term contracts of affreightment.

We also own 8 vessels that are in operation, consisting of four very large ore carriers with a capacity of 400,000 DWT each, and four capesize vessels with capacities ranging from 150,000 to 250,000 DWT.

We have changed our strategy with respect to maritime shipping. In the past, we owned and operated a low-cost fleet of vessels to transport our cargoes from Brazil to our markets, especially in Asia. We now focus on securing long-term shipping capacity and protecting against volatility in freight pricing through long-term contracts of affreightment, without incurring the costs relating to building and owning the vessels. Since 2014, we have sold 15 of our very large ore carriers of 400,000 DWT for an aggregate amount of US\$1.584 billion. We sold three of these very large ore carriers in 2016. Also, in September 2016, we agreed to sell four of our capesize vessels to Polaris Shipping Co. Ltd. for US\$35 million per vessel. Two of the vessels were delivered in December 2016, and two in January 2017.

We also own and operate two Floating Transfer Stations ("FTS") in Subic Bay, Philippines, which transfer iron ore from very large ore carriers to smaller vessels that deliver the cargo to its destinations. We have suspended operations at one of our FTS since February 2016, and we may sell both FTS in 2017.

Paraná-Paraguay waterway system

In the Paraná and Paraguay waterway system, we transport iron ore and manganese ores through our subsidiary Transbarga Navegación, which transported 2.98 million tons through the waterway system in 2016, and other chartered convoys. The barges are discharged in our local customers' terminals, in contracted terminals in Argentina or in the facilities of our subsidiary Vale Logística Argentina, which load the ore into ocean-going vessels. We loaded 1.76 million tons of ore, at two ports in Argentina, namely San Nicolas and Rosario, and at a transshipper into ocean-going vessels in 2016.

Tugboats

We manage a fleet of 16 owned tugboats in total. We directly operate nine tugboats in the ports of Vitória and Mangaratiba, in the Brazilian states of Espírito Santo and Rio de Janeiro, respectively. We have a 50% stake in a consortium that operates four tugboats in the port of São Luís in the Brazilian states of Maranhão. Three additional tugboats are freighted to and operated by third parties, under their responsibility, in other ports in Brazil.

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4.2 Energy

We have developed our energy assets based on the current and projected energy needs of our operations, with the goal of reducing our energy costs and minimizing the risk of energy shortages.

Brazil

Energy management and efficient supply in Brazil are priorities for us, given the uncertainties associated with changes in the regulatory environment and the risk of rising electricity prices. In 2016, our installed capacity in Brazil was 1.4 GW, sourced from directly and indirectly owned power plants. We use the electricity produced by these plants for our internal consumption needs. We currently own direct stakes in three hydroelectric power plants and four small hydroelectric power plants in operation. The hydroelectric power plant of Candonga, the operations of which remain suspended since November 2015 as a result of the failure of the Samarco Dam, is located in the Southeastern region, Machadinho is located in the Southern region, and Estreito is located in the Northern region. The small hydroelectric power plants of Ituerê, Mello, Glória and Nova Maurício are located in the Southeastern region. We also have indirect stakes in the hydroelectric power plants of Igarapava, Porto Estrela, Funil, Candonga, Aimorés, Capim Branco I, Capim Branco II, through our 55% participation in Aliança Geração de Energia S.A. ("Aliança Geração"). These hydroelectric power plants are located in the Southeastern region and part of its generated electricity is directed to Vale's operations through a power purchase agreement with Aliança Geração.

We also have a 4.59% indirect stake in Norte Energia S.A. ("Norte Energia"), the company established to develop and operate the Belo Monte hydroelectric plant in the Brazilian state of Pará, which started operations in April 2016. Our participation in the Belo Monte project gives us the right to purchase 9% of the electricity generated by the plant, which has already been contracted through a long-term power purchase agreement entered into with Norte Energia.

We also produce, through our subsidiary Biopalma da Amazônia S.A. ("Biopalma"), palm oil in the Brazilian state of Pará, with the objective to produce biodiesel in the future through an industrial plant to be installed by Biopalma. This biodiesel, blended with regular diesel to produce diesel B20 (20% biodiesel), may be used to power our fleet of mining trucks, heavy machinery and locomotives in the Northern System operations.

Canada

In 2016, our wholly-owned and operated hydroelectric power plants in Sudbury generated 17% of the electricity requirements of our Sudbury operations. The power plants consist of five separate generation stations with an installed generator nameplate capacity of 56 MW. The output of the plants is limited by water availability, as well as by constraints imposed by a water management plan regulated by the provincial government of Ontario. Over the course of 2016, average demand for electrical energy was 199 MW to all surface plants and mines in the Sudbury area.

In 2016, diesel generation provided 100% of the electric requirements of our Voisey's Bay operations. We also have six diesel generators on-site, with output ranging from 12 to 14 MW, in order to meet seasonal demands.

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Energy costs are a significant component of our nickel production costs for the processing of lateritic ore at our PTVI operations in Indonesia. A major portion of PTVI's electric furnace power requirements is supplied at a low cost by its three hydroelectric power plants on the Laron River: (i) the Laron plant, which has an average generating capacity of 165 MW, (ii) the Balambano plant, which has an average capacity of 110 MW and (iii) the Karebbe plant, with 90 MW of average generating capacity. These plants help reduce production costs by substituting oil used for power generation with hydroelectric power, reduce CO₂ emissions by replacing non-renewable power generation, and enable us to increase our current nickel production capacity in Indonesia.

5. Other investments

Below is a list of our main investments:

- *Pelletizing plants.* We have a 25% stake in two iron ore pelletizing plants in China, Zhuhai YPM and Anyang. The remaining stake in Zhuhai YPM is owned by Zhuhai Yueyufeng Iron and Steel Co. Ltd. and Halswell Enterprises Limited, and the remaining stake in Anyang is owned by Anyang Iron & Steel Co., Ltd.
- *Coal operations.* We have a 25% stake in Longyu (in the Henan province) coal operations in China. Longyu produces metallurgical and thermal coal and other related products, and the remaining interests are owned by Yongmei Group Co., Ltd. (former Yongcheng Coal & Electricity (Group) Co. Ltd.), Shanghai Baosteel International Economic & Trading Co., Ltd. and other minority shareholders.
- *Nickel refinery.* We have a 25% indirect stake in Korea Nickel Corporation, which operates a nickel refinery in South Korea. The remaining stake is held by Korea Zinc Co., Ltd, Posteel Co., Ltd., Young Poong Co., Ltd., Pohang Technology College and a number of individual investors. Korea Nickel Corporation produces finished nickel for the stainless steel industry using intermediate products from our Matsuzaka and New Caledonia operations.
- *Steel producers.* We own a 50% stake in California Steel Industries, Inc. ("CSI"), a producer of flat-rolled steel and pipe products located in California, United States. The remainder is owned by JFE Steel. CSI's annual production capacity is approximately 2.8 million metric tons of flat and pipe products. We also own a 50% stake in Companhia Siderúrgica do Pecém ("CSP"), an integrated steel slab plant in the Brazilian state of Ceará in partnership with Dongkuk Steel Mill Co. ("Dongkuk") and Posco, two major steel producers in South Korea. CSP's annual production capacity is 3.0 million metric tons. We are currently negotiating the sale of the Aços Laminados do Pará ("Alpa") steel project with the Cevital Group. In April 2016, we sold our total 26.9% stake in the ThyssenKrupp Companhia Siderúrgica do Atlântico ("TKCSA") integrated steel slab plant in the Brazilian state of Rio de Janeiro.
- *Bauxite.* We own a 40% stake in Mineração Rio do Norte S.A. ("MRN"), a bauxite mining business located in Brazil.
- *Hydrocarbon exploration licenses.* In February 2016, we sold our onshore hydrocarbon exploration licenses in Peru, and during the year we sold or relinquished offshore exploration licenses in Brazil. We are currently on the process of selling our participations in the respective joint ventures in both countries.

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RESERVES

Presentation of information concerning reserves

The estimates of proven and probable ore reserves at our mines and projects and the estimates of mine life included in this annual report have been prepared by our staff of experienced geologists and engineers, unless otherwise stated, and in accordance with the technical definitions established by the SEC. Under the SEC's Industry Guide 7:

- Reserves are the part of a mineral deposit that could be economically and legally extracted or produced at the time of the reserve determination.
- Proven (measured) reserves are reserves for which (a) quantity is computed from dimensions revealed in outcrops, trenches, workings or drill holes; grade and/or quality are computed from the results of detailed sampling; and (b) the sites for inspection, sampling and measurement are spaced so closely and the geologic character is so well defined that size, shape, depth and mineral content of reserves are well-established.
- Probable (indicated) reserves are reserves for which quantity and grade and/or quality are computed from information similar to that used for proven (measured) reserves, but the sites for inspection, sampling and measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for proven (measured) reserves, is high enough to assume continuity between points of observation.

We periodically revise our reserve estimates when we have new geological data, economic assumptions or mining plans. During 2016, we performed an analysis of our reserve estimates for certain projects and operations, which is reflected in new estimates as of December 31, 2016. Reserve estimates for each operation assume that we either have or expect to obtain all of the necessary rights and permits to mine, extract and process mineral reserves at each mine. For some of our operations, the projected exhaustion date includes stockpile reclamation. Where we own less than 100% of the operation, reserve estimates have not been adjusted to reflect our ownership interest. Certain figures in the tables, discussions and notes have been rounded. For a description of risks relating to reserves and reserve estimates, see *Risk factors*.

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Our reserve estimates are based on certain assumptions about future prices. We have determined that our reported reserves could be economically produced if prices for the products identified in the following table were equal to the three-year average historical prices through December 31, 2016. For this purpose, we used the three-year historical average prices set forth in the following table.

Commodity	Three-year average historical price	Pricing source
<i>Iron ore:</i>		
Vale(1)	US\$70.2 per dry metric ton	Average Platts IODEX (62% Fe CFR China)
<i>Coal(2):</i>		
Metallurgical Moatize	US\$111.13 per metric ton	Average hard metallurgical coal realized price
Thermal Moatize.	US\$48.45 per metric ton	Average thermal realized price
<i>Base metals:</i>		
Nickel(3)	US\$5.79 per lb	LME Ni
Copper	US\$2.61 per lb	LME Cu
<i>Nickel byproducts:</i>		
Platinum	US\$1,142 per oz	Average realized price
Palladium	US\$702 per oz	Average realized price
Gold	US\$1,225 per oz	Average realized price
Cobalt(3)	US\$12.70 per lb	99.3% low cobalt metal (source: Metal Bulletin)
<i>Manganese ore(4):</i>		
Manganese	US\$3.9 per dry metric ton	Average CRU (44% Mn CFR China basis)

- (1) The economic assessment of our iron ore reserves is based on the average of 62% Fe iron ore prices, as adjusted to reflect the effects of freight, moisture and the quality premium for our iron ore.
- (2) As received basis (8% moisture).
- (3) Premiums (or discounts) are applied to the nickel and cobalt spot prices at certain operations to derive realized prices. These premiums (or discounts) are based on product form, long-term contracts, packaging and market conditions.
- (4) The economic assessment of our manganese ore reserves is based on the average CRU prices, adjusted to reflect the effects of freight, moisture and the quality premium for our manganese ore prices on a CFR China basis.

Iron ore reserves

The following tables set forth our iron ore reserves and other information about our iron ore mines. Our reserve table reflects our production and operational plans, which are based on the facilities (consisting of both mines and processing plants) within each system, rather than the individual mines.

We periodically review the economic viability of our iron ore reserves in light of changes in the iron ore industry. Although in production stage, Urucum and Corumbá reserves are not economically viable based on expected long-term prices. Since last year we are not reporting reserves at those facilities. Also, following the failure of the Fundão tailings dam in November 2015 and the shutdown of its operations, Samarco is reviewing the operation's reserves. Under these circumstances, Vale is currently not in a position to report reserves for Samarco as of December 31, 2016.

The variations in iron ore reserves from 2015 to 2016 reflect new strategic guidelines in the review of the final pits, considering new price, cost, projects and blending assumptions, which affected all deposits. In addition, we have new deposits disclosed for the first time and resource models update. The reserve statement also contemplates depletion by mine production.

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Also in 2016, a portion of our reserves in all of our mining systems was reclassified from "proven" to "probable" reserves, without impacting the overall tonnage. This reclassification was a result of a complete review of our open pits and is consistent with best practices in the mining industry. It reflects as "proven" only reserves for which all environmental licenses have been obtained, and under "probable" the reserves for which the licensing process is still ongoing, although we have a reasonable expectation of receiving the required licenses on a timely basis.

	Iron ore reserves(1)					
	Proven 2016 Tonnage	Probable 2016 Tonnage	Total 2016 Tonnage	Proven 2015 Tonnage	Probable 2015 Tonnage	Total 2015 Tonnage
Southeastern System(2)						
Itabira(3)	811.4	45.2	198.9	45.4	101.3	45.2
Minas Centrais(4)	198.5	49.0	650.9	56.8	849.4	55.0
Mariana(5)	535.4	45.3	603.4	44.2	138.8	44.3
Total Southeastern System	1,545.3	45.8	1,453.1	46.5	998.5	46.6
Southern System(6)						
Minas Itabirito(7)	467.7	56.6	279.1	43.5	746.8	45.2
Vargem Grande(8)	100.6	50.5	442.4	48.0	543.0	48.2
Paraopeba(9)	85.5	62.5	245.3	60.5	330.7	61.0
Total Southern System	653.8	56.4	966.8	45.6	620.6	46.9
Northern System(10)						
Serra Norte(11)	552.7	66.5	784.7	65.9	337.4	66.0
Serra Sul (S11)(12)	1,730.5	65.8	494.1	65.3	224.6	65.6
Serra Leste	18.9	64.5	241.6	65.5	260.4	65.4
Total Northern System	2,302.1	65.9	520.4	65.7	822.5	65.7
Total Vale Systems	4,501.2	57.1	6,940.3	52.1	1,441.5	53.1

- (1) Tonnage is stated in millions of metric tons of wet run-of-mine, based on the following moisture contents: Itabira 1.6%; Minas Centrais 5.9%; Mariana 3.9%; Minas Itabirito 5.1%; Vargem Grande 6.1%; Paraopeba 5.1%; Serra Norte 6.8%; Serra Sul 4.6%; Serra Leste 3.6%;
- (2) Approximate drill hole spacing used to classify the Reserves was: 100m x 100m to proven reserves and 200m x 200m to probable reserves. Average product recovery (tonnage basis) is: 53% for Itabira, 82% for Minas Centrais and 62% for Mariana.
- (3) Itabira integrated operation includes Conceição and Minas do Meio mines.
- (4) Minas Centrais integrated operation includes Brucutu and Agua Limpa mines. Additionally, we have Apolo deposit, not currently in production. Agua Limpa mine and plants are owned by Baovale Mineração S.A. ("Baovale"). Vale's equity interest in Agua Limpa is 50.0% and the reserve figures have not been adjusted to reflect our ownership interest.
- (5) Mariana integrated operation includes Alegria, Fábrica Nova and Fazendão mines. Additionally, we have Capanema and Conta História deposits, not currently in production.
- (6) Approximate drill hole spacing used to classify the Reserves was: 100m x 100m to proven reserves and 200m x 200m to probable reserves. Average product recovery (tonnage basis) is: 60% for Minas Itabirito, 61% for Vargem Grande and 100% for Paraopeba.
- (7) Minas Itabirito integrated operation includes Sapocado, Galinheiro, João Pereira and Segredo mines.
- (8) Vargem Grande integrated operation includes Tamanduá, Capitão do Mato and Abóboras mines.
- (9) Paraopeba integrated operation includes Jangada, Capão Xavier, Córrego do Feijão and Mar Azul mines. Additionally, we have Capim Branco deposit, not currently in production. Córrego do Feijão, Mar Azul and Capim Branco mineral reserves were included in the table this year.
- (10) Approximate drill hole spacing used to classify the reserves was: 150m x 100m to proven reserves and 300m x 200m to probable reserves, except Serra Leste which is 100m x 100m to proven reserves and 200m x 200m to probable reserves. Average product recovery (tonnage basis) 100% for Serra Norte, 100% for Serra Leste and 100% for Serra Sul.
- (11)

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Serra Norte integrated operation includes, N4W, N4E and N5 mines. Additionally, we have N1, N2 and N3 deposits, disclosed for the first time and not currently in production.

(12)

Serra Sul integrated operation includes S11C and S11D deposits.

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The mine exhaustion schedule has been adjusted due to our new production plan and our revision of project capacity. As a result of the Fundão dam failure, the Alegria and Germano operations' projected exhaustion dates are currently being reevaluated as part of Samarco's general review of its iron ore resources and reserves.

	Iron ore integrated operations			
	Type	Operating since	Projected exhaustion date ⁽¹⁾	Ownership interest (%)
Southeastern System				
Itabira	Open pit	1957	2029	100.0
Minas Centrais	Open pit	1994	2056	100.0
Mariana	Open pit	1976	2104	100.0
Southern System				
Minas Itabirito	Open pit	1942	2105	100.0
Vargem Grande	Open pit	1993	2055	100.0
Paraopeba	Open pit	2001	2032	100.0
Northern System				
Serra Norte	Open pit	1984	2041	100.0
Serra Sul (S11CD)	Open pit	2016	2049	100.0
Serra Leste (SL1)	Open pit	2014	2059	100.0

(1)

Indicates the life-of-mine for the operating mine with the longest projected exhaustion date in the complex.

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Manganese ore reserves

The following tables set forth manganese ore reserves and other information about our mines. We are able to report mineral reserve for Urucum in 2016 due to the logistics cost reduction. We are revising our reported reserves due to the updating of its resource models and mineral reserves currently in progress, to consider new geological information and new reserve assumptions. As this revision is still ongoing, we are disclosing current reserves by depletion.

	Manganese ore reserves(1)(2)							
	Proven 2016		Probable 2016		Total 2016		Total 2015	
	Tonnage	Grade	Tonnage	Grade	Tonnage	Grade	Tonnage	Grade
Azul(3)	35.9	28.5	2.0	25.5	38.0	28.4	43.6	29.3
Urucum	8.3	46.3	1.7	46.5	10.1	46.3		
Morro da Mina(4)	5.8	31.0	2.8	29.7	8.6	30.6	8.6	30.6
Total	50.1	31.8	6.5	32.9	56.6	31.9	52.2	29.6

- (1) Tonnage is stated in millions of metric tons of wet run-of-mine, based on the following moisture contents: Azul 16.2%, Urucum 4.2%, Morro da Mina 3.4%. Manganese grade is reported on a dry basis. Approximate drill hole spacing used to classify the reserves was: 100m x 100m for proven reserves and 200m x 200m for probable reserves.
- (2) The average recovery of the manganese ore reserves is: Azul 39%, Urucum 82%, Morro da Mina 70%.
- (3) Total reserve includes 4.5 million metric tons of ore from Azul's tailing dam.
- (4) Morro da Mina mine operations restarted in October 2016.

	Manganese ore mines			
	Type	Operating since	Projected exhaustion date	Vale interest (%)
Azul(1)	Open pit	1985	2032	100.0
Urucum	Underground	1976	2032	100.0
Morro da Mina	Open pit	1902	2049	100.0

- (1) Ore from Azul's tailings dam was not included.

Coal reserves

Our coal reserve estimates have been provided on an in-place material basis after adjustments for depletion, moisture content, anticipated mining losses and dilution. Marketable reserves include adjustments for losses associated with beneficiation of raw coal mined to meet saleable product requirements.

Coal type	Coal ore reserves(1)					
	ROM(2)			Marketable reserves(3)		
	Proven 2016	Probable 2016	Total 2016	2016 Total	2015	2015
	(tonnage)	(tonnage)	(tonnage)	(tonnage)	(tonnage)	(tonnage)
Moatize	247.4	1,148.3	1,395.6	1,411.7	499.6	505.5

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Metallurgical & thermal 1	28.3 (thermal)	28.3 (thermal)
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- (1) The reserves stated above by deposit are on a 100% shareholding basis. Vale's ownership interest in accordance with the table below should be used to calculate the portion of reserves directly attributable to Vale.
- (2) Tonnage is stated in millions of metric tons. Moatize is reported on in situ 6.5% moisture basis. Calorific value of product coal derived from beneficiation of ROM coal is typically stated in MJ/kg. Calorific value is used in marketing thermal (th) and PCI coals.
- (3) Tonnage is stated in millions of metric tons.

	Coal mines			Vale interest (%)
	Type	Operating since	Projected exhaustion date	
Moatize(1)	Open pit	2011	2047(2)	95.0

-
- (1) Vale's stake in Moatize will decrease to 81% upon completion of the transaction with Mitsui.
- (2) The mine exhaustion date was extended due to the current production plan and plant capacity.

Table of Contents**Nickel ore reserves**

Our nickel mineral reserve estimates are of in-place material after adjustments for depletion and mining losses (or screening and drying in the case of PTVI) and recoveries, with no adjustments made for metal losses due to processing.

	Nickel ore reserves(1)								
	Proven Tonnage	2016 Grade	Probable Tonnage	2016 Grade	Total Tonnage	2016 Grade	Total Tonnage	2016 Grade	Recovery range (%)
<i>Canada</i>									
Sudbury	32.4	1.48	39.5	1.33	71.9	1.40	76.4	1.27	75 - 85
Thompson							20.6	1.71	85 - 90
Voisey's Bay	18.4	2.35	15.4	2.02	33.8	2.20	36.1	2.24	80 - 90
<i>Indonesia</i>									
PTVI	91.6	1.78	19.2	1.75	110.9	1.78	119.3	1.78	85 - 90
<i>New Caledonia</i>									
VNC									
<i>Brazil</i>									
Onça Puma	63.0	1.65	45.0	1.37	108.0	1.53	97.4	1.56	85 - 90
Total	205.4	1.75	119.1	1.50	324.5	1.66	349.8	1.65	

(1) Tonnage is stated in millions of dry metric tons. Grade is % of nickel.

In Canada, our Sudbury operations mineral reserves decreased due to mining depletions, the reclassification of mineral reserves to mineral resource at Garson, downgrading of mineral reserve to exploration target at Stobie and a decrease of mineral reserves at all mines due to re-interpretation and planning changes. The nickel grades at the Sudbury operations increased due to a change in the cutoff policy. The Voisey's Bay operations mineral reserves decreased due to mining depletions. The mineral reserves at PTVI decreased due to mining depletion, pit redesigns and reevaluations, and reclassification to mineral resource. The mineral reserves at Onça Puma increased due to a decrease in operating costs and cutoff.

We are not reporting the reserves of VNC and Thompson as of December 31, 2016, because the mineral reserves for our operations in New Caledonia and Thompson would not be economically viable at the three-year historical average price, due to the decline in nickel prices in the past three years. However, based on our expectations about future prices, our operations in New Caledonia and Thompson continue to be economically viable. VNC and Thompson continue to operate and are currently conducting studies to identify measures to reduce their costs of production.

	Type	Nickel ore mines		
		Operating since	Projected depletion date	Mineral interest (%)
<i>Canada</i>				
Sudbury	Underground	1885	2042	100.0
Thompson	Underground	1961		100.0
Voisey's Bay(1)	Open pit/Underground	2005	2032	100.0
<i>Indonesia</i>				
PTVI	Open pit	1977	2035	59.2
<i>New Caledonia</i>				
VNC	Open pit	2011		95.0
<i>Brazil</i>				
Onça Puma	Open pit	2011	2061	100.0

(1)

Voisey's bay will transition from an open pit mine to an underground mine. For further details on the Voisey's Bay mine expansion project, see *Capital Expenditures*.

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Copper ore reserves

Our copper mineral reserve estimates are of in-place material after adjustments for depletion and mining losses and recoveries, with no adjustments made for metal losses due to processing.

	Copper ore reserves(1)								Recovery range	
	Proven	Probable	Total	Proven	Probable	Total	Proven	Probable		
	Tonnage	Grade	Tonnage	Grade	Tonnage	Grade	Tonnage	Grade	(%)	
<i>Canada</i>										
Sudbury	32.4	2.06	39.5	1.43	71.9	1.71	76.4	1.61	90	95
Voisey's Bay	18.4	1.12	15.4	0.89	33.8	1.02	36.1	1.05	90	95
<i>Brazil</i>										
Sossego	101.5	0.64	9.4	0.66	110.9	0.65	117.8	0.67	90	95
Salobo	623.7	0.68	554.6	0.58	1,178.3	0.63	1,156.8	0.67	80	90
<i>Zambia</i>										
Lubambe	5.4	2.22	40.0	2.18	45.4	2.18	48.6	2.25	85	90
Total	781.3	0.75	659.0	0.74	1,440.3	0.75	1,435.7	0.78		

(1) Tonnage is stated in millions of dry metric tons. Grade is % of copper.

In Canada, our Sudbury operations mineral reserves decreased due to mining depletions, the reclassification of mineral reserves to mineral resource at Garson, downgrading of mineral reserve to exploration target at Stobie and a decrease of mineral reserves at all mines due to re-interpretation and planning changes. The copper grades at the Sudbury operations increased due to a change in the cutoff grade policy. The Voisey's Bay operations mineral reserves decreased due to mining depletions. In Brazil, the Sossego operations mineral reserves decreased due to mining depletion, partially offset by the addition of mineral reserves located in the bottom of the pits and the reevaluation of the existing pit designs and unplanned dilution factors. The mineral reserve estimates at the Salobo operation increased due to mining depletion being offset by the addition of new mineral reserves from an updated final pit design and the reevaluation of the mineral block model. The Lubambe mineral reserves decreased due to mining depletion.

	Type	Copper ore mines		
		Operating since	Projected mine life	Mineral interest (%)
<i>Canada</i>				
Sudbury	Underground	1885	2042	100.0
Voisey's Bay	Open pit/Underground	2005	2032	100.0
<i>Brazil</i>				
Sossego	Open pit	2004	2025	100.0
Salobo	Open pit	2012	2066	100.0
<i>Zambia</i>				
Lubambe	Underground	2013	2038	40.0

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PGMs and other precious metals reserves

We expect to recover significant quantities of precious metals as byproducts of our Sudbury, Sossego and Salobo operations. Our mineral reserve estimates are of in-place material after adjustments for mining depletion and mining losses and recoveries, with no adjustments made for metal losses due to processing.

	Precious metals reserves(1)									
	Proven Tonnage	2016 Grade	2016 Tonnage	2016 Grade	2016 Total Tonnage	2016 Grade	2016 Total Tonnage	2016 Grade	2016 Recovery range (%)	2016 Recovery range (%)
<i>Canada</i>										
<i>Sudbury</i>										
Platinum	32.4	1.1	39.5	1.3	71.9	1.2	76.4	1.1	80	90
Palladium	32.4	1.3	39.5	1.3	71.9	1.3	76.4	1.1	80	90
Gold	32.4	0.5	39.5	0.4	71.9	0.4	76.4	0.4	80	90
<i>Brazil</i>										
<i>Sossego</i>										
Gold	101.5	0.2	9.4	0.2	110.9	0.2	117.8	0.2	75	80
<i>Salobo</i>										
Gold	623.7	0.4	554.6	0.3	1,178.3	0.4	1,156.8	0.4	60	70
Total Pt + Pd(2)	32.4	2.4	39.5	2.6	71.9	2.5	76.4	2.2		
Total Gold	757.6	0.3	603.5	0.3	1,361.1	0.3	1,351.0	0.4		

- (1) Tonnage is stated in millions of dry metric tons. Grade is grams per dry metric ton.
- (2) Pt+Pd is the sum of Platinum and Palladium grades.

In Sudbury our mineral reserve estimates for platinum, palladium and gold decreased for the same reasons discussed above in connection with the nickel mineral reserves. In Brazil, mineral reserve estimates for gold changed for the same reasons discussed above in connection with the copper mineral reserves.

	Precious metals mines Projected			
	Type	Operating since	exhaustion date	stake interest (%)
<i>Canada</i>				
<i>Sudbury</i>				
	Underground	1885	2042	100.0
<i>Brazil</i>				
<i>Sossego</i>				
	Open pit	2004	2025	100.0
<i>Salobo</i>				
	Open pit	2012	2066	100.0

Cobalt ore reserves

We expect to recover significant quantities of cobalt as a byproduct of our Sudbury and Voisey's Bay operations. Our cobalt reserve estimates are of in-place material after adjustments for depletion and mining losses, with no adjustments for metal losses due to processing.

	Cobalt ore reserves(1)				
	Proven	2016 Grade	2016 Tonnage	2016 Total Tonnage	2016 Recovery range (%)

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	Tonnage		Tonnage		Tonnage		Tonnage		range
	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade (%)	
<i>Canada</i>									
Sudbury	32.4	0.04	39.5	0.04	71.9	0.04	76.4	0.04	20-40
Voisey's Bay	18.4	0.13	15.4	0.13	33.8	0.13	36.1	0.13	70-80
<i>New Caledonia</i>									
VNC									
Total	50.8	0.07	54.9	0.07	105.7	0.07	112.5	0.07	

(1) Tonnage is stated in millions of metric tons. Grade is % of cobalt.

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Our cobalt reserve estimates decreased in 2016 for the same reasons discussed above in connection with the nickel mineral reserves.

	Type	Cobalt ore mines		Mine interest (%)
		Operating since	Projected exhaustion date	
<i>Canada</i>				
Sudbury	Underground	1885	2042	100.0
Voisey's Bay	Open pit/Underground	2005	2032	100.0
<i>New Caledonia</i>				
VNC	Open pit	2011		95.0

Table of Contents**CAPITAL EXPENDITURES**

We have an extensive program of investments in the organic growth of our businesses. The figures discussed in this section are for project execution and sustaining existing operations and replacement projects.

The 2017 investment budget approved by our Board of Directors is US\$1.846 billion for project execution, reflecting a 41.8% decrease compared to the 2016 investment budget, and US\$2.702 billion for sustaining existing operations and replacement projects, reflecting a 9.8% decrease compared to 2016. This is the sixth consecutive year of lower capital expenditures, maintaining capital discipline and focusing only on world class projects.

Most of the capital expenditures budget for project execution will be invested in Brazil (95.1%).

	2015 expenditures	2016 expenditures	2017 budget	
	(US\$ million)	(US\$ million)	(US\$ million)	(% of total)
Project execution	5,548	3,179	1,846	40.6%
Investments to sustain existing operations and replacement projects	2,853	2,302	2,702	59.4%
Total	US\$8,401	US\$5,482	US\$4,548	100%

We are developing a focused organic growth portfolio with fewer projects, but higher expected rates of return. Our main initiative, the S11D project, accounts for 87.2% of the US\$1.846 billion budgeted for project execution in 2017.

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The following table sets forth total expenditures in 2016 for our main investment projects and expenditures budgeted for those projects in 2017, together with estimated total expenditures for each project and the actual or estimated start-up date of each project as of December 31, 2016.

Business area	Main projects(1)	Actual or estimated start-up	Executed CAPEX		Expected CAPEX	
			2016(2)	Total executed(3)	2017(4)	Total expected(5)
(US\$ million)						
Iron ore	Carajás Serra Sul S11D(6)(8)	2H16 1H14 to	940	5,595	649	6,750
	CLN S11D(7)	2H19	1,195	5,662	962	7,850
Coal mining	Moatize II(8)	2H16	117	2,058	6	2,105
Base Metals	Voisey's Bay Mine Expansion(9)	1H20	10	10	76	1,904

- (1) Projects approved by our Board of Directors.
- (2) All figures are presented on a cash basis.
- (3) Total executed CAPEX through December 31, 2016, including capital expenditures in prior periods.
- (4) All figures are presented on a cash basis and correspond to the figures approved in the US\$4.548 billion investment budget.
- (5) Estimated total capital expenditure cost for each project, including capital expenditures in prior periods. Total expected CAPEX includes expenses, in line with the budget approved by our Board of Directors, while these expenses are not included in the expected CAPEX for the year or in the total executed CAPEX figures.
- (6) Original expected CAPEX for S11D was US\$8.089 billion.
- (7) Original expected CAPEX for CLN S11D was US\$11.582 billion.
- (8) Projects delivered in 2016.
- (9) Replacement projects.

The paragraphs below describe the status of each project as of December 31, 2016 and have not been updated to reflect any developments after that date.

Ferrous minerals and logistics projects

Iron ore mining and logistics projects:

- *CLN S11D.* Increase in the logistics capacity of the Northern System to support the S11D project, including the expansion of approximately 570 km of railway (291 km of which we have already built), construction of a railway spur of 101 km, acquisition of wagons and locomotives and port expansion (onshore and offshore expansions at Ponta da Madeira maritime terminal). This project is expected to increase EFC's nominal logistics capacity to approximately 230 Mtpy. The duplication of the railway achieved 60% of physical progress and the railway spur was totally completed. The port offshore started up in the last quarter of 2016, having loaded 11 vessels (aggregate of 3,100,000 tons) until the end of 2016. The project is 76% complete, with total realized expenditures of US\$5.66 billion. The start-up is expected to continue through the second half of 2019.

Base metals projects

- *Voisey's Bay Mine Expansion.* We completed, in March 2015, the study to replace the depletion of the open pit mine at Voisey's Bay with an underground mine. The project was approved to commence execution in 2016, and the first ore is expected to be delivered from the Reid Brook Deposit in 2020. In 2016, construction commenced and a project office was

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opened in St. John's, Newfoundland. The total expenditures in 2016 reached US\$10 million. When complete, the underground mine will produce an average of 46 ktpy contained nickel and extend the operational life until 2032.

Table of Contents**REGULATORY MATTERS**

We are subject to a wide range of governmental regulation in all the jurisdictions in which we operate worldwide. The following discussion summarizes the kinds of regulation that have the most significant impact on our operations.

Mining rights and regulation of mining activities

Mining and mineral processing are subject to extensive regulation. In order to conduct these activities, we are required to obtain and maintain some form of governmental or private permits, which may include concessions, licenses, claims, tenements, leases or permits (all of which we refer to below as "concessions"). The legal and regulatory regime applicable to the mining industry and governing concessions differs among jurisdictions, often in important ways. In most jurisdictions, including Brazil, mineral resources belong to the State and may only be exploited pursuant to a governmental concession. In other jurisdictions, such as Ontario in Canada, a substantial part of our mining operations is conducted pursuant to mining rights we own (private permits). Government agencies are typically in charge of granting mining concessions and monitoring compliance with mining law and regulations.

The table below summarizes our principal concessions and other similar rights for our continuing operations. It does not include information with respect to our fertilizer business (discontinued operations).

Location	Mining title	Approximate area covered (in hectares)	Expiration date
<i>Brazil</i>	Mining concessions (including under applications)	574,967	Indefinite
<i>Canada(1)</i>	Mining concessions (terminology varies among provinces)	225,685	2017 2036
<i>Indonesia(2)</i>	Contract of work	118,435	2025
<i>Australia</i>	Mining leases	4,559	2041
<i>New Caledonia</i>	Mining concessions	21,077	2017 2051
<i>Mozambique(3)</i>	Mining concessions	23,780	2032

- (1) The expiration date of our leases in Sudbury is subject to current renewal applications. The approval process for these applications is in progress, but may take a number of years.
- (2) Entitled to two 10-year extensions, subject to approval of the Indonesian government.
- (3) Entitled to 25-year extensions, subject to approval by the Mozambique government.

In addition to the concessions listed above, we have exploration licenses and exploration applications covering 4.4 million hectares in Brazil and 1.4 million hectares in other countries.

There are several proposed or recently adopted changes in mining legislation and regulations in the jurisdictions where we have operations that could materially affect us.

- In Brazil, the government sent to Congress in 2013 a bill of law with proposed changes to the Brazilian mining law. This bill provides for the preservation of the main provisions applicable to the existing mining rights as of the date of its enactment, a new royalties regime, a new regime for mining concessions and the creation of a mining agency. The bill is under discussion in the Brazilian Congress, and the government recently expressed its intention to split the bill into separate pieces (royalties, new mining concessions regime and the creation of a mining agency) to expedite the approval process.

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- In New Caledonia, a mining law passed in 2009 requires mining projects to obtain authorization from governmental authorities, rather than a declaration, as required under the former statute. VNC submitted an updated application for this authorization in October 2015. VNC's mining operations permit was granted in September 2016 and is valid until the end of 2036. The new mining authorization is now approved and effective. Also, in 2014, the local authorities of New Caledonia created a protected wetland area, which covers 27% of the surface area of the total VNC tenements and could affect potential mining activities. Part of this protected wetland area is adjacent to the location of VNC's next tailings storage facility, and may impact the design of the facility, which, in turn may result in additional capital costs.

Royalties and other taxes on mining activities

We are required in many jurisdictions to pay royalties or taxes on our revenues or profits from mineral extractions and sales. These payments are an important element of the economic performance of a mining operation. The following royalties and taxes apply in some of the jurisdictions in which we have our largest operations:

- *Brazil.* We pay a royalty known as the CFEM (*Compensação Financeira pela Exploração de Recursos Minerais*) on the revenues from the sale of minerals we extract, net of taxes, insurance costs and costs of transportation. The current rates on our products are: 2% for iron ore, copper, nickel, fertilizers and other materials; 3% for bauxite, potash and manganese ore; and 1% for gold. In 2013, the Brazilian government sent to Congress a bill that proposed changes to the Brazilian mining law and that could result in the increase of royalty rates. The bill is currently under discussion in the Brazilian Congress.

- *Brazilian states.* Several Brazilian states impose a tax on mineral production (*Taxa de Fiscalização de Recursos Minerais* - TFRM), which is assessed at rates ranging from R\$0.50 to R\$3.214 per metric ton of minerals produced in or transferred from the state.

- *Canada.* The Canadian provinces in which we operate charge us a tax on profits from mining operations. Profit from mining operations is generally determined by reference to gross revenue from the sale of mine output and deducting certain costs, such as mining and processing costs and investment in processing assets. The statutory mining tax rates are 10% in Ontario; with graduated rates up to 17% in Manitoba; and a combined mining and royalty tax rate of 16% in Newfoundland and Labrador. The mining tax paid is deductible for corporate income tax purposes.

- *Indonesia.* Our subsidiary PTVI pays mining royalties of 2% on its nickel matte revenues when LME nickel prices are below US\$21,000 per metric ton and 3% of its nickel matte revenues when LME nickel prices are above or equal to US\$21,000 per metric ton.

