Vale S.A.
Form 20-F
April 18, 2019

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Vale S.A. Financial Statements

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As filed with the Securities and Exchange Commission on April 18, 2019

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, 2018
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 3485 5000

Praia de Botafogo 186 offices 701 1901 Botafogo
22250-145 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	Name of Each Exchange on Which Registered
Common shares of Vale, no par value per share	New York Stock Exchange*
American Depositary Shares (evidenced by American Depositary Receipts), each representing one common share of Vale	New York Stock Exchange
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, 2018 was:

5,126,258,410 common 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 þ No o

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 o No þ

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 þ No o

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted 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 such files).

Yes þ No o

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer þ Accelerated filer o Non-accelerated filer o
Emerging growth company o

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

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

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.

Item 17 o Item 18 o

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 o No þ

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I. OVERVIEW

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 presently engaged in greenfield mineral exploration in five countries. 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 distribution center to support the delivery of iron ore worldwide. Directly and through affiliates and joint ventures, we also have investments in energy and steel businesses.

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 "ADSs" or "American Depositary Shares" are to our common American Depositary Shares (our "common ADSs"), each of which represents one common share of Vale. American Depositary Shares are represented by American Depositary Receipts ("ADRs") issued by the depositary.

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 Praia de Botafogo 186 offices 701-1901 Botafogo, 22250-145 Rio de Janeiro, RJ, Brazil, and its telephone number is 55-21-3485-5000.

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 "€" are to Euros.

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BUSINESS OVERVIEW

FAILURE OF THE TAILINGS DAM AT THE CÓRREGO DO FEIJÃO MINE

On January 25, 2019, a tailings dam ("Dam I") failed at our Córrego do Feijão mine, in the city of Brumadinho, state of Minas Gerais. The failure released a flow of tailings debris, which affected our administrative area at the Córrego do Feijão mine and parts of the communities of Córrego do Feijão and Parque da Cachoeira outside of Brumadinho, reaching the nearby Paraopeba River. The dam failure resulted in nearly 300 fatalities or presumed fatalities, and also caused extensive property and environmental damage in the region. Our priority now is to provide support to those affected by the dam failure.

The causes of the accident are still uncertain and are being investigated by us and by several governmental authorities. We are providing our full cooperation to the authorities and to the investigations into the dam failure.

Dam I

The Córrego do Feijão mine is part of the Paraopeba complex, in the Southern System. Dam I was first built in 1976 by Ferteco Mineração, a company we acquired in 2001. Dam I received disposed tailings from the Córrego do Feijão and Jangada mines from 1976 until it became inactive in 2016. Dam I contained approximately 11.7 million cubic meters of iron ore tailings.

The dam was raised by building successive layers (lifts) above the tailings accumulated in the reservoir, a technique known as the "upstream" method. There are two other raising methods, the "downstream" method and the "centerline" method, in which the dam is raised by placing new layers away from the initial dam or on top of it, as opposed to over the accumulated tailings. Each of these methods presents a different risk profile.

Dam VI, another dam located at the Córrego do Feijão mine, was impacted by the tailings debris flow from the failure of Dam I. Due to the ongoing investigation into potential damages from the impact of the tailings debris, it has not received the certification of stability (Stability Condition Statement, or "DCE") required by the rules of the national mining agency, the ANM (*Agência Nacional de Mineração*). Dam VI is being continuously monitored.

The Jangada mine, also located in the Paraopeba complex, was not affected by the tailings debris flow, but its operations were suspended because of the closure of Feijão processing plant, which processed the run-of-mine of the Jangada mine.

Vale's response

Our senior management has been focused on emergency and long-term initiatives, with three main purposes: (i) providing assistance to victims and remediation of the affected area, (ii) determining the causes of the failure of Dam I, and (iii) preventing further accidents through improved standards and accelerated decommissioning of upstream dams.

(i) Assistance and remediation efforts

Immediately following the failure of Dam I, we contacted the local authorities and activated our Emergency Mining Dam Response Plan (*Plano de Ação de Emergência de Barragens de Mineração* (PAEBM)) to rescue and provide immediate humanitarian assistance to affected parties, including employees and members of the community. We also mobilized our teams to monitor the Paraopeba River basin, rescue wildlife and domestic animals and support sanitation measures. We mobilized over 400

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doctors, nurses, psychologists, social workers and volunteers to set up assistance centers for those affected. These assistance centers provided humanitarian aid, including medical, psychological and social assistance, distributed basic emergency items, including pharmaceuticals, food, potable water and clothing, and provided duplicate records (such as identification cards, marriage certificates, and birth certificates) to those who lost their homes. We also provided 40 ambulances, a support helicopter, shopping vouchers for clothing, accommodation and transportation for over 800 people.

On January 31, 2019, we presented an emergency plan to the Minas Gerais Public Prosecutor's Office, and to the state and federal environmental agencies, including containment, retention, remediation and recovery actions. The plan contemplates removing debris, installing hydraulic barriers and small dams to assist in the tailings control process, establishing water treatment stations, restoring roads and installing membrane barriers downstream to contain ultrafine sediments and protect the water system on the Paraopeba River basin.

On February 6, 2019, we entered into an agreement with various governmental authorities undertaking to gradually replace our professionals who had been providing assistance to the populations affected since the dam failure, with a team to join the health and social service teams of the city of Brumadinho. We will bear for at least six months the costs of employing 142 professionals, including doctors, nurses, psychologists, physical therapists, occupational therapists, social workers and endemic disease control agents, in addition to administrative and operational professionals, as well as logistics costs incurred by these teams.

We have donated resources to the Municipality of Brumadinho, the fire department of Minas Gerais and other entities that provided assistance to the affected parties. For those affected by the dam failure, we established a three-tiered financial assistance program, under which, we have made donations to more than 440 people. We are also providing funeral assistance and contributing to funeral expenses for each affected family. These donations are without prejudice to any right that any person affected by the dam failure may have to claim damages against us.

(ii) Determination of the causes for the failure of the dam

We are investigating the causes of the failure of Dam I. We engaged a legal advisor and technical experts to conduct an investigation into the causes of the failure of the dam. In addition, our Board of Directors established the Independent Ad Hoc Consulting Committee for Investigation (CIAEA), an independent committee to investigate and advise the Board of Directors in connection with the determination of the causes of the dam failure.

(iii) Prevention of further accidents and accelerated decommissioning of upstream dams

On January 29, 2019, we decided to accelerate our existing plan to decommission our tailings dams built using the upstream method. "Decommissioning" or "decharacterization" means reintegrating the dam and its contents into the local environment, so that the structure is effectively no longer a dam. We will determine the appropriate actions to decommission each dam safely, in accordance with the geotechnical and geographic conditions of each dam. For certain of our upstream dams, we will first convert the dam into a downstream or centerline dam and conclude the decommissioning subsequently. Some of our existing downstream or centerline dams contain smaller dikes or structures that were built using the upstream technique, and we are also planning to remove these upstream dikes or structures. At this point, we cannot predict the costs and timing for decommissioning our upstream tailings dams.

We have been taking steps to decommission upstream dams since late 2015, in response to the failure of Samarco's Fundão dam. In February 2019, we announced our plan to accelerate this process and our

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decision to temporarily suspend our operations at mines and concentration plants located in areas where upstream dams are located. Also, based on our initial assessments, we determined that certain dams would not meet the requirements of new safety requirements imposed by ANM, and evacuated certain areas and relocated the population located within the Self-Rescue Zone of these dams. We expect to resume production at these mines and concentration plants in the future.

Independent Committees

Our Board of Directors has created three independent ad hoc advisory committees to support the Board in matters relating to the dam failure. All of these committees are composed of external and independent members appointed by our Board of Directors. These committees are described below.

Independent Ad Hoc Consulting Committee for Investigation (CIAEA): established to conduct an independent investigation into the causes of the dam failure and to advise our Board of Directors in connection with these matters. The committee is chaired by Dr. Ellen Gracie, former Justice of the Brazilian Supreme Court, and also includes Manuel Martins and Jose Francisco Compagno.