- *Zambia.* In June 2016, the Zambian government amended the Mines and Minerals Act and implemented a series of changes in the fiscal regime applicable to the mining industry. The mineral royalties applicable to copper underground operations, such as our joint venture's operations, are 4% of the norm value when the price of copper is less than US\$4,500 per ton; 5% when the price of copper is between US\$4,500 and US\$6,000; and 6% when the price of copper is greater than US\$6,000. The 15% variable profit tax on income, applicable when taxable earnings exceed 8% of gross sales, has not been re-introduced and the tax on income from mining operations has remained at 30% and 35% for income from mineral processing.

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Environmental regulations

We are also subject to environmental regulations that apply to the specific types of mining and processing activities we conduct. We are required to obtain approvals, licenses, permits or authorizations from governmental authorities to operate. In most jurisdictions, the development of new facilities requires us to submit environmental and social impacts statements for approval and often to make investments to mitigate environmental and social impacts, and we must operate our facilities in compliance with the terms of the approvals, licenses, permits or authorizations.

We are taking several steps to improve the efficiency of the licensing process, including stronger integration of our environmental and project development teams, the implementation of a Best Practices Guide for Environmental Licensing and the Environment, the deployment of highly-skilled specialist teams, closer interaction with environmental regulators and the creation of an executive committee to expedite internal decisions regarding licensing.

Environmental regulations affecting our operations relate, among other matters, to emissions into the air, soil and water; recycling and waste management; protection and preservation of forests, coastlines, caves, watersheds and other features of the ecosystem; water use; financial provisions and closure plans needed since the mining license; climate change and decommissioning and reclamation. Environmental legislation is becoming stricter worldwide, which could lead to greater costs for environmental compliance. In particular, we expect heightened attention from various governments to reducing greenhouse gas emissions as a result of concern over climate change, especially following the entry into force of the Paris Agreement in late 2016. There are several examples of environmental regulation and compliance initiatives that could affect our operations.

- *Canada.* In Canada, more stringent water effluent regulations are being proposed federally and a greenhouse gas cap and trade regime regulations have been enacted in Ontario and proposed in Manitoba and Newfoundland and Labrador, which may affect our operations. In Canada, we are making significant capital investments to ensure compliance with air emission regulations that address, among other things, sulfur dioxide, greenhouse gas emissions, particulates and metals.
- *Indonesia.* Under the 2014 Indonesia Government Regulation on B3 waste, PTVI's slag is classified as hazardous waste and PTVI has submitted the formal application to the regulator for approval.
- *China.* An amendment to the environment protection law was approved in April 2014, imposing stricter pollution prevention and control obligations on companies and providing for more severe penalties. This amendment may adversely impact our coal exports from Mozambique to China.
- *New Caledonia.* A law enacted by the South Province of New Caledonia in February 2014 imposes stricter limits on emissions of nitrogen oxide and sulfur oxide and particulates from large combustion power stations, which will affect the power station that supplies electricity to VNC. This is expected to result in the increase in the price of power paid by VNC.

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- *Brazil.* Under applicable Brazilian regulations for the protection of caves, we are required to conduct extensive technical studies and negotiate compensatory measures with Brazilian environmental regulators in order to continue to operate in certain sites. In certain of our iron ore mining operations or projects, we may be required to limit or modify our mining plans or to incur additional costs to preserve caves or to compensate for the impact on them, with potential consequences for production volumes, costs or reserves in our iron ore business. Also, a Brazilian regulation for the protection of indigenous people, which was enacted in 2011 and revised in 2015, requires us to conduct specific studies of impact and sponsor mitigation programs in connection with operations and projects close to indigenous people's lands. In May 2016, the state of Minas Gerais issued a decree ordering an immediate assessment of the stability conditions of the upstream dams and suspending new licensing procedures for building or heightening upstream dams, until the state environmental authority defined new rules and procedures. We have conducted extraordinary audits on the stability conditions of our upstream dams, and no anomalies were identified. We filed a report with local governmental authorities in September 2016. In March 2017, the state of Minas Gerais determined that upstream dams, or dams that have been once heightened by this method, that had their stability conditions attested by audit could be heightened by other constructive methods.

Regulation of other activities

In addition to mining and environmental regulation, we are subject to comprehensive regulatory regimes for some of our other activities, including rail transport, port operations and electricity generation. We are also subject to more general legislation on workers' health and safety, safety and support of communities near mines, and other matters. The following descriptions relate to some of the other regulatory regimes applicable to our operations:

- *Brazilian railway regulation.* Our Brazilian railroad business operates pursuant to concession contracts granted by the federal government, and our railroad concessions are subject to regulation and supervision by the Brazilian Ministry of Transportation, Ports and Civil Aviation and the regulatory agency for ground transportation (ANTT). The concessions for EFC and EFVM expire in 2027 and may be renewed at the federal government's discretion. VLI has also been awarded a subconcession contract for commercial operation of a 720-kilometer segment of the FNS railroad in Brazil, which expires in 2037, and FCA and MRS concessions expire in 2026. Rail transportation prices can be negotiated directly with the users of such services, subject to tariff ceilings approved by ANTT for each of the concessionaires and each of the different products transported. ANTT regulations also require concessionaires to give trackage rights to other railway operators, to make investments in the railway network, and to meet certain productivity and safety requirements, among other obligations. In 2016, we and other railroad concessionaires in Brazil initiated discussions with ANTT regarding the possibility of early renewal of railways concession contracts. If we agree to an earlier renewal of our concession, we may have to agree with additional performance indications, new investments obligations and service standards.

- *Brazilian port regulation.* Port operations in Brazil are subject to regulation and supervision by ANTAQ, the federal agency in charge of maritime transportation services, and by the Ministry of Transport, Ports and Civil Aviation through the Secretary of Ports (SEP), whose purpose is to formulate policies and guidelines. In 2014, we renewed the agreements pursuant to which the SEP grants us rights to operate our private terminals, with the exception of the agreement with CPBS, which will expire in 2026. These renewed agreements will be effective until 2039.

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- *Regulation of chemicals.* Some of our products are subject to regulations applicable to the marketing, distribution and use of chemical substances present in their composition. For example, the European Commission has adopted a European Chemicals Policy, known as REACH ("Registration, Evaluation and Authorization of Chemicals"). Under REACH, European manufacturers and importers are required to register substances prior to their entry into the European market and in some cases may be subject to an authorization process. A company that fails to comply with the REACH regulations could face fines and penalties.
- *Regulation of international maritime transportation.* We are subject to health, safety and environmental regulation by the International Maritime Organization ("IMO"). IMO rules are based not only on the international shipping categories, but also on the types of cargoes transported, including special rules for iron ore, coal, nickel and copper. The IMO is currently discussing further measures for enhancing the energy efficiency of international shipping including the development of a global data collection system which will eventually enable market-based measures to curb greenhouse gas emissions. These measures to curb greenhouse gas emissions may increase our freight cost in the future. In 2016, the IMO also approved regulation establishing limits for sulfur oxides emission limits, which will become effective in 2020. This regulation may increase freight cost due to the need to use bunker with low sulphur content or additional pollutant control equipment associated with air emissions. Also, the International Convention for the Control and Management of Ships' Ballast Water and Sediments will become effecting in September 2017. Under this convention, all ships during their international voyages are required to manage their ballast water and sediments in compliance with the defined requirements, which may also result in increases of freight and port operation costs.

Table of Contents**DISCONTINUED OPERATIONS**

In December 2016, we agreed to sell substantially all of our fertilizer business to Mosaic, subject to certain conditions precedent. Until closing of the transaction, which is expected by the end of 2017, we continue to conduct potash and phosphate operations in Brazil and to hold a 40% economic interest and 51% voting interest in a joint venture that operates a phosphate rock mine in Peru. As a result of this transaction, our Fertilizer business is reported as discontinued operations, which requires the presentation of prior periods of this line of business as discontinued operations.

Phosphates and nitrogen

Our subsidiary Vale Fertilizantes is a producer of phosphate rock, phosphate fertilizers (e.g., monoammonium phosphate (MAP), triple superphosphate (TSP) and single superphosphate (SSP)), dicalcium phosphate (DCP) and nitrogen fertilizers (e.g., ammonia and ammonium nitrate). It is the largest producer of phosphate and nitrogen crop nutrients in Brazil. Vale Fertilizantes operates the following phosphate rock mines, through concessions for indefinite period: Catalão, in the Brazilian state of Goiás, Tapira, Patos de Minas and Araxá, all in the Brazilian state of Minas Gerais, and Cajati, in the Brazilian state of São Paulo. In addition, Vale Fertilizantes has nine processing plants for the production of phosphate and nitrogen nutrients, located in Catalão in the Brazilian state of Goiás; Araxá, Patos de Minas and Uberaba, which are all in the Brazilian state of Minas Gerais; Cajati and three plants in Cubatão, which are all in the Brazilian state of São Paulo. In February 2015, operation at our plant in Guará was suspended due to market conditions.

Since 2010, we also have a 40% economic interest and 51% voting interest in the joint venture Compañía Minera Miski Mayo S.R.L., which operates the Bayóvar phosphate rock mine in Peru, with nominal capacity of 3.9Mtpy, through a concession for indefinite period.

The following table sets forth information about our phosphate rock production.

Mine	Type	Production for the year ended December 31,		
		2014	2015	2016
		(thousand metric tons)		
Bayóvar	Open pit	3,801	3,881	3,853
Catalão	Open pit	1,055	1,000	872
Tapira	Open pit	2,005	1,970	1,633
Patos de Minas(1)	Open pit	73	23	0
Araxá	Open pit	883	707	711
Cajati	Open pit	605	581	477
Total		8,421	8,163	7,546

(1)

Patos de Minas operation was suspended in the third quarter of 2015 due to market conditions.

The following table sets forth information about our phosphate and nitrogen nutrients production.

Product	Production for the year ended December 31,		
	2014	2015	2016
	(thousand metric tons)		
Monoammonium phosphate (MAP)	1,065	1,097	1,020
Triple superphosphate (TSP)	910	866	833
Single superphosphate (SSP)	1,854	1,953	1,753
Dicalcium phosphate (DCP)	502	480	487
Ammonia(1)	178	138	135
Nitric acid	469	475	468
Ammonium nitrate	485	515	523

(1)

After the sale of Araucária in June 2013, we only produce ammonia at our Cubatão plant.

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Phosphate reserves

Our phosphate reserves estimates are of in-place material after adjustments for depletion, mining dilution and recovery. The total phosphate reserves have decreased mainly due to reevaluation of our reserves at Araxá and Cajati, and because certain reserves from Bayóvar were downgraded to resources. The remaining phosphate reserves decreased due to mine production depletion.

	Phosphate reserves(1)(2)								
	Proven Tonnage	Probable Tonnage	Total Tonnage	Proven Grade	Probable Grade	Total Grade	Proven Tonnage	Probable Tonnage	Total Tonnage
Bayóvar(3)	101.6	16.96	145.6	14.97	247.2	15.79	402.0	15.40	
Catalão	56.3	10.52	29.1	10.62	85.5	10.55	93.5	10.53	
Tapira	276.9	7.76	378.0	7.41	655.0	7.56	666.6	7.57	
Araxá	21.3	10.71	1.0	7.75	22.3	10.59	86.6	11.86	
Cajati	40.5	5.16	41.2	5.15	81.7	5.15	104.8	5.20	
Patrocínio(4)	183.8	13.73	302.3	11.10	486.1	12.09	486.1	12.09	
Total	680.4	10.91	897.3	9.88	1,577.7	10.32	1,839.6	10.69	

- (1) Tonnage is stated in millions of dry metric tons. Grade is % of P₂O₅.
- (2) Average mass recoveries (tonnage basis) are: 15.8% for Araxá, 11.7% for Cajati, 14.0% for Catalão, 22.9% for Patrocínio, 14.6% for Tapira and 38.0% for Bayóvar.
- (3) Vale holds 51% of the voting capital and 40% of the total capital of MVM Resources International, B.V., the entity that controls Bayóvar. The reserves figures have not been adjusted to reflect our ownership interest.
- (4) Reserves reflect the original scope of the Patrocínio project. Due to the macroeconomic scenario, we have modified the scope of this project in order to integrate it with the Araxá operation.

	Type	Phosphate rock ore mine Projected		Vale interest (%)
		Operating since	exhaustion date	
Bayóvar	Open pit	2010	2040(1)	40.0
Catalão	Open pit	1982	2033	100.0
Tapira	Open pit	1979	2042(2)	100.0
Araxá	Open pit	1977	2042(3)	100.0
Cajati	Open pit	1970	2033	100.0
Patrocínio	Open pit	2016	2042(2)	100.0

- (1) Life of mine decreased from 2045 to 2040 because reserves of layers 6 and 7 were downgraded to resources.
- (2) Projected exhaustion date limited to economic feasibility study. The expected mine life is longer than indicated above.
- (3) Life of mine increased from 2024 to 2042 due to reevaluation of reserves and integration with Patrocínio ROM project.

Potash

We conduct potash operations in Brazil at the parent-company level, with mining concessions of indefinite duration. We have leased Taquari-Vassouras, the only potash mine in Brazil (in Rosario do Catete, in the Brazilian state of Sergipe), from Petrobras since 1992. In April 2012, we extended the lease for 30 more years. The following table sets forth information on our potash production.

Mine	Type	Production for the year ended December 31, 2016			
		2014	2015	2016	process recovery
		(thousand metric tons)			(%)
Taquari-Vassouras	Underground	492	481	501	86.1

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Potash ore reserves

The total potash reserves have increased due to update of Taquari-Vassouras reserves model, supported by approximately 30.000 meters of underground drilling. We were able to increase the reserves due to reevaluation of extraction ratio; also we have made a partial pillar mining extraction. The reserve estimates are of in-place material after adjustments for depletion, mining losses and recoveries, with no adjustments made for metal losses due to processing.

	Potash ore reserves(1)(2)							
	Proven Tonnage	2016 Grade	Probable Tonnage	2016 Grade	Total Tonnage	2015 Grade	Total Tonnage	2015 Grade
Taquari-Vassouras(3)	3.6	25.05	6.0	21.88	9.5	23.06	7.7	23.72
Carnalita Project	247.1	12.18	54.5	12.18	301.6	12.18	301.6	12.18
Total	250.7	12.36	60.5	13.14	311.1	12.51	309.3	12.47

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- (1) Tonnage is stated in millions of dry metric tons. Grade is % of KCl.
- (2) Tonnage is before processing recovery.
- (3) Silvinite potash reserves.

	Type	Potash ore mines Projected		Vale interest (%)
		Operating since	exhaustion date	
Taquari-Vassouras	Underground Solution mining	1986	2020(1)	100.0
Carnalita Project(2)			2042(3)	100.0

-
- (1) Life of mine increased from 2018 to 2020 due to reevaluation of reserves; reevaluation of extraction ratio; partial pillar mining extraction.
- (2) The Carnalita project is subject to approval by our Board of Directors.
- (3) We have a 30-year lease with Petrobras, which was signed in 2012.

For purposes of determining our phosphate and potash reserves, we used the three-year historical average prices set forth in the following table:

Fertilizer nutrients:		
Phosphate	US\$113.43 per dry metric ton	Average benchmark price for phosphate concentrate, FOB Morocco (source: CRU Fertilizer Week)
Potash	US\$282.23 per dry metric ton	Average benchmark price for potash, FOB Vancouver (source: CRU Fertilizer Week)

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II. OPERATING AND FINANCIAL REVIEW AND PROSPECTS

OVERVIEW

In 2016, we delivered a sound operational performance, with multiple production records, particularly (i) total iron ore production of 348.8 million metric tons, (ii) iron ore production of 148.1 million metric tons in Carajás, (iii) nickel production of 311,000 tons, (iv) copper production of 453,100 tons, (v) cobalt production of 5,799 tons, (vi) contained gold as byproduct in copper and nickel concentrates of 483,000 oz and (vii) coal production of 5.5 million metric tons in Moatize.

In 2016, we generated net income attributable to our stockholders of US\$3.982 billion compared to a loss of US\$12.129 billion in 2015. The most relevant factors impacting our results in 2016 were (i) the partial recovery of average prices for iron ore and iron ore pellets, with an impact of US\$2.966 billion on our net revenues, (ii) higher sales volumes of iron ore fines and pellets (an impact of US\$715 million on our net revenues), nickel, copper and coal, (iii) lower prices for base metals (negative impact of US\$431 million on our net revenues), (iv) US\$1.174 billion in charges for impairment of assets of continuing operations and onerous contracts, and (v) loss in the amount of US\$1.738 billion in loss of discontinued operations, as a result of the sale of our fertilizer business to Mosaic.

We received US\$1.343 billion as a result of divestments and sales of interests in certain joint ventures and investments in 2016, including US\$800 million as part of the sale an additional 25% of the gold produced from the Salobo copper mine for the life of mine to Silver Wheaton, US\$269 million from the sale of three very large ore carriers of 400,000 DWT to ICBC International, and US\$113 million from the sale of our remaining 13.63% indirect interest in Paragominas to Hydro.

Major factors affecting prices

Iron ore and iron ore pellets

Iron ore and iron ore pellets are priced based on a wide array of quality levels and physical characteristics. Price differences derive from various factors, such as the iron content of specific ore deposits, the beneficiation processes required to produce the desired final product, particle size, moisture content and the type and concentration of contaminants (such as phosphorus, alumina, silica and manganese ore) in the ore. Also, fines, lump ore and pellets typically command different prices.

Demand for our iron ore and iron ore pellets is a function of global demand for carbon steel. Demand for carbon steel, in turn, is strongly influenced by real estate and infrastructure construction and global industrial production. Demand from China has been the principal driver of world demand and prices.

Prices are also influenced by the supply of iron ore and iron ore pellets in the international market. In 2015, an excess in the iron ore supply had a negative impact on prices. In 2016, prices began to rise in February driven by policies and supply restrictions imposed by the Chinese government, which caused iron ore prices to reach a peak of US\$70 per dry metric ton by early May. As expected, steel mills increased their productivity in response to the increase in demand and price, which increased the premium for high grade ores, such as our iron ore from Carajás, and pellets. Steel mill productivity rates stabilized through August 2016, as well as high grade material premiums, with high coking coal prices increasing the value perception of high grade ores even more. Prices increased again in October 2016, reaching US\$83.95 per dry metric ton in December 2016, with the price spread between the 65% Ferrous content iron ore that we produce in Carajás and the benchmark 62% Ferrous content iron ore reaching US\$15 per dry metric ton.

The expected conclusion of certain iron ore projects in 2017, especially in Australia and in Brazil, may result in negative pressures on prices, which would pose additional challenges for higher cost producers of iron ore. We expect China's economic growth to slow down in 2017, principally due to slower growth in the real estate and manufacturing sectors, which may be partially offset by infrastructure investments.

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Our iron ore prices are based on a variety of pricing options, which generally use spot price indices as a benchmark. Our pricing is generally based on published indices and uses a variety of mechanisms, including current spot prices, average prices over an agreed period and future prices on delivery. In cases where the final price is only determinable on a future date after shipment, we recognize the sale based on a provisional price at the time of shipment with a subsequent adjustment reflecting the final price.

Nickel

Nickel is an exchange-traded metal, listed on the LME and, starting in 2015, on the SHFE. Most nickel products are priced based on a discount or premium to the LME price, depending on the nickel product's physical and technical characteristics. Demand for nickel is strongly affected by stainless steel production, which represents, on average, 69% of global nickel consumption.

We have short-term fixed-volume contracts with customers for the majority of our expected annual nickel sales. These contracts, together with our sales for non-stainless steel applications (alloy steels, high nickel alloys, plating and batteries), provide stable demand for a significant portion of our annual production. In 2016, 58% of our refined nickel sales were made for non-stainless steel applications, compared to the industry average for primary nickel producers of 30%, bringing more stability to our sales volumes. As a result of our focus on such higher-value segments, our average realized nickel prices for refined nickel have typically exceeded LME cash nickel prices.

Stainless steel is a significant driver of demand for nickel, particularly in China. In 2016, Chinese stainless steel demand represented 65% of total global demand. As a consequence, changes in Chinese stainless steel production have a large impact on global nickel demand. In 2016, Chinese stainless steel production grew 10% compared to 3% in 2015. Also, the growth in stainless focused on 300-series grade steels, which contains relatively high amounts of nickel, due to superior physical characteristics compared to other austenitic series. We anticipate that demand will continue growing in 2017.

While stainless steel production is a major driver of global nickel demand, stainless steel producers can obtain nickel with a wide range of nickel content, including secondary nickel (scrap). The choice between primary and secondary nickel is largely based on their relative prices and availability. Between 2012 and 2016, secondary nickel accounted for approximately 40% of total nickel used for stainless steels, and primary nickel accounted for approximately 60%. Regional availability and consumption of secondary nickel varies. In China, due to low availability of scrap, the use of secondary nickel represents 20% of the total nickel used for stainless steels, while nickel pig iron, a relatively low-grade nickel product made primarily in China from imported lateritic ores, accounts for approximately 32%.

In recent years, Chinese domestic production of nickel pig iron accounted for the majority of world nickel supply growth. In 2016, approximately 360,000 metric tons, representing 19% of world primary nickel supply was produced as nickel pig iron, mainly using nickel ore from the Philippines. Chinese nickel pig iron production was adversely affected by export restriction of unprocessed ores from Indonesia, beginning in 2014. As a result, despite the increase of ore supply from the Philippines, nickel pig iron production declined and has continued to decline in 2016 by 9% year-over-year. Nickel pig iron projects in Indonesia continued to ramp up in 2016, with production levels increasing significantly relative to 2015. However, due to the low price environment the overall global supply declined 2% as producers reduced production and several mines closed. Recent market developments in Indonesia and the Philippines may further impact nickel pig iron production in China. In January 2017, the Indonesian government issued a ministerial decree changing the 2009 mining law that banned the export of unprocessed and semi-processed ores from the country. The ministerial decree allows for the controlled recommencement of nickel ore exports from Indonesia. In February 2017, the government of the Philippines announced the results of a country-wide mining audit with over half of the mines associated with Philippine nickel ore exports identified for potential closure. The government of the Philippines is currently auditing the mining industry, which may result in restrictions on mining exports, which in turn would further contribute to the decline of the Chinese nickel pig iron industry.

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As a result of increased demand and decrease in supply, the nickel market was in deficit in 2016. Global exchange inventories declined 26,000 tons from January 1, 2016 to December 31, 2016. We expect the market to remain in deficit in 2017.

Copper

Copper demand in recent years has been driven primarily by China, given the important role copper plays in construction in addition to electrical and consumer applications. Copper prices are determined on the basis of (i) prices of copper metal on terminal markets, such as the LME and the NYMEX, and (ii) in the case of intermediate products, such as copper concentrate (which comprise most of our sales) and copper anode, treatment and refining charges negotiated with each customer. Under a pricing system referred to as MAMA ("month after month of arrival"), sales of copper concentrates and anodes are provisionally priced at the time of shipment, and final prices are settled on the basis of the LME price for a future period, generally one to three months after the shipment date.

Demand for refined copper grew by an estimated 2% in 2016, and China was responsible for an approximately 48% of worldwide consumption. Most of the copper imported by China was used in infrastructure and the electrical grid. New projects primarily in Peru and mine expansions continued to ramp up in 2016, resulting in a global mine output increase of 5% in 2016 relative to 2015. As supply grew more than demand in 2016, copper prices declined in 2016. Prices recovered in fourth quarter of 2016, as the market anticipated a potential increase in U.S. demand given the election results. We anticipate that the market will reach a balance in 2017, as demand continues to grow and projects complete ramping up.

Coal

Demand for metallurgical coal is driven by steel demand, and future growth continues to be expected in Asia. Asia, including India, accounts for more than half of the steel market and consumes approximately 75% of seaborne metallurgical coal. Chinese total import demand increased by 17% to almost 68 million metric tons in 2016 compared to approximately 57 million metric tons imported in 2015. In 2016, China accounted for approximately 20% of all metallurgical coal imports. Global demand excluding China declined by 1.8% in 2016, compared to 2015, partially due to the decline in imports in Europe and Brazil.

In 2016, the Chinese government imposed a 276-days per year constraint on the operations of coal producers, creating a major supply shortage. Consequently, coal production in China declined by more than 10% in 2016, causing significant increase in prices. Disruptions in Australian operations and cutbacks from U.S. producers over the last two years also contributed to the price surge. The seaborne metallurgical coal market, which has been affected by four years of constant price declines, registered a rapid increase in metallurgical coal rise, exceeding US\$100 per metric ton in July, then exceeding US\$200 per metric ton in September 2016 and finally exceeding US\$300 per metric ton in November 2016. The steep rise in prices prompted the Chinese government to gradually loosen coal production controls, causing prices to decline. Metallurgical coal price on February 28, 2017 was US\$162.5 per ton.

Demand for thermal coal is closely related to electricity consumption, which continues to be driven by global economic growth and urbanization, with the highest levels of growth found in Asia and emerging markets. Global seaborne demand decreased by approximately 1.4% in 2016 compared to 2015. Chinese seaborne coal demand soared in mid-2016 due to a hot summer and strong industrial activity. Chinese seaborne imports reached approximately 150 million metric tons, an increase of 12% year on year, while European seaborne imports fell by nearly 18%. European seaborne import decline was largely due to capacity closures in coal-fired power plants in the United Kingdom. In addition, Germany and Spain produced more electricity from gas in 2016, and Germany increased electricity production from hydro. In India, thermal coal demand remained stable year on year, and imports dropped by 6.3% in 2016, compared to 2015, amid an increase in domestic thermal coal supply. Even though Indian domestic coal production has underperformed against government targets affected by infrastructure bottlenecks, heavy rains and by lackluster demand.

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After China introduced the 276-working-day policy in April, the price of thermal coal reached US\$110 per ton in Asia as Chinese utility companies sought seaborne material to offset domestic supply shortage. While there have been several drivers of thermal coal seaborne prices in 2016, the coal industry reform led by the Chinese government altered thermal coal prices globally. The renewed production control relaxation measure is likely to allow the market to return to balance in 2017. Together with normalized inventory levels and lower influence of speculative activities, we expect thermal coal prices to decline through the year.

Climate change policies will continue to adversely impact coal demand in Europe, North America and China. However, consumption in other developing Asian economies is expected to expand. On the supply side, current investments are low and the lack of new project developments is expected to impact supply and demand balance by 2020, at which point prices will be set by incentive prices.

Sale of fertilizer business

As part of our ongoing efforts to optimize the structure of our portfolio of businesses in order to achieve the most efficient allocation of capital, in December 2016 we entered into an agreement with Mosaic for the sale of our Fertilizers business, including assets in Brazil, Peru and Canada. As a result of this agreement, we report operational and financial results for our fertilizers business in the income statements under "discontinued operations." Therefore, unless otherwise indicated, all figures presented in this annual report do not include the results of the fertilizers business. For more information on the sale of our fertilizer business, see *Information on the Company Business Overview Significant changes in our business Dispositions and asset sales Sale of Fertilizer Business*.

The net assets of our fertilizer business in our balance sheet as of December 31, 2016 were adjusted to reflect their fair value minus the cost to sell the business, and we recognized a loss in the amount of US\$1.738 billion (US\$1.147 billion, net of tax) under "loss of discontinued operations" in our income statement for the year ended December 31, 2016.

Impairment charges

In recent years, we have recognized significant impairments of our assets and investments, attributable to a variety of factors. In 2016, the most important factor was the changing price environment's effects on our short to medium-term pricing assumptions for nickel. As a result, in 2016 we recognized impairments on assets and investments of continuing operations, and a provision for losses on onerous contracts, totaling US\$1.174 billion.

The main impairment charges we recognized in 2016 were:

- US\$631 million on assets of our nickel operations in Newfoundland and Labrador, in Canada, and US\$284 million on assets of our nickel operations in New Caledonia, due to lower nickel prices;
- US\$27 million on assets of our coal operations in Australia, due to the revision of mining plans in the Australian coal mines; and
- US\$257 million on two onerous contracts relating to our ferrous minerals business, a port services agreements providing for minimum guaranteed volume in the Midwestern System and a manganese ore supply agreement.

These amounts were partially offset by reversal of prior impairments on assets of our Northern System's pelletizing plant based on new market circumstances and on studies carried out by our management demonstrating economic feasibility. Accordingly, the total of US\$160 million impairment recorded in 2013 and 2015 was fully reversed.

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Failure of Samarco's Fundão tailings dam

We own a 50% interest in Samarco and accounts for it under the equity method. Below is a summary of the impact of the failure of Samarco's dam in our financial statements:

- Because Samarco is a joint venture, these impacts were accounted for under the equity method in our consolidated financial statements. The carrying value for our investment in Samarco was reduced to zero in 2015.
- In June 2016, pursuant to the Framework Agreement, Samarco, Vale S.A. and BHPB created the Renova foundation to develop and implement remediation and compensation programs over many years. The Framework Agreement provides that to the extent that Samarco does not meet its funding obligations to the foundation, each of Vale S.A. and BHPB must provide funds to the foundation in proportion to its 50% equity interest in Samarco. Samarco initially expected to resume its operations in the last quarter of 2016. In the second quarter of 2016, in light of the status of the necessary procedures for Samarco to resume operations and the uncertainties related to the licensing approval by the governmental authorities, Samarco reviewed its initial assumptions and concluded that it was unable to make a reliable estimate of how and when its operations will resume. As a result of these uncertainties, and other uncertainties with respect to Samarco's expected cash flows, we recognized a provision in the second quarter of 2016 for estimated costs in the amount of R\$5.560 billion, which was discounted at a risk-free rate, resulting in a provision on our balance sheet as of June 30, 2016 in the amount of US\$1.163 billion (R\$3.733 billion, based on the exchange rate of June 30, 2016). This provision represents the present value of our best estimate of the amounts we may incur to comply with our obligations under the Framework Agreement, considering our 50% stake in Samarco. The amount of the provisions related to Samarco as of December 31, 2016 is US\$1.077 billion. At each reporting period, we will reassess the key assumptions used by Samarco in the preparation of its projected future cash flows and will adjust the provision, if required.
- In August 2016, Samarco issued non-convertible private debentures which were equally subscribed by Vale S.A. and BHPB. The resources contributed by Vale S.A. were allocated as follows: (i) R\$222 million (US\$68 million) was used by Samarco in the reparation programs in accordance with the Framework Agreement, and therefore, deducted from the provision of US\$1.163 billion mentioned above; and (ii) R\$234 million (US\$71 million) was used by Samarco's to fund its working capital, and therefore recognized in our income statement as "Impairment and other results in associates and joint ventures." We intend to make available short-term facilities of up to US\$115 million to support Samarco's operations during the first half of 2017. These funds will be released as needed and subject to achieving certain milestones, but we have not undertaken an obligation to Samarco. BHPB has stated that it will make available to Samarco short-term facilities with similar terms and conditions as mentioned above.
- Upon creation of the foundation, Samarco transferred to the foundation most of the reparation and compensation programs. Therefore, we made contributions to the foundation in the total amount of R\$239 million (US\$71 million) in 2016 to be used in the programs in accordance with the Framework Agreement. This total amount was deducted from the provision of US\$1.163 billion mentioned above.

Effect of Brazilian currency exchange variation

Our results are affected in several ways by changes in the Brazilian *real* exchange rate. The year-end exchange rate variations impact our financial results, while the average exchange rate impacts our operational performance.

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In 2016, the Brazilian *real* appreciated 17% against the U.S. dollar, from an exchange rate of R\$3.90 to US\$1.00 on December 31, 2015 to R\$3.26 to US\$1.00 on December 31, 2016. The most important effects were non-cash gains, as described below.

- Most of our debt (US\$22.386 billion as of December 31, 2016, not including accrued charges) is denominated in currencies other than the Brazilian *real*, principally the U.S. dollar. Because the functional currency of our parent company for accounting purposes is the Brazilian *real*, changes in the value of the U.S. dollar against the Brazilian *real* result in exchange gain or loss on our net liabilities. In 2016, the appreciation of the Brazilian *real* against the U.S. dollar had a positive impact in our financial results due to exchange gains on our net U.S. dollar-denominated liabilities of US\$3.094 billion.
- We had *real*-denominated debt of US\$6.305 billion as of December 31, 2016, excluding accrued charges. Since most of our revenues are in U.S. dollars, we may use swaps to convert our debt service from Brazilian *reals* to U.S. dollars. Changes in the value of the U.S. dollar against the Brazilian *real* result in fair value variation on these derivatives, affecting our financial results. As a result of the appreciation of the Brazilian *real* against the U.S. dollar in 2016, we had fair value gains on our currency derivatives of US\$959 million. For more information on our use of derivatives, see *Risk management*.

In 2016, on an annual average, the Brazilian *real* depreciated by 4% against the U.S. dollar, from an average exchange rate of R\$3.34 to US\$1.00 in 2015 to R\$3.48 to US\$1.00 in 2016. The Brazilian *real* depreciation on an annual average brought positive impacts to our operational result and cash flows. The most important effect is described below:

- Most of our revenues are denominated in U.S. dollars, while most of our cost of goods sold are denominated in other currencies, including the Brazilian *real* (54% in 2016), and the Canadian dollar (12% in 2016). In 2016, 29% of our cost of goods sold was denominated in U.S. dollars. As a result, the depreciation of the Brazilian *real* and other currencies against the U.S. dollar reduced our costs and expenses by US\$399 million.

In January 2017, Vale implemented hedge accounting for the foreign currency risk arising from its net investments in Vale International and Vale Austria. The purpose of the program is to mitigate the impact of foreign exchange variations in Vale's earnings, reducing volatility and allowing financial statements to better reflect the economic performance of the company.

Under the hedge accounting program, the Vale S.A. debt denominated in U.S. dollars and Euros will serve as a hedge instrument for Vale S.A. investments in Vale International and Vale Austria. With the program, the impact of exchange rate variations over debt denominated in U.S. dollars and Euros will be partially recorded under other comprehensive income reducing volatility on financial performance.

Table of Contents**RESULTS OF OPERATIONS****Consolidated Revenues**

In 2016, our net operating revenues from continuing operations increased by 17.6% to US\$27.488 billion, primarily resulting from higher realized prices for iron ore fines and pellets (an impact of US\$2.966 billion on our net revenues) and other commodities, and higher sales volumes of iron ore fines and pellets (an impact of US\$715 million on our net revenues), nickel, copper and coal. Our net operating revenues were adversely impacted by lower prices for base metals (negative impact of US\$431 million). Net operating results of each segment are discussed below under *Results of operations by segment*.

Our revenue depends, among other factors, on the volume of production at our facilities and the prices for our products. We publish a quarterly production report that is available on our website and furnished to the SEC on Form 6-K. Increases in the capacity of our facilities resulting from our capital expenditure program have an important effect on our performance. Our production is also affected by acquisitions and dispositions.

The following table summarizes, for the periods indicated, the distribution of our net operating revenues of continuing operations based on the geographical location of our customers.

	Net operating revenues by destination					
	2014		2015		2016	
	(US\$ million)	(% of total)	(US\$ million)	(% of total)	(US\$ million)	(% of total)
North America						
Canada	US\$1,393	40.5	US\$1,122	41.8	US\$1,172	4.3%
United States	1,368	3.9	855	3.7	1,005	3.6
	2,761	7.9	1,977	8.5	2,177	7.9
South America						
Brazil	3,696	10.5	2,017	8.6	2,064	7.5
Other	656	1.9	377	1.6	354	1.3
	4,352	12.4	2,394	10.2	2,418	8.8
Asia						
China	12,657	36.0	9,095	38.9	12,747	46.4
Japan	3,627	10.3	1,959	8.4	1,741	6.3
South Korea	1,555	4.4	790	3.4	880	3.2
Taiwan	721	2.1	620	2.6	621	2.3
Other	976	2.8	830	3.5	889	3.2
	19,536	55.6	13,294	56.8	16,878	61.4
Europe						
Germany	2,111	6.0	1,433	6.1	1,379	5.0
United Kingdom	709	2.0	399	1.7	326	1.2
Italy	849	2.4	461	2.0	435	1.6
France	565	1.6	331	1.4	429	1.6
Other	2,374	6.8	1,905	8.1	2,079	7.5
	6,608	18.8	4,529	19.4	4,648	16.9
Rest of the world						
	1,867	5.3	1,190	5.1	1,367	5.0
Total	US\$35,124	100.0	US\$23,384	100.0	US\$27,488	100.0%

Consolidated operating costs and expenses

Our cost of goods sold and services rendered from continuing operations totaled US\$17.650 billion in 2016, decreasing by 5.9%, or US\$1.101 billion, from the US\$18.751 billion recorded in 2015. Lower costs were mostly driven by the positive results of cost-saving initiatives (US\$1.718 billion, of which US\$1.374 billion in our ferrous minerals business), exchange rate variation (US\$463 million) and partially offset by higher sales volume.

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Our selling, general, administrative and other expenses from continuing operations decreased by 28.3% in 2016, mostly due to simplification of corporate functions, lower expenses with corporate services and other cost-cutting measures. We reduced our research and evaluation expenses by 19.2%, to US\$319 million in 2016 from US\$395 million in 2015. Our pre-operating and stoppage expenses decreased by US\$489 million in 2016, primarily because the ramp-up of our nickel operation in New Caledonia approached operational targets in 2015 and therefore started to be accounted for as costs in 2016. Other operating expenses increased by 29%, mainly due to the positive effect of US\$150 million from goldstream transaction recorded in 2016, compared to US\$230 million in 2015, and to the positive effect of US\$37 million reversal of provisions for asset retirement obligations in 2016 compared to US\$331 million in 2015.

Results of operations by segment***Net operating revenue by segment***

The following table summarizes our net operating revenues by product for the periods indicated.

	2014(1)	Year ended December 31,		2016
		change	2015(1)	
	(US\$ million, except for %)			
Ferrous minerals:				
Iron ore	US\$19,301	(36.1)	US\$12,330	281.0
Pellets	5,263	(31.6)	3,600	6.3
Ferrous alloys and manganese	392	(58.7)	162	86.4
Other ferrous products and services	741	(36.6)	470	(6.8)
Subtotal	25,697	(35.5)	16,562	22.9
Coal	739	(28.8)	526	59.5
Base metals:				
Nickel and other products(2)	6,241	(24.8)	4,693	(4.7)
Copper concentrate(3)	1,451	1.3	1,470	13.4
Subtotal	7,692	(19.9)	6,163	(0.4)
Other products and services(4)	996	(86.6)	133	19.5
Net operating revenues	US\$35,124	(33.4)	US\$23,384	176.6

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- (1) Information for the years ended December 31, 2014 and 2015 were re-presented to reflect results of discontinued operations (see note 14 to our consolidated financial statements).
- (2) Includes nickel coproducts (copper) and byproducts (precious metals, cobalt and others).
- (3) Does not include copper produced in our nickel operations.
- (4) Includes energy.

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The following table sets forth, for our principal products, the total volumes we sold in each of the periods indicated.

	Year ended December 31,		
	2014	2015	2016
	(thousand metric tons, except where indicated)		
Ferrous minerals:			
Iron ore fines	255,877	276,393	289,940
Pellets	43,682	46,284	47,709
Manganese	1,879	1,764	1,851
Ferroalloys	150	69	127
ROM	14,075	12,269	3,496
Coal:			
Thermal coal	1,152	892	5,457
Metallurgical coal	6,330	5,614	4,907
Base metals:			
Nickel	272	292	311
Copper	353	397	430
PGMs (000' oz)	577	519	507
Gold (000' oz)	351	425	497
Silver (000' oz)	1,889	2,303	2,578
Cobalt (metric tons)	3,188	3,840	4,734

Average realized prices

The following table sets forth our average realized prices for our principal products for each of the periods indicated. We determine average realized prices based on our net operating revenues, which consist of the price charged to customers, excluding certain items that we deduct in arriving at net operating revenues, mainly value-added tax.

	Year ended December 31,		
	2014	2015	2016
	(US\$ per metric ton, except where indicated)		
Ferrous minerals:			
Iron ore	75.43	44.61	54.44
Pellets	120.48	77.79	80.26
Manganese	118.15	56.42	110.87
Ferroalloys	1,125.83	899.32	757.67
Coal:			
Thermal coal	67.65	52.36	46.17
Metallurgical coal	104.37	85.55	119.54
Base metals:			
Nickel	16,426.47	11,684.30	9,800.00
Copper	6,015.47	4,352.94	4,458.00
Platinum (US\$/oz)	1,261.87	1,020.14	919.00
Gold (US\$/oz)	1,192.51	1,123.07	1,260.49
Silver (US\$/oz)	19.42	12.63	16.22
Cobalt (US\$/lb)	10.67	9.95	11.01

Table of Contents*Cost of goods sold by segment*

The following table presents, for each indicated period, our cost of goods sold by segment and the percentage change from year to year. Because significant portions of changes in our cost of goods sold may derive from exchange rate variations, we also present in the table below the effect of exchange variations and the changes on a constant currency basis.

	Year ended December 31,					
	2016	2015(1)	Variation reported	2016		Variation - constant currency basis
	Cost of goods sold (US\$ million)	Cost of goods sold (US\$ million)		Exchange rate impact in 2016	Variation without exchange rate impact	
(US\$ million)	(US\$ million)	(%)	(US\$ million)	(US\$ million)	(%)	
Ferrous minerals:						
Iron ore	6,622	7,604	(12.9)%	(148)	(834)	(11.2)%
Pellets	2,002	2,121	(5.6)	(51)	(68)	(3.2)
Ferroalloys and manganese	231	175	32.0	(6)	62	36.6
Other ferrous products and services	269	341	(21.1)	(13)	(59)	(18.3)
Subtotal	9,124	10,241	(10.9)	(218)	(899)	(9.0)
Coal	872	839	3.9	(3)	36	4.3
Base metals:						
Nickel and other products(2)	3,204	3,393	(5.6)	(86)	(103)	(3.1)
Copper(3)	924	903	2.3	(37)	58	6.7
Subtotal	4,128	4,296	(3.9)	(123)	(45)	(1.1)
Other	259	139	86.3	(6)	126	95.3
Total (excluding depreciation)	14,383	15,515	(7.3)	(350)	(782)	(5.2)
Depreciation	3,267	3,236	1.0	(113)	144	4.6
Total (including depreciation)	17,650	18,751	(5.9)%	(463)	(638)	(3.5)%

	Year ended December 31,					
	2015(1)	2014(1)	Variation reported	2015		Variation - constant currency basis
	Cost of goods sold (US\$ million)	Cost of goods sold (US\$ million)		Exchange rate impact in 2015	Variation without exchange rate impact	
(US\$ million)	(US\$ million)	(%)	(US\$ million)	(US\$ million)	(%)	
Ferrous minerals:						
Iron ore	7,604	9,532	(20.2)%	(1,442)	(486)	(6.0)%
Pellets	2,121	2,705	(21.6)	(540)	(44)	(2.0)
Ferroalloys and manganese	175	261	(33.0)	(73)	(13)	(6.9)
Other ferrous products and services	341	565	(39.6)	(179)	(45)	(11.7)
Subtotal	10,241	13,063	(21.6)	(2,234)	(588)	(5.4)
Coal	839	1,071	(21.7)	(80)	(152)	(15.3)
Base metals:						
Nickel and other products(2)	3,393	3,710	(8.5)	(336)	19	0.6

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Copper ⁽³⁾	903	877	3.0	(258)	284	45.7
Subtotal	4,296	4,587	(6.3)	(594)	303	7.6
Other	139	601	(76.9)	(112)	(350)	(71.6)
Total (excluding depreciation)	15,515	19,322	(19.7)	(3,020)	(787)	(4.8)
Depreciation	3,236	3,468	(6.7)	(695)	463	16.7
Total (including depreciation)	18,751	22,790	(17.7)%	(3,715)	(324)	(1.7)%

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- (1) Information for the years ended December 31, 2014 and 2015 has been re-presented to reflect results of discontinued operations (see note 14 to our consolidated financial statements).
- (2) Includes nickel coproducts (copper) and byproducts (precious metals, cobalt and others).
- (3) Does not include copper produced in our nickel operations.

Table of Contents*Expenses by segment (excluding impairment charges)*

The following table summarizes, for each indicated period, our expenses (including selling, general and administrative, research and evaluation, pre-operating, stoppage and other expenses, net of other revenues) by segment and the percentage change from year to year. Because significant portions of changes in our expenses may derive from exchange rate variations, we also present in the table below the effect of exchange variations and the changes on a constant currency basis. The table excludes the effect of impairment charges. See *Impairment charges*.

	Year ended December 31,					
	2016	2015(1)	2016		2015	
	Expenses	Expenses	Variation	Exchange	Variation	Variation -
	reported	reported	without	rate	without	constant
	impact	impact	exchange	rate	exchange	currency
	in 2016	in 2015	rate	rate	rate	basis
	(US\$ million)	(US\$ million)	(%)	(US\$ million)	(US\$ million)	(%)
Ferrous minerals:						
Iron ore	727	643	13.1%	(23)	107	17.3%
Pellets	108	19	468.4		89	468.4
Ferroalloys and manganese	15	18	(16.7)	(1)	(2)	(11.8)
Other ferrous products and services	14	(3)	(566.7)	2	15	(1500.0)
Subtotal	864	677	27.6	(22)	209	31.9
Coal	21	223	(90.6)	(1)	(201)	(90.5)
Base metals:						
Nickel and other products(2)	287	668	(57.0)		(381)	(57.0)
Copper(3)	30	41	(26.8)	(1)	(10)	(25.0)
Other base metals	(150)	(230)	(34.8)		80	(34.8)
Subtotal	167	479	(65.1)	(1)	(311)	(65.1)
Others	274	294	(6.8)	4	(24)	(8.1)
Total (excluding depreciation)	1,326	1,673	(20.7)	(20)	(327)	(19.8)
Depreciation	220	483	(54.5)	(6)	(257)	(53.9)
Total (including depreciation)	1,546	2,156	(28.3)%	(26)	(584)	(27.4)%

	Year ended December 31,					
	2015(1)	2014(1)	2015		2014	
	Expenses	Expenses	Variation	Exchange	Variation	Variation -
	reported	reported	without	rate	without	constant
	impact	impact	exchange	rate	exchange	currency
	in 2015	in 2014	rate	rate	rate	basis
	(US\$ million)	(US\$ million)	(%)	(US\$ million)	(US\$ million)	(%)
Ferrous minerals:						
Iron ore	643	1,737	(63.0)%	(539)	(555)	(46.3)%
Pellets	19	59	(67.8)	(11)	(29)	(60.4)
Ferroalloys and manganese	18	36	(50.0)	(9)	(9)	(33.3)
Other ferrous products and services	(3)	7	(142.9)	(1)	(9)	(150.0)
Subtotal	677	1,839	(63.2)	(560)	(602)	(47.1)

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Coal	223	365	(38.9)	(8)	(134)	(37.5)
Base metals:						
Nickel and other products(2)	668	551	21.2	(27)	144	(27.5)
Copper(3)	41	33	24.2	(9)	17	(70.8)
Other base metals	(230)				(230)	
Subtotal	479	584	(18.0)	(36)	(69)	(12.6)
Others	294	507	(42.0)	(153)	(60)	(16.9)
Total (excluding depreciation)	1,673	3,295	(49.2)	(757)	(865)	(34.1)
Depreciation	483	401	20.4	67	15	3.2
Total including depreciation	2,156	3,696	(41.7)%	(690)	(850)	(28.3)%

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- (1) Information for the years ended December 31, 2014 and 2015 were re-presented to reflect results of discontinued operations (see note 14 to our consolidated financial statements).
- (2) Includes nickel coproducts (copper) and byproducts (precious metals, cobalt and others).
- (3) Does not include copper produced in our nickel operations.

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Our management uses adjusted EBITDA to assess each segment's contribution to our performance and to support decisions about resource allocation. Adjusted EBITDA is a non-GAAP measure, which is calculated for each segment using operating income or loss plus dividends received from joint ventures and associates, and adding back the amounts charged as (i) depreciation, depletion and amortization, (ii) impairment of non-current assets and provisions for losses on onerous contracts and (iii) results on measurement or sale of non-current assets. For more information, see note 3 to our consolidated financial statements.

The table below shows a reconciliation of our Adjusted EBITDA from continuing operations with our net income (loss) from continuing operations for the years ended December 31, 2016, 2015 and 2014.

	Year ended December 31,		
	2014	2015	2016
	(US\$ million)		
Income (loss) from continuing operations attributable to Vale's stockholders	1,499	(11,929)	5,211
Loss attributable to noncontrolling interests	(308)	(501)	(8)
Income (loss) from continuing operations	1,191	(12,430)	5,203
Income taxes	1,603	(5,249)	2,781
Impairment and others results in associates and joint ventures	61	349	1,220
Equity results in associates and joint ventures	(501)	445	(309)
Financial results, net	6,018	10,654	(1,843)
Operating income (loss)	8,372	(6,231)	7,052
Impairment of non-current assets and onerous contracts	99	8,769	1,174
Results on measurement or sale of non-current assets	167	(61)	66
Dividends received from associates and joint ventures	568	318	193
Depreciation, depletion and amortization	3,869	3,719	3,487
Adjusted EBITDA from continuing operations	13,075	6,514	11,972
Adjusted EBITDA from discontinued operations (Fertilizers)	278	567	209
Total Adjusted EBITDA	13,353	7,081	12,181

The following table summarizes Adjusted EBITDA for each of our segments.

	Year ended December 31,		
	2014 Adjusted EBITDA	2015 Adjusted EBITDA	2016 Adjusted EBITDA
	(US\$ million)		
Ferrous minerals:			
Iron ore	8,076	4,105	8,445
Pellets	2,981	1,685	1,820
Ferroalloys and manganese	95	(31)	56
Other ferrous products and services	169	140	155
Subtotal	11,321	5,899	10,476
Coal	(669)	(508)	(54)

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Base metals:			
Nickel and other products(1)	1,980	632	985
Copper(2)	541	526	713
Other		230	150
Subtotal	2,521	1,388	1,848
Other(3)	(98)	(265)	(298)
Total Adjusted EBITDA from continuing operations	13,075	6,514	11,972
Adjusted EBITDA from discontinued operations (Fertilizers)	278	567	209
Total Adjusted EBITDA	13,353	7,081	12,181

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- (1) Includes nickel coproducts (copper) and byproducts (precious metals, cobalt and others).
- (2) Does not include copper produced in our nickel operations.
- (3) Includes energy.

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We discuss below, for each segment, the changes in our net operating revenues, cost of goods sold (excluding depreciation, depletion and amortization), expenses (excluding depreciation, depletion and amortization and excluding impairment charges) and Adjusted EBITDA.

Ferrous minerals

2016 compared to 2015

- *Our net operating revenues from sales of ferrous minerals* increased by 22.9%, from US\$16.562 billion in 2015 to US\$20.351 billion in 2016, reflecting higher prices and sales volumes of iron ore and iron ore pellets. Our average realized prices in 2016 were 22.0% and 3.2% higher than our average realized prices in 2015 for iron ore and iron ore pellets, respectively. Our iron ore sales volume increased by 4.9% in 2016 due to improved operational performance of the Northern System.
- *Our cost of goods sold from ferrous minerals*, excluding depreciation, amortization and depletion, decreased by 9.0% on a constant currency basis, mainly as a result of a decrease in our freight costs, in the amount of US\$705 million, the termination in December 2015 of our bunker oil hedge accounting program, which had a negative impact in the amount of US\$460 million on our results for 2015, and other cost-cutting measures implemented in 2016, including the renegotiation and termination of freight charter contracts. The decrease in our costs of goods sold was partially offset by increased costs associated with higher sales volumes, in the amount of US\$446 million.
- *Our net expenses from ferrous minerals*, excluding depreciation, amortization and depletion, and excluding impairment charges, increased by 31.9% on a constant currency basis, mainly due to a reversion of provisions for asset retirement obligations in 2015 in the amount of US\$322 million. We also saw an increase in pre-operating and stoppage expenses from US\$169 million in 2015 to US\$187 million in 2016, mainly as a result of the increase in S11D pre-operating expenses and stoppage expense in our iron ore operations in Mariana, in the state of Minas Gerais.
- *Our adjusted EBITDA from ferrous minerals* was US\$10.476 billion in 2016, 77.6% higher than the US\$5.899 billion we reported in 2015. The increase was mainly due to the increase in market prices (impact of US\$2.727 billion), and also increases in sales volume and a positive impact of exchange rate variations, in the amount of US\$244 million. Dividends received from joint ventures and associates operating in the ferrous minerals segment totaled US\$113 million in 2016 compared to US\$255 million in 2015, reflecting lower dividends, especially due to the lack of dividends from Samarco.

2015 compared to 2014

- *Our net operating revenues from sales of ferrous minerals* decreased by 35.5%, from US\$25.697 billion in 2014 to US\$16.562 billion in 2015, reflecting lower iron ore and iron ore pellet prices, partially offset by higher sale volumes of iron ore and iron ore pellets. Our average realized prices in 2015 were 40.8% and 35.4% lower than our average realized prices in 2014 for iron ore and iron ore pellets, respectively. Our iron ore sales volume increased by 8.0% in 2015, due to the ramp-up of the Carajás plant 2, Vargem Grande and Conceição I and II Itabirites projects, and improvement of our distribution logistics, while the volume of our iron ore pellets sales increased by 6.0% due to the ramp-up of the Tubarão VIII pelletizing plant.

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- Our cost of goods sold from ferrous minerals, excluding depreciation, amortization and depletion, decreased by 5.4% on a constant currency basis, mainly as a result of (i) a decrease in our freight costs, in the amount of US\$1.246 billion, (ii) a reduction in the railroad transportation fees paid to MRS in the amount of US\$104 million, (iii) US\$185 million reduction in the cost of acquisition of iron ore, mainly due to lower prices, and (iv) a decrease in pellet plants leasing, in the amount of US\$63 million mainly due to the decline in prices. These effects were partially offset by increased costs associated with the increase in volume sold, in the amount of US\$1.077 billion. In addition, we implemented general cost-cutting measures, including the renegotiation and termination of contracts.
- Our net expenses from ferrous minerals, excluding depreciation, amortization and depletion, and excluding impairment charges, decreased by 47.1% on constant currency basis, from US\$1.279 billion in 2014 to US\$677 million in 2015, mainly due to a reversion of provisions for asset retirement obligations in the amount of US\$322 million and a US\$201 million reduction in research and evaluation expenses.
- Our adjusted EBITDA from ferrous minerals was US\$5.899 billion in 2015, 47.9% lower than in 2014, for the reasons described above, partially offset by the positive impact of exchange rate variation, in the amount of US\$2.787 billion. Dividends received from joint ventures and associates operating in the ferrous minerals segment totaled US\$255 million in 2015 compared to US\$526 million in 2014, reflecting lower dividends from Samarco.

Coal

2016 compared to 2015

- Our net operating revenues from sales of coal increased by 59.5%, to US\$839 million in 2016 from US\$526 million in 2015. This increase primarily reflected higher sales prices of metallurgical coal (impact of US\$161 million) and higher sales volumes for thermal coal (impact of US\$208 million) as a result of an increase in logistics capacity with the ramp-up of the Nacala Logistics Corridor, allowing for the sale of thermal coal inventories. Sales volumes of metallurgical coal totaled 4.907 Mt in 2016, decreasing 707 kt as compared to 2015, as a result of a 33% decrease in sales volumes from Carborough Downs, which faced geological issues in 2016 and was divested in November 2016. Sales volumes of thermal coal reached 5.457 Mt in 2016, compared to 0.892 Mt in 2015.
- Our cost of goods sold from coal, excluding depreciation, amortization and depletion, increased by 4.3% on a constant currency basis, from US\$872 million in 2016 to US\$836 million in 2015, as a result of the ramp-up of the Nacala Logistics Corridor.
- Our net expenses from coal, excluding depreciation, amortization and depletion, and excluding impairment charges, decreased by 90.5% on a constant currency basis, from US\$222 million in 2015 to US\$21 million in 2016, due to (i) reduced selling, general and administrative expenses in Australia (impact of US\$4 million) and (ii) higher effects of inventory adjustments on thermal coal in Mozambique in 2016 as compared to 2015 (impact of US\$165 million).
- Our adjusted EBITDA from coal was a loss of US\$54 million in 2016, while in 2015 we had a loss of US\$508 million, reflecting higher coal prices (impact of US\$155 million) and lower costs and expenses, adjusted by the impact of higher volumes and exchange rate variation (impact of US\$386 million).

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2015 compared to 2014

- *Our net operating revenues from sales of coal* decreased to US\$526 million in 2015, from US\$739 million in 2014. This 28.8% decrease primarily reflected lower prices and sales volume for both thermal and metallurgical coal. Our sales volumes decreased due to lower sales from our Isaac Plains and Integra Coal mines operations, which we suspended in May 2014, and eventually sold in the last quarter of 2015.
- *Our cost of goods sold from coal*, excluding depreciation, amortization and depletion, decreased to US\$839 million in 2015, or 15.3% on a constant currency basis, due to the stoppage of our Isaac Plains and Integra Coal mines, partially offset by additional costs in our operations in Mozambique driven by higher sales volumes.
- *Our net expenses from coal*, excluding depreciation, amortization and depletion, and excluding impairment charges, decreased by 37.5% on a constant currency basis, from US\$365 million in 2014 to US\$223 million in 2015, due to (i) reduced selling, general and administrative expenses in Australia, (ii) the receipt of insurance proceeds of US\$36 million in connection with a flood that occurred in Australia in 2010 and (iii) lower effects of inventory adjustments on thermal coal in Mozambique in 2015, as compared to 2014.
- *Our adjusted EBITDA from coal* was a loss of US\$508 million in 2015, while in 2014 we had a loss of US\$669 million, reflecting the decline in coal prices and lower sales volume due to the suspension of the Isaac Plains and Integra Coal mines in Australia. Dividends received from joint ventures and associates operating in the coal segment amounted to US\$28 million in 2015 and US\$28 million in 2014.

Base metals

2016 compared to 2015

- *Our net operating revenues from sales of base metals* totaled US\$6.139 billion in 2016, a 0.4% decrease from US\$6.163 billion in 2015. The decrease was mainly driven by lower nickel prices (US\$544 million), which were partially offset by higher sales of nickel (US\$182 million) and copper (US\$144 million), higher prices for gold, cobalt and silver byproducts (US\$101 million) and higher volumes for gold, cobalt and silver byproducts (US\$89 million). The increase in nickel sales volumes was primarily driven by the ramp up of our operations in New Caledonia and at Long Harbour. The increase in copper sales volumes was mainly the result of higher copper production in Sudbury and the completed ramp up of operations at Salobo.
- *Our cost of goods sold from base metals*, excluding depreciation, amortization and depletion, decreased 1.1% on a constant currency basis. After adjusting for the effects of higher volumes (US\$260 million), costs decreased by US\$305 million compared to 2015 mainly as a result of higher production in Sudbury and the conclusion of the ramp-up of Salobo operations resulting in dilution of fixed costs, lower fuel costs at PTVI and lower planned shutdown maintenance costs at our Canadian operations.
- *Our net expenses from base metals*, excluding depreciation, amortization and depletion, and excluding impairment charges, decreased 65.1% on a constant currency basis, mainly due to lower pre-operating expenses reflecting the full transition of VNC costs from pre-operating expenses to costs of goods sold (impact of US\$287 million), partially offset by the effects from goldstream transactions totaling US\$150 million in 2016.
- *Our adjusted EBITDA from base metals* was US\$1.848 billion in 2016, a 33.1% increase from 2015. The increase was mainly due to lower expenses and costs (impact of US\$617 million), higher nickel and copper sales volumes (US\$148 million) and exchange variation (US\$126 million), which was partially offset by lower prices (US\$431 million)

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- Our net operating revenues from sales of base metals decreased to US\$6.163 billion in 2015 from US\$7.692 billion in 2014. The 19.9% decrease primarily reflected lower prices for nickel and copper, partially offset by higher nickel sales volumes, resulting from ramp-up of our operations in New Caledonia and of Onça Puma, in Brazil, and higher copper sales volume, resulting from the ramp-up of Salobo operations.
- Our cost of goods sold from base metals, excluding depreciation, amortization and depletion, increased 7.6% on a constant currency basis, due to higher costs related to ramp-up of Onça Puma and Salobo operations and increased allocation of VNC pre-operating expenses to costs of goods sold.
- Our net expenses from base metals, excluding depreciation, amortization and depletion, and excluding impairment charges, decreased 12.6% on constant currency basis, mainly due to lower pre-operating expenses and a US\$230 million gain on the gold stream transaction in 2015, partly offset by lower insurance proceeds in 2015 of US\$212 million (US\$64 million in 2015 compared to US\$276 million in 2014).
- Our adjusted EBITDA from base metals was US\$1.388 billion in 2015, 44.9% lower than in 2014. Despite the lower nickel and copper prices, certain non-recurring items contributed to our income generation, such as insurance proceeds received in 2014 and the proceeds received in the gold stream transaction in 2015.

Financial results, net

The following table details our net financial results, net, from continuing operations for the periods indicated.

	Year ended December 31,		
	2014	2015	2016
	(US\$ million)		
Financial income(1)	US\$389	US\$251	US\$170
Financial expenses(2)	(2,900)	(1,068)	(2,677)
Gains (losses) on derivatives, net	(1,334)	(2,477)	1,256
Foreign exchange gains (losses), net	(2,076)	(7,044)	3,252
Indexation losses, net	(97)	(316)	(158)
Financial results, net	US\$(6,018)	US\$(10,654)	US\$1,843

(1) Includes short-term investments and other financial income (see note 6 to our consolidated financial statements)

(2) Includes loans and borrowings gross interest, capitalized loans and borrowing costs, financial expenses associated with labor, tax and civil lawsuits, participative stockholders' debentures, expenses of REFIS and others financial expenses (see note 6 to our consolidated financial statements).

2016 compared to 2015. In 2016, our financial results, net, was income of US\$1.843 billion, compared to an expense of US\$10.654 billion in 2015. This principally resulted from:

- A decrease in financial income from US\$251 million in 2015 to US\$170 million in 2016, as a result of a decrease in our average cash position in 2016, as compared to 2015.

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An increase in financial expenses of US\$1.609 billion, from US\$1.068 billion in 2015 to US\$2.677 billion in 2016, attributable primarily to the US\$1.382 billion increase in the marked-to-market fair value of our shareholder debentures due to an increase in commodities price.

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- Net foreign exchange gains of US\$3.252 billion in 2016 compared to net foreign exchange losses of US\$7.044 billion in 2015, principally due to the appreciation of the Brazilian *real* against the U.S. dollar.

- The net effect of fair value changes in derivatives, which represented a gain of US\$1.256 billion in 2016 compared to a loss of US\$2.477 billion in 2015. This reflected the following main categories of derivatives transactions:

Currency and interest rate swaps. We recognized gains of US\$959 million in 2016 from currency and interest rate swaps, compared to a net loss of US\$1.502 billion in 2015. These swaps are primarily used to convert debt denominated in other currencies into U.S. dollars in order to protect our cash flow from exchange rate volatility.

Nickel derivatives. We recognized a loss of US\$42 million in 2016 compared to a loss of US\$49 million in 2015. These *derivatives* are part of our nickel price protection program.

Bunker oil derivatives. We recognized a gain of US\$268 million in 2016 compared to a loss of US\$742 million in 2015. These gains or losses resulted from the mark to market of the hedge contracts on bunker oil price; for 2016, we had entered in these contracts only in the last quarter of the year, when we resumed hedging the bunker oil price due to the risk of increased oil prices in 2017. In 2016, we also recognized a financial loss of US\$799 million compared to a loss of US\$270 million in 2015, due to the settlement of outstanding bunker oil hedge contracts in each of these years. As we resumed hedging bunker oil price in the last quarter of 2016, our financial results in 2017 will be impacted by the changes in the fair value of the outstanding derivatives position at the end of each quarter and by the gains or losses related to the settlements recorded in each quarter. These derivatives are structured to minimize the volatility of the cost of maritime freight, and the variation is due to the sharp volatility in the spot price of bunker oil.

- A net indexation loss of US\$158 million in 2016 compared to a net loss of US\$316 million in 2015, mainly due to changes in discount rates on asset retirement obligation provisions.

2015 compared to 2014. Our financial results, net increased 77.0%, to US\$10.654 billion in 2015 from US\$6.018 billion in 2014. This principally resulted from:

- Net foreign exchange losses of US\$7.044 billion in 2015 compared to net foreign exchange losses of US\$2.076 billion in 2014, principally due to the depreciation of the Brazilian *real* against the U.S. dollar.

- The net effect of fair value changes in derivatives, which represented a loss of US\$2.477 billion in 2015 compared to a loss of US\$1.334 billion in 2014. This reflected the following main categories of derivatives transactions:

Currency and interest rate swaps. We recognized a net loss of US\$1.502 billion in 2015 from currency and interest rate swaps, compared to net loss of US\$683 million in 2014. These swaps are primarily used to convert debt denominated in other currencies into U.S. dollars in order to protect our cash flow from exchange rate volatility.

Nickel derivatives. We recognized a loss of US\$49 million in 2015 compared to a gain of US\$9 million in 2014. These derivatives are part of our nickel price protection program.

Bunker oil derivatives. We recognized a net loss of US\$742 billion in 2015 compared to a net loss of US\$533 million in 2014. These derivatives are structured to minimize the volatility of the cost of maritime freight, and the variation is due to the sharp decrease in the spot bunker oil price.

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Warrants. We recognized a net loss of US\$142 million in 2015 compared to a net loss of US\$5 million in 2014. These derivatives were part of the consideration we received under the 2013 gold sale contract with Silver Wheaton.

- A net indexation loss of US\$316 million in 2015 compared to a loss of US\$97 million in 2014, as a result of higher inflation in Brazil.
- A decrease in financial income from US\$389 million in 2014 to US\$251 million in 2015, as a result of lower average cash position in 2015, as compared to 2014.
- A decrease in financial expenses of US\$1.832 billion, from US\$2.900 billion in 2014 to US\$1.068 billion in 2015, attributable primarily to the US\$1.280 billion decrease in the amount of our shareholder debentures, which are marked-to-market, due to the decline in commodities price.

Equity results in associates and joint ventures

2016 compared to 2015. Our equity results in associates and joint ventures increased to a gain of US\$309 million in 2016 from a loss of US\$445 million in 2015 mostly due to the positive results in 2016 from our equity positions in Companhia Siderurgica do Pecém (US\$25 million gain), MRN (US\$48 million gain) and California Steel Industries, Inc. CSI (US\$32 million gain), as compared to the negative results in 2015 from Samarco (US\$167 million loss), Companhia Siderurgica do Pecém (US\$307 million loss), CSI (US\$27 million loss) and Companhia Siderurgica do Atlântico CSA (US\$80 million loss).

2015 compared to 2014. Our equity results in associates and joint ventures in 2015 decreased to a loss of US\$445 million from an income of US\$501 million in 2014, mostly due to the negative results from Companhia Siderurgica do Pecém (US\$307 million loss in 2015) and from Samarco (US\$167 million loss in 2015) while in 2014 we had a positive result from Samarco (US\$392 million income).

Impairment and other results in associates and joint ventures

2016 compared to 2015. We recognized a loss resulting from impairment and other results in associates and joint ventures of US\$1.220 billion in 2016, of which US\$1.109 billion related to our investments in Samarco, US\$75 million resulted from the sale of CSA and US\$36 million from the sale of Mineração Paragominas. We recognized a loss resulting from impairment and other results in associates and joint ventures of US\$349 million in 2015, of which US\$446 million related to impairment from investments in associates and joint ventures, which was partially offset by a gain in the sale of our participation in Shandong Yankuang (US\$79 million), a coking coal producer, and a gain in the disposal of energy generation assets (US\$18 million). See *Business overview Failure of Samarco's tailings dam in Minas Gerais* and note 15 to our consolidated financial statements.

2015 compared to 2014. In 2015, we recognized a loss resulting from impairment and other results in associates and joint ventures of US\$349 million, of which US\$132 million resulted from impairment from investments in related to our investment in Samarco and US\$314 million related to our investment in TEAL. This was partially offset by US\$97 million a gain in the sale of our participation in Shandong Yankuang (US\$79 million), a coking coal producer, and a gain in the disposal of energy generation assets (US\$18 million). In 2014, we recognized a loss resulting from impairment and other results in associates and joint ventures of US\$61 million, primarily resulting from a US\$30 million loss resulting from the sale of Vale Florestar.

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Results of discontinued operations

2016 compared to 2015. In 2016, we had a net loss from discontinued operations attributable to Vale's stockholders of US\$1.229 billion, compared to a loss of US\$200 million in 2015. In December 2016, we entered into an agreement with Mosaic to sell a significant part of our fertilizer business. As a result of this transaction, our fertilizer business is being reported as discontinued operations in our financial statements for the year ended December 31, 2016, and we have re-presented our financial statements for the years ended December 31, 2015 and 2014 accordingly. The net assets of our fertilizer business in our balance sheet as of December 31, 2016 were adjusted to reflect their fair value minus the cost to sell the business, and we recognized a loss in the amount of US\$1.738 billion (US\$1.147 billion, net of taxes) in "loss from discontinued operations" in our income statement for the year ended December 31, 2016. For more information on our discontinued operations see note 14 to our consolidated financial statements.

Income taxes

For 2016, we recorded net income tax expense of US\$2.781 billion, compared to a net income tax gain of US\$5.249 billion in 2015. In 2016, our effective tax rate was 34.8%. The effective tax rate was slightly different from the statutory rate mainly due to US\$708 million of unrecognized tax on current year losses, partially offset by the tax incentives for our iron ore, copper and nickel operations in the North and Northeast regions of Brazil. The incentives are calculated based on the taxable income of the incentive activity (tax operating income), taking into account the allocation of tax operating income to different tranches of production during the periods specified for each product. In 2016, this tax incentive structure reduced our net income tax expense by US\$344 million.

For 2015, we recorded net income tax gain of US\$5.249 billion, compared to a net income tax expense of US\$1.603 billion in 2014. In 2015, our effective tax rate was 29.7%. Tax legislation that became effective in 2015 provides that income of our foreign subsidiaries will be taxed in Brazil, on an accrual basis, applying the differential between the local rate and the Brazilian tax rates. Accordingly, the effective tax rate was different from the statutory rate mainly due to: (i) unrecognized tax losses and (ii) nondeductible impairment, partially offset by the constitution of tax loss forward related to losses at foreign subsidiaries that we were able to recognize due to change of law. Under the legislation that became effective in 2015, the accumulated losses of our foreign subsidiaries as of December 31, 2014 were available to offset their future profits. On September 30, 2015, we filed the required tax return and completed the review of the income tax loss carryforwards available in each foreign subsidiary as of December 31, 2014, which permitted us to recognize a deferred tax asset of US\$2.952 billion related to accumulated losses in certain of our foreign subsidiaries.

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LIQUIDITY AND CAPITAL RESOURCES

Overview

In the ordinary course of business, our principal funding requirements are for capital expenditures, dividend payments and debt service. We have historically met these requirements by using cash generated from operating activities and borrowings, supplemented by dispositions of assets.

For 2017, we have budgeted capital expenditures of US\$4.548 billion, including US\$1.846 billion for project execution and US\$2.702 billion for sustaining existing operations and replacement projects. A principal amount of US\$1.061 billion of our debt matures in 2017.

We have taken measures to reduce our capital expenditures, and we are constantly evaluating opportunities for additional cash generation. Also, we continue to consider the sale of certain assets and investments, and joint ventures for certain of our businesses. Finally, we are committed to continue the reduction in our costs and expenses to reduce our debt leverage and to maintain discipline in capital allocation.

Sources of funds

Our principal sources of funds are operating cash flow and borrowings, supplemented by disposition of assets. The amount of operating cash flow is strongly affected by global prices for our products. In 2016, our operating activities generated cash flows from continuing operations of US\$6.581 billion, compared to US\$4.491 billion in 2015, primarily reflecting the increase in prices of iron ore.

In 2016, we borrowed US\$6.919 billion under our new and existing financing agreements. Our major new borrowing transactions in 2016 are summarized below.

- In January 2016, we drew US\$3.0 billion under our existing revolving credit facilities with syndicates of international banks, which will mature in 2018 and 2020. This amount was fully repaid in 2016; US\$1.0 billion was repaid in June and the outstanding balance of US\$2.0 billion was paid in November.
- In June 2016, our wholly owned subsidiary Vale Overseas Ltd. issued US\$1.25 billion notes due 2021, guaranteed by Vale S.A.
- In August 2016, our wholly owned subsidiary Vale Overseas Ltd. issued US\$1.0 billion notes due 2026, guaranteed by Vale S.A.
- In December 2016, our wholly owned subsidiary, Vale Canada, received a €200 million loan from the French State with a repayment schedule starting at the end of 2021 and ending in November 2026. This loan is guaranteed by Vale S.A.
- In 2016, we borrowed US\$950 million in pre-export financing agreements with commercial banks.

In 2016, we received US\$1.343 billion as a result of divestments and sales of interests in certain joint ventures and investments. The main divestment transactions in 2016 are described below:

- In August 2016, we received an initial cash payment of US\$800 million from Silver Wheaton, as part of the sale an additional 25% of the gold produced from the Salobo copper mine for the life of mine. As a result of this transaction, we recorded a deferred liability in the amount of US\$524 million, which will be recognized in our future income statement as the gold is extracted.

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- In August 2016, we received US\$269 million from the sale of three very large ore carriers of 400,000 DWT to ICBC International, a wholly owned subsidiary of the Industrial and Commercial Bank of China. In December 2016, we received US\$35 million per vessel from the sale of four capesize vessels to Polaris Shipping Co. Ltd. In January 2017, we received payment for the other two vessels.
- In December 2016, we received US\$113 million from the sale of our remaining 13.63% indirect interest in Paragominas to Hydro.

Uses of funds

In the ordinary course of business, our principal funding requirements are for capital expenditures, dividend payments and debt service.

Capital expenditures

Our capital expenditures in 2016, including the fertilizer business, amounted to US\$5.482 billion, including US\$3.179 billion for project execution and US\$2.302 billion dedicated to sustaining existing operations. For more information about the specific projects for which we have budgeted funds, see *Information on the Company Capital expenditures*.

Distributions and repurchases

We paid total dividends of US\$250 million in December 2016 (classified as interest on shareholders' equity). We did not repurchase any of our shares in 2016.

Tax payments

We paid US\$388 million in income tax in 2016, excluding the payments in connection with REFIS, compared to US\$544 million in 2015. In connection with our participation in the REFIS, our outstanding commitment totals US\$5.419 billion, which will be paid in 142 monthly installments. In 2016, we paid a total of US\$417 million in connection with the REFIS.

Liability Management

In 2016, we repaid US\$5.565 billion in debt that was set to mature in future years. Our main liability management transactions in the year are summarized below.

- The full repayment of US\$3.0 billion dollars drawn in January under our existing revolving credit facilities. US\$1.0 billion was repaid in June 2016 with part of the proceeds of the offering of our US\$1.250 billion notes due 2021, and the remaining balance of US\$2.0 billion was paid in November 2016.
- In September 2016, we fully redeemed the outstanding principal amount of US\$1.250 billion of Vale Overseas' notes that was set to mature in January 2017.

Debt

As of December 31, 2016, our total outstanding debt was US\$29.322 billion (including US\$28.691 billion of principal and US\$631 million of accrued interest) compared with US\$28.853 billion at the end of 2015. As of December 31, 2016, US\$472 million of our debt was secured by liens on some of our assets. As of December 31, 2016, the weighted average of the remaining term of our debt was 7.9 years, compared to 8.1 years in 2015.

As of December 31, 2016, the short-term debt and the current portion of long-term debt was US\$1.660 billion, including charges.

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Our major categories of long-term indebtedness are described below. The principal amounts given below include the current portion of long-term debt and exclude accrued charges.

- *U.S. dollar-denominated loans and financing (US\$7.283 billion as of December 31, 2016).* This category includes export financing lines, loans from export credit agencies, and loans from commercial banks and multilateral organizations.
- *U.S. dollar-denominated fixed rate notes (US\$13.083 billion as of December 31, 2016).* We have issued in public offerings several series of fixed-rate debt securities, directly by Vale and through our finance subsidiary Vale Overseas Limited, guaranteed by Vale, totaling US\$12.549 billion. Our subsidiary Vale Canada has outstanding fixed rate debt in the amount of US\$400 million.
- *Euro-denominated loans and financing (US\$211 million as of December 31, 2016).* This category includes loans from export credit agencies.
- *Euro-denominated fixed rate notes (US\$1.583 billion as of December 31, 2016).* We have issued in public offerings two series of fixed-rate debt securities denominated in Euro in the aggregate amount of €1.500 billion.
- *Other debt (US\$6.531 billion as of December 31, 2016).* We have outstanding debt, principally owed to BNDES, Brazilian commercial banks and infrastructure debentures, denominated in Brazilian *reais* and other currencies.

We have a variety of credit lines available, including the following, as of December 31, 2016:

- Credit lines with BNDES in the amount of R\$7.3 billion (US\$2.2 billion) to finance our investment program. As of December 31, 2016, the total amount available under these facilities was R\$283 million, or US\$88 million.
- A R\$3.9 billion (US\$1.2 billion) financing agreement with BNDES to finance part of the implementation of the CLN 150 Mtpy project, which will expand the logistics infrastructure in Vale's Northern System. As of December 31, 2016, this facility was almost fully drawn.
- A R\$6.2 billion (US\$1.9 billion) financing agreement with BNDES to finance part of the implementation of the S11D project and its infrastructure (CLN S11D). As of December 31, 2016, the total amount available under this facility was R\$2.1 billion (US\$629 million).
- We have two revolving credit facilities with syndicates of international banks, which will mature in 2018 and 2020. As of December 31, 2016, the total amount available under these facilities was US\$5.0 billion, which can be drawn by Vale, Vale Canada and Vale International. In January 2016, we drew US\$3.0 billion under these facilities. In November 2016, we repaid the outstanding balance drawn under these facilities.

Some of our long-term debt instruments contain financial covenants. In particular, instruments representing approximately 21% of the aggregate principal amount of our total debt require that we maintain, as of the end of each quarter, (a) a consolidated ratio of total debt to adjusted EBITDA for the past 12 months not exceeding 4.5 to one and (b) a consolidated interest coverage ratio of at least 2.0 to one. These covenants appear in our financing agreements with BNDES, with other export and development agencies, and with some other lenders. During the last quarter of 2015, we agreed with lenders under these agreements to amend the leverage ratio to require a ratio of 5.5 to one through the end of 2016 in order to give us flexibility to finalize our investment cycle. As of December 31, 2016, (i) our consolidated ratio of total debt to adjusted EBITDA for the past 12 months was 2.4 to one and (ii) our consolidated interest coverage ratio was 6.9 to one.

As of December 31, 2016, the corporate guarantees we provided (corresponding to our direct or indirect interest) for the companies Norte Energia S.A. and Companhia Siderúrgica do Pecem S.A. totaled US\$361 million and US\$1.450 billion, respectively.

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The following table summarizes our contractual obligations as of December 31, 2016. This table excludes other common non-contractual obligations that we may have, including pension obligations, deferred tax liabilities and contingent obligations arising from uncertain tax positions, all of which are discussed in the notes to our consolidated financial statements.

	Payments due by period					
	Total	Less than 1 year	2018	2019	2020	Thereafter
	(US\$ million)					
Debt less accrued interest	28,691	1,061	3,824	3,449	3,857	16,500
Interest payments(1)	13,635	1,583	1,369	1,211	1,010	8,462
Operating lease obligations(2)	1,029	149	134	131	130	485
Purchase obligations(3)	4,388	2,572	363	186	140	1,127
Total	US\$47,741	US\$5,365	US\$5,690	US\$4,977	US\$5,137	US\$26,574

- (1) Consists of estimated future payments of interest on our loans, financings and debentures, calculated based on interest rates and foreign exchange rates applicable as of December 31, 2016 and assuming that (i) all amortization payments and payments at maturity on our loans, financings and debentures will be made on their scheduled payments dates, and (ii) our perpetual bonds are redeemed on the first permitted redemption date. Amounts do not include derivatives transactions.
- (2) Amounts include fixed payments related to the operating lease contracts for the pellet plants.
- (3) The purchase obligations derive mainly from take or pay contracts, contracts for the acquisition of fuel and the acquisition of raw materials and services. For more information, see note 32 to our consolidated financial statements.

OFF-BALANCE SHEET ARRANGEMENTS

As of December 31, 2016, we did not have any off-balance sheet arrangements as defined in the Form 20-F not disclosed in our consolidated financial statements.

CRITICAL ACCOUNTING POLICIES AND ESTIMATES

We believe that the following are our critical accounting policies. We consider an accounting policy to be critical if it is important to our financial condition and results of operations and if it requires significant judgments and estimates on the part of our management.

Mineral reserves and useful life of mines

We regularly evaluate and update our estimates of proven and probable mineral reserves. Our proven and probable mineral reserves are determined using generally accepted estimation techniques. Calculating our reserves requires us to make assumptions about future conditions that are uncertain, including future ore and metal prices, currency prices, inflation rates, mining technology, availability of permits, production and capital costs. Changes in some or all of these assumptions could have a significant impact on our recorded proven and probable reserves.

The estimated volume of mineral reserves is used as basis for the calculation of depletion of the mineral properties and also for the estimated useful life, which is a major factor to quantify the provision for asset retirement obligation, environmental recovery of mines and impairment of long lived assets. Any changes to the estimates of the volume of mine reserves and the useful lives of assets may have a significant impact on the depreciation, depletion and amortization charges and assessments of impairment.

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Asset retirement obligation

Expenditures relating to ongoing compliance with environmental regulations are charged against earnings or capitalized as appropriate. These ongoing programs are designed to minimize the environmental impact of our activities.

We recognize a liability for the fair value of our estimated asset retirement obligations in the period in which they are incurred, if a reasonable estimate can be made. We consider the accounting estimates related to reclamation and closure costs to be critical accounting estimates because:

- we will not incur most of these costs for a number of years, requiring us to make estimates over a long period;
- reclamation and closure laws and regulations could change in the future or circumstances affecting our operations could change, either of which could result in significant changes to our current plans;
- calculating the fair value of our asset retirement obligations requires us to assign probabilities to projected cash flows, to make long-term assumptions about inflation rates, to determine our credit-adjusted risk-free interest rates and to determine market risk premiums that are appropriate for our operations; and
- given the significance of these factors in the determination of our estimated environmental and site reclamation costs, changes in any or all of these estimates could have a material impact on net income. In particular, given the long periods over which many of these charges are discounted to present value, changes in our assumptions about credit-adjusted risk-free interest rates could have a significant impact on the size of our provision.

Our executive officers define the policies and procedures that are used to evaluate our asset retirement obligations. The future costs of retirement of our mines and processing assets at all our sites are reviewed annually, in each case considering the actual stage of exhaustion and the projected exhaustion date of each mine and site. The future estimated retirement costs are discounted to present value using a credit-adjusted risk-free interest rate.

As of December 31, 2016, we estimated the fair value of our total asset retirement obligations to be US\$2.877 billion.

Impairment of non-current assets and onerous contract

Non-financial assets are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount might not be recoverable. An impairment loss is recognized for the amount by which the asset's carrying value exceeds its recoverable amount. The recoverable amount is the higher of an asset's fair value less costs of disposal ("FVLCS") and value in use ("VIU").

FVLCS is generally determined as the present value of the estimated future cash flows expected to arise from the continued use of the asset, including any expansion prospects, and its eventual disposal. VIU model is determined as the present value of the estimated future cash flows expected to arise from the continued use of the asset in its present form. VIU is determined by applying assumptions specific to the company's continued use and cannot take into account future development. These assumptions are different to those used in calculating fair value and consequently the VIU calculation is likely to give a different result to a FVLCS calculation.

The future cash flows are based on the current life-of-mine plan or long-term production plan for the cash-generating unit. Assets that have an indefinite useful life and are not subject to amortization, such as goodwill, are tested annually for impairment.

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For the purposes of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash flows (Cash Generating Units (CGUs)). Goodwill is allocated to Cash Generating Units or Cash Generating Units groups that are expected to benefit from the business combinations in which the goodwill arose and are identified in accordance with the operating segment.

Non-current assets (excluding goodwill) in which the company recognized impairment in the past are reviewed whenever events or changes in circumstances indicate that the impairment may no longer be applicable. In such cases, an impairment reversal will be recognized.

For onerous contracts, provision is recognized for the present value of certain long-term contracts where the unavoidable cost of meeting the company's obligations exceed the economic benefits to be received under it.

Fair values of derivatives and other financial instruments

Derivatives transactions that are not qualified for hedge accounting are classified and presented as an economic hedge, as we use derivative instruments to manage our financial risks as a way of hedging against these risks. Derivative financial instruments are recognized as assets or liabilities in the balance sheet and are measured at their fair values. Changes in the fair values of derivatives are recorded in income statement or in stockholders' equity when the transaction is eligible for effective hedge accounting.

We use well-known market participants' valuation methodologies to compute the fair value of instruments. To evaluate the financial instruments, we use estimates and judgments related to present values, taking into account market curves, projected interest rates, exchange rates, counterparty (credit) risk adjustments, forward market prices and their respective volatilities, when applicable. We evaluate the impact of credit risk on financial instruments and derivative transactions, and we enter into transactions with financial institutions that we consider to have a high credit quality. The financial institution's credit risk tracking is performed making use of a credit risk valuation methodology that considers, among other information, published ratings provided by international rating agencies and other management judgments.

Deferred income taxes

We recognize deferred tax effects of tax loss carryforwards and temporary differences in our consolidated financial statements. We record a valuation allowance when we believe that it is probable that tax assets will not be fully recoverable in the future.

Deferred tax assets arising from tax losses, negative social contribution basis and temporary differences are registered taking into consideration the analysis of future performance, based on economic and financial projections, prepared based on internal assumptions and macroeconomic, trade and tax scenarios that may be subject to changes in future.

When we prepare our consolidated financial statements, the provision for income tax is calculated individually for each entity in the group based on Brazilian tax rates, on an accrual basis, by applying the differential between the nominal local tax rates (based on rules in force in the location of the entity) and the Brazilian rate.

Determining our provision for income taxes, our deferred tax assets and liabilities and any valuation allowance to be recorded against our net deferred tax assets requires significant management judgment, estimates and assumptions about matters that are highly uncertain. For each income tax asset, we evaluate the likelihood of whether some portion or the entire asset will not be realized. The valuation allowance made in relation to accumulated tax loss carryforwards depends on our assessment of the probability of generation of future taxable profits within the legal entity in which the related deferred tax asset is recorded, based on our production and sales plans, commodity prices, operating costs, environmental costs, group restructuring plans for subsidiaries and site reclamation costs and planned capital costs.

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Litigation

We disclose material contingent liabilities unless the possibility of any loss arising is considered remote, and we disclose material contingent assets where the inflow of economic benefits is probable. We discuss our material contingencies in Note 28 to our consolidated financial statements.

We record an estimated loss from a loss contingency when information available prior to the issuance of our financial statements indicates that it is probable that an outflow of resources will be required to settle an obligation, and the amount of the loss can be reasonably estimated. In particular, given the nature of Brazilian tax legislation, the assessment of potential tax liabilities requires significant management judgment. By their nature, contingencies will only be resolved when one or more future events occurs or fails to occur, and typically those events will occur a number of years in the future. Assessing such liabilities, particularly in the Brazilian legal environment, inherently involves the exercise of significant management judgment and estimates of the outcome of future events.

The provision for litigation as of December 31, 2016, totaling US\$839 million, consists of provisions of US\$534 million for labor, US\$84 million for civil, US\$214 million for tax and US\$7 million for environmental claims. Claims for which the likelihood of loss, in our opinion and based on the advice of our legal counsel, is reasonably possible but not probable, and for which we have not made provisions, amounted to a total of US\$13.427 billion as of December 31, 2016, including claims of US\$2.418 billion for labor claims, US\$1.502 billion for civil claims, US\$7.636 billion for tax claims and US\$1.871 billion for environmental claims.

Employee post-retirement benefits

We sponsor defined benefit pension and other post-retirement benefit plans covering some of our employees. The determination of the amount of our obligations for these benefits depends on certain actuarial assumptions. These assumptions are described in Note 29 to our consolidated financial statements and include, among others, the discount rate, the expected long-term rate of return on plan assets and increases in salaries.

Provision related to the dam failure of Samarco Mineração S.A.

The provision requires the use of assumptions that may be mainly affected by: (i) changes in scope of work required under the Framework Agreement as result of further technical analysis, (ii) uncertainty regarding the timing of resumption of Samarco's operations; (iii) updates in the discount rate; and (iv) resolution of existing and potential legal claims. As a result, future expenditures may differ from the amounts currently provided and changes to key assumptions could result in a material impact to the amount of the provision in future reporting periods.

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RISK MANAGEMENT

The aim of our risk management strategy is to promote enterprise-wide risk management that supports the achievement of our objectives, financial strength and flexibility and business continuity.

We developed an integrated framework for managing risk, which considers the impact on our business of not only market risk factors (market risk), but also risks arising from third-party obligations (credit risk), risks associated with inadequate or failed internal processes, people, systems or external events (operational risk) and risks associated with political and regulatory conditions in countries in which we operate (political risk), among others.

In order to achieve this objective and to further improve our corporate governance practices, our Board of Directors has established a company-wide risk management policy and an Executive Risk Management Committee. The risk management policy requires that we regularly evaluate and monitor the corporate risks on a consolidated basis in order to guarantee that our overall risk level remains in accordance with our strategic guidelines.

See note 22 to our consolidated financial statements for quantitative information about risks relating to financial instruments, including financial instruments entered into pursuant to our risk management policies.

Market risk

We are exposed to various market risk factors that can impact our cash flow. An assessment of the potential impact of the consolidated market risk exposure is performed periodically to support the decision making process regarding the risk management strategy, which may incorporate financial instruments, including derivatives. The financial instrument portfolio is monitored on a monthly basis, enabling us to properly evaluate financial results and their impact on cash flow, and ensure correlation between the strategies implemented and the proposed objectives.

Considering the nature of our business and operations, the main market risk factors that we are exposed to are:

- *Foreign exchange rates and interest rates:* our cash flows are exposed to the volatility of several currencies against the U.S. dollar and of interest rate on loans and financings. While most of our product prices are indexed to U.S. dollars, most of our costs, disbursements and investments are indexed to currencies other than the U.S. dollar, principally the Brazilian *real* and the Canadian dollar. We may use derivative instruments in order to reduce our potential cash flow volatility arising from this currency mismatch. We also have debt instruments denominated in currencies other than U.S. dollars, mainly in Brazilian *reals* and euros. We use swaps and forward transactions to convert into U.S. dollars a portion of the cash outflows from most of these debt instruments.

Our floating rate debt consists mainly of loans including export pre-payments, commercial bank loans and multilateral organization loans. In general, the U.S. dollar floating rate debt is subject to changes to LIBOR (London Interbank Offer Rate) in U.S. dollars. We take advantage of the potential correlation between commodity prices and U.S. dollar floating interest rates as a partial natural hedge for this risk.

- *Product prices and input costs:* we are also exposed to market risks associated with commodities price volatilities. In line with our risk management policy, we may also employ risk mitigation strategies to manage this risk that include predominantly forward transactions, futures contracts and zero-cost collars.

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Credit risk

We are exposed to credit risk arising from trade receivables, derivative transactions, guarantees, down payment for suppliers and cash investments. Our credit risk management process provides a framework for assessing and managing counterparties' credit risk and for maintaining our risk at an acceptable level.

Commercial credit risk management

We assign an internal credit rating and a credit limit to each counterparty using our own quantitative methodology for credit risk analysis, which is based on market prices, external credit ratings and financial information of the counterparty, as well as qualitative information regarding the counterparty's strategic position and history of commercial relations.

Based on the counterparty's credit risk, risk mitigation strategies may be used to manage our credit risk. The main credit risk mitigation strategies include non-recourse discount of receivables, insurance instruments, letters of credit, corporate and bank guarantees, mortgages, among others.

From a geographic standpoint, we have a diversified accounts receivable portfolio, with Asia, Europe and Brazil, the regions with the most significant exposure. According to each region, different guarantees can be used to enhance the credit quality of the receivables. We monitor the counterparty exposure in the portfolio periodically and we block additional sales to customers in delinquency.

Treasury credit risk management

To manage the credit exposure arising from cash investments and derivative instruments, credit limits are approved to each counterparty to which we have credit exposure. We control the portfolio diversification and monitor different indicators of solvency and liquidity of our different counterparties that were approved for trading.

Operational risk

Operational risk management is the structured approach we take to manage uncertainty related to internal and external events. Internal events consist of inadequate or failed internal processes, people and systems, while external events include natural or third party-caused operational catastrophes, regulatory, political, economic or social actions taken by governments or other key stakeholders.

We mitigate operational risk with new controls and improvement of existing ones, new mitigation plans and transfer of risk through insurance. We seek a clear view of the major risks we are exposed to, the cost-benefit on mitigation plans and the controls in place to closely monitor the impact of operational risks and to efficiently allocate capital to reduce it.

Table of Contents**III. SHARE OWNERSHIP AND TRADING****MAJOR SHAREHOLDERS**

Our corporate capital is currently composed of 3,217,188,402 common shares and 2,027,127,718 preferred shares, including 12 golden shares issued to the Brazilian government. Holders of our preferred shares and the golden shares are generally entitled to the same voting rights as holders of common shares, except with respect to the election of members of the Board of Directors, and are entitled to certain preferential dividends as described below. The 12 golden shares owned by the Brazilian government have veto powers over certain actions, such as changes to our name, the location of our headquarters and our corporate purpose as it relates to mining activities.

Valepar is Vale's controlling shareholder. Valepar is a special-purpose company organized under the laws of Brazil that was incorporated for the sole purpose of holding an interest in Vale. Valepar does not have any other business activity. Valepar acquired its controlling stake in Vale from the Brazilian government in 1997 as part of the first stage of Vale's privatization.

The following table sets forth information regarding ownership of Vale shares by the shareholders we know beneficially own more than 5% of any class of our outstanding capital stock, and by our directors and executive officers as a group, as of December 31, 2016.

	Common shares		Preferred	
	owned	% of class	shares owned	% of class
Valepar(1)	1,716,435,045	53.9%	20,340,000	1.0%
BNDESPAR(2)	206,378,882	6.5%	66,185,272	3.4%
Capital Group International, Inc.(3)	n/a	n/a	202,763,494	10.0%
Capital Research Global Investors(3)	n/a	n/a	220,419,398	10.9%
Directors and executive officers as a group	9,300	1.0%	1,645,064	1.0%

(1) See the tables below for information about Valepar's shareholders.

(2) BNDESPAR is a wholly-owned subsidiary of BNDES. The figures for BNDESPAR do not include common shares owned by Valepar.

(3) Based on notices provided to the Company pursuant to Brazilian law by Capital Group International, Inc. (CGII) and Capital Research Global Investors (CRGI) in August 2016. According to the notices, (a) CGII and CRGI are part of the same economic group, (b) the economic group also includes Capital World Investors (CWI), which together with CRGI is a division of Capital Research and Management Company, and (c) CWI holds 5,620,000 additional preferred shares, corresponding to 0.28% of Vale's preferred shares.

The table below sets forth information regarding ownership of Valepar common shares as of December 31, 2016.

	Common shares owned	% of class
<i>Valepar shareholders</i>		
Litel Participações S.A.(1)	637,443,857	49.00
Eletron S.A.	380,708	0.03
Bradespar S.A.(2)	275,965,821	21.21
Mitsui	237,328,059	18.24
BNDESPAR	149,787,385	11.51
Total	1,300,905,830	100.00%

(1) Litel also owns 200,864,272 preferred class A shares of Valepar, which represents 71.41% of the preferred class A shares. Litela Participações S.A. ("Litela"), an affiliate of Litel, also owns 80,416,931 preferred class A shares of Valepar, which represents 28.59% of the preferred class A shares.

(2) Bradespar is controlled by a control group consisting of Cidade de Deus Cia. Comercial Participações, Fundação Bradesco, NCF Participações S.A. and Nova Cidade de Deus Participações S.A.

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The table below sets forth information regarding ownership of Litel Participações S.A., one of Valepar's shareholders, as of December 31, 2016.

	Common shares owned	% of class
<i>Litel Participações S.A. shareholders(1)</i>		
BB Carteira Ativa	222,125,498	80.62
Carteira Ativa II	31,688,469	11.50
Carteira Ativa III	19,115,635	6.94
Singular FIA	2,583,921	0.94
Caixa de Previdência dos Funcionários do Banco do Brasil	168	0.00
Others	658	0.00
 Total	 275,514,349	 100.00%

(1)

Each of BB Carteira Ativa and Carteira Ativa II is a Brazilian investment fund. BB Carteira Ativa is 100.00% owned by Caixa de Previdência dos Funcionários do Banco do Brasil ("Previ"). Carteira Ativa II is 100% owned by Funcef. Carteira Ativa III is 100% owned by Petros. Singular is 100% owned by Fundo de Investimentos em Cotas de Fundo de Investimento em Ações VRD ("FIC de FI em Ações VRD"). FIC de FI em Ações VRD is 100% owned by Fundação Cesp. Each of Previ, Petros, Funcef and Fundação Cesp is a Brazilian pension fund.

The shareholders of Valepar are party to a shareholders' agreement dated April 24, 1997, which expires on May 9, 2017 (the "existing Valepar shareholders' agreement"). A new shareholder's agreement among Litel, Litela, Bradespar, Mitsui and BNDESPAR, shareholders of Valepar, dated February 19, 2017 (the "February 2017 shareholders' agreement"), will become effective immediately after expiration of the existing agreement for a period of six months or until the merger of Valepar into Vale. In addition to provisions relating to voting rights and rights of first refusal for the acquisition of the controlling shareholders' shares, which are generally similar to the provisions under the existing shareholder's agreement of Valepar, pursuant to the February 2017 shareholders' agreement, Valepar is expected to make a proposal for eventually enabling Vale to be listed on BM&FBOVESPA's *Novo Mercado* special segment and making Vale a company without defined control. See *Changes in our shareholding structure and share ownership by controlling shareholders*.

Each of the existing Valepar shareholders' agreement and the February 2017 shareholders' agreement:

- grants rights of first refusal on any transfer of Valepar shares and preemptive rights on any new issue of Valepar shares;
- prohibits the direct acquisition of Vale shares by Valepar's shareholders unless authorized by the other shareholders party to the agreement;
- prohibits encumbrances on Valepar shares (other than in connection with financing an acquisition of Vale shares);
- requires each party generally to retain control of the special purpose company through which it holds its interest in shares of Valepar, unless the rights of first refusal previously mentioned are observed;
- allocates seats on Valepar's and Vale's boards among representatives of the parties;
- commits the Valepar shareholders to support a Vale dividend policy of distributing 50% of Vale's net profit for each fiscal year, unless the Valepar shareholders commit to support a different dividend policy for a given year;
-

provides for the maintenance by Vale of a capital structure that does not exceed specified debt to equity thresholds;

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- requires the Valepar shareholders to vote their indirectly held Vale shares and to cause their representatives on Vale's Board of Directors to vote only in accordance with decisions made at Valepar meetings held prior to meetings of Vale's Board of Directors or shareholders; and
- establishes supermajority voting requirements for certain significant actions relating to Valepar and to Vale.

Pursuant to each of the existing Valepar shareholders' agreement and the February 2017 shareholders' agreement, Valepar cannot support any of the actions described below with respect to Vale without the consent of at least 75% of the holders of Valepar's common shares:

- any amendment of Vale's bylaws;
- any increase of Vale's capital stock by share subscription, creation of a new class of shares, change in the characteristics of the existing shares or any reduction of Vale's capital stock;
- any issuance of debentures of Vale, whether or not convertible into shares of Vale, call options (*bônus de subscrição*) or any other security of Vale;
- any determination of issuance price for any new shares of capital stock or other security of Vale;
- any amalgamation, spin-off or merger to which Vale is a party, as well as any change to Vale's corporate form;
- any dissolution, receivership, bankruptcy or any other voluntary act for financial reorganization or any suspension thereof;
- the election and removal of members of Vale's Board of Directors and the election and removal of members of Vale's Board of Executive Officers, under the existing shareholders' agreement, or the removal of members of Vale's Board of Directors and election and removal of members of Vale's Board of Executive Officers, under the February 2017 shareholders' agreement;
- the disposition or acquisition by Vale of an equity interest in any company (under the existing shareholders' agreement only), and the acquisition of any shares of capital stock of Vale;
- the participation by Vale in a group of companies or in a consortium of any kind;
- the execution by Vale of agreements relating to distribution, investment, sales exportation, technology transfer, trademark license, patent exploration, license to use and leases;
- the approval and amendment of Vale's business plan (under the existing shareholders' agreement only);
- the approval of the compensation of members of Vale's Board of Directors and Board of Executive Officers, under the existing shareholders' agreement, and the total compensation of the members of Vale's Board of Directors, Board of Executive Officers, Fiscal Council and advisory committees, under the February 2017 shareholders' agreement;
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the allocations of profit-sharing among members of Vale's Board of Directors, Board of Executive Officers, Fiscal Council and Advisory Committees;

- the determination of duties of the Board of Directors (under the existing shareholders' agreement only) and the Board of Executive Officers;
- any change in the corporate purpose of Vale;

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- the distribution or non-distribution of any dividends (including distributions classified as interest on shareholders' equity) on any shares of capital stock of Vale, other than pursuant the dividend policy of distributing 50% of Vale's net profit for each fiscal year;
- the appointment and replacement of Vale's independent auditor;
- the creation of any security interests or granting of guarantees by Vale with respect to obligations of any unrelated party, including any affiliates or subsidiaries;
- any resolution on any matter which, pursuant to applicable law, entitles a shareholder to withdrawal rights;
- the appointment and replacement by Vale's Board of Executive Officers of any representative of Vale in subsidiaries, companies affiliated with Vale or other companies in which Vale is entitled to appoint directors and officers; and
- any change in the debt to equity threshold, as defined in the shareholders' agreement (under the existing shareholders' agreement only).

The February 2017 shareholders' agreement adds additional actions to this list, including:

- the acquisition of shares in the capital stock of Vale to be held in treasury, cancelled or subsequently disposed;
- setting forth Vale's maximum limit of indebtedness;
- entering into financing agreements by Vale or similar transactions that are not provided for in Vale's fundraising plan;
- approval of the strategic guidelines and plan of Vale;
- approval of the annual and pluriannual budgets and of the fundraising plan of Vale;
- approval of investment or disinvestment by Vale;
- approval of the management's annual report and the financial statements of Vale;
- approval of any related-party transactions policy, and approving the execution or modification of transactions with a related party;
- disposal by Vale of fixed assets, the value of which, separately or in the aggregate, in a twelve-month period exceeds one percent of the total assets, based on the most recent Vale quarterly information; and
- waiver of the right of first refusal of Valepar in case of a capital increase at Vale.

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Pursuant to the February 2017 shareholders' agreement, the disposal of shares of Vale owned by Valepar is subject to approval of 95% of the common shares subject to the agreement.

Changes in our shareholding structure and share ownership by controlling shareholders

If we successfully implement the changes in our shareholder structure described below, Litel, Bradespar, Mitsui and BNDESPAR, which are currently shareholders of Valepar, will become shareholders of Vale and will enter into a new shareholder's agreement (the "proposed Vale shareholders' agreement").

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Pursuant to the February 2017 shareholders' agreement, Valepar is expected to make a proposal to simplify our shareholding structure and corporate governance, with the purpose of eventually enabling Vale to be listed on BM&FBOVESPA's *Novo Mercado* special segment and making Vale a company without defined control.

The initial proposal comprises, beyond the performance of all acts and procedures imposed by the applicable legal provisions and rules, the following indivisible and interdependent steps to simplify our shareholding structure, which are subject to approval by our executive officers, Board of Directors and shareholders:

- (i) Voluntary conversion of our class A preferred shares into common shares at a fixed exchange ratio based on the volume-weighted average market prices over the last 30 trading sessions on the BM&FBOVESPA prior to February 19, 2017. The holders of ADSs representing our class A preferred shares will be able to elect voluntary conversion into ADSs representing our common shares on the same terms available to holders of class A preferred shares. Class A preferred shares, and preferred ADSs, that do not elect voluntary conversion will remain outstanding.
- (ii) Amendment of our bylaws so as to adjust them, to the extent possible, to *Novo Mercado* rules so we may be effectively listed on such special segment. The key proposed changes to our bylaws are described below:
 - At least 20% of the Board of Directors will be composed of independent directors.
 - Any transfer of corporate control will have to provide to all holders of common shares equal treatment with the transferring controlling shareholder, through a public offer to acquire common shares.
 - No shareholder or group of shareholders will be permitted to hold our common shares in an amount equal to or greater than 25% of the total amount of common shares issued by us or of the total capital stock, excluding common shares held in treasury, unless it makes a public offer to acquire the common shares of the other shareholders.
 - Any disputes shall be resolved by arbitration before the BM&FBOVESPA Arbitration Chamber.
- (iii) The merger of Valepar into Vale at an exchange ratio that contemplates a 10% increase in the number of shares held by the shareholders of Valepar, and represents a dilution of approximately 3% of the shareholding interest held by the other shareholders of Vale.

Pursuant to item (iii) above, Valepar's shareholders will receive 1.2065 of our common shares for each Valepar share held by them. As a result, we will issue 173,543,667 new common shares, all registered and without par value, in favor of Valepar's shareholders. Consequently, Valepar's shareholders will own 36.73% of our outstanding common stock after the merger of Valepar.

The R\$3,073 million goodwill balance carried on Valepar's financial statements and its future use by Vale will not be subject to capitalization in favor of Valepar's shareholders, but will be for the benefit of all of our shareholders. Valepar will hold at the time of the merger enough cash and cash equivalents to fully settle its liabilities.

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We cannot predict how long it will take to implement each of these steps or whether they will be successfully implemented. The implementation of the proposal is subject to the approval of the proposal, including the merger of Valepar into us, by the executive officers, board of directors and shareholders of Vale and Valepar, and the acceptance initially by at least 54.09% of class A preferred shares of the voluntary conversion, as mentioned in item (i) above, within the maximum term of 45 days from the shareholders' meeting decision on the matter, resulting in a combined shareholding interest held by the shareholders of less than 50% of our total common shares.

After the simplification of our corporate ownership structure pursuant to the proposal, we will seek to list our common shares on the *Novo Mercado* segment of the BM&FBOVESPA. However, such listings are dependent on a number of factors, over which we have no control, including approvals by our shareholders and the applicable regulators, and the conversion of all of our preferred shares into common shares.

Proposed Vale shareholders' agreement

The proposal will also contemplate the execution of a shareholders' agreement at Vale level on the date of effectiveness of the merger of Valepar into us, if the merger is approved, by Litel, Bradespar, Mitsui and BNDESPAR to give us greater stability and to adapt our corporate governance structure during the period of transition to a new corporate structure without defined control. For six months from the date of entry into force of the Vale shareholder's agreement, the controlling shareholders will be under certain restrictive obligations with respect to trading of our shares. The following are key provisions of the proposed Vale shareholders' agreement:

- *Term:* The proposed shareholders' agreement of Vale will be effective until November 9, 2020.
- *Shares subject to the agreement:* The proposed Vale shareholders' agreement will only apply to a portion of the common shares of Vale to be owned by the parties thereto, in a total amount of 20% of Vale's common shares (not including treasury shares).
- *Shareholders' prior meetings:* The proposed Vale shareholders' agreement does not require meetings thereunder prior to each meeting of the Vale Board of Directors or general shareholders' meeting, unless convened any of the parties to the proposed Vale shareholders' agreement.
- *Qualified quorum matters:* The proposed Vale shareholders' agreement requires approval of shareholders holding at least 75% of the shares subject to the agreement owned by the parties in attendance for approval of the following matters, among others:
 - any amendment of Vale's bylaws.;
 - any increase or reduction of Vale's capital stock;
 - any issuance of debentures of Vale, whether or not convertible into shares of Vale, call options (*bônus de subscrição*) or any other security of Vale;
 - any amalgamation, spin-off or merger to which Vale is a party, as well as any change to Vale's corporate form;
 - any dissolution, receivership, bankruptcy or any other voluntary act for financial reorganization of Vale or the suspension of any of these proceedings;
 - the removal of any member of Vale's Board of Directors, and the election and removal of any executive officer of Vale;

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the approval of the aggregate and individual compensation of members of the Board of Directors, Board of Executive Officers, Fiscal Council and advisory committees;

creation of companies by Vale, the conversion of currently existing companies into another types of legal entity, the direct or indirect acquisition or disposition of Vale's interests in the capital stock of other companies or entities, including through mergers and spin-offs, as well as the amendment of the corporate documents of these legal entities, whenever the amount involved is equal or greater than 1% of Vale's shareholders' equity, based on Vale's most recent quarterly financial information;

the distribution or non-distribution of any dividends (including distributions classified as interest on shareholders' equity) on any shares of capital stock of Vale other than 50% of the net income;

the creation of any security interest or guarantee by Vale to any third parties, including companies controlled by or affiliated with Vale, except for subsidiaries of which Vale owns at least 99% of the capital stock;

the approval of Vale's maximum limit of indebtedness;

the approval of Vale's strategic guidelines and plan, as well as annual and pluriannual budgets and fundraising plan;

any investments or divestments by Vale, as well as any investment agreements, in an amount equal to or greater than 1% of Vale's shareholders' equity, based on Vale's most recent quarterly financial information;

the approval of any related-party transactions policy;

the disposal of fixed assets of Vale in an amount exceeding (a) separately, 0.15% of Vale's total assets, or (b) in the aggregate, in a twelve-month period, 0.5% of Vale's total assets, based on Vale's most recent quarterly financial information;

the cancellation of Vale's listing or the reduction of Vale's listing level on the BM&FBovespa; and

the appointment and removal by Vale's Board of Executive Officers of the chief executive officer in subsidiaries, companies affiliated with Vale or other companies in which Vale is entitled to appoint the chief executive officer.

• *Novo Mercado Listing:* The parties to the Vale shareholders' agreement will undertake to take all necessary measures to list Vale on the BM&FBovespa *Novo Mercado* as soon as listing is possible without material risk that any holders of Vale's class A preferred shares will exercise their right of withdrawal, based on the market price and book value. The current rules of the *Novo Mercado* do not permit the effective listing of Vale as long as the class A preferred shares remain outstanding.

Table of Contents**RELATED PARTY TRANSACTIONS**

We have a policy on related party transactions, which sets forth rules and principles to ensure transparency and arm's-length terms in our transactions with related parties and other situations of potential conflicts of interest. Pursuant to that policy and our bylaws, our Governance and Sustainability Committee is responsible for issuing reports about potential conflicts of interest between us and our shareholders or management and for reviewing the procedure and terms of related party transactions that are submitted to our Board of Directors for approval. Under the policy, if we identify a conflict of interest with a shareholder, then that shareholder or its representative may not participate in any discussions related to the transaction at any shareholders' meeting and will only have access to publicly available information about the matter. The policy also prohibits the extension of any loans to related parties other than our subsidiaries and affiliated companies. For information regarding investments in associate companies and joint ventures and for information regarding transactions with major related parties, see Notes 15 and 31 of our consolidated financial statements.

We have engaged, and expect to continue to engage, in arm's-length transactions with certain entities controlled by, or affiliated with, our controlling shareholders, including the following:

Bradesco

Bradespar, a controlling shareholder of Valepar, is controlled by a group of entities that also control Banco Bradesco S.A. ("Bradesco"). Bradesco and its affiliates are full service financial institutions that have performed, and may perform in the future, investment banking, advisory or general financing and banking services for us and our affiliates, from time to time, in the ordinary course of business.

Banco do Brasil

Previ, a pension fund of the employees of Banco do Brasil S.A. ("Banco do Brasil"), owns 100% of the investment fund BB Carteira Ativa, which holds the majority of the common equity of Litel Participações S.A., which holds 49% of the common equity of Valepar. Banco do Brasil appoints three out of the six members of Previ's senior management. An affiliate of Banco do Brasil is the manager of BB Carteira Ativa. Banco do Brasil is also a full service financial institution, and Banco do Brasil and its affiliates have performed, and may perform in the future, investment banking, advisory or general financing and banking services for us and our affiliates, from time to time, in the ordinary course of business.

Mitsui

We have commercial relationships in the ordinary course of our business with Mitsui, a large Japanese conglomerate and a shareholder of Valepar. Mitsui has direct investments in some of our subsidiaries, joint ventures and associated companies. Mitsui has a minority stake in our subsidiary MVM Resources International B.V., which controls the Bayóvar (Peru) phosphate operations. Mitsui is also our joint venture partner at VLI. We have an investment agreement with Mitsui in connection with our coal business in Mozambique (see *Information on the Company Business overview Significant changes in our business*).

BNDES

BNDES is the Brazilian state-owned development bank and the parent company of one of our major shareholders, BNDESPAR. Below is a description of our main transactions with BNDES:

We and BNDES are parties to a contract relating to authorizations for mining exploration. This contract, which we refer to as the Mineral Risk Contract, provides for the joint development of certain unexplored mineral deposits that form part of our Northern System, except for our iron ore and manganese ore deposits which were specifically excluded from the contract, as well as proportional participation in any profits earned from the development of such resources. In 2007, the Mineral Risk Contract was extended indefinitely, with specific rules for all exploration projects and exploration targets and mineral rights covered under the contract.

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BNDES has provided us with credit lines of R\$7.3 billion (US\$2.2 billion) to finance our investment program, facilities totaling R\$985 million (US\$302 million) to finance the acquisition of equipment in Brazil, a R\$3.9 billion (US\$1.2 billion) financing for our CLN 150 Mtpy project and a R\$6.2 billion (US\$1.9 billion) financing for our S11D project and its infrastructure (CLN S11D). For more information on our transactions with BNDES, see *Operating and financial review and prospects Liquidity and capital resources*.

BNDES holds a total of R\$1.289 billion (US\$396 million), in debentures of our subsidiary Salobo Metais S.A., with a right to subscribe for Salobo's preferred shares in exchange for part of the outstanding debentures, which right expires two years after Salobo reaches an accumulated revenue equivalent to 200,000 tons of copper.

BNDES holds debentures issued by Vale exchangeable into common shares of VLI.

BNDESPAR is in the control group of several Brazilian companies with which we have commercial relationships in the ordinary course of our business.

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DISTRIBUTIONS

Our shareholders approved our new dividend policy at the shareholders' meeting held on April 25, 2016. Distributions may be classified as "dividends" or "interest on shareholders' equity," for Brazilian tax purposes, and references to "dividends" should be understood to cover all distributions, regardless of their classification, unless otherwise stated. Pursuant to the new dividend policy, our Board of Executive Officers proposes dividend payments to the Board of Directors, which approves the amount of dividend distributions based on the context of the company's business, taking into consideration, among other factors, our debt level and expected future commitments of cash.

Pursuant to our new dividend policy, dividends will be paid in two installments. The first installment must be proposed by the Executive Officers and, if approved by the Board of Directors, paid in October of each year. The second installment must be proposed during the first three months of the subsequent fiscal year and, if approved by the annual shareholders' meeting, paid in April. The amount of the first installment must be determined based on the accumulated results for the year and expected free cash flow for the remainder of the year. The second installment will be included in the results from the allocation of net income proposed for the preceding fiscal year. The distribution amount of the first installment is expressed in U.S. dollars and payment is made in *reais* upon the conversion of the proposed amount in U.S. dollars to *reais* based on the PTAX-Option 5 exchange rate published by the Brazilian Central Bank on the business day prior to the meeting of our Board of Directors on which payment is approved. The distribution amount of the second installment is expressed and paid in *reais*. Our board of executive officers may propose additional dividend payments to our Board of Directors, based on analysis of our cash flows and the availability of profits or reserves of profits.

We typically pay the same amount per share on both common and preferred shares. Under Brazilian law and our bylaws, we are required to distribute to our shareholders an annual amount equal to not less than 25% of the distributable amount, referred to as the mandatory dividend, unless the Board of Directors advises our shareholders at our shareholders' meeting that payment of the mandatory dividend for the preceding year is inadvisable in light of our financial condition. For a discussion of dividend distribution provisions under Brazilian corporate law and our bylaws, see *Additional information*.

The tax regime applicable to distributions to ADR and to non-resident shareholders will depend on whether those distributions are classified as dividends or as interest on shareholders' equity. See *Additional information Taxation Brazilian tax considerations*.

By law, we are required to hold an annual shareholders' meeting by April 30 of each year at which an annual dividend may be declared. Additionally, our Board of Directors may declare interim dividends. Under Brazilian corporate law, dividends are generally required to be paid to the holder of record on a dividend declaration date within 60 days following the date the dividend was declared, unless a shareholders' resolution sets forth another date of payment, which, in either case, must occur prior to the end of the fiscal year in which the dividend was declared. A shareholder has a three-year period from the dividend payment date to claim dividends (or payments of interest on shareholders' equity) in respect of its shares, after which we will have no liability for such payments.

We make cash distributions on the common shares and preferred shares underlying the ADSs in *reais* to the custodian on behalf of the depositary. The custodian then converts such proceeds into U.S. dollars and transfers such U.S. dollars to be delivered to the depositary for distribution to holders of ADRs net of the depositary's fees. For information on taxation of dividend distributions, see *Additional information Taxation Brazilian tax considerations*.

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The following table sets forth the cash distributions we paid to holders of common shares and preferred shares for the periods indicated. Amounts have been restated to give effect to stock splits that we carried out in subsequent periods. Amounts are stated before any applicable withholding tax.

Year	Payment date	Reais per share			U.S. dollars per share(1)	U.S. dollars total (US\$ million)(1)
		Dividends	Interest on equity	Total		
2012	April 30		1.08	1.08	0.59	3,000
	October 31	0.66	0.53	1.19	0.58	3,000
2013	April 30	0.15	0.71	0.86	0.44	2,250
	October 31	0.12	0.82	0.94	0.44	2,250
2014	April 30		0.90	0.90	0.41	2,100
	October 31	0.34	0.65	0.99	0.41	2,100
2015	April 30		0.60	0.60	0.19	1,000
	October 31	0.37		0.37	0.10	500
2016	December 16		0.17	0.17	0.05	250

(1) As approved by the Board of Directors.

TRADING MARKETS

Our publicly traded share capital consists of common shares and preferred shares, each without par value. Our common shares and our preferred shares are publicly traded in Brazil on the BM&FBOVESPA, under the ticker symbols VALE3 and VALE5, respectively. Our common shares and preferred shares also trade on the LATIBEX, under the ticker symbols XVALO and XVALP, respectively. The LATIBEX is a non-regulated electronic market created in 1999 by the Madrid stock exchange in order to enable trading of Latin American equity securities.

Our common ADSs, each representing one common share, and our preferred ADSs, each representing one preferred share, are traded on the New York Stock Exchange ("NYSE"), under the ticker symbols VALE and VALE.P, respectively. Our common ADSs and preferred ADSs are traded on Euronext Paris, under the ticker symbols VALE3 and VALE5, respectively. Citibank N.A. serves as the depository for both the common and the preferred ADSs. On March 1, 2017, there were 1,365,783,260 ADSs outstanding, 773,593,512 common ADSs and 592,189,748 preferred ADSs, representing 56.6% of our outstanding common shares and 43.4% of our outstanding preferred shares, or 26.5% of our total share capital.

Table of Contents**SHARE PRICE HISTORY**

The following table sets forth trading information for our ADSs, as reported by the New York Stock Exchange and our shares, as reported by the BM&FBOVESPA, for the periods indicated. Share prices in the table have been adjusted to reflect stock splits.

	BM&F BOVESPA (Reais per share)				NYSE (US\$ per share)			
	Common share		Preferred share		Common ADS		Preferred ADS	
	High	Low	High	Low	High	Low	High	Low
2012	45.87	32.45	53.41	32.12	37.08	15.88	32.50	15.67
2013	44.10	28.39	42.60	26.00	21.49	12.63	20.88	11.47
2014								
1Q	35.71	29.26	32.73	25.90	15.25	12.42	14.01	10.93
2Q	33.34	28.40	30.12	25.47	15.07	12.62	13.61	11.19
3Q	32.92	26.54	29.36	23.30	14.83	10.87	13.23	9.49
4Q	28.31	18.69	24.80	16.00	11.80	6.86	10.31	5.89
2015								
1Q	22.84	17.94	20.10	15.45	8.69	5.65	7.63	4.85
2Q	27.06	17.54	20.30	14.95	8.80	5.58	6.66	4.77
3Q	19.94	15.35	16.00	12.27	5.90	4.03	5.00	3.21
4Q	20.79	11.65	16.26	9.32	5.48	3.07	4.31	2.43
2016								
1Q	17.58	8.60	12.78	6.57	4.65	2.15	3.42	1.60
2Q	21.76	14.02	16.68	11.24	6.07	3.91	4.66	3.02
3Q	19.12	16.02	16.17	12.78	6.07	4.82	5.05	3.79
4Q	31.03	17.65	27.84	15.55	9.16	5.45	8.20	4.78
Last six months								
October 2016	22.14	17.65	20.80	15.55	6.95	5.45	6.58	4.78
November 2016	31.01	21.61	27.50	20.45	9.10	6.67	8.00	6.30
December 2016	31.03	25.19	27.84	21.78	9.16	7.62	8.20	6.64
January 2017	34.13	25.06	32.38	22.85	10.78	7.62	10.26	6.89
February 2017	36.43	29.92	34.24	28.60	11.52	9.56	10.87	9.10
March 2017	33.32	29.00	31.87	27.29	10.69	9.30	10.26	8.77

DEPOSITARY SHARES

Citibank N.A. serves as the depositary for our ADSs. ADR holders are required to pay various fees to the depositary, and the depositary may refuse to provide any service for which a fee is assessed until the applicable fee has been paid.

ADR holders are required to pay the depositary amounts in respect of expenses incurred by the depositary or its agents on behalf of ADR holders, including expenses arising from compliance with applicable law, taxes or other governmental charges, facsimile transmission or conversion of foreign currency into U.S. In this case, the depositary may decide in its sole discretion to seek payment by either billing holders or by deducting the fee from one or more cash dividends or other cash distributions. The depositary may recover any unpaid taxes or other governmental charges owed by an ADR holder by billing such holder, by deducting the fee from one or more cash dividends or other cash distributions, or by selling underlying shares after reasonable attempts to notify the holder, with the holder liable for any remaining deficiency.

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ADR holders are also required to pay additional fees for certain services provided by the depositary, as set forth in the table below.

Depositary service	Fee payable by ADR holders
Issuance of ADSs upon deposit of shares, excluding issuances as a result of distributions described in the following item	Up to US\$5.00 or less per 100 ADSs (or fraction thereof) issued
Distribution of securities other than ADSs or rights to purchase additional ADSs (i.e., spin-off shares)	Up to US\$5.00 or less per 100 ADSs (or fraction thereof) held
Distribution of cash dividends or other cash distributions (i.e., sale of rights and other entitlements)	Up to US\$5.00 or less per 100 ADSs (or fraction thereof) held
Distribution of ADSs pursuant to (i) stock dividends or other free stock distributions, or (ii) exercise of rights to purchase additional ADSs	Up to US\$5.00 or less per 100 ADSs (or portion thereof) held
Delivery of deposited property against surrender of ADSs	Up to US\$5.00 or less per 100 ADSs (or portion thereof) surrendered
ADS services	Up to US\$5.00 per 100 ADSs (or fraction thereof) held on the applicable record date(s) established by the depositary

The depositary may deduct applicable depositary fees and charges from the funds being distributed in the case of cash distributions. For distributions other than cash, the depositary will invoice the amount of the applicable depositary fees to the applicable holders.

In June 2016, we terminated our HDR program, and in July 2016 we concluded the delisting of HDRs from the Hong Kong Stock Exchange.

Additional Charges

The holders, beneficial owners, persons depositing shares and persons surrendering ADSs for cancellation and for the purpose of withdrawing deposited securities are also subject to the following charges: (i) taxes (including applicable interest and penalties) and other governmental charges; (ii) registration fees as may be applicable from time to time; (iii) reimbursement of certain expenses as provided in the deposit agreement; (iv) the expenses and charges incurred by the depositary in the conversion of foreign currency; (v) certain fees and expenses incurred by the depositary in connection with compliance with exchange control regulations and other regulatory requirements; and (v) certain fees and expenses incurred in connection with the delivery or servicing of deposited shares, as provided for under the deposit agreement.

The depositary reimburses us for certain expenses we incur in connection with the ADR programs and other expenses, subject to a ceiling agreed between us and the depositary from time to time. These reimbursable expenses currently include legal and accounting fees, listing fees, investor relations expenses and fees payable to service providers for the distribution of material to ADR holders. The depositary also agreed to make an additional reimbursement annually based on the issuance and cancellation fees, dividend fees and depositary service fees charged by the depositary to our ADS holders. In this context, for the year ended December 31, 2016, Citibank N.A. reimbursed us US\$3.202 million.

PURCHASES OF EQUITY SECURITIES BY THE ISSUER AND AFFILIATED PURCHASERS

Vale did not engage in any share repurchase program during 2016.

Table of Contents**IV. MANAGEMENT AND EMPLOYEES****MANAGEMENT****Board of Directors**

Our Board of Directors sets general guidelines and policies for our business and monitors the implementation of those guidelines and policies by our executive officers. Our bylaws provide for a Board of Directors consisting of 11 members and 11 alternates, each of whom serves on behalf of a particular director. All members (and their respective alternates) are elected for the same two-year term at a general shareholders' meeting, can be re-elected, and are subject to removal at any time. Our bylaws provide that the chief executive officer cannot serve as chairman of the Board of Directors.

The Board of Directors holds regularly scheduled meetings on a monthly basis and holds additional meetings when called by the chairman, vice-chairman or any two directors. Decisions of the Board of Directors require a quorum of a majority of the directors and are taken by majority vote. Alternate directors may attend and vote at meetings in the absence of the director for whom the alternate director is acting.

Ten of our 11 current directors (and ten of our 11 alternate directors) were appointed by Valepar. This includes an additional director appointed by Valepar, because no individual or group of common and preferred shareholders met the thresholds described under our bylaws and Brazilian corporate law. One director and his respective alternate are appointed by our employees, pursuant to our bylaws. Non-controlling shareholders holding common shares representing at least 15% of our voting capital, and preferred shares representing at least 10% of our total share capital, have the right to appoint one member and an alternate to our Board of Directors. Our employees and our non-controlling shareholders each have the right, as a class, to appoint one director and an alternate. The terms of all of our directors and alternate directors will expire at the Ordinary General Shareholder's meeting of 2017.

The following table lists the current members of the Board of Directors and each director's alternate.

Director(1)	Year first elected	Alternate director(1)	Year first elected
Gueitiro Matsuo Genso (chairman)	2015	Gilberto Antonio Vieira	2015
Fernando Jorge Buso Gomes (vice-chairman)	2015	Moacir Nachbar Junior	2015
Oscar Augusto de Camargo Filho	2003	Eduardo de Oliveira Rodrigues Filho	2011
Dan Antônio Marinho Conrado	2012	Arthur Prado Silva(8)	2015
Marcel Juvinião Barros	2012	Francisco Ferreira Alexandre	2013
Alberto Ribeiro Guth(2)	2015	Marcelo Gasparino da Silva(9)	2016
Lucio Azevedo(3)	2015	Carlos Roberto de Assis Ferreira(3)	2015
Eduardo Refinetti Guardia(4)	2016	Robson Rocha	2011
Eduardo de Salles Bartolomeo(5)	2016	Marcelo Marcolino(10)	2016
Motomu Takahashi(6)	2016	Yoshitomo Nishimitsu	2015
Denise Pauli Pavarina(7)	2017	Luiz Mauricio Leuzinger	2012

- (1) Appointed by Valepar and approved at the shareholders' meeting unless otherwise indicated.
- (2) As a result of the resignation of a member, Mr. Alberto Ribeiro Guth was appointed by the Board of Directors as effective Director on June 25, 2015, and such appointment was ratified by the General Ordinary and Extraordinary Shareholders' Meeting of April 25, 2016.
- (3) Appointed by our employees.
- (4) As a result of the resignation of a member, Eduardo Refinetti Guardia was appointed by the Board of Directors as effective Director on July 27, 2016.
- (5) As a result of the resignation of a member, Eduardo de Salles Bartolomeo was appointed by the Board of Directors as effective Director on September 29, 2016.
- (6) As a result of the resignation of a member, Motomu Takahashi was appointed by the Board of Directors as effective Director on April 27, 2016, and such appointment was ratified by the General Extraordinary Shareholders' Meeting of August 12, 2016.
- (7)

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- (8) Denise Pauli Pavarina was appointed by the Board of Directors as effective Director on February 22, 2017.
- (8) As a result of the resignation of an alternate member, Mr. Arthur Prado Silva was appointed by the Board of Directors as alternative member of Mr. Dan Antonio Marinho Conrado on July 29, 2015, and such appointment was ratified by the General Ordinary and Extraordinary Shareholders' Meeting of April 25, 2016.
- (9) Marcelo Gasparino da Silva was appointed by the Board of Directors as alternate on May 25, 2016, and such appointment was ratified by the General Extraordinary Shareholders' Meeting of August 12, 2016.

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(10)

As a result of the resignation of a member, Marcelo Marcolino was appointed by the Board of Directors as alternate Director on September 29, 2016.

Below is a summary of the business experience, activities and areas of expertise of our current directors.

Gueitiro Matsuo Genso, 45: Chairman of Vale's Board of Directors since February 2016 (Member of Vale's Board of Directors since March 2015).

Other current director or officer positions: Member of the Strategic Committee of Vale since 2015; Chief Executive Officer of Valepar since 2015; and Chief Executive Officer of PREVI Caixa de Previdência dos Funcionários do Banco do Brasil S.A. since 2015.

Professional experience: Executive Officer of Private Customers of Banco do Brasil S.A. from 2014 to 2015; Member of the Board of Directors of the Brazilian Interbank Payment Chamber from 2014 to 2015; Member of the Fiscal Council of Grupo Segurador BB Mapfre from 2011 to 2015; Sector Officer of the Brazilian Bank Federation (Febraban) from 2010 to 2015; Executive Officer of Real Estate Credit of Banco do Brasil S.A. from 2011 to 2014; Executive Officer of Home Loans of Banco do Brasil S.A. from 2011 to 2014; Executive Officer of Loans of Banco do Brasil S.A. from 2010 to 2011; and Executive Officer of Products of Banco Nossa Caixa S.A. from 2009 to 2010.

Academic background: Degree in Business Administration from Faculdade SPEI; MBA from Fundação Getúlio Vargas; and MBA in Agribusiness from Escola Superior de Agricultura Luiz de Queiroz.

Dan Antonio Marinho Conrado, 52: Member of Vale's Board of Directors since October 2012.

Other current director or officer positions: Chairman of Valepar's Board of Directors since 2012; and Alternate Member of the Board of Directors of Mapfre BB SH2 Participações S.A. since 2011.

Professional experience: Chairman of Vale's Board of Directors from 2012 to 2016; Chief Executive Officer of Valepar from 2012 to 2015; Member of Vale's Strategic Committee from 2012 to 2015; Permanent Participant of Vale's Strategic Committee from 2015 to 2016; Alternate Member of the Board of Directors of Petróleo Brasileiro S.A. Petrobrás and, Member of the Board of Directors of its wholly owned subsidiary, BR Distribuidora, from July 2015 to November 2015; Member of the Board of Directors of Fras-le S.A. from 2010 to 2013; Member of the Board of Directors of Aliança do Brasil S.A. from 2010 to 2011; and Vice-President of Retail, Distribution and Operations of Banco do Brasil S.A. from 2011 to 2012.

Academic background: Degree in Law from Universidade Dom Bosco; MBA from Universidade Federal do Rio de Janeiro, COPPEAD; and MBA from Instituto de Ensino e Pesquisa em Administração of Universidade Federal de Mato Grosso, Inepad.

Marcel Juvinião Barros, 54: Member of Vale's Board of Directors since October 2012; and Member of the Executive Development Committee of Vale since February 2013.

Other current director or officer positions: Officer of Securities of PREVI Caixa de Previdência dos Funcionários do Banco do Brasil S.A. since 2012; Member of the Board of Directors of Valepar since 2012; and Member of the Board of PRI Principles for Responsible Investment of the UN since 2012.

Professional experience: Between 1987 and 2012 held several positions at Banco do Brasil S.A., including the position of Union Auditor; and General Secretary of the National Confederation of Financial Branch Workers, where he coordinated international networks from 2008 to 2011.

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Academic background: Degree in History from Fundação Municipal de Ensino Superior de Bragança Paulista.

Eduardo Refinetti Guardia, 51: Member of Vale's Board of Directors since July 2016.

Other current director or officer positions: Executive Secretary of the Department of the Treasury since 2016; and Chairman of Banco do Brasil S.A.'s Board of Directors since 2016.

Professional experience: Executive Officer of Products of BM&FBOVESPA from 2013 to 2016; and Executive Officer of Finance and Investor Relations of BM&FBOVESPA from 2010 to 2013.

Academic background: Degree in Economics from Pontífica Universidade Católica; Master's Degree in Economics from Universidade Estadual de Campinas; and PhD in Economics from Universidade de São Paulo.

Fernando Jorge Buso Gomes, 60: Vice-Chairman of Vale's Board of Directors since January 2017 (Member of Vale's Board of Directors since April 2015); Coordinator of the Governance Sustainability Committee of Vale since April 2015; and Member of the Financial Committee and the Executive Development Committee of Vale since April 2015.

Other current director or officer positions: Executive Officer of Valepar since 2015; Member of the Board of Directors of Valepar since 2015 (and Vice-Chairman of Board of Directors since 2017); Chief Executive Officer and Investor Relations Executive Officer of Bradespar since 2015; Member of the Board of Directors of 2b Capital S.A. since 2014; and Executive Officer of Banco Bradesco BBI S.A. since 2006.

Professional experience: Member of the Board of Directors of Sete Brasil S.A. from 2011 to 2015; Chairman of the Board of Directors of Smartia Corretora de Seguros S.A. from 2012 to 2015; Chairman of the Board of Directors of SMR Grupo de Investimentos e Participações S.A. from 2014 to 2015; Member of the Board of Directors of BCPAR S.A. from 2013 to 2015; Member of the Board of Directors of BR Towers S.A. from 2013 to 2014; Member of the Board of Directors of CPFL Energias Renováveis S.A. from 2011 to 2012; and Member of the Board of Directors of LOG Commercial Properties S.A. from 2013 to 2015.

Academic background: Degree in Economic Sciences from Integrated College Bennett.

Oscar Augusto de Camargo Filho, 79: Member of Vale's Board of Directors since September 2003; Member of Vale's Strategy Committee since March 2006; and Coordinator of Vale's Executive Development Committee since November 2003.

Other current director or officer positions: Managing Partner of CWH Consultoria Empresarial, since 2003.

Professional experience: Member of the Board of Directors of Valepar from 2003 to 2014.

Academic background: Degree in Law from Universidade de São Paulo; and Post-graduate Degree in International Marketing from Cambridge University.

Eduardo de Salles Bartolomeo, 53: Member of Vale's Board of Directors and Strategic Committee since September 2016.

Other current director or officer positions: Member of the Board of Directors of Arteris S.A. since 2015; and Member of the Board of Directors of Login Logística Intermodal since 2016.

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Professional experience: Executive Officer of Vale from 2007 to 2012; Chief Executive Officer of BHG Brazilian Hospitality Group from 2013 to 2015; and Member of the Board of Directors of MRS Logística S.A. from 2007 to 2009.

Academic background: Degree in Metallurgical Engineering from Universidade Federal Fluminense; MBA from Katholieke Universiteit Leuven; and MBA from Massachusetts Institute of Technology.

Motomu Takahashi, 63: Member of Vale's Board of Directors since April 2016.

Other current director or officer positions: Representative Director and Executive Vice-president of Mitsui & Co. Ltd. since 2016.

Professional experience: Executive Vice-President and Chief Operating Officer of the American business unit of Mitsui & Co. Ltd. from 2015 to 2016; Senior Executive Managing Officer and Chief Operating Officer of the American business unit of Mitsui & Co. Ltd. from 2014 to 2015; and Executive Managing Officer and Chief Operating Officer of iron and steel products business unit of Mitsui & Co. Ltd from 2011 to 2014.

Academic background: Degree in Economics from Tokyo University; and Advanced Management Program from Harvard Business School.

Alberto Ribeiro Guth, 57: Member of Vale's Board of Directors since June 2015.

Other current director or officer positions: Managing Partner of Angra Partners Gestão de Recursos Ltda. since 2003; Director of Angra Infraestrutura Gestão de Informações Ltda. since 2006; Managing Partner of Angra Partners Participações Ltda. since 2010; Managing Partner of Angra Partners Assessoria Financeira Ltda. since 2010; Member of the Board of Directors of TG Participações S.A. since 2008; Member of the Board of Directors of Via Varejo S.A. since 2012; Member of the Board of Directors of Centrais Elétricas de Santa Catarina S.A. CELESC since 2015; Executive Officer of Futuarel S.A. since 2012; Executive Officer of Zain Participações S.A. since 2012; Executive Officer of Sul 116 Participações S.A. since 2012; Executive Officer of Newtel Participações S.A. since 2012; Executive Officer of Invitel Legacy S.A. since 2012; Member of the Board of Directors of Estre Ambiental S.A. since 2014; Director of Aconcágua Investimentos e Participações Ltda. since 2013; Member of the Board of Directors of Geradora Aluguel de Máquinas S.A. since 2013; Director of Neustift Participações Ltda. since 2014; and Member of the Board of Directors of Rio Barigui Participações S.A. since 2012; and Member of the Board of Directors of Capinaú Participações S.A. since 2007.

Professional experience: Managing Partner of Angra Partners Participações Ltda. from 2010 to 2014, and of Angra Partners Assessoria Financeira Ltda. from 2010 to 2015; Member of the Board of Directors of Ediouro Participações S.A. from 2013 to 2014; Member of the Board of Directors of Companhia Providência Indústria e Comércio S.A. from 2013 to 2014; and Executive Officer of Daleth Participações S.A. from 2012 to 2015.

Academic background: Degree in Engineering from Instituto Militar de Engenharia; and MBA in Finance from Wharton Business School.

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Denise Pauli Pavarina, 53: Member of Vale's Board of Directors since February 2017

Other current director or officer positions: Member of the Board of Directors of Valepar since 2017; Member of the Conduct and Ethics Committee of Banco Bradesco S.A. since 2016; Member of the IT Committee of BM&FBOVESPA S.A. Bolsa de Valores, Mercadorias e Futuro since 2016; Member of the Board of Directors of BM&FBOVESPA S.A. Bolsa de Valores, Mercadorias e Futuro since 2015; Member of the Advisory Committee for Intermediation Sector of BM&FBOVESPA S.A. Bolsa de Valores, Mercadorias e Futuro since 2015; Managing Director of BRAM Bradesco Asset Management S.A. since 2012; Member of the Management Board of Fundação Bradesco since 2009; Member of the Board of Directors of Fundação Instituto de Moléstias do Aparelho Digestivo e da Nutrição since 2012; Member of the Board of Directors (representing ANBIMA) of Instituto BRAIN Brasil Investimentos & Negócios since 2012; Managing Director of Kirton Bank S.A. and Kirton Gestão de Recursos Ltda. since 2016; Member of the Investment Committee of NEO Capital Mezanino Fundo de Investimentos em Participações since 2010; and Vice-Chairman of the Board of Directors of 2bCapital S.A. since 2014.

Professional experience: Adjunct Executive Officer of Banco Bradesco S.A. from 2012 to 2015; Managing Executive Officer of Banco Bradesco S.A. from 2015 to 2017; Member of the Management Board of Fundação Bradesco from 2001 to 2007; President of Associação Brasileira das Entidades dos Mercados Financeiros e de Capitais ANBIMA from 2012 to 2016; Superintendent Director of BRAM Bradesco Asset Management S.A. from 2009 to 2012; Member of the Representatives Council (representing ANBIMA) of Confederação Nacional das Instituições Financeiras CNF from 2012 to 2016; Member of the Consulting Board of Instituto BRAIN Brasil Investimentos & Negócios from 2012 to 2014; Member of the Strategic Committee (representing ANBIMA) of Instituto BRAIN Brasil Investimentos & Negócios from 2012 to 2013; and Member of the Board of Directors of 2bCapital S.A. from 2010 to 2014.

Academic background: Degree in Economic Sciences from Faculdade Armando Álvares Penteado; Law Degree from Universidade Paulista; and MBA from Institute de Ensino e Pesquisa.

Lucio Azevedo, 58: Member of Vale's Board of Directors since April 2015.

Professional experience: Chairman of Railway Labor Unions in the Brazilian states of Maranhão, Pará and Tocantins since 2013.

Academic background: Incomplete secondary education.

Technical and advisory committees to the Board of Directors

Our bylaws provide for the following technical and advisory committees to the Board of Directors:

Executive Development Committee, which is responsible for (i) reporting on general human resources policies as submitted by the executive officers to the Board of Directors, (ii) analyzing and issuing reports to the Board of Directors on proposals relating to the annual, global budget for the remuneration of administrators and members of the executive officers, (iii) proposing and updating methodologies and goals for evaluating the performance of our executive officers, and (iv) monitoring the development of the executive officer succession plan.

The *Strategy Committee*, which is responsible for reviewing and making recommendations to the Board of Directors concerning (i) the strategic guidelines and plan submitted annually to the Board of Directors by our executive officers, (ii) investment or divestiture opportunities submitted by executive officers and (iii) mergers and acquisitions and other reorganizations.

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The *Finance Committee*, which is responsible for (i) reviewing and making recommendations to the Board of Directors concerning our corporate risks and financial policies and the internal financial control systems, compatibility between the level of distributions to shareholders and the parameters established in the annual budget and the consistency between our general dividend policy and capital structure, (ii) evaluating our annual budget and investment plan as well as our annual funding plan and risk exposure limits, (iii) evaluating our risk management procedures and (iv) monitoring the execution of our capital expenditure projects and ongoing budget.

The *Accounting Committee*, which is responsible for (i) issuing reports on the Company's annual auditing plan and policies, (ii) tracking and evaluating the Company's internal auditing results and procedures with respect to best practices, as requested by the Board of Directors, and (iii) assisting the Board of Directors, as requested, in appointing and evaluating the annual performance of the designated employee responsible for overseeing the Company's internal auditing procedures.

The *Governance and Sustainability Committee*, which is responsible for (i) evaluating and recommending improvements to the effectiveness of our corporate governance practices and the functioning of our Board of Directors, (ii) recommending improvements to the Code of Ethics and Conduct and our management system in order to avoid conflicts of interests between Vale and its shareholders or management, (iii) evaluating related party transactions submitted to our Board of Directors and issuing reports on potential conflicts of interest involving related parties, according to the policy on Related Party Transactions, (iv) evaluating proposals for revision of policies that are not attributed to other committees pursuant to the bylaws or the internal rules or other committees, (v) evaluating proposals for modifying, analyzing and recommending improvements to our sustainability report, (vi) evaluating Vale's performance with respect to sustainability and recommending improvements based on our long-term strategic vision, (vii) assisting our Board of Directors, as requested, in appointing and evaluating the annual performance of our ombudsman (person in charge of receiving reports of violation of our Code of Ethics and Conduct), (viii) assisting the Board of Directors, as requested, in evaluating our ombudsman in respect of matters involving the ombudsman channel and violations of the Code of Ethics and Conduct.

Executive officers

The executive officers are responsible for day-to-day operations and the implementation of the general policies and guidelines set forth by our Board of Directors. Our bylaws provide for a minimum of six and a maximum of 11 executive officers. The executive officers hold weekly meetings and hold additional meetings when called by any executive officer. Under Brazilian corporate law, executive officers must be Brazilian residents.

The Board of Directors appoints executive officers for two-year terms and may remove them at any time. The following table lists our current executive officers.

Officer	Year of appointment	Position	Age
Murilo Pinto de Oliveira Ferreira(1)	2011	Chief Executive Officer	63
Luciano Siani Pires	2012	Chief Financial Officer and Executive Officer for Investor Relations	47
Gerd Peter Poppinga(2)	2014	Executive Officer (Ferrous Minerals)	57
Jennifer Anne Maki	2015	Executive Officer (Base Metals)	46
Humberto Ramos de Freitas	2011	Executive Officer (Logistics and Mineral Research)	63
Roger Allan Downey	2012	Executive Officer (Fertilizer, Coal and Strategy)	49
Clovis Torres Junior	2016	Executive Officer (Human Resources, Sustainability, Compliance and General Counsel)	49

(1) Murilo Pinto de Oliveira Ferreira will not renew his term ending in May 2017. On March 27, 2017, Vale announced the appointment of Fabio Schvartsman as its new Chief Executive Officer. A summary of Mr. Schvartsman's business experience and areas of expertise is provided below.

(2) Gerd Peter Poppinga was Executive Officer for Base Metals Operations and Information Technology of Vale from November 2011 to November 2014.

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Below is a summary of the business experience, activities and areas of expertise of our current executive officers.

Murilo Pinto de Oliveira Ferreira, 63: Chief Executive Officer of Vale and Participant of Vale's Strategy and Disclosure Committees since May 2011.

Professional experience: Executive Officer of Vale with responsibility over several different departments from 2005 to 2008, including business development, M&A, steel, energy, nickel and base metals; Chief executive officer of Vale Canada from 2007 to 2008 and member of its board of directors from 2006 to 2007; Chairman of the board of directors of Petrobras from May to November 2015, Alunorte from 2005 to 2008, MRN from 2006 to 2008 and Valesul Alumínio S.A. ("Valesul"), a subsidiary of Vale involved in the production of aluminum, from 2006 to 2008; Member of the board of commissioners of PTVI, from 2007 to 2008. Mr. Ferreira has been a member of the board of directors of several companies, including Usiminas, a Brazilian steel company, from 2006 to 2008, and was a partner at Studio Investimentos, an asset management firm with a focus on the Brazilian stock market, from October 2009 to March 2011.

Academic background: Degree in business administration from Fundação Getúlio Vargas in São Paulo; post-graduate degree in business administration and finance from Fundação Getúlio Vargas in Rio de Janeiro; senior executive education program at the IMD Business School in Lausanne, Switzerland.

Luciano Siani Pires, 47: Chief Financial Officer and Executive Officer for Investor Relations of Vale since August 2012 and Member of Vale's Executive Risk Management and Disclosure Committees since August 2012.

Professional experience: Alternate Member of the Board of Directors of Vale, from 2005 to 2007; Global Officer of Strategic Planning, from 2008 to 2009 and in 2011, and Global Officer of Human Resources, from 2009 to 2011 of Vale; Member of the board of directors of Valepar, from 2007 to 2008; Member of the board of directors of Telemar Participações S.A., from 2005 to 2008; Member of the board of directors of Suzano Papel e Celulose S.A., from 2005 to 2008; Several executive positions at BNDES, including executive secretary and chief of staff of the presidency, head of capital markets and head of export finance, from 1992 to 2008; Consultant at McKinsey & Company from 2003 to 2005.

Academic background: Degree in mechanical engineering from Pontifícia Universidade Católica do Rio de Janeiro; MBA in finance from the Stern School of Business, New York University.

Gerd Peter Poppinga, 57: Executive Officer for Ferrous Minerals of Vale since November 2014.

Other current director or officer positions: Member of the Board of Directors of Vale International since June 2015.

Professional experience: Executive Officer for Base Metals Operations and Information Technology of Vale from November 2011 to November 2014; Executive vice president for Asia Pacific of Vale Canada from November 2009 to November 2011; Director for strategy, business development, human resources and sustainability of Vale Canada from May 2008 to October 2009; Director for strategy and information technology of Vale Canada from November 2007 to April 2008. In connection with his roles at Vale, Mr. Poppinga was also member of the board of directors and the executive board of several companies from 2005 to 2010. From 1985 until 1999, Mr. Poppinga also held several positions at Mineração da Trindade S.A. SAMITRI, a publicly held mining company that was acquired by Vale in 2001.

Academic Background: Degree in geology from Universität Clausthal Zellerfeld, Germany; Participated in geostatistics extension course at Universidade Federal de Ouro Preto (UFOP); participated in the executive MBA from Fundação Dom Cabral; negotiation dynamics at INSEAD; Senior leadership program at M.I.T.; Leadership program at IMD Business School, Lausanne, Switzerland; and strategic megatrends with Asia Focus program at Kellogg Singapore.

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Jennifer Anne Maki, 46: Executive Officer for Base Metals of Vale since November 2015.

Other current director or officer positions: President commissioner of PTVI; Member of the board of directors of Vale New Caledonia and Vale's Global Pension Committee; Chairwoman and member of the Canadian pension committee since 2009 and 2007, respectively.

Professional experience: Chief financial officer of Vale Canada from 2007 to 2013, prior to which Ms. Maki held positions in the base metals treasury and controllership areas. From 1993 to 2003, she worked at PricewaterhouseCoopers LLP in roles of increasing responsibility.

Academic background: Degree in business from Queens University; post-graduate degree in accounting from the Institute of Chartered Accountants of Ontario.

Humberto Ramos de Freitas, 63: Executive Officer for Logistics and Mineral Research of Vale since November 2011.

Other current director or officer positions: Chairman of the board of the Brazilian Association of Port Terminals since May 2009.

Professional experience: Member of the board of directors of MRS from December 2010 to October 2012; Logistics Operations Officer of Vale from September 2009 to June 2010; Director for Ports and Navigation of Vale from March 2007 to August 2009; Chief executive officer of Valesul from August 2003 to February 2007; General superintendent of ports of CSN from December 1997 to November 1999.

Academic background: Degree in metallurgical engineering from the Escola de Minas de Ouro Preto; Executive development program at the Kellogg School of Management at Northwestern University; Advanced management and business development partnership programs from Fundação Dom Cabral/INSEAD; Senior executive program at MIT; Strategic business planning from McKinsey Consulting; Management training course from the Association of Overseas Technical Scholarship in Tokyo, Japan.

Roger Allan Downey, 49: Executive Officer for Fertilizer, Coal and Strategy of Vale (Executive Officer for Fertilizer and Coal since May 2012 and for Strategy since 2015).

Professional experience: Managing partner of CWH Consultoria Empresarial SC Ltda., a privately-held consulting company, from January 2012 to April 2012; Alternate member of the board of directors of Valepar from February 2012 to April 2012; Chief executive officer of MMX Mineração e Metálicos S.A., a publicly-held mining company, from August 2009 to November 2011; Director of equity research of Banco de Investimentos Credit Suisse (Brasil) S.A., a privately-held brokerage and investment bank, from August 2005 to August 2009; Strategic Marketing Manager for Iron Ore at Vale from 2002 to 2005; Commercial and new business manager of Rio Tinto, a publicly-held mining company, from October 1996 to September 2002; Market coordinator of CAEMI from December 1991 to October 1996.

Academic background: Graduate certificate of management and MBA from the University of Western Australia; Graduate diploma in business administration from the Australian National Business School.

Clovis Torres Junior, 49: Executive Officer for Human Resources, Sustainability, Compliance and General Counsel of Vale since August 2016.

Other current director or officer positions: Chairman of the Managing Council of the Brazilian Mining Institute (IBRAM); Vice President of the National Iron and Base Metals Mining Trade Association (SINFERBASE); Member of the Corporate Law Commission of the Brazilian Bar Association (OAB); Member of the Board of Trustees of Fundação Getulio Vargas; Member of the Economics Council of the Rio de Janeiro State Federation of Industry (FIRJAN).

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Professional experience: General Counsel and Chief Compliance Officer of Vale, from July 2011 to July 2016; Executive Vice President of Bahia Mineração Ltda., from September 2007 to July 2011; Director of the Corporate Legal Department of Vale, from May 2003 to September 2007; Partner in the law firm Machado, Meyer, Sendaz & Opice Advogados, from December 2000 to May 2003; Senior Lawyer at the International Finance Corporation in the United States, from January 1997 to December 2000; Senior Lawyer at Cargill Agrícola S.A., from August 1995 to January 1997; Senior Lawyer at Clyde & Co International Law Firm, in Brazil and England, from June 1993 to July 1995. From May 2015 to November 2015, Clovis chaired the Board of Directors of Petrobras Distribuidora S.A. and served on the Board of Directors of Petrobras S.A.

Academic background: Bachelor Degree in Law from the Catholic University of Salvador and a Master in International Law, Trade and Finance from Tulane Law School, Louisiana, United States; Executive MBA degree from Fundação Getúlio Vargas in São Paulo; and several courses on management, leadership, corporate finance and mergers and acquisitions at the Massachusetts Institute of Technology, Harvard University, the International Institute for Management Development (IMD), and INSEAD.

On March 27, 2017, Vale announced the appointment of **Fabio Schvartsman**, 63, as its new Chief Executive Officer starting in late May 2017. Mr. Schvartsman has graduate and post-graduate degrees in production engineering from the University of São Paulo and a post-graduate degree in Business Administration from Fundação Getúlio Vargas. He worked for 10 years at Duratex and for 22 years at the Ultra Group, which he left in 2007 as the Ultrapar Holding CFO and managing partner of Ultra S.A. Mr. Schvartsman was CEO of Telemar Participações and of San Antonio International and has been Klabin's CEO since 2011.

Conflicts of interest

Under Brazilian corporate law, if a director or an executive officer has a conflict of interest with the company in connection with any proposed transaction, such director or executive officer may not vote in any decision of the board of directors or of the board of executive officers regarding such transaction and must disclose the nature and extent of the conflicting interest for transcription in the minutes of the meeting. Under our Policy on Related Party Transactions, any director or executive officer who has a conflict of interest cannot receive any relevant documentation or information and may not participate in any related discussions. None of our directors or executive officers can transact any business with us, except on reasonable or fair terms and conditions that are identical to the terms and conditions prevailing in the market or offered by unrelated parties. For more details about our Policy on Related Party Transactions see *Share ownership and trading Related party transactions*.

Fiscal Council

We have a fiscal council established in accordance with Brazilian law. The primary responsibilities of the fiscal council under Brazilian corporate law are to monitor management's activities, review the Company's financial statements, and report its findings to the shareholders. Our management is required to obtain the Fiscal Council's pre-approval before engaging independent auditors to provide any audit or permitted non-audit services to Vale or its consolidated subsidiaries. Our Fiscal Council has pre-approved a detailed list of services based on detailed proposals from our auditors up to specified monetary limits. The list of pre-approved services is updated from time to time. Services that are included in this list, or that exceed the specified limits, or that relate to internal controls must be separately approved by the Fiscal Council. The policy also sets forth a list of prohibited services. The Fiscal Council is provided with reports on engagement and performance of the services included in the list on a periodic basis, and it also reviews and monitors the Company's external auditor's independence and objectivity. The Fiscal Council has the power to review and evaluate the performance of the Company's external auditors on an annual basis and make a recommendation to the Board of Directors on whether the Company should remove and replace its existing external auditors. The Fiscal Council may also recommend withholding the payment of compensation to the independent auditors and has the power to mediate disagreements between management and the auditors regarding financial reporting.

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Under our bylaws and internal regulations, our Fiscal Council is also responsible for evaluating the effectiveness of the procedures for the receipt, retention and treatment of any complaints related to accounting, controls and audit issues, as well as procedures for the confidential, anonymous submission of concerns regarding such matters.

Brazilian law requires the members of a fiscal council to meet certain eligibility requirements. A member of our Fiscal Council cannot (i) hold office as a member of the board of directors, fiscal council or advisory committee of any company that is a competitor of Vale or otherwise has a conflicting interest with Vale, unless compliance with this requirement is expressly waived by shareholder vote, (ii) be an employee or member of senior management or the Board of Directors of Vale or its subsidiaries or affiliates, or (iii) be a spouse or relative within the third degree by affinity or consanguinity of an officer or director of Vale.

We are subject to Rule 10A-3 under the Exchange Act, which requires, absent an exemption, that a listed company maintains a standing audit committee composed of members of the Board of Directors that meet specified requirements. In lieu of establishing an independent audit committee, we have given our Fiscal Council the necessary powers to qualify for the exemption set forth in Exchange Act Rule 10A-3(c)(3). We believe our Fiscal Council satisfies the independence and other requirements of Exchange Act Rule 10A-3 that would apply in the absence of our reliance on the exemption.

Our Board of Directors has determined that one of the members of our Fiscal Council, Mr. Aníbal Moreira dos Santos, is an audit committee financial expert. In addition, Mr. Moreira dos Santos meets the applicable independence requirements for Fiscal Council membership under Brazilian law and the NYSE independence requirements that would apply to audit committee members in the absence of our reliance on the exemption set forth in Exchange Act Rule 10A-3(c)(3).

Members of the Fiscal Council are elected by our shareholders for one-year terms. The current members of the Fiscal Council and their respective alternates were elected on April 25, 2016. The terms of the members of the Fiscal Council expire at the next annual shareholders' meeting following election.

Two members of our Fiscal Council (and the respective alternates) may be elected by non-controlling shareholders: one member may be appointed by our preferred shareholders and one member may be appointed by minority holders of common shares pursuant to applicable CVM rules.

The following table lists the current and alternate members of the Fiscal Council.

Current member	Year first elected	Alternate	Year first elected
Paulo José dos Reis Souza(1)	2016	Paula Bicudo de Castro Magalhães(1)	2016
Raphael Manhães Martins(2)	2015	Julio Sergio de Souza Cardoso(2)	2016
Marcelo Amaral Moraes(3)	2004	Vacant(4)	
Aníbal Moreira dos Santos(3)	2005	Oswaldo Mário Pêgo de Amorim Azevedo(3)	2004
Sandro Kohler Marcondes (3)	2016	Sergio Mamede Rosa do Nascimento (3)	2016

- (1) Appointed shareholders of preferred shares.
- (2) Appointed by minority shareholders of common shares.
- (3) Appointed by Valepar.
- (4) Vacant since the General Ordinary Shareholders' meeting of 2014.

Below is a summary of the business experience, activities and areas of expertise of the members of our Fiscal Council.

Paulo José dos Reis Souza, 54 Member of Vale's Fiscal Council since April 2016.

Other current director or officer positions: Program Director of the Department of the Treasury since 2016.

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Professional experience: Subsecretary of Fiscal Policy of the Department of the Treasury from 2015 to 2016; Program Director of the Department of the Treasury from 2011 to 2015; Member of the Fiscal Council of Petróleo Brasileiro S.A. Petrobras from 2012 to 2016, and from January 2017 to April 2017; Member of the Fiscal Council of Banco do Brasil S.A. from 2012 to 2016; Member of the Fiscal Council of BR Distribuidora from 2008 to 2012; Member of the Fiscal Council of Indústrias Nucleares do Brasil S.A. from 2011 to 2012; and Member of the Fiscal Council of Serviço Federal de Processamento de Dados SERPRO from 2015 to 2016.

Academic background: Degree in Business Administration from Centro Universitário UNA; Specialization in Public Policies and Corporate Governance from Escola Nacional de Administração Públicas ENAP; and Master Degree in Public Sector Economy from Fundação Getúlio Vargas.

Raphael Manhães Martins, 34: Member of Vale's Fiscal Council since April 2015.

Other current director or officer positions: Member of the Board of Directors of Eternit S.A. since 2015; Member of the Fiscal Council of Light S.A. since 2014; and Attorney for Faoro Advogados since 2010.

Professional experience: Alternate Member of the Fiscal Council of Light S.A. from 2012 to 2013; Member of the Fiscal Council of Embratel Participações S.A. from September 2014 to December 2014.

Academic background: Degree in Law from Universidade Estadual do Rio de Janeiro.

Marcelo Amaral Moraes, 49: Member of Vale's Fiscal Council since April 2004.

Other current director or officer positions: President of the Fiscal Council of Aceco TI S.A. since 2016; and Member of the Board of Directors of Eternit S.A. since 2016.

Professional experience: Managing Director of Capital Dynamics Investimentos Ltda. from 2012 to 2015.

Academic background: Degree in Economics from Universidade Federal do Rio de Janeiro; MBA from Universidade Federal do Rio de Janeiro COPPEAD; and Post-graduate Degree in Corporate Law and Arbitration from Fundação Getúlio Vargas.

Aníbal Moreira dos Santos, 78: Member of Vale's Fiscal Council since July 2005.

Professional experience: From 1998 until his retirement in 2003, Mr. Moreira dos Santos served as Executive Officer of several Caemi Mineração e Metalurgia S.A. subsidiaries, including Caemi Canada Inc., Caemi Canada Investments Inc., CMM Overseas, Ltd., Caemi International Holdings BV and Caemi International Investments NV, and as Chief Accounting Officer of Caemi Mineração e Metalurgia S.A. from 1983 to 2003. He also served as Member of the Fiscal Councils of Log-in S.A. from 2009 to 2014.

Academic background: Degree in Accounting from Fundação Getúlio Vargas.

Sandro Kohler Marcondes, 52: Member of Vale's Fiscal Council since April 2016.

Other current director or officer positions: Chief Financial Officer of Neoenergia S.A. since 2016.

Professional experience: Member of Vale's Board of Directors from 2007 to 2011; Alternate Member of the Board of Directors of Valepar from 2009 to 2015; Executive Officer of Banco do Brasil S.A. from 2005 to 2016; Alternate Member of the Board of Directors of Banco Patagônia S.A. from 2011 to 2012; Member of the Fiscal Council of PREVI Caixa de Previdência dos Funcionários do Banco do Brasil S.A. from 2012 to 2014; Member of the Embraer S.A. Fiscal Council from 2014 to 2015; Member of the decision-making body of CASSI Caixa de Assistência de Funcionários do Banco do Brasil S.A. from 2012 to 2013.

Academic background: Degree in Business Administration from Faculdade de Foz do Iguaçu; and Master Degree in Business Administration from the Fundação Getúlio Vargas.

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Under our bylaws, our shareholders are responsible for establishing the aggregate compensation we pay to the members of our Board of Directors and our Board of Executive Officers, and the Board of Directors allocates the compensation among its members and the Board of Executive Officers.

Our shareholders determine this annual aggregate compensation at the general shareholders' meeting each year. In order to establish aggregate director and officer compensation, our shareholders usually take into account various factors, which range from attributes, experience and skills of our directors and executive officers to the recent performance of our operations. Once aggregate compensation is established, our Board of Directors is then responsible for distributing such aggregate compensation in compliance with our bylaws among the directors and executive officers. The Executive Development Committee makes recommendations to the Board concerning the annual aggregate compensation of the executive officers. In addition to fixed compensation, our executive officers are also eligible for bonuses and incentive payments.

Executive officers

For the year ended December 31, 2016, the amount paid to the executive officers, including compensation accrued for the year and payable at a later date, is set forth in the table below.

	For the year ended December 31, 2016
	(US\$ million)
Fixed compensation and in kind benefits	7.27
Variable compensation	0.98
Pension, retirement or similar benefits	1.47
Severance	4.66
Social security contributions	2.24
 Total paid to the executive officers	 16.61

Fixed compensation and in kind benefits include a base salary in cash, paid on a monthly basis, reimbursement for certain investments in private pension plans, health care, relocation expenses, life insurance, driver and car expenses.

Variable compensation consists of (i) an annual cash bonus, based on specific targets for each executive officer, approved by our Board of Directors, and (ii) payments tied to the performance of our shares under two programs, the Matching Program and the Performance Shares Units (PSU).

Under our Matching Program, our executive officers are permitted to purchase a certain number of preferred shares or ADRs in the market within a purchase window through the plan administrator. At the end of a three-year cycle, participants are entitled to receive a reward equivalent to the same number of preferred shares of ADRs held through the end of the cycle. Participants may sell or transfers its preferred shares or ADRs at any time during the vesting period, in which case they forfeit the right to any receive reward with respect to these preferred shares or ADRs. Participation in our Matching Program is mandatory for our Board of Executive Officers in the years in which we pay cash bonuses.

Under our PSU program, our executive officers receive payments in cash tied to Vale's performance, as compared to a selected group of peer companies, based on the total return (dividend payments and share appreciation) of the common shares of those companies in a four-year cycle.

Pension, retirement or similar benefits consist of our contribution to Valia, the manager of pension plans sponsored by Vale. Social security contributions are mandatory contributions we are required to make to the Brazilian government for our executive officers.

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Board of Directors

In 2016, we paid US\$1.5 million in aggregate to the members of our Board of Directors for services in all capacities, all of which was fixed compensation. There are no pension, retirement or similar benefits for the members of our Board of Directors. On March 31, 2017, the total number of common shares owned by our directors and executive officers was 22,764, and the total number of preferred shares owned by our directors and executive officers was 2,011,050. None of our directors or executive officers beneficially owns 1% or more of any class of our shares.

Fiscal Council

We paid an aggregate of US\$0.51 million to members of the Fiscal Council in 2016. In addition, the members of the Fiscal Council are reimbursed for travel expenses related to the performance of their functions.

Advisory committees

We paid an aggregate of US\$0.10 million to members of our advisory committees in 2016. Under our bylaws, those members who are directors or officers of Vale are not entitled to additional compensation for participating on a committee. Members of our advisory committees are reimbursed for travel expenses related to the performance of their duties.

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The following tables set forth the number of our employees by business and by location as of the dates indicated.

By business:	As of December 31,		
	2014	2015	2016
Ferrous minerals	46,832	42,838	42,579
Coal	1,897	1,608	2,039
Base metals	15,564	15,554	15,239
Fertilizer nutrients(1)	6,773	9,181	8,935
Corporate activities	5,465	4,917	4,270
Total	76,531	74,098	73,062

(1) Discontinued operations.

By location:	As of December 31,		
	2014	2015	2016
South America	60,903	58,830	57,535
North America	6,673	6,773	6,630
Europe	395	385	385
Asia	4,476	4,516	4,499
Oceania	1,706	1,654	1,521
Africa	2,378	1,940	2,492
Total	76,531	74,098	73,062

We negotiate wages and benefits with a large number of unions worldwide that represent our employees. We have collective agreements with unionized employees at our operations in Australia, Brazil, Canada, Indonesia, Malawi, Mozambique, New Caledonia, Oman, Peru and the United Kingdom.

Wages and benefits

Wages and benefits for Vale and its subsidiaries are generally established on a company-by-company basis. We establish our wage and benefits programs for Vale S.A. and its subsidiaries, other than Vale Canada. In November 2016, we reached a one-year agreement with the Brazilian unions providing for a salary increase of 8.5% beginning in November 2016. The provisions of our collective bargaining agreements with unions also apply to our non-unionized employees. Vale Canada also establishes wages and benefits for its unionized employees through collective bargaining agreements. In March 2016, Vale Newfoundland & Labrador Limited, a subsidiary of Vale Canada Limited, reached a three-year agreement with the union representing the production and maintenance employees at the Voisey's Bay mine. For non-unionized employees, Vale Canada undertakes an annual review of salaries. We also provide our employees and their dependents with other benefits, including supplementary medical assistance.

Pension plans

Brazilian employees of Vale and of most of its Brazilian subsidiaries are eligible to participate in pension plans managed by Valia.

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Most of the participants in plans held by Valia are participants in a plan named "Vale Mais", which Valia implemented in 2000. This plan is primarily a defined contribution plan with a defined benefit feature relating to service prior to 2000 and another defined benefit feature to cover temporary or permanent disability, pension and financial protection to dependents in case of death. Valia also operates a defined benefit plan, closed to new participants since May 2000, with benefits based on years of service, salary and social security benefits. This plan covers retired participants and their beneficiaries, as well as a relatively small number of employees that declined to transfer from the old plan to the "Vale Mais" plan when it was established in May 2000.

Employees within our Base Metals operations, principally in Canada and the United Kingdom, participate in defined benefit pension plans and defined contribution pension plans. All new employees within our Base Metals operations participate in defined contribution pension plans. Employees in Japan and Taiwan participate in a defined benefit pension plan. Employees in other jurisdictions, including China, Indonesia, Malawi, Switzerland, the United States and Zambia, participate in defined contribution pension plans.

Performance-based compensation

All Vale parent-company employees may receive incentive compensation each year in an amount based on the performance of Vale, which can range from 0 to 200% of a market-based reference amount, depending on certain targets set, and the cash generation in each period. Similar incentive compensation arrangements are in place at our subsidiaries.

Qualifying management personnel are eligible to participate in the PSU and Matching programs. See description of these programs under *Management compensation Executive officers*.

V. ADDITIONAL INFORMATION

LEGAL PROCEEDINGS

We and our subsidiaries are defendants in numerous legal actions in the ordinary course of business, including civil, administrative, tax, social security and labor proceedings. The most significant proceedings are discussed below. Except as otherwise noted below, the amounts claimed, and the amounts of our provisions for possible losses, are stated as of December 31, 2016. See note 28 to our consolidated financial statements for further information.

Legal proceedings related to the failure of Samarco's tailings dam in Minas Gerais

We are engaged in several legal proceedings relating to the failure of Samarco's tailings dam in the city of Mariana, in the state of Minas Gerais. We have notified our insurers of the dam failure event and related complaints. For further discussion of the principal legal proceedings in which we are engaged, see *Information on the Company Business overview Failure of Samarco's tailings dam in Minas Gerais*. Most of these proceedings are in early stages, and we cannot reasonably estimate the possible loss or range of losses or the timing for a decision.

a) Putative class action in the United States

We and certain of our officers have been named as defendants in civil class action suits in federal court in New York brought by holders of our securities under U.S. federal securities laws. The plaintiffs allege that we made false and misleading statements or omitted to make disclosures concerning the risks and dangers of the operations of Samarco's Fundão dam and the adequacy of the related programs and procedures. The plaintiffs have not specified an amount of alleged damages in these actions.

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In March 2016, the judge overseeing the securities class action issued an order consolidating these actions and designating lead plaintiffs and counsel. In July 2016, we filed a motion to dismiss the consolidated amended complaint. On March 23, 2017, the Judge issued a ruling dismissing a significant part of the claims against us and the individual defendants, and allowing the case to continue based on more limited claims. The claims that were not dismissed relate to certain statements contained in our 2013 and 2014 sustainability reports concerning risk mitigation plans, policies and procedures, and certain statements made in a conference call in November 2015 concerning our responsibility for the Fundão dam collapse.

We believe that the remaining claims have no merit, we will continue vigorously contesting this action. It is not possible to determine a range of outcomes or reliable estimates of the potential exposure at this time, and no provision has been recognized.

b) Public civil action filed by the Brazilian government and others

In November 2015, the Brazilian federal government, the states of Minas Gerais and Espírito Santo, certain federal and state authorities and certain entities collectively filed a public civil action before a federal court in Minas Gerais against Samarco and its shareholders, Vale and BHPB. The plaintiffs claimed approximately R\$20.2 billion in monetary damages and a number of measures to remediate the environmental damages caused by the Fundão dam failure. Certain claims brought by the plaintiffs refer to specific defendants individually, while other claims are directed at all defendants.

In December 2015, the federal court in Minas Gerais granted an injunction preventing Vale from selling or otherwise transferring its mining rights in Brazil. In November 2016, the federal court ordered that the defendants: (i) in 90 days, present evidence that the leakage of waste from Fundão tailing dam has been definitely contained; (ii) in six months, present conclusive studies, with the endorsement from the appropriate environmental agencies, regarding an action plan and the feasibility of the withdrawal of mud placed on the banks of Rio Doce river, its affluents and the areas near its estuary; (iii) in 30 days, make a deposit in the total amount of R\$1.2 billion to secure future reparation measures. The court has provisionally suspended our obligation to make this R\$1.2 billion cash deposit to the extent that we provide the guarantees required under the agreements with MPF described under item c) below.

In March 2016, we, together with Samarco and BHPB, entered into the Framework Agreement with the federal government, the state governments of Espírito Santo and Minas Gerais and certain other federal and state authorities. See *Business overview Failure of Samarco's tailings dam in Minas Gerais*. In January 2017, Samarco, Vale and BHPB entered into two preliminary agreements with the MPF as described below. We expect the Framework Agreement and the agreements with the MPF to be a first step towards the settlement of these actions. Any settlement of these actions is subject to approval by the court.

c) Public civil action filed by Federal Prosecution Office

In May 2016, the Federal Prosecution Office (MPF) filed a public civil action against Samarco, Vale, BHPB, BNDES and the governmental authorities that are parties to the Framework Agreement. In July 2016, the court excluded all the governmental authorities and BNDES as defendants in this proceeding. In this action, the MPF requested that the court order a broad range of specific actions to be taken by the various parties. The MPF also stated in its complaint that the required remedial measures would have a total value of R\$155 billion, based on a comparison with the costs of the Deepwater Horizon oil spill in the Gulf of Mexico in 2010.

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In this public civil action, the MPF claims monetary damages from the defendants on a joint and several basis as well as other forms of relief, including injunctions (i) ordering the defendants to implement several measures to mitigate or remediate social, economic and environmental impacts arising from the collapse of the Fundão dam, as well as other emergency measures; (ii) preventing the defendants from encumbering or disposing of their assets; (iii) preventing the defendants from paying dividends; (iv) ordering the defendants to deposit R\$7.7 billion into a fund, managed by the defendants, for implementation of social, environmental and emergency programs; (v) ordering the defendants to provide collateral in the amount of R\$155 billion to secure their compliance with the final court decision; (vi) ordering the defendants to maintain working capital in the amount of R\$2 billion initially, and thereafter in an amount equal to 100% of the expenses of the remediation and compensation measures projected for the subsequent twelve months; and (vii) ordering BNDES to take actions under its credit agreements with the defendants, including cessation of further drawings and acceleration of outstanding principal. A preliminary hearing for conciliation was held in September 2016.

In January 2017, Samarco, Vale and BHPB entered into two preliminary agreements with the Federal Prosecution Office relating to this public civil action and the public civil action brought by the Brazilian government and others. See *Business overview Failure of Samarco's tailings dam in Minas Gerais*. The preliminary agreement was partially ratified, pending the appointment of an expert and conclusion of the final agreement. We expect the Framework Agreement and the agreements with the MPF to be a first step towards the settlement of the public civil action brought by the Brazilian government and others, the public civil action brought by MPF and other related proceedings.

d) Criminal proceeding

In October 2016, the MPF filed criminal charges before the federal court of Ponte Nova, state of Minas Gerais, against Samarco, Vale, BHPB and a number of individuals who were employees of Samarco or members of Samarco's governance bodies or advisory committees. The charges include murder, physical injury and various environmental crimes due to the failure of Samarco's dam.

Together with the indictment, the MPF is seeking a pre-judgment attachment order to seize assets from the three companies to secure the payment of the R\$20 billion claimed in connection with the failure of Fundão dam and is also seeking the imposition of external monitoring of the companies' ethical and social-environmental matters practices for 10 years.

A decision is pending on the requests for injunctions against the defendants. The criminal charges were accepted by the judge in November 2016, which initiated the criminal proceeding. We submitted our initial defense in March 2017.

e) Other proceedings

Vale has been named as a defendant in a number of other actions seeking remediation and compensation for environmental, property and personal damages resulting from the Fundão dam failure, including several other public civil actions brought by state prosecutors of Minas Gerais and Espírito Santo and other authorities and civil associations. The claims in these proceedings are generally similar to the claims in the public civil action brought by the Brazilian government and others, the public civil action brought by the MPF and the criminal proceedings described above. These other proceedings include requests for injunctions, pre-judgment attachment of assets and seizure of our bank accounts. Other proceedings and investigations in connection with the dam failure are expected.

In March 2017, certain holders of debt securities issued by Samarco, who are plaintiffs in a securities class action against Samarco arising out of the failure of the Fundão dam before the Southern District of New York, filed an amended complaint adding Vale and BHPB as defendants in this proceeding. The plaintiffs are seeking damages for alleged violations of securities laws and other claims in connection with the purchase and sale of debt securities issued by Samarco. We will vigorously contest this action, which we believe to be without merit.

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Samarco is engaged in several other investigations and proceedings claiming damages resulting from the dam failure. Immediately after the dam failure, the environmental authority of the state of Minas Gerais and the DNPM, an agency of the Ministry of Mines and Energy of the Brazilian government, commenced investigation into the causes of the dam failure, and determined the suspension of Samarco's operations pending the conclusion of these investigations.

Tubarão port litigation

In January 2016, as part of an environmental investigation conducted by the Brazilian federal police, a federal court in the Brazilian state of Espírito Santo ordered the suspension of our activities in the Pier II and the coal pier of the Tubarão Port, due to potential environmental damages resulting from the release of iron ore in the sea area around the Pier II and the coal pier. Our operations in the Pier II and the coal pier of the Tubarão Port were suspended for four days, until the Federal Court of Appeals ("TRF") of the Second Region (*Tribunal Regional Federal da Segunda Região*) suspended the effects of the injunction. The TRF granted us 60 days to implement certain measures to monitor, control and mitigate the release of iron ore in the terminal. This 60-day period expired on March 25, 2016, and we believe that we are in compliance with the requirements imposed by the TRF. In July 4, 2016, the TRF confirmed the suspension of the effects of the injunction and ordered an expert investigation to confirm that we have properly implemented the measures monitor, control and mitigate the release of iron ore in the terminal.

As part of this proceeding, we may be required to implement additional measures to prevent or mitigate the release of iron ore in the sea. The environmental investigation is still ongoing. Depending on the outcome of this investigation, the federal police or the federal prosecutors may bring other legal proceedings against us in the future and may seek injunctions to suspend the activities of the Tubarão port.

Onça Puma litigation

In 2009, the federal prosecutor brought a public civil action against Vale and the Brazilian state of Pará, seeking the suspension of our nickel operations in Onça Puma, in the state of Pará, due to the alleged impact on the Xikrin do Cateté and Kayapó indigenous communities located close to the mining site. The federal prosecutor contends that (i) our operations would be contaminating the water of the Catete River, which crosses the communities, (ii) we have failed to comply with certain conditions under our environmental licenses, and (iii) the state of Pará should not have granted environmental license to this operation.

In 2015, the federal court in the city of Redenção, state of Pará granted an injunction suspending our nickel operations in Onça Puma and ordering the payment of a cash compensation to the affected indigenous communities. In response to our appeal, the Supreme Court suspended the injunction, and granted us 120 days to implement certain monitoring and other mitigating measures and to comply with certain requirements of our environmental license. Although we have taken all the possible steps for implementation, we were unable to conclude the implementation of these measures because the indigenous communities refused to grant us access to their lands, as determined by court.

A final decision from the Supreme Court with respect to the injunction for suspension of operations in Onça Puma, following the impossibility to implement the monitoring and mitigating measures, is still pending. In September 2016, the federal court issued a preliminary injunction determining the payment of R\$17 million to the indigenous people and ordering us to pay the amount of R\$1 million per month for each of Xikrin do Cateté land involved. We have appealed this decision, and the Supreme Court issued a preliminary decision suspending these payments to the indigenous people. We are vigorously contesting this action, which we believe to be without merit.

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Itabira suits

We are a defendant in two separate actions brought by the municipality of Itabira, in the Brazilian state of Minas Gerais. In the first action, filed in August 1996, the municipality of Itabira alleges that our Itabira iron ore mining operations have caused environmental and social harm, and claims damages with respect to the alleged environmental degradation of the site of one of our mines, as well as the immediate restoration of the affected ecological complex and the performance of compensatory environmental programs in the region. The damages sought, as adjusted from the date of the claim, amount to approximately R\$4.702 billion. An expert report favorable to Vale has been issued, but the court granted the municipality's request for additional expert evidence. The elaboration of this additional expert evidence is pending.

In the second action, filed in September 1996, the municipality of Itabira claims the right to be reimbursed for expenses it has incurred in connection with public services rendered as a consequence of our mining activities. The damages sought, as adjusted from the date of the claim, amount to approximately R\$5.440 billion. This proceeding was suspended for a settlement negotiation, but has resumed its normal course as the parties have not reached an agreement, and the evidence production phase will follow.

Public civil action seeking suspension of S11D project

In May 2016, associations representing the indigenous Xikrin do Cateté people brought a public civil action against Vale, the Federal Environmental Agency (IBAMA), the Federal Indigenous Agency (FUNAI) and the National Bank of Economic and Social Development (BNDES), seeking the suspension of the environmental permitting procedure of our S11D project. The associations contend that FUNAI and IBAMA have failed to conduct the appropriate studies regarding the indigenous people during the environmental permitting procedure, and that the indigenous groups consequently did not provide a required consent. They also requested a monthly payment of R\$2 million for each association until the defendants conclude the studies.

We will take all necessary steps to defend our rights in this public civil action. Applicable legislation provides for mandatory consultation of indigenous communities located within ten kilometers of the project, and these indigenous communities are located more than 12 kilometers away from the project. We have submitted our preliminary defense, and in January 2017 the court denied plaintiffs' request for an injunction suspending our S11D project. This decision is subject to appeal.

Environmental proceedings involving Jangada and Feijão mines

In June 2016, the environmental authority of the Brazilian state of Minas Gerais ordered the suspension of part of our Jangada and Feijão mines in the Southern System, in order to protect caves located near these mines, under Brazilian legislation for the protection of caves. We have obtained an injunction from the state courts of Minas Gerais suspending the order of the environmental authority, and the environmental authority has appealed. In the event that the injunction is overturned or revoked, we may be required to suspend approximately 50% of our operations at the affected mines, with potential consequences for production volumes, costs or reserves in our iron ore business. Our total production in the mines of Jangada and Feijão in 2016 was 0.3 million metric tons and 8.3 million metric tons, respectively.

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Ministry of Labor proceeding

In February 2015, following an inspection in the facilities of a company that provided transportation services to us between our mines Mina do Pico and Mina de Fábrica in Minas Gerais, the Ministry of Labor determined that this transportation company had failed to comply with certain obligations relating to health, safety, overtime and other labor matters. By adopting a broad interpretation of the law, the Ministry of Labor concluded that its employees were working in conditions similar to slavery. Upon learning of the findings, we promptly remediated the problems and we eventually terminated the agreement with the transportation company. Nevertheless, the Ministry of Labor made findings against us. We submitted our defense at the administrative level, which was rejected. In June 2016, we commenced judicial proceedings challenging the administrative findings and seeking a ruling that the Ministry of Labor may not classify us as engaging in practices similar to slavery.

CFEM-related proceedings

We are engaged in numerous administrative and judicial proceedings related to the mining royalty known as the CFEM. For more information about CFEM, see *Information on the Company Regulatory matters Royalties and other taxes on mining activities*. These proceedings arise out of a large number of assessments by the DNPM. The proceedings concern different interpretations of DNPM's method of estimating sales, the statute of limitations, due process of law, payment of royalties on pellet sales and CFEM charges on the revenues generated by our subsidiaries abroad. The aggregate amount claimed in the pending assessments is approximately R\$6.278 billion, including interest and penalties through December 31, 2016.

We are contesting DNPM's claims using the available avenues under Brazilian law, beginning with challenges in administrative tribunals and proceeding with challenges in the judicial courts. We have received some favorable and unfavorable decisions, and we cannot predict the amount of time required before final judicial resolutions.

DNPM's assessments initially covered a period of up to 20 years before their issuances, based on the interpretation that the applicable statute of limitation for CFEM claims would be 20 years. We challenged all the assessments contending that these claims are subject to a 5-year statute of limitation. In December 2015, the Attorney General's Office issued a legal opinion concluding that CFEM claims are subject to a 10-year statute of limitations. This conclusion is consistent with recent decisions of the Superior Court of Justice ("STJ"), and we expect that the DNPM will revise all the assessments to exclude charges that are time barred under this legal opinion.

ICMS tax assessments and legal proceedings

We are engaged in several administrative and court proceedings relating to additional charges of value-added tax on services and circulation of goods (ICMS) by the tax authorities of different Brazilian states. In each of these proceedings, the tax authorities claim that (i) certain credits we have deducted from our payments of ICMS were not deductible and (ii) we have failed to comply with certain accessory obligations; (iii) we are required to pay the ICMS on electricity purchases and (iv) we are required to pay ICMS in connection with goods that we bring into the State of Pará. We have determined that we have a possible loss in proceedings involving a total estimated amount of R\$4.4 billion.

In connection with a legal proceeding relating to ICMS, prosecutors in the state of Rio de Janeiro are seeking criminal charges against members of management of our subsidiary MBR, alleging tax fraud. The amount involved in the underlying tax proceeding is small (approximately R\$7 million), but if these charges are accepted by the court, a criminal proceeding against these individuals will be started. We believe that these allegations are without merit.

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In addition to the tax assessments described above, the tax authorities of Pará has issued tax assessments asserting that the calculation of ICMS should be based on the market value of the iron ore transported, as opposed to the cost of production of the ore, which we have used to calculate the ICMS owed in years past. We are engaged in two judicial proceedings challenging these tax assessments, one of which covers the years 2007, 2008 and 2009, in an aggregate amount of R\$1.08 billion, and the other covering the years 2010, 2011 and 2012, in an aggregate amount of R\$1.07 billion, as of December 2016. We have provided a bank guarantee in the full amount in dispute to suspend the collection proceeding while our judicial challenge is pending, as required by Brazilian law. The state attorney of Pará has issued an opinion in our favor, and we are waiting for a decision of the tax authorities, and we have determined that the possibility of a loss in connection with these proceedings is remote.

Also, the tax authorities of the State of Minas Gerais contend that Vale should also have paid ICMS in relation to the transportation of the iron ore, but in the Company's point of view such taxation is not applicable because the ore was transported directly by Vale. The court decided in our favor with respect to the tax assessment covering the years of 2009 and 2010, in an aggregate amount of R\$566 million. The discussion remains in relation to the years of 2011, 2012 and 2013, in the aggregate amount of R\$855 million, and we also expect a favorable outcome.

Litigation on Brazilian taxation of foreign subsidiaries

We are engaged in legal proceedings concerning the contention of the Brazilian federal tax authority (*Receita Federal*) that we should pay Brazilian corporate income tax and social security contributions on the net income of our non-Brazilian subsidiaries and affiliates. The position of the tax authority is based on Article 74 of Brazilian Provisional Measure 2,158-34/2001 ("Article 74"), a tax regulation issued in 2001.

In 2013, we significantly reduced the amount in dispute by participating in the REFIS, a federal tax settlement program for payment of amounts relating to Brazilian corporate income tax and social contribution. We settled the claims related to the net income of our non-Brazilian subsidiaries and affiliates from 2003 to 2012, and we continue to dispute the assessments with respect to 1996 to 2002. Under the REFIS, we paid US\$2.6 billion in 2013, and we agreed to pay the remaining US\$7.0 billion in monthly installments, bearing interest at the SELIC rate. As of December 31, 2016, the remaining balance was US\$5.419 billion to be paid in 142 further installments.

We had initiated a direct legal proceeding (*mandado de segurança*) in 2003 challenging the tax authority's position. In December 2013, as required by the REFIS statute, we waived the legal arguments with respect to the period between 2003 and 2012.

We are continuing our direct legal proceeding with respect to the years not included in the REFIS. The total amount in dispute for the period between 1996 and 2002 is R\$2.179 billion. In 2014, the Superior Court of Justice (STJ) ruled in our favor on certain of our arguments against those assessments. In particular, the STJ ruled that: (a) Article 74 violates certain provisions under the international treaties against double taxation between Brazil and the countries where some of our subsidiaries are based, so profits realized by Vale's subsidiaries in those jurisdictions are not taxable in Brazil under Article 74; and (b) it is illegal to charge income tax and social contribution tax on our interest in the profits of affiliates that we account for under the equity method. The STJ also ruled that the profits realized by Vale's subsidiaries in the Bermuda are subject to taxation in Brazil under Article 74. The tax authorities filed an appeal before the Federal Supreme Court and a decision is pending.

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PIS/COFINS assessments

Between 2011 and 2016, we received tax assessments from the Brazilian federal tax authority contending that we incorrectly claimed PIS and COFINS tax credits for the period between 2004 and 2011. PIS and COFINS are taxes imposed by the Brazilian government on our gross revenues, which may be partially offset by credits resulting from PIS and COFINS payments made by our suppliers. The tax authorities claim that (i) some credits we have deducted from our payments of PIS and COFINS were not deductible and (ii) we have not submitted adequate evidence of certain other credits. We are contesting these assessments in the administrative level. The total amount of these tax assessments is R\$3.2 billion.

Income tax assessments

In 2004, a decision of the Brazilian Superior Court of Justice (STJ) granted us the right to deduct the amounts we pay as social security contributions on the net income (CSLL) from our taxable income. In 2006, the Brazilian federal tax authorities commenced a rescission action (*ação rescisória*) against us, seeking the reversal of the 2004 decision. The rescission action was rejected by the federal court in Rio de Janeiro and by the Federal Court of Appeals of the Second Region (TRF2). The tax authorities have appealed to the Superior Court of Justice (STJ) and to the Supreme Court (STF). If the courts decide for rescission of the 2004 decision, we will no longer be able to deduct the CSLL from our future taxable income, and the decision will determine whether or not we will be required to supplement the income tax payments we made between 2003 and 2016. As of December 31, 2016, the total CSLL deducted from our taxable income between 2003 and 2016 was R\$6.414 billion.

Railway litigation

In 1994, prior to our privatization, we entered into a contract with Rede Ferroviária Federal S.A. ("RFFSA"), the Brazilian federal rail network, to build two railway networks in Belo Horizonte, Brazil, which were to be incorporated into an existing railway segment, in a project called "*Transposição de Belo Horizonte*." We subsequently entered into a related agreement with the Brazilian government to begin the construction of an alternative railway segment, because the initially agreed segments could not be built. In August 2006, RFFSA (now succeeded as defendant by the Brazilian government) filed a breach of contract claim against us stemming from the 1994 contract regarding the construction of two railway networks.

Before the RFFSA lawsuit was filed, we filed a claim against RFFSA challenging the inflation adjustment provisions in the contract with RFFSA. We contend that the method of calculation employed by the Brazilian government is not lawful under Brazilian law. Pursuant to a partial settlement of the original RFFSA lawsuit, if the claim is decided in the Brazilian government's favor, then the construction costs of the new railway segment assumed by Vale will offset the damages due from Vale under such claim, representing a significant reduction in the amount we would be required to pay.

In June 2012, the federal judge rejected both RFFSA's claims and our contractual claim for review of the inflation adjustment provisions. On February 24, 2016, the Federal Court of Appeals (*Tribunal Regional Federal*) affirmed the June 2012 decision of the federal judge. A request for clarification from RFFSA and our appeal to the Superior Court of Justice (STJ) are pending. The current amount claimed by RFFSA, including adjustments for inflation and interest, is approximately of R\$4.3 billion.

Praia Mole suit

We are among the defendants in a public civil action filed by the federal prosecutor in November 1997 seeking to annul the concession agreements under which the defendants operate the Praia Mole maritime terminal in the Brazilian state of Espírito Santo. In July 2012, the Federal Court of Appeals affirmed the November 2007 decision that rejected the prosecutor's claim and recognized the validity of those concession agreements. The prosecutor has appealed that ruling, and a final decision on the appeal is still pending.

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MEMORANDUM AND ARTICLES OF ASSOCIATION

Company objectives and purposes

Our corporate purpose is defined by our bylaws to include:

- the exploration of mineral deposits in Brazil and abroad by means of research, extraction, processing, industrialization, transportation, shipment and commerce of mineral goods;
- the building and operation of railways and the provision of our own or unrelated-party rail traffic;
- the building and operation of our own or unrelated-party maritime terminals, and the provision of shipping activities and port services;
- the provision of logistics services integrated with cargo transport, including inflow management, storage, transshipment, distribution and delivery, all within a multimodal transport system;
- the production, processing, transport, industrialization and commercialization of any and all sources and forms of energy, including the production, generation, transmission, distribution and commercialization of our own products, derivatives and sub products;
- engagement, in Brazil or abroad, in other activities that may be of direct or indirect consequence for the achievement of our corporate purposes, including research, industrialization, purchases and sales, importation and exportation, the development, industrialization and commercialization of forest resources and the provision of services of any kind whatsoever; and
- the establishment or participation, in any fashion, in other companies, consortia or associations directly or indirectly related to our business purpose.

Common shares and preferred shares

Set forth below is certain information concerning our authorized and issued share capital and a brief summary of certain significant provisions of our bylaws and Brazilian corporate law. This description does not purport to be complete and is qualified by reference to our bylaws (an English translation of which we have filed with the SEC) and to Brazilian corporate law.

Our bylaws authorize the issuance of up to 3.6 billion common shares and up to 7.2 billion preferred shares, in each case based solely on the approval of the Board of Directors without any additional shareholder approval.

Each common share entitles the holder thereof to one vote at meetings of our shareholders. Holders of common shares are not entitled to any preference relating to our dividends or other distributions.

Holders of preferred shares and the golden shares are generally entitled to the same voting rights as holders of common shares, except with respect to the election of members of the Board of Directors, and are entitled to a preferential dividend as described below. Non-controlling shareholders holding common shares representing at least 15% of our voting capital, and preferred shares representing at least 10% of our total share capital, have the right to appoint each one member and an alternate to our Board of Directors. If no group of common or preferred shareholders meets the thresholds described above, shareholders holding preferred or common shares representing at least 10% of our total share capital are entitled to combine their holdings to appoint one member and an alternate to our Board of Directors. Holders of preferred shares, including the golden shares, may elect one member of the permanent Fiscal Council and the respective alternate. Non-controlling holders of common shares may also elect one member of the Fiscal Council and an alternate, pursuant to applicable CVM rules.

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The Brazilian government holds 12 golden shares of Vale. The golden shares are preferred shares that entitle the holder to the same rights (including with respect to voting and dividend preference) as holders of preferred shares. In addition, the holder of the golden shares is entitled to veto any proposed action relating to the following matters:

- a change in our name;
- a change in the location of our head office;
- a change in our corporate purpose as regards mining activities;
- any liquidation of the Company;
- any disposal or winding up of activities in any of the following parts of our iron ore mining integrated systems:
 - (a) mineral deposits, ore deposits, mines;
 - (b) railways; or
 - (c) ports and maritime terminals;
- any change in the bylaws relating to the rights afforded to the classes of capital stock issued by us; and
- any change in the bylaws relating to the rights afforded the golden shares.

Calculation of distributable amount

At each annual shareholders' meeting, the Board of Directors is required to recommend, based on the executive officers' proposal, how to allocate our earnings for the preceding fiscal year. For purposes of Brazilian corporate law, a company's net income after income taxes and social contribution taxes for such fiscal year, net of any accumulated losses from prior fiscal years and amounts allocated to employees' and management's participation in earnings represents its "net profits" for such fiscal year. In accordance with Brazilian corporate law, an amount equal to our net profits, as further reduced by amounts allocated to the legal reserve, to the fiscal incentive investment reserve, to the contingency reserve or to the unrealized income reserve established by us in compliance with applicable law (discussed below) and increased by reversals of reserves constituted in prior years, is available for distribution to shareholders in any given year. Such amount, the adjusted net profits, is referred to herein as the distributable amount. We may also establish discretionary reserves, such as reserves for investment projects.

The Brazilian corporate law provides that all discretionary allocations of net profits, including discretionary reserves, the contingency reserve, the unrealized income reserve and the reserve for investment projects, are subject to approval by the shareholders voting at the annual meeting and can be transferred to capital or used for the payment of dividends in subsequent years. The fiscal incentive investment reserve and legal reserve are also subject to approval by the shareholders voting at the annual meeting and may be transferred to capital but are not available for the payment of dividends in subsequent years.

The sum of certain discretionary reserves may not exceed the amount of our paid-in capital. When such limit is reached, our shareholders may vote to use the excess to pay in capital, increase capital or distribute dividends.

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Our calculation of net profits and allocations to reserves for any fiscal year are determined on the basis of the unconsolidated financial statements of our parent company, Vale S.A., in *reais*, prepared in accordance with Brazilian corporate law. Our consolidated financial statements have been prepared in accordance with IFRS using U.S. dollars as the reporting currency and, although our allocations to reserves and dividends will be reflected in these financial statements, investors will not be able to calculate such allocations or required dividend amounts from our consolidated financial statements in U.S. dollars.

Mandatory dividend

The Brazilian corporate law and our bylaws prescribe that we must distribute to our shareholders in the form of dividends or interest on shareholders' equity an annual amount equal to not less than 25% of the distributable amount, referred to as the mandatory dividend, unless the Board of Directors advises our shareholders at our general shareholders' meeting that payment of the mandatory dividend for the preceding year is inadvisable in light of our financial condition. To date, our Board of Directors has never determined that payment of the mandatory dividend was inadvisable. The Fiscal Council must review any such determination and report it to the shareholders. In addition to the mandatory dividend, our Board of Directors may recommend to the shareholders payment of dividends from other funds legally available therefore. Any payment of interim dividends will be netted against the amount of the mandatory dividend for that fiscal year. The shareholders must also approve the recommendation of the Board of Directors with respect to any required distribution. The amount of the mandatory dividend is subject to the size of the legal reserve, the contingency reserve, and the unrealized income reserve. The amount of the mandatory dividend is not subject to the size of the discretionary tax incentive reserve. See *Calculation of distributable amount*.

Dividend preference of preferred shares

Pursuant to our bylaws, holders of preferred shares and the golden shares are entitled to a minimum annual non-cumulative preferential dividend equal to (i) at least 3% of the book value per share, calculated in accordance with the financial statements which serve as reference for the payment of dividends, or (ii) 6% of their pro rata share of our paid-in capital, whichever is higher. To the extent that we declare dividends in any particular year in amounts which exceed the preferential dividends on preferred shares, and after holders of common shares have received distributions equivalent, on a per share basis, to the preferential dividends on preferred shares, holders of common shares and preferred shares shall receive the same additional dividend amount per share. We regularly have had sufficient distributable amounts to be able to distribute equal amounts to both common and preferred shareholders.

Other matters relating to our preferred shares

Our bylaws do not provide for the conversion of preferred shares into common shares. In addition, the preferred shares do not have any preference upon our liquidation and there are no redemption provisions associated with the preferred shares.

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Distributions classified as shareholders' equity

Brazilian companies are permitted to pay limited amounts to shareholders and treat such payments as an expense for Brazilian income tax purposes. Our bylaws provide for the distribution of interest on shareholders' equity as an alternative form of payment to shareholders. The interest rate applied is limited to the Brazilian long-term interest rate, or TJLP, for the applicable period. The deduction of the amount of interest paid cannot exceed the greater of (1) 50% of net income (after the deduction of the provision of social contribution on net profits and before the deduction of the provision of the corporate income tax) before taking into account any such distribution for the period in respect of which the payment is made or (2) 50% of the sum of retained earnings and profit reserves. Any payment of interest on shareholders' equity is subject to Brazilian withholding income tax. See *Additional information Taxation Brazilian tax considerations*. Under our bylaws, the amount paid to shareholders as interest on shareholders' equity (net of any withholding tax) may be included as part of any mandatory and minimum dividend. Under Brazilian corporate law, we are obligated to distribute to shareholders an amount sufficient to ensure that the net amount received, after payment by us of applicable Brazilian withholding taxes in respect of the distribution of interest on shareholders' equity, is at least equal to the mandatory dividend.

Voting rights

Each common share entitles the holder thereof to one vote at meetings of our shareholders. Holders of preferred shares are entitled to the same voting rights as holders of common shares except for the election of members of the Board of Directors, which will no longer apply in the event of any dividend arrearage, as described below. One of the members of the permanent Fiscal Council and his or her alternate are elected by majority vote of the holders of preferred shares. Holders of preferred shares and common shares may, in certain circumstances, combine their respective holdings to elect members of our Board of Directors, as described under *Common shares and preferred shares*.

The golden shares entitle the holder thereof to the same voting rights as holders of preferred shares. The golden shares also confer certain other significant veto rights in respect of particular actions, as described under *Common shares and preferred shares*.

The Brazilian corporate law provides that non-voting or restricted-voting shares, such as the preferred shares, acquire unrestricted voting rights beginning when a company has failed for three consecutive fiscal years (or for any shorter period set forth in a company's constituent documents) to pay any fixed or minimum dividend to which such shares are entitled and continuing until payment thereof is made. Our bylaws do not set forth any such shorter period.

Any change in the preferences or advantages of our preferred shares, or the creation of a class of shares having priority over the preferred shares, would require the approval of the holder of the golden shares, who can veto such matters, as well as the approval of the holders of a majority of the outstanding preferred shares, voting as a class at a special meeting.

Shareholders' meetings

Our Ordinary General Shareholders' Meeting is convened by April of each year for shareholders to resolve upon our financial statements, distribution of profits, election of Directors and Fiscal Council Members, if necessary, and compensation of senior management. Extraordinary General Shareholders' Meetings are convened by the Board of Directors as necessary in order to decide all other matters relating to our corporate purposes and to pass such other resolutions as may be necessary.

Pursuant to Brazilian corporate law, shareholders voting at a general shareholders' meeting have the power, among other powers, to:

- amend the bylaws;

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- elect or dismiss members of the Board of Directors and members of the Fiscal Council at any time;
- establish the remuneration of senior management and members of the Fiscal Council;
- receive annual reports by management and accept or reject management's financial statements and recommendations including the allocation of net profits and the distributable amount for payment of the mandatory dividend and allocation to the various reserve accounts;
- authorize the issuance of convertible and secured debentures;
- suspend the rights of a shareholder in default of obligations established by law or by the bylaws;
- accept or reject the valuation of assets contributed by a shareholder in consideration for issuance of capital stock;
- pass resolutions to reorganize our legal form, to merge, consolidate or split us, to dissolve and liquidate us, to elect and dismiss our liquidators and to examine their accounts; and
- authorize management to file for bankruptcy or to request a judicial restructuring.

Pursuant to CVM recommendations, all general shareholders' meetings, including the annual shareholders' meeting, require no fewer than 30 days' notice to shareholders prior to the scheduled meeting date. Where any general shareholders' meeting is adjourned, 8 days' prior notice to shareholders of the reconvened meeting is required. Pursuant to Brazilian corporate law, this notice to shareholders is required to be published no fewer than three times, in the *Diário Oficial do Estado do Rio de Janeiro* and in a newspaper with general circulation in the city where we have our registered office, in Rio de Janeiro *Valor Econômico*. *Estado do Rio de Janeiro* is the newspaper currently designated for this purpose. Such notice must contain the agenda for the meeting and, in the case of an amendment to our bylaws, an indication of the meeting's subject matter. In addition, under our bylaws, the holder of the golden shares is entitled to a minimum of 15 days' prior formal notice to its legal representative of any general shareholders' meeting to consider any proposed action subject to the veto rights accorded to the golden shares. See *Common shares and preferred shares*.

A shareholders' meeting may be held if shareholders representing at least one-quarter of the voting capital are present, except as otherwise provided, including for meetings convened to amend our bylaws, which require a quorum of at least two-thirds of the voting capital. If no such quorum is present, notice must again be given in the same manner as described above, and a meeting may then be convened without any specific quorum requirement, subject to the minimum quorum and voting requirements for certain matters, as discussed below. A shareholder without a right to vote may attend a general shareholders' meeting and take part in the discussion of matters submitted for consideration.

Except as otherwise provided by law, resolutions of a shareholders' meeting are passed by a simple majority vote, abstentions not being taken into account. Under Brazilian corporate law, the approval of shareholders representing at least one-half of the issued and outstanding voting shares is required for the types of action described below, as well as, in the case of the first two items below, a majority of issued and outstanding shares of the affected class:

- creating a new class of preferred shares or disproportionately increasing an existing class of preferred shares relative to the other classes of preferred shares, other than to the extent permitted by the bylaws;
- changing a priority, preference, right, privilege or condition of redemption or amortization of any class of preferred shares or creating a new class of shares with greater privileges than the existing classes of preferred shares;

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- reducing the mandatory dividend;
- changing the corporate purposes;
- merging us with another company or consolidating or splitting us;
- participating in a centralized group of companies as defined under Brazilian corporate law;
- dissolving or liquidating us; and
- canceling any ongoing liquidation of us.

Whenever the shares of any class of capital stock are entitled to vote, each share is entitled to one vote. Annual shareholders' meetings must be held by April 30 of each year. Shareholders' meetings are called, convened and presided over by the chairman or, in case of his absence, by the vice-chairman of our Board of Directors. In the case of temporary impediment or absence of the chairman or vice-chairman of the Board of Directors, the shareholders' meetings may be chaired by their respective alternates, or in the absence or impediment of such alternates, by a director especially appointed by the chairman of the Board of Directors. A shareholder may be represented at a general shareholders' meeting by a proxy appointed in accordance with applicable Brazilian law not more than one year before the meeting, who must be a shareholder, a company officer, a lawyer or a financial institution.

Redemption rights

Our common shares and preferred shares are not redeemable, except that a dissenting shareholder is entitled under Brazilian corporate law to obtain redemption upon a decision made at a shareholders' meeting approving any of the items listed above, as well as:

- any decision to transfer all of our shares to another company in order to make us a wholly-owned subsidiary of such company, a stock merger;
- any decision to approve the acquisition of control of another company at a price which exceeds certain limits set forth in Brazilian corporate law; or
- in the event that the entity resulting from (a) a merger, (b) a stock merger as described in clause (i) above or (c) a spin-off that we conduct fails to become a listed company within 120 days of the general shareholders' meeting at which such decision was taken.

Only holders of shares adversely affected by shareholder decisions altering the rights, privileges or priority of a class of shares or creating a new class of shares may require us to redeem their shares. The right of redemption triggered by shareholder decisions to merge, consolidate or to participate in a centralized group of companies may only be exercised if our shares do not satisfy certain tests of liquidity, among others, at the time of the shareholder resolution. The right of redemption lapses 30 days after publication of the minutes of the relevant general shareholders' meeting, unless, as in the case of resolutions relating to the rights of preferred shares or the creation of a new class of preferred shares, the resolution is subject to confirmation by the preferred shareholders (which must be made at a special meeting to be held within one year), in which case the 30-day term is counted from the publication of the minutes of the special meeting.

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We would be entitled to reconsider any action giving rise to redemption rights within 10 days following the expiration of such rights if the redemption of shares of dissenting shareholders would jeopardize our financial stability. Any redemption pursuant to Brazilian corporate law would be made at no less than the book value per share, determined on the basis of the last balance sheet approved by the shareholders; provided that if the general shareholders' meeting giving rise to redemption rights occurred more than 60 days after the date of the last approved balance sheet, a shareholder would be entitled to demand that his or her shares be valued on the basis of a new balance sheet dated within 60 days of such general shareholders' meeting.

Preemptive rights

Each of our shareholders has a general preemptive right to subscribe for shares in any capital increase, in proportion to his or her shareholding. A minimum period of 30 days following the publication of notice of a capital increase is assured for the exercise of the right, and the right is transferable. Under our bylaws and Brazilian corporate law, and subject to the requirement for shareholder approval of any necessary increase to our authorized share capital, our Board of Directors may decide not to extend preemptive rights to our shareholders, or to reduce the 30-day period for the exercise of preemptive rights, in each case with respect to any issuance of shares, debentures convertible into shares or warrants in the context of a public offering. In the event of a capital increase that would maintain or increase the proportion of capital represented by preferred shares, holders of preferred shares will have preemptive rights to subscribe only to newly issued preferred shares. In the event of a capital increase that would reduce the proportion of capital represented by preferred shares, shareholders will have preemptive rights to subscribe for preferred shares, in proportion to their shareholdings, and for common shares only to the extent necessary to prevent dilution of their overall interest in us. In the event of a capital increase that would maintain or increase the proportion of capital represented by common shares, shareholders will have preemptive rights to subscribe only to newly issued common shares. In the event of a capital increase that would reduce the proportion of capital represented by common shares, holders of common shares will have preemptive rights to subscribe for preferred shares only to the extent necessary to prevent dilution of their overall interest in us.

Tag-along rights

According to Brazilian corporate law, in the event of a sale of control of a company, the acquirer is obliged to offer to holders of voting shares the right to sell their shares for a price equal to at least 80% of the price paid for the voting shares representing control.

Form and transfer of shares

Our preferred shares and common shares are in book-entry form registered in the name of each shareholder. The transfer of such shares is made under Brazilian corporate law, which provides that a transfer of shares is effected by our transfer agent, Banco Bradesco, upon presentation of valid share transfer instructions to us by a transferor or its representative. When preferred shares or common shares are acquired or sold on a Brazilian stock exchange, the transfer is effected on the records of our transfer agent by a representative of a brokerage firm or the stock exchange's clearing system. Transfers of shares by a foreign investor are made in the same way and are executed by the investor's local agent, who is also responsible for updating the information relating to the foreign investment furnished to the Central Bank of Brazil.

The BM&FBOVESPA operates a central clearing system through *Companhia Brasileira de Liquidação e Custódia*, or CBLC. A holder of our shares may participate in this system and all shares elected to be put into the system will be deposited in custody with CBLC (through a Brazilian institution that is duly authorized to operate by the Central Bank of Brazil and maintains a clearing account with CBLC). The fact that such shares are subject to custody with the relevant stock exchange will be reflected in our registry of shareholders. Each participating shareholder will, in turn, be registered in the register of our beneficial shareholders that is maintained by CBLC and will be treated in the same way as registered shareholders.

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SHAREHOLDER DEBENTURES

At the time of the first stage of our privatization in 1997, we issued shareholder revenue interests known in Brazil as "*debêntures participativas*" to our then-existing shareholders. The terms of the debentures were established to ensure that our pre-privatization shareholders, including the Brazilian government, would participate alongside us in potential future financial benefits that we derive from exploiting certain mineral resources that were not taken into account in determining the minimum purchase price of our shares in the privatization. In accordance with the debentures deed, holders have the right to receive semi-annual payments equal to an agreed percentage of our net revenues (revenues less value-added tax, transport fee and insurance expenses related to the trading of the products) from certain identified mineral resources that we owned at the time of the privatization, to the extent that we exceed defined thresholds of sales volume relating to certain mineral resources, and from the sale of mineral rights that we owned at that time. Our obligation to make payments to the holders will cease when the relevant mineral resources are exhausted.

We made available for withdrawal by holders of shareholder debentures US\$118 million in 2014, US\$65 million in 2015 and US\$84 million in 2016. In October 2013, the accumulated sales volume of iron ore from the Northern System reached the relevant threshold established in the debentures deed, which triggered our obligation to make additional semi-annual payments of the premium on iron ore products, starting in 2014. See note 32 to our consolidated financial statements for a description of the terms of the debentures.

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**EXCHANGE CONTROLS AND OTHER LIMITATIONS
AFFECTING SECURITY HOLDERS**

Under Brazilian corporate law, there are no restrictions on ownership of our capital stock by individuals or legal entities domiciled outside Brazil. However, the right to convert dividend payments and proceeds from the sale of preferred shares or common shares into foreign currency and to remit such amounts outside Brazil is subject to restrictions under foreign investment legislation, which generally requires, among other things, that the relevant investment be registered with the Central Bank of Brazil. These restrictions on the remittance of foreign capital abroad could hinder or prevent the depositary bank and its agents for the preferred shares or common shares represented by ADSs from converting dividends, distributions or the proceeds from any sale of preferred shares, common shares or rights, as the case may be, into U.S. dollars and remitting such amounts abroad. Delays in, or refusal to grant any required government approval for conversions of Brazilian currency payments and remittances abroad of amounts owed to holders of ADSs could adversely affect holders of ADRs.

Under Resolution No. 4,373/2014 of the CMN, foreign investors may invest in almost all financial assets and engage in almost all transactions available in the Brazilian financial and capital markets, provided that certain requirements are fulfilled. In accordance with Resolution No. 4,373/2014, the definition of foreign investor includes individuals, legal entities, mutual funds and other collective investment entities, domiciled or headquartered outside Brazil.

Under Resolution No. 4,373/2014, a foreign investor must:

- (1) appoint at least one representative in Brazil, with powers to perform actions relating to its investment,
- (2) complete the appropriate foreign investor registration form,
- (3) register as a foreign investor with the CVM, and register its foreign investment with the Central Bank of Brazil, and
- (4) appoint a custodian, duly licensed by the Central Bank of Brazil, if the Brazilian representative in item (1) is not a financial institution.

Resolution No. 4,373/2014 specifies the manner of custody and the permitted means for trading securities held by foreign investors under the resolution. The offshore transfer or assignment of securities or other financial assets held by foreign investors pursuant to Resolution No. 4,373/2014 is prohibited, except for transfers resulting from a corporate reorganization, or occurring upon the death of an investor by operation of law or will.

Resolution No. 4,373/2014 also provides for the issuance of depositary receipts in foreign markets in respect of shares of Brazilian issuers. It provides that the proceeds from the sale of ADSs by holders of ADRs outside Brazil are not subject to Brazilian foreign investment controls and holders of ADSs who are not residents of a low-tax jurisdiction (*país com tributação favorecida*), as defined by Brazilian law, will be entitled to favorable tax treatment.

An electronic registration has been issued to the custodian in the name of the depositary with respect to the ADSs. Pursuant to this electronic registration, the custodian and the depositary are able to convert dividends and other distributions with respect to the underlying shares into foreign currency and to remit the proceeds outside Brazil. If a holder exchanges ADSs for preferred shares or common shares, the holder must, within five business days, seek to obtain its own electronic registration with the Central Bank of Brazil under Law No. 4,131/1962 and Resolution No. 4,373/2014. Thereafter, unless the holder has registered its investment with the Central Bank of Brazil, such holder may not convert into foreign currency and remit outside Brazil the proceeds from the disposition of, or distributions with respect to, such preferred shares or common shares.

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Under Brazilian law, whenever there is a serious imbalance in Brazil's balance of payments or reasons to foresee a serious imbalance, the Brazilian government may impose temporary restrictions on the remittance to foreign investors of the proceeds of their investments in Brazil, and on the conversion of Brazilian currency into foreign currencies. Such restrictions may hinder or prevent the custodian or holders who have exchanged ADSs for underlying preferred shares or common shares from converting distributions or the proceeds from any sale of such shares, as the case may be, into U.S. dollars and remitting such U.S. dollars abroad. In the event the custodian is prevented from converting and remitting amounts owed to foreign investors, the custodian will hold the *reais* it cannot convert for the account of the holders of ADRs who have not been paid. The depositary will not invest the *reais* and will not be liable for interest on those amounts. Any *reais* so held will be subject to devaluation risk against the U.S. dollar.

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TAXATION

The following summary contains a description of the principal Brazilian and U.S. federal income tax consequences of the ownership and disposition of preferred shares, common shares or ADSs. You should know that this summary does not purport to be a comprehensive description of all the tax considerations that may be relevant to a holder of preferred shares, common shares or ADSs.

Holders of preferred shares, common shares or ADSs should consult their own tax advisors to discuss the tax consequences of the purchase, ownership and disposition of preferred shares, common shares or ADSs, including, in particular, the effect of any state, local or other national tax laws.

Although there is at present no treaty to avoid double taxation between Brazil and the United States, both countries' tax authorities have been having discussions that may result in the execution of such a treaty. In this regard, the two countries signed a Tax Information Exchange Agreement on March 20, 2007, which the Brazilian government approved in May 2013. We cannot predict whether or when such a treaty will enter into force or how, if entered into, such a treaty will affect the U.S. holders, as defined below, of preferred shares, common shares or ADSs.

Brazilian tax considerations

The following discussion summarizes the principal Brazilian tax consequences of the acquisition, ownership and disposition of preferred shares, common shares or ADSs by a holder not deemed to be domiciled in Brazil for purposes of Brazilian taxation ("Non-Brazilian Holder"). It is based on the tax laws of Brazil and regulations thereunder in effect on the date hereof, which are subject to change (possibly with retroactive effect). This discussion does not specifically address all of the Brazilian tax considerations applicable to any particular Non-Brazilian Holder. Therefore, Non-Brazilian Holders should consult their own tax advisors concerning the Brazilian tax consequences of an investment in preferred shares, common shares or ADSs.

Shareholder distributions

For Brazilian corporations, such as the Company, distributions to shareholders are classified as either dividend or interest on shareholders' equity.

Dividends

Amounts distributed as dividends will generally not be subject to Brazilian withholding income tax if the distribution is paid only from profits for the corresponding year, as determined under Brazilian tax principles. Dividends paid from profits generated before January 1, 1996 may be subject to Brazilian withholding income tax at varying rates depending on the year the profits were generated. Dividends paid from sources other than profits as determined under Brazilian tax principles may be subject to withholding tax.

Interest on shareholders' equity

Amounts distributed as interest on shareholders' equity are generally subject to withholding income tax at the rate of 15%, except where:

- (1) the beneficiary is exempt from tax in Brazil, in which case the distribution will not be subject to withholding income tax;
- (2) the beneficiary is located in a jurisdiction that does not impose income tax or where the maximum income tax rate is lower than 17% (a "Low Tax Jurisdiction") or where internal legislation imposes restrictions on the disclosure of the shareholding structure or the ownership of the investment, in which case the applicable withholding income tax rate is 25%; or
- (3) the effective beneficiary is resident in Japan, in which case the applicable withholding income tax rate is 12.5%.

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Interest on shareholders' equity is calculated as interest rate on the sum of the following accounts: (i) share capital, (ii) capital reserves, (iii) profits reserves, (iv) treasury stocks and (v) accumulated losses. The interest rate applied may not exceed the TJLP, the benchmark Brazilian long-term interest rate. In addition, the amount of distributions classified as interest on shareholders' equity may not be more than the greater of (1) 50% of net income (after the deduction of social contribution on net profits but before taking into account such payment of interest and the provision for corporate income tax) for the period in respect of which the payment is made and (2) 50% of the sum of retained earnings and profit reserves.

Payments of interest on shareholders' equity are deductible for the purposes of corporate income tax and social contribution on net profit, to the extent of the limits described above. The tax benefit to the Company in the case of a distribution by way of interest on shareholders' equity is a reduction in the Company's corporate tax charge by an amount equivalent to 34% of such distribution.

Taxation of capital gains

Taxation of Non-Brazilian Holders on capital gains depends on the status of the holder as either:

- (i) a holder that is not resident or domiciled in a Low Tax Jurisdiction, or in a jurisdiction where internal legislation imposes restrictions on the disclosure of shareholding structure or the ownership of the investment, and that has registered its investment in Brazil in accordance with Resolution No. 4,373/2014 (a 4,373 Holder), or (ii) a holder of ADSs; or
- any other Non-Brazilian Holder.

Investors identified in items (i) or (ii) are subject to favorable tax treatment, as described below.

Capital gains realized by a Non-Brazilian Holder from the disposition of "assets located in Brazil" are subject to taxation in Brazil. Preferred shares and common shares qualify as assets located in Brazil, and the disposition of such assets by a Non-Brazilian Holder may be subject to income tax on the gains assessed, in accordance with the rules described below, regardless of whether the transaction is carried out with another non-Brazilian resident or with a Brazilian resident.

There is some uncertainty as to whether ADSs qualify as "assets located in Brazil" for this purpose. Arguably, the ADSs constitute assets located in Brazil and therefore the gains realized by a Non-Brazilian Holder on the disposition of ADSs to another non-Brazilian resident should not be subject to income tax in Brazil. However, it is not certain that the Brazilian courts will uphold this interpretation of the definition of "assets located in Brazil" in connection with the taxation of gains realized by a Non-Brazilian Holder on the disposition of ADSs. Consequently, gains on a disposition of ADSs by a Non-Brazilian Holder (whether in a transaction carried out with another Non-Brazilian Holder or a person domiciled in Brazil) may be subject to income tax in Brazil in accordance with the rules applicable to a disposition of shares.

Although there are arguments to the contrary, the deposit of preferred shares or common shares in exchange for ADSs may be subject to Brazilian income tax if the acquisition cost of the shares being deposited is lower than the average price, determined as either:

- the average price per preferred share or common share on the Brazilian stock exchange in which the greatest number of such shares were sold on the day of deposit; or
- if no preferred shares or common shares were sold on that day, the average price on the Brazilian stock exchange in which the greatest number of preferred shares or common shares were sold in the 15 trading sessions immediately preceding such deposit.

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The positive difference between the average price of the preferred shares or common shares calculated as described above and their acquisition cost will be considered to be a capital gain subject to income tax in Brazil. In some circumstances, there are grounds to conclude that such taxation is not applicable with respect to any 4,373 Holder, provided such holder is not located in a Low Tax Jurisdiction.

The withdrawal of preferred shares or common shares by holders in exchange for ADSs is not subject to Brazilian income tax, subject to compliance with applicable regulations regarding the registration of the investment with the Central Bank of Brazil.

For the purpose of Brazilian taxation, the income tax rules on gains related to disposition of preferred shares or common shares vary depending on:

- the domicile of the Non-Brazilian Holder;
- the method by which such Non-Brazilian Holder has registered his investment with the Central Bank of Brazil; and
- how the disposition is carried out, as described below.

The gain realized as a result of a transaction on a Brazilian stock exchange is the difference between: (i) the amount in Brazilian currency realized on the sale or disposition and (ii) the acquisition cost, without any adjustment for inflation, of the securities that are the subject of the transaction.

Through December 31, 2016, any gain realized by a Non-Brazilian Holder on a sale or disposition of preferred shares or common shares carried out on the Brazilian stock exchange was:

- exempt from income tax where the Non-Brazilian Holder (i) is a 4,373 Holder; and (ii) is not located in a Low Tax Jurisdiction;
- subject to income tax at a rate of 15% where the Non-Brazilian Holder either (A) (i) is not a 4,373 Holder and (ii) is not resident or domiciled in a Low Tax Jurisdiction or (B) (i) is a 4,373 Holder and (ii) is resident or domiciled in a Low Tax Jurisdiction; or
- subject to income tax at a rate of 25% where the Non-Brazilian Holder (i) is not a 4,373 Holder and (ii) is resident or domiciled in a Low Tax Jurisdiction.

The sale or disposition of common shares carried out on the Brazilian stock exchange is subject to withholding tax at the rate of 0.005% on the sale value. This withholding tax can be offset against the eventual income tax due on the capital gain. A 4,373 Holder that is not resident or domiciled in a Low Tax Jurisdiction is not subject to this withholding tax.

Beginning on January 1, 2017, the taxation regime for capital gains in Brazil was significantly amended. Under the new regime, capital gains realized by non-Brazilian residents and individuals resident in Brazil are subject to progressive taxation, and the rates range from 15% to 22.5% as described below:

- 15% on the portion of gains up to R\$5 million;
- 17.5% on the portion of gains above R\$5 million and below R\$10 million;
- 20% on the portion of gains above R\$10 million and below R\$30 million ; and

- 22.5% on the portion of gains exceeding R\$30 million.

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We believe that this new regime of capital gains taxation replaces previous instances of taxation at the rate of 15%, but does not change the rate of 25% applicable to residents in a Low Tax Jurisdiction. We expect that the tax authorities will adapt regulations to clarify, among other issues, whether the new regime applies or not to 4,373 Holders, to a residents in a Low Tax Jurisdiction. You should consult your own tax advisors concerning the implications of these rules in light of your particular circumstances.

With respect to transactions arranged by a broker that are conducted on the Brazilian non-organized over-the-counter market, a withholding income tax at a rate of 0.005% on the sale value is levied on the transaction and can be offset against the eventual income tax due on the capital gain.

In the case of a redemption of preferred shares, common shares or ADSs or a capital reduction by a Brazilian corporation, the positive difference between the amount received by any Non-Brazilian Holder and the acquisition cost of the preferred shares, common shares or ADSs being redeemed is treated as capital gain and is therefore generally subject to income tax at the progressive rate from 15% to 22.5%, while the 25% rate applies to residents in a Low Tax Jurisdiction.

Any exercise of pre-emptive rights relating to our preferred shares or common shares will not be subject to Brazilian taxation. Any gain realized by a Non-Brazilian Holder on the disposition of pre-emptive rights relating to preferred shares or common shares in Brazil will be subject to Brazilian income taxation in accordance with the same rules applicable to the sale or disposition of preferred shares or common shares.

Tax on foreign exchange and financial transactions

Foreign exchange transactions

Brazilian law imposes a tax on foreign exchange transactions, or an IOF/Exchange Tax, due on the conversion of *reais* into foreign currency and on the conversion of foreign currency into *reais*. Currently, for most foreign currency exchange transactions, the rate of IOF/Exchange Tax is 0.38%.

The outflow of resources from Brazil related to investments held by a Non-Brazilian Holder in the Brazilian financial and capital markets is currently subject to IOF/Exchange Tax at a zero percent rate. In any case, the Brazilian government may increase such rates at any time, up to 25%, with no retroactive effect.

Transactions involving securities

Brazilian law imposes a tax on transactions involving securities, or an IOF/Securities Tax, including those carried out on the Brazilian stock exchange. The rate of IOF/Securities Tax applicable to transactions involving publicly traded securities in Brazil is currently zero. The rate of IOF/Securities Tax applicable to a transfer of shares traded on the Brazilian stock exchange to back the issuance of depositary receipts has also been zero since December 24, 2013. However, the Brazilian Government may increase such rates at any time up to 1.5% of the transaction amount per day, but the tax cannot be applied retroactively.

Other Brazilian taxes

There are no Brazilian inheritance, gift or succession taxes applicable to the ownership, transfer or disposition of preferred shares, common shares or ADSs by a Non-Brazilian Holder, except for gift and inheritance taxes which are levied by some states of Brazil on gifts made or inheritances bestowed by a Non-Brazilian Holder to individuals or entities resident or domiciled within such states in Brazil. There are no Brazilian stamp, issue, registration, or similar taxes or duties payable by holders of preferred shares or common shares or ADSs.

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U.S. federal income tax considerations

This summary does not purport to be a comprehensive description of all the U.S. federal income tax consequences of the acquisition, holding or disposition of the preferred shares, common shares or ADSs. This summary applies to U.S. holders, as defined below, who hold their preferred shares, common shares or ADSs as capital assets and does not apply to special classes of holders, such as:

- certain financial institutions,
- insurance companies,
- dealers in securities or foreign currencies,
- tax-exempt organizations,
- securities traders who elect to account for their investment in preferred shares, common shares or ADSs on a mark-to-market basis,
- persons holding preferred shares, common shares or ADSs as part of hedge, straddle, conversion or other integrated financial transactions for tax purposes,
- holders whose functional currency for U.S. federal income tax purposes is not the U.S. dollar,
- partnerships or other holders treated as "pass-through entities" for U.S. federal income tax purposes, or
- persons owning, actually or constructively, 10% or more of our voting shares.

This discussion is based on the Internal Revenue Code of 1986, as amended to the date hereof, administrative pronouncements, judicial decisions and final, temporary and proposed Treasury Regulations, all as in effect on the date hereof. These authorities are subject to differing interpretations and may be changed, perhaps retroactively, so as to result in U.S. federal income tax consequences different from those discussed below. There can be no assurance that the U.S. Internal Revenue Service (the "IRS") will not challenge one or more of the tax consequences discussed herein or that a court will not sustain such a challenge in the event of litigation. This summary does not address the Medicare tax on net investment income, the alternative minimum tax, or any aspect of state, local or non-U.S. tax law.

YOU SHOULD CONSULT YOUR TAX ADVISORS WITH REGARD TO THE APPLICATION OF THE U.S. FEDERAL INCOME TAX LAWS TO YOUR PARTICULAR SITUATIONS AS WELL AS ANY TAX CONSEQUENCES ARISING UNDER THE LAWS OF ANY STATE, LOCAL OR NON-U.S. TAXING JURISDICTION.

This discussion is also based, in part, on representations of the depositary and the assumption that each obligation in the deposit agreement and any related agreement will be performed in accordance with its terms.

For purposes of this discussion, you are a "U.S. holder" if you are a beneficial owner of preferred shares, common shares or ADSs that is, for U.S. federal income tax purposes:

- a citizen or resident alien individual of the United States,

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- a corporation created or organized in or under the laws of the United States or of any political subdivision thereof, or
- otherwise subject to U.S. federal income taxation on a net income basis with respect to the preferred shares, common shares or ADSs.

The term U.S. holder also includes certain former citizens of the United States.

In general, if you are the beneficial owner of American depositary receipts evidencing ADSs, you will be treated as the beneficial owner of the preferred shares or common shares represented by those ADSs for U.S. federal income tax purposes. Deposits and withdrawals of preferred shares or common shares by you in exchange for ADSs will not result in the realization of gain or loss for U.S. federal income tax purposes. Your tax basis in such preferred shares or common shares will be the same as your tax basis in such ADSs, and the holding period in such preferred shares or common shares will include the holding period in such ADSs.

Taxation of dividends

The gross amount of a distribution paid on ADSs, preferred shares or common shares, including distributions paid in the form of payments of interest on capital for Brazilian tax purposes, out of our current or accumulated earnings and profits (as determined for U.S. federal income tax purposes) will be taxable to you as foreign source dividend income and will not be eligible for the dividends-received deduction allowed to corporate shareholders under U.S. federal income tax law. The amount of any such distribution will include the amount of Brazilian withholding taxes, if any, withheld on the amount distributed. To the extent that a distribution exceeds our current and accumulated earnings and profits, such distribution will be treated as a nontaxable return of capital to the extent of your basis in the ADSs, preferred shares or common shares, as the case may be, with respect to which such distribution is made, and thereafter as a capital gain.

You will be required to include dividends paid in *reais* in income in an amount equal to their U.S. dollar value calculated by reference to an exchange rate in effect on the date such distribution is received by the depository, in the case of ADSs, or by you, in the case of common shares or preferred shares. If the depository or you do not convert such *reais* into U.S. dollars on the date they are received, it is possible that you will recognize foreign currency loss or gain, which would be ordinary loss or gain, when the *reais* are converted into U.S. dollars. If you hold ADSs, you will be considered to receive a dividend when the dividend is received by the depository.

Subject to certain exceptions for short-term and hedged positions, the U.S. dollar amount of dividends received by certain non-corporate taxpayers, including individuals, will be subject to taxation at the preferential rates applicable to long-term capital gains if the dividends are "qualified dividends." Dividends paid on the ADSs will be treated as qualified dividends if (i) the ADSs are readily tradable on an established securities market in the United States and (ii) the Company was not, in the year prior to the year in which the dividend was paid, and is not, in the year in which the dividend is paid, a passive foreign investment company ("PFIC"). The ADSs are listed on the New York Stock Exchange and will qualify as readily tradable on an established securities market in the United States so long as they are so listed. Based on Vale's audited financial statements and relevant market and shareholder data, Vale believes that it was not treated as a PFIC for U.S. federal income tax purposes with respect to its 2016 taxable year. In addition, based on Vale's audited financial statements and its current expectations regarding the value and nature of its assets, the sources and nature of its income, and relevant market and shareholder data, Vale does not anticipate becoming a PFIC for its 2017 taxable year.

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Based on existing guidance, it is not entirely clear whether dividends received with respect to the preferred shares and common shares will be treated as qualified dividends (and therefore whether such dividends will qualify for the preferential rates of taxation applicable to long-term capital gains), because the preferred shares and common shares are not themselves listed on a U.S. exchange. In addition, the U.S. Treasury has announced its intention to promulgate rules pursuant to which holders of ADSs, preferred shares or common stock and intermediaries through whom such securities are held will be permitted to rely on certifications from issuers to establish that dividends are treated as qualified dividends. Because such procedures have not yet been issued, it is unclear whether we will be able to comply with them. You should consult your own tax advisors regarding the availability of the reduced dividend tax rate in light of your own particular circumstances.

Subject to generally applicable limitations and restrictions, you will be entitled to a credit against your U.S. federal income tax liability, or a deduction in computing your U.S. federal taxable income, for Brazilian income taxes withheld by us. You must satisfy minimum holding period requirements to be eligible to claim a foreign tax credit for Brazilian taxes withheld on dividends. The limitation on foreign taxes eligible for credit is calculated separately for specific classes of income. For this purpose dividends paid by us on our shares will generally constitute "passive income." Foreign tax credits may not be allowed for withholding taxes imposed in respect of certain short-term or hedged positions in securities or in respect of arrangements in which a U.S. holder's expected economic profit is insubstantial. You should consult your own tax advisors concerning the implications of these rules in light of your particular circumstances.

Taxation of capital gains

Upon a sale or exchange of preferred shares, common shares or ADSs, you will recognize a capital gain or loss for U.S. federal income tax purposes equal to the difference, if any, between the amount realized on the sale or exchange and your adjusted tax basis in the preferred shares, common shares or ADSs. This gain or loss will be long-term capital gain or loss if your holding period in the preferred shares, common shares or ADSs exceeds one year. The net amount of long-term capital gain recognized by individual U.S. holders generally is subject to taxation at preferential rates. Your ability to use capital losses to offset income is subject to limitations.

Any gain or loss will be U.S. source gain or loss for U.S. foreign tax credit purposes. Consequently, if a Brazilian withholding tax is imposed on the sale or disposition of ADSs, preferred shares or common shares, and you do not receive significant foreign source income from other sources, you may not be able to derive effective U.S. foreign tax credit benefits in respect of such Brazilian withholding tax. You should consult your own tax advisor regarding the application of the foreign tax credit rules to your investment in, and disposition of, ADSs, preferred shares or common shares.

If a Brazilian tax is withheld on the sale or disposition of shares, the amount realized by a U.S. holder will include the gross amount of the proceeds of such sale or disposition before deduction of the Brazilian tax. See *Brazilian tax considerations* above.

Information reporting and backup withholding

Information returns may be filed with the IRS in connection with distributions on the preferred shares, common shares or ADSs and the proceeds from their sale or other disposition. You may be subject to United States backup withholding tax on these payments if you fail to provide your taxpayer identification number or comply with certain certification procedures or otherwise establish an exemption from backup withholding. If you are required to make such a certification or to establish such an exemption, you generally must do so on IRS Form W-9.

The amount of any backup withholding from a payment to you will be allowed as a credit against your U.S. federal income tax liability and may entitle you to a refund, provided that the required information is timely furnished to the IRS.

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EVALUATION OF DISCLOSURE CONTROLS AND PROCEDURES

Our management, with the participation of our chief executive officer and chief financial officer, has evaluated the effectiveness of our disclosure controls and procedures as of December 31, 2016. There are inherent limitations to the effectiveness of any system of disclosure controls and procedures, including the possibility of human error and the circumvention or overriding of the controls and procedures. Accordingly, even effective disclosure controls and procedures can only provide reasonable assurance of achieving their control objectives.

Our chief executive officer and chief financial officer have concluded that our disclosure controls and procedures were effective to provide reasonable assurance that information required to be disclosed by us in the reports filed or submitted under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the applicable rules and forms, and that it is accumulated and communicated to our management, including our chief executive officer and chief financial officer, as appropriate to allow timely decisions regarding required disclosure.

MANAGEMENT'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

Our management is responsible for establishing and maintaining adequate internal control over financial reporting. Our internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. Our internal control over financial reporting includes those policies and procedures that: (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the Company; (ii) provide reasonable assurance that transactions are recorded to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the Company are being made only in accordance with authorizations of management and directors of the Company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of our assets that could have a material effect on the financial statements. Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of the effectiveness to future periods are subject to the risk that controls may become inadequate and that the degree of compliance with the policies or procedures may deteriorate.

Our management has assessed the effectiveness of Vale's internal control over financial reporting as of December 31, 2016 based on the criteria established in "Internal Control Integrated Framework (2013)" issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO"). Based on such assessment and criteria, our management has concluded that our internal control over financial reporting was effective as of December 31, 2016. The effectiveness of our internal control over financial reporting as of December 31, 2016 has been audited by KPMG Auditores Independentes, an independent registered public accounting firm, as stated in their report which appears herein.

Our management identified no change in our internal control over financial reporting during our fiscal year ended December 31, 2016 that has materially affected or is reasonably likely to materially affect our internal control over financial reporting.

Table of Contents**CORPORATE GOVERNANCE**

Under NYSE rules, foreign private issuers are subject to more limited corporate governance requirements than U.S. domestic issuers. As a foreign private issuer, we must comply with four principal NYSE corporate governance rules: (1) we must satisfy the requirements of Exchange Act Rule 10A-3 relating to audit committees; (2) our chief executive officer must promptly notify the NYSE in writing after any executive officer becomes aware of any non-compliance with the applicable NYSE corporate governance rules; (3) we must provide the NYSE with annual and interim written affirmations as required under the NYSE corporate governance rules; and (4) we must provide a brief description of any significant differences between our corporate governance practices and those followed by U.S. companies under NYSE listing standards. The table below briefly describes the significant differences between our practices and the practices of U.S. domestic issuers under NYSE corporate governance rules.

Section	NYSE corporate governance rule for U.S. domestic issuers	Our approach
303A.01	A listed company must have a majority of independent directors. "Controlled companies" are not required to comply with this requirement.	We are a controlled company because more than a majority of our voting power for the appointment of directors is controlled by Valepar. As a controlled company, are not required to comply with the majority of independent director requirements. There is no legal provision or policy that requires us to have independent directors.
303A.03	The non-management directors of a listed company must meet at regularly scheduled executive sessions without management.	We do not have any management directors.
303A.04	A listed company must have a nominating/corporate governance committee composed entirely of independent directors, with a written charter that covers certain minimum specified duties. "Controlled companies" are not required to comply with this requirement.	<p>We do not have a nominating committee. As a controlled company, we are not required to comply with the nominating/corporate governance committee requirements. However, we do have a Governance and Sustainability Committee, which is an advisory committee to the Board of Directors and may include members who are not directors.</p> <p>According to its charter, this committee is responsible, among other matters, for:</p> <ul style="list-style-type: none"> • evaluating and recommending improvements to the effectiveness of our corporate governance practices and the functioning of the Board of Directors; • recommending improvements to our Code of Ethics and Conduct and our management system in order to avoid conflicts of interest between us and our shareholders or management; • issuing reports on potential conflicts of interest between us and our shareholders or management; and <p>The committee's charter requires at least one of its members to be independent. For this purpose, an independent member is a person who:</p> <ul style="list-style-type: none"> • does not have any current relationship with us other than being part of a committee, or being a shareholder of the Company; • does not participate, directly or indirectly, in the sales efforts or provision of services by Vale; • is not a representative of the controlling shareholders; • has not been an employee of the controlling shareholder or of entities affiliated with a controlling shareholder; and • has not been an executive officer of the controlling shareholder.

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Section	NYSE corporate governance rule for U.S. domestic issuers	Our approach
303A.05	A listed company must have a compensation committee composed entirely of independent directors, with a written charter that covers certain minimum specified duties. "Controlled companies" are not required to comply with this requirement.	As a controlled company, we are not required to comply with the compensation committee requirements. However, we have an Executive Development Committee, which is an advisory committee to the Board of Directors and may include members who are not directors. This committee is responsible for: <ul style="list-style-type: none"> • reporting on general human resources policies; • analyzing and reporting on the adequacy of compensation levels for our executive officers; • proposing and updating guidelines for evaluating the performance of our executive officers; and • reporting on policies relating to health and safety.
303A.06	A listed company must have an audit committee with a minimum of three	In lieu of appointing an audit committee composed of independent
303A.07	independent directors who satisfy the independence requirements of Rule 10A-3 under the Exchange Act, with a written charter that covers certain minimum specified duties.	members of the Board of Directors, we have established a permanent <i>conselho fiscal</i> , or fiscal council, in accordance with the applicable provisions of Brazilian corporate law, and provided the fiscal council with additional powers to permit it to meet the requirements of Exchange Act Rule 10A-3(c)(3). Under our bylaws, the Fiscal Council shall have between three and five members. Under Brazilian corporate law, which provides standards for the independence of the Fiscal Council from us and our management, none of the members of the Fiscal Council may be a member of the Board of Directors or an executive officer. Management does not elect any Fiscal Council member. Our Board of Directors has determined that one of the members of our Fiscal Council meets the New York Stock Exchange independence requirements that would apply to audit committee members in the absence of our reliance on Exchange Act Rule 10A-3(c)(3). The responsibilities of the Fiscal Council are set forth in its charter. Under our bylaws, the charter must give the Fiscal Council responsibility for the matters required under Brazilian corporate law, as well as responsibility for: <ul style="list-style-type: none"> • establishing procedures for the receipt, retention and treatment of complaints related to accounting, controls and audit issues, as well as procedures for the confidential, anonymous submission of concerns regarding such matters; • recommending and assisting the Board of Directors in the appointment, establishment of compensation and dismissal of independent auditors; • pre-approving services to be rendered by the independent auditors; • overseeing the work performed by the independent auditors, with powers to recommend withholding the payment of compensation to the independent auditors; and • mediating disagreements between management and the independent auditors regarding financial reporting.
303A.08	Shareholders must be given the opportunity to vote on all equity-compensation plans and material revisions thereto, with limited exemptions set forth in the NYSE rules.	Under Brazilian corporate law, shareholder pre-approval is required for the adoption of any equity compensation plans.
303A.09	A listed company must adopt and disclose corporate governance guidelines that cover certain minimum specified subjects.	We have not published formal corporate governance guidelines.

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Section	NYSE corporate governance rule for U.S. domestic issuers	Our approach
303A.10	A listed company must adopt and disclose a code of business conduct and ethics for directors, officers and employees, and promptly disclose any waivers of the code for directors or executive officers.	We have adopted a formal code of ethical conduct, which applies to our directors, officers and employees. We report each year in our annual report on Form 20-F any waivers of the code of ethical conduct granted for directors or executive officers. Our code of ethical conduct has a scope that is similar, but not identical, to that required for a U.S. domestic company under the NYSE rules.
303A.12	<p>a) Each listed company CEO must certify to the NYSE each year that he or she is not aware of any violation by the company of NYSE corporate governance listing standards.</p> <p>b) Each listed company CEO must promptly notify the NYSE in writing after any executive officer of the listed company becomes aware of any non-compliance with any applicable provisions of this Section 303A.</p> <p>c) Each listed company must submit an executed Written Affirmation annually to the NYSE. In addition, each listed company must submit an interim Written Affirmation as and when required by the interim Written Affirmation form specified by the NYSE.</p>	We are subject to (b) and (c) of these requirements, but not (a).

CODE OF ETHICS AND CONDUCT

We have a code of ethics and conduct that applies to our employees and to the members of our Board of Directors and our Board of Executive Officers, including the chief executive officer, the chief financial officer and the principal accounting officer. We have posted this Code of Ethics and Conduct on our website, at: <http://www.vale.com> (under English Version/Investors/The Company/Corporate Governance/Policies). Copies of our code of ethics and conduct may be obtained without charge by writing to us at the address set forth on the front cover of this Form 20-F. We have not granted any implicit or explicit waivers from any provision of our code of ethics and conduct since its adoption.

Table of Contents**PRINCIPAL ACCOUNTANT FEES AND SERVICES**

The following table summarizes the fees billed to us by our independent auditors KPMG Auditores Independentes for professional services in 2016 and 2015:

	Year ended December 31,	
	2015	2016
	(US\$ thousand)	
Audit fees	4,844	6,084
Audit-related fees	206	63
Other fees		6
Total fees	5,050	6,143

"Audit fees" are the aggregate fees billed by KPMG Auditores Independentes for the audit of our annual financial statements, the audit of the statutory financial statements of our subsidiaries, and reviews of interim financial statements and attestation services that are provided in connection with statutory and regulatory filings or engagements. They also include fees for services that only the independent auditor reasonably can provide, including the provision of comfort letters and consents in connection with statutory and regulatory filings and the review of documents filed with the SEC and other capital markets or local financial reporting regulatory bodies. "Audit-related fees" are fees charged by KPMG Auditores Independentes for assurance and related services that are reasonably related to the performance of the audit or review of our financial statements and are not reported under "Audit fees."

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INFORMATION FILED WITH SECURITIES REGULATORS

We are subject to various information and disclosure requirements in those countries in which our securities are traded, and we file financial statements and other periodic reports with the CVM, BM&FBOVESPA, the SEC and the French securities regulator Autorité des Marchés Financiers.

- *Brazil.* Vale's Common Shares and Class A Preferred Shares are listed on BM&FBOVESPA in São Paulo, Brazil. As a result, we are subject to the information and disclosure requirements of Brazilian Corporate Law, as amended. We are also subject to the periodic disclosure requirements of CVM rules applicable to listed companies and to BM&FBOVESPA's "Level 1" Corporate Governance Requirements. Our CVM filings are available from the CVM at <http://www.cvm.gov.br> or from BM&FBOVESPA at <http://www.bmfbovespa.com.br>. In addition, as with all of our security filings, they may be accessed at our website, <http://www.vale.com>.
- *United States.* As a result of our ADSs being listed on the New York Stock Exchange, we are subject to the information requirements of the Securities Exchange Act of 1934, as amended, and accordingly file reports and other information with the SEC. Reports and other information filed by us with the SEC may be inspected and copied at the public reference facilities maintained by the SEC at 100 F Street, N.E., Washington, D.C., 20549. You can obtain further information about the operation of the Public Reference Room by calling the SEC at 1-800-SEC-0330. You may also inspect Vale's reports and other information at the offices of the New York Stock Exchange, 11 Wall Street, New York, New York 10005, on which Vale's ADSs are listed. Our SEC filings are also available to the public from the SEC at <http://www.sec.gov>. For further information on obtaining copies of Vale's public filings at the New York Stock Exchange, you should call (212) 656-5060.
- *France.* As a result of the admission of the ADSs to listing and trading on NYSE Euronext Paris, we must comply with certain French periodic and ongoing disclosure rules (for example, annual report with audited financial statements and interim financial statements). In general, the Company is deemed to comply with the French periodic and ongoing disclosure rules through its compliance with U.S. disclosures.

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EXHIBITS

**Exhibit
Number**

- 1 Bylaws of Vale S.A., as amended on May 13, 2015 incorporated by reference to the current report on Form 6-K furnished to the Securities and Exchange Commission on May 14, 2015 (File No.: 001-15030)
- 8 List of subsidiaries
- 10.1 Stock Purchase Agreement, dated as of December 19, 2016, by and among Vale S.A., Vale Fertilizer Netherlands B.V. and The Mosaic Company, incorporated by reference to Exhibit 2.1 to Mosaic's current report on Form 8-K dated December 19, 2016 (File No. 001-32327)
- 12.1 Certification of Chief Executive Officer of Vale pursuant to Rules 13a-14 and 15d-14 under the Securities Exchange Act of 1934
- 12.2 Certification of Chief Financial Officer of Vale pursuant to Rules 13a-14 and 15d-14 under the Securities Exchange Act of 1934
- 13.1 Certification of Chief Executive Officer and Chief Financial Officer of Vale, pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
- 15.1 Consent of KPMG Auditores Independentes

The amount of long-term debt securities of Vale or its subsidiaries authorized under any individual outstanding agreement does not exceed 10% of Vale's total assets on a consolidated basis. Vale hereby agrees to furnish the SEC, upon its request, a copy of any instruments defining the rights of holders of its long-term debt or of its subsidiaries for which consolidated or unconsolidated financial statements are required to be filed.

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Alumina	Aluminum oxide. It is the main component of bauxite, and extracted from bauxite ore in a chemical refining process. It is the principal raw material in the electro-chemical process from which aluminum is produced.
Aluminum	A white metal that is obtained in the electro-chemical process of reducing aluminum oxide.
Ammonium nitrate	Primarily the ammonium salt of nitric acid and contains no less than 33% nitrogen by weight. Predominantly used in agriculture as a high-nitrogen fertilizer. The compound is used as a component of explosives in mining and is the main component of ANFO, a popular explosive.
Austenitic stainless steel	Steel that contains a significant amount of chromium and sufficient nickel to stabilize the austenite microstructure, giving to the steel good formability and ductility and improving its high temperature resistance. They are used in a wide variety of applications, ranging from consumer products to industrial process equipment, as well as for power generation and transportation equipment, kitchen appliances and many other applications where strength, corrosion and high temperature resistance are required.
A\$	The Australian dollar.
Bauxite	A rock composed primarily of hydrated aluminum oxides. It is the principal ore of alumina, the raw material from which aluminum is made.
Beneficiation	A variety of processes whereby extracted ore from mining is reduced to particles that can be separated into ore-mineral and waste, the former suitable for further processing or direct use.
CAD	The Canadian dollar.
CFR	Cost and freight. Indicates that all costs related to the transportation of goods up to a named port of destination will be paid by the seller of the goods.
Coal	Coal is a black or brownish-black solid combustible substance formed by the decomposition of vegetable matter without access to air. The rank of coal, which includes anthracite, bituminous coal (both are called hard coal), sub-bituminous coal, and lignite, is based on fixed carbon, volatile matter, and heating value.
Cobalt	Cobalt is a hard, lustrous, silver-gray metal found in ores, and used in the preparation of magnetic, wear-resistant, and high-strength alloys (particularly for jet engines and turbines). Its compounds are also used in the production of inks, paints, catalysts and battery materials.
Coke	Coal that has been processed in a coke oven, for use as a reduction agent in blast furnaces and in foundries for the purposes of transforming iron ore into pig iron.
Coking Coal	Hard coking coal is the highest value segment of the metallurgical coal market segments (see metallurgical coal) because of its high strength factors to form a strong coke.
Concentration	Physical, chemical or biological process to increase the grade of the metal or mineral of interest.

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Copper	A reddish brown metallic element. Copper is highly conductive, both thermally and electrically. It is highly malleable and ductile and is easily rolled into sheet and drawn into wire.
Copper anode	Copper anode is a metallic product of the converting stage of smelting process that is cast into blocks and generally contains 99% copper grade, which requires further processing to produce refined copper cathodes.
Copper cathode	Copper plate with purity higher than or equal to 99.9% that is produced by an electrolytic process.
Copper concentrate	Material produced by concentration of copper minerals contained in the copper ore. It is the raw material used in smelters to produce copper metal.
CVM	The <i>Comissão de Valores Mobiliários</i> (Brazilian Securities and Exchange Commission).
DWT	Deadweight ton. The measurement unit of a vessel's capacity for cargo, fuel oil, stores and crew, measured in metric tons of 1,000 kg. A vessel's total deadweight is the total weight the vessel can carry when loaded to a particular load line.
Electrowon copper cathode	Refined copper cathode is a metallic product produced by an electrochemical process in which copper is recovered from an electrolyte and plated onto an electrode. Electrowon copper cathodes generally contain 99.99% copper grade.
Ferroalloys	Manganese ferroalloys are alloys of iron that contain one or more other chemical elements. These alloys are used to add these other elements into molten metal, usually in steelmaking. The principal ferroalloys are those of manganese, silicon and chromium.
FOB	Free on board. It indicates that the purchaser pays for shipping, insurance and all the other costs associated with transportation of the goods to their destination.
Gold	A precious metal sometimes found free in nature, but usually found in conjunction with silver, quartz, calcite, lead, tellurium, zinc or copper. It is the most malleable and ductile metal, a good conductor of heat and electricity and unaffected by air and most reagents.
Grade	The proportion of metal or mineral present in ore or any other host material.
Hard metallurgical coal	Coal used in the production of steel, comprising multiple segments, including hard coking coal (see hard coking coal), semi-hard coking coal, semi-soft coking coal, all used to produce coke to feed a blast furnace; and, PCI (pulverized coal injection) coal used for direct injection fuel source into the blast furnace (see PCI).
Hematite Ore	Hematite is an iron oxide mineral, but also denotes the high-grade iron ore type within the iron deposits.
Iron ore pellets	Agglomerated ultra-fine iron ore particles of a size and quality suitable for particular iron making processes. Our iron ore pellets range in size from 8 mm to 18 mm.
Itabirite ore	Itabirite is a banded iron formation and denotes the low-grade iron ore type within the iron deposits.

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Lump ore	Iron ore or manganese ore with the coarsest particle size in the range of 6.35 mm to 50 mm in diameter, but varying slightly between different mines and ores.
Manganese ore	A hard brittle metallic element found primarily in the minerals pyrolusite, hausmannite and manganite. Manganese ore is essential to the production of virtually all steels and is important in the production of cast iron.
Metallurgical coal	Coal used in the production of steel, comprising multiple segments, including hard coking coal (see hard coking coal), semi-hard coking coal, semi-soft coking coal, all used to produce coke to feed a blast furnace; and, PCI (pulverized coal injection) coal used for direct injection fuel source into the blast furnace (see PCI). A bituminous hard coal with a quality that allows the production of coke. Normally used in coke ovens for metallurgical purposes.
Mineral deposit(s)	A mineralized body that has been intersected by a sufficient number of closely spaced drill holes and/or underground/surface samples to support sufficient tonnage and grade of metal(s) or mineral(s) of interest to warrant further exploration-development work.
Mineral resource	A concentration or occurrence of minerals of economic interest in such form and quantity that could justify an eventual economic extraction. The location, quantity, grade, geological characteristics and continuity of a mineral resource are known, estimated or interpreted from specific geological evidence through drill holes, trenches and/or outcrops. Mineral resources are sub-divided, in order of increasing geological confidence, into Inferred, Indicated and Measured Resources.
Mt	Million metric tons
Mtpy	Million metric tons per year.
Nickel	A silvery white metal that takes on a high polish. It is hard, malleable, ductile, somewhat ferromagnetic, and a fair conductor of heat and electricity. It belongs to the iron-cobalt group of metals and is chiefly valuable for the alloys it forms, such as stainless steel and other corrosion-resistant alloys.
Nickel laterite	Deposits are formed by intensive weathering of olivine-rich ultramafic rocks such as dunite, peridotite and komatite.
Nickel matte	An intermediate smelter product that must be further refined to obtain pure metal.
Nickel pig iron	A low-grade nickel product, made from lateritic ores, suitable primarily for use in stainless steel production. Nickel pig iron typically has a nickel grade of 1.5-6% produced from blast furnaces. Nickel pig iron can also contain chrome, manganese, and impurities such as phosphorus, sulfur and carbon. Low grade ferro-nickel (FeNi) produced in China through electric furnaces is often also referred to as nickel pig iron.
Nickel sulfide	Formed through magmatic processes where nickel combines with sulfur to form a sulfide phase. Pentlandite is the most common nickel sulfide ore mineral mined and often occurs with chalcopyrite, a common copper sulfide mineral.

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Nitric acid	Nitric acid is manufactured from ammonia and is a key chemical in the manufacture of fertilizers. The acid from the absorption towers typically contains 53-61% nitric acid by mass. Uses for diluted nitric acid other than fertilizer production include metallurgy, cleaning (in food industries) and nylon for the textile industry.
Ntk	Net ton (the weight of the goods being transported excluding the weight of the wagon) kilometer.
Open-pit mining	Method of extracting rock or minerals from the earth by their removal from an open pit. Open-pit mines for extraction of ore are used when deposits of commercially useful minerals or rock are found near the surface; that is, where the overburden (surface material covering the valuable deposit) is relatively thin or the material of interest is structurally unsuitable for underground mining.
Oxides	Compounds of oxygen with another element. For example, magnetite is an oxide mineral formed by the chemical union of iron with oxygen.
Palladium	A silver-white metal that is ductile and malleable, used primarily in automobile-emissions control devices, and electrical applications.
PCI	Pulverized coal injection. Type of coal with specific properties ideal for direct injection via the tuyeres of blast furnaces. This type of coal does not require any processing or coke making, and can be directly injected into the blast furnaces, replacing lump cokes to be charged from the top of the blast furnaces.
Pelletizing	Iron ore pelletizing is a process of agglomeration of ultra-fines produced in iron ore exploitation and concentration steps. The three basic stages of the process are: (i) ore preparation (to get the correct fineness); (ii) mixing and balling (additive mixing and ball formation); and (iii) firing (to get ceramic bonding and strength).
PGMs	Platinum group metals. Consist of platinum, palladium, rhodium, ruthenium, osmium and iridium.
Phosphate	A phosphorous compound, which occurs in natural ores and is used as a raw material for primary production of fertilizer nutrients, animal feeds and detergents.
Pig iron	Product of smelting iron ore usually with coke and limestone in a blast furnace.
Platinum	A dense, precious, grey-white transition metal that is ductile and malleable and occurs in some nickel and copper ores. Platinum is resistant to corrosion and is used primarily in jewelry, and automobile-emissions control devices.
Potash	A potassium chloride compound, chiefly KCl, used as simple fertilizer and in the production of mixture fertilizer.
Precious metals	Metals valued for their color, malleability, and rarity, with a high economic value driven not only by their practical industrial use, but also by their role as investments. The widely-traded precious metals are gold, silver, platinum and palladium.
Primary nickel	Nickel produced directly from mineral ores.

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Probable (indicated) reserves	Reserves for which quantity and grade and/or quality are computed from information similar to that used for proven (measured) reserves, but the sites for inspection, sampling and measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for proven (measured) reserves, is high enough to assume continuity between points of observation.
Proven (measured) reserves	Reserves for which (a) quantity is computed from dimensions revealed in outcrops, trenches, working or drill holes; grade and/or quality are computed from the results of detailed sampling and (b) the sites for inspection, sampling and measurement are spaced so closely and the geologic character is so well defined that size, shape, depth and mineral content of reserves are well-established.
<i>Real, reais</i> or R\$	The official currency of Brazil is the <i>real</i> (singular) (plural: <i>reais</i>).
Reserves (ore/mineral)	The part of a mineral deposit that could be economically and legally extracted or produced at the time of the reserve determination.
ROM	Run-of-mine. Ore in its natural (unprocessed) state, as mined, without having been crushed.
Secondary or scrap nickel	Stainless steel or other nickel-containing scrap.
Seaborne market	Comprises the total ore trade between countries using ocean bulk vessels.
Silver	A ductile and malleable metal used in photography, coins and medal fabrication, and in industrial applications.
Sinter feed (also known as fines)	Iron ore fines with particles in the range of 0.15 mm to 6.35 mm in diameter. Suitable for sintering.
Sintering	The agglomeration of sinter feed, binder and other materials, into a coherent mass by heating without melting, to be used as metallic charge into a blast furnace.
Slabs	The most common type of semi-finished steel. Traditional slabs measure 10 inches thick and 30-85 inches wide (and average 20 feet long), while the output of the recently developed "thin slab" casters is two inches thick. Subsequent to casting, slabs are sent to the hot-strip mill to be rolled into coiled sheet and plate products.
Stainless steel	Alloy steel containing at least 10% chromium and with superior corrosion resistance. It may also contain other elements such as nickel, manganese, niobium, titanium, molybdenum, copper, in order to improve mechanical, thermal properties and service life. It is primarily classified as austenitic (200 and 300 series), ferritic (400 series), martensitic, duplex or precipitation hardening grades.
Thermal coal	A type of coal that is suitable for energy generation in thermal power stations, cement plants and other coal fired ovens/kilns in general industry.
Tpy	Metric tons per year.
Troy ounce	One troy ounce equals 31.103 grams.
Underground mining	Mineral exploitation in which extraction is carried out beneath the earth's surface.
U.S. dollars or US\$	The United States dollar.

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SIGNATURES

The registrant hereby certifies that it meets all of the requirements for filing on Form 20-F and that it has duly caused and authorized the undersigned to sign this annual report on its behalf.

VALE S.A.

By: /s/ MURILO PINTO DE OLIVEIRA FERREIRA

Name: Murilo Pinto de Oliveira Ferreira
Title: Chief Executive Officer

By: /s/ LUCIANO SIANI PIRES

Name: Luciano Siani Pires
Title: Chief Financial Officer

Date: April 10, 2017

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Vale S.A. Financial Statements

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Report of Independent Registered Public Accounting Firm

The Board of Directors and Stockholders of Vale S.A.
Rio de Janeiro RJ

We have audited the accompanying consolidated statements of financial position of Vale S.A. and subsidiaries ("Vale" or "the Company") as of December 31, 2016 and 2015, and the related consolidated statements of income, comprehensive income, changes in equity and cash flows for each of the years in the three-year period ended December 31, 2016. We also have audited Vale's internal control over financial reporting as of December 31, 2016, based on criteria established in *Internal Control Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Vale's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on these consolidated financial statements and an opinion on Vale's internal control over financial reporting based on our audits.

We conducted our audits in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement and whether effective internal control over financial reporting was maintained in all material respects. Our audits of the consolidated financial statements included examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provides a reasonable basis for our opinions.

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A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of Vale S.A. and subsidiaries as of December 31, 2016 and 2015, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2016, in conformity with International Financial Reporting Standards as issued by the International Accounting Standards Board. Also in our opinion, Vale maintained, in all material respects, effective internal control over financial reporting as of December 31, 2016, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

/s/ KPMG Auditores Independentes

KPMG Auditores Independentes
Rio de Janeiro, Brazil
February 22, 2017

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Management's Report on Internal Control over Financial Reporting

The management of Vale S.A (Vale) is responsible for establishing and maintaining adequate internal control over financial reporting.

The Vale's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. The company's internal control over financial reporting includes those policies and procedures that: (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of the effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, and that the degree of compliance with the policies or procedures may deteriorate.

Vale's management has assessed the effectiveness of the company's internal control over financial reporting as of December 31, 2016 based on the criteria established in Internal Control Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Based on such assessment and criteria, Vale's management has concluded that the company's internal control over financial reporting are effective as of December 31, 2016.

The effectiveness of the company's internal control over financial reporting as of December 31, 2016 has been audited by KPMG Auditores Independentes, an independent registered public accounting firm, as stated in their report which appears herein.

February 22nd, 2017

/s/ Murilo Ferreira

Murilo Ferreira
Chief Executive Officer

/s/ Luciano Siani

Luciano Siani
Chief Financial Officer and Investors Relations

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Consolidated Income Statement
In millions of United States dollars, except earnings per share data

	Year ended December 31			
	Notes	2016	2015	2014
Continuing operations				
Net operating revenue	3(d)	27,488	23,384	35,124
Cost of goods sold and services rendered	5(a)	(17,650)	(18,751)	(22,790)
Gross profit		9,838	4,633	12,334
Operating expenses				
Selling and administrative expenses	5(b)	(507)	(612)	(1,036)
Research and evaluation expenses		(319)	(395)	(662)
Pre operating and operational stoppage		(453)	(942)	(975)
Other operating expenses, net	5(c)	(267)	(207)	(1,023)
		(1,546)	(2,156)	(3,696)
Impairment of non-current assets and onerous contracts	19	(1,174)	(8,769)	(99)
Results on measurement or sale of non-current assets	14	(66)	61	(167)
Operating income (loss)		7,052	(6,231)	8,372
Financial income	6	7,968	7,792	3,704
Financial expenses	6	(6,125)	(18,446)	(9,722)
Equity results in associates and joint ventures	15	309	(445)	501
Impairment and other results in associates and joint ventures	15, 19 and 21	(1,220)	(349)	(61)
Net income (loss) before income taxes		7,984	(17,679)	2,794
Income taxes				
Current tax	8	(943)	(332)	(1,060)
Deferred tax		(1,838)	5,581	(543)
		(2,781)	5,249	(1,603)
Net income (loss) from continuing operations		5,203	(12,430)	1,191
Loss attributable to noncontrolling interests		(8)	(501)	(308)
Net income (loss) from continuing operations attributable to Vale's stockholders		5,211	(11,929)	1,499
Discontinued operations				
Loss from discontinued operations	14	(1,227)	(190)	(838)
Income attributable to noncontrolling interests		2	10	4
Loss from discontinued operations attributable to Vale's stockholders		(1,229)	(200)	(842)
Net income (loss)		3,976	(12,620)	353
Loss attributable to noncontrolling interests		(6)	(491)	(304)
Net income (loss) attributable to Vale's stockholders		3,982	(12,129)	657

Earnings (loss) per share attributable to Vale's stockholders:

Basic and diluted earnings (loss) per share:	9			
Preferred share (US\$)	0.77	(2.35)	0.13	
Common share (US\$)	0.77	(2.35)	0.13	

The accompanying notes are an integral part of these financial statements.

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Consolidated Statement of Comprehensive Income
In millions of United States dollars

	Year ended December 31		
	2016	2015	2014
Net income (loss)	3,976	(12,620)	353
Other comprehensive income (loss):			
Items that will not be reclassified subsequently to the income statement			
Cumulative translation adjustments	6,460	(18,128)	(7,436)
Retirement benefit obligations			
Gross balance for the year	(112)	66	(279)
Effect of taxes	42	3	85
Equity results in associates and joint ventures, net of taxes			2
	(70)	69	(192)
Total items that will not be reclassified subsequently to the income statement	6,390	(18,059)	(7,628)
Items that may be reclassified subsequently to the income statement			
Cumulative translation adjustments			
Gross balance for the year	(3,603)	9,340	3,407
Effect of taxes	(74)	904	
Transfer of realized results to net income	(75)		
	(3,752)	10,244	3,407
Available-for-sale financial instruments			
Gross balance for the year	1	1	(4)
Transfer of realized results to net income, net of taxes			4
	1	1	
Cash flow hedge			
Gross balance for the year	6	828	(290)
Effect of taxes	(1)	(7)	(3)
Equity results in associates and joint ventures, net of taxes	5	(5)	(1)
Transfer of realized results to net income, net of taxes	(3)	(369)	(122)
	7	447	(416)
Total of items that may be reclassified subsequently to the income statement	(3,744)	10,692	2,991
Total comprehensive income (loss)	6,622	(19,987)	(4,284)
Comprehensive income (loss) attributable to noncontrolling interests	111	(543)	(330)
Comprehensive income (loss) attributable to Vale's stockholders	6,511	(19,444)	(3,954)

The accompanying notes are an integral part of these financial statements.

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Consolidated Statement of Cash Flows
In millions of United States dollars

	Year ended December 31		
	2016	2015	2014
Cash flow from operating activities:			
Net income (loss) before income taxes from continuing operations	7,984	(17,679)	2,794
Continuing operations adjustments for:			
Equity results in associates and joint ventures	(309)	445	(501)
Results on measurement or sale of non-current assets	(84)	(213)	258
Impairment and others results in associates and joint ventures	1,220	349	61
Impairment of non-current assets and onerous contracts	1,174	8,769	99
Depreciation, amortization and depletion	3,487	3,719	3,869
Financial results, net	(1,843)	10,654	6,018
Changes in assets and liabilities:			
Accounts receivable	(2,744)	1,671	2,567
Inventories	288	(217)	(467)
Suppliers and contractors	243	658	1,014
Payroll and related charges	133	(578)	(106)
Other taxes assets and liabilities, net	(109)	(222)	(252)
Deferred revenue Gold stream (note 7)	524	532	
Other assets and liabilities, net	591	(304)	256
Cash provided from operations	10,555	7,584	15,610
Interest on loans and borrowings paid	(1,663)	(1,457)	(1,539)
Derivatives received (paid), net (note 25)	(1,602)	(1,202)	(179)
Interest on participative stockholders' debentures paid	(84)	(65)	(112)
Income taxes	(388)	(544)	(491)
Income taxes Settlement program	(417)	(384)	(494)
Net cash provided by operating activities from continuing operations	6,401	3,932	12,795
Net cash provided by operating activities from discontinued operations	180	559	309
Net cash provided by operating activities	6,581	4,491	13,104
Cash flow from investing activities continuing:			
Financial investments redeemed (invested)	12	308	