Independent Ad Hoc Consulting Committee for Support and Recovery (CIAEAR): established to monitor our measures to support the affected community and to remediate the impacted area, and our provision of resources for this purpose, and to recommend measures to our Board of Directors in connection with these matters. The committee is chaired by Leonardo Pereira, former chair of the Brazilian Securities Commission, and also includes Ana Cristina Barros and Márcio Gagliato.

Independent Ad Hoc Consulting Committee for Dam Safety (CIAESB): established to monitor safety initiatives, risk management and risk mitigation efforts related to our tailings dams and recommending measures to strengthen safety at these dams. This committee is chaired by Flávio Miguez de Mello, and also includes Willy Lacerda and Pedro Repetto.

Impacts of the failure of Dam I on Vale

The impacts of the dam failure on our operations and results of operations will be very significant, but their full scale and scope remains uncertain. Some of major impacts are described below.

(i) Freeze orders

Various Brazilian courts have ordered freezes, attachments, deposits and similar measures affecting an aggregate of R$17.6 billion (US$4.5 billion) of our financial assets, including balances in our bank accounts and judicial deposits to secure the payment of damages resulting from the dam failure. This total amount also includes common shares that we hold in treasury and that have been attached. We are also subject to a number of other proceedings and investigations related to the dam failure, which may result in additional attachment of assets and seizure of balances in our bank accounts.

(ii) Liabilities and legal proceedings

Our potential legal liabilities resulting from the dam failure are significant, and we cannot estimate the total amount at this time. We are already the subject of several investigations and legal proceedings relating to the failure of Dam I, and we expect to face other investigations and proceedings. For additional information regarding the legal proceedings relating to the failure of Dam I, see *Additional Information Legal proceedings*. We will continue to cooperate fully with the authorities and to support the investigations into the dam failure. We will also contest any actions that we believe are unjustified.

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The proceedings are all in very early stages, and we cannot reasonably estimate the size of potential losses or settlements or the timing for decisions. We estimate that we will recognize provisions in our financial statements for the first quarter of 2019 in the amount of R$850 million (US$220 million) in connection with an ongoing public civil action brought by labor prosecutors and provisions ranging from R$1.0 billion to R$2.0 billion (US$260 million to US$520 million) in connection with our preliminary agreement with the State of Minas Gerais and other authorities. Our potential liabilities resulting from the dam failure are significant, and additional provisions are expected.

(iii) Suspension of operations

Following the dam failure, we have suspended various operations, either voluntarily or as a result of revocation of licenses or court orders. As of April 15, 2019, the estimated impact of the suspension of operations following the dam failure on our production is 92.8 million metric tons per year (including the estimated annual impact of the suspension of the Brucutu mine). Additional operations may be suspended as a result of new laws and regulations relating to the use of dams, or our inability to obtain the required licenses or the stability reports required by applicable regulations, as discussed below.

Below is a summary of operations suspended since the date of the dam failure.

Southern System: Immediately after the dam failure, we suspended our operations at the Córrego do Feijão site, including the Jangada mine, pursuant to an order of the environmental authority of the State of Minas Gerais (SEMAD). Also, to permit the acceleration of our decommissioning plan for upstream dams, and following a determination of the ANM, we temporarily suspended operations at the entire Vargem Grande and Fábrica complexes and at the Vargem Grande and Fábrica pelletizing plants on February 20, 2019. The estimated impact of the suspension of these operations is a reduction of approximately 40 million metric tons of iron ore production per year, including the pellet feed needed for the production of 11 million metric tons of pellets per year.

Southeastern System: Our operations at the Timbopeba mine and Alegria mine are currently suspended. Our operations at the Brucutu mine have been suspended since February 4, 2019, but on April 15, 2019, the court of appeals of the State of Minas Gerais partially reversed the last injunction that prevented us from operating the Brucutu mine. We expect to resume operations at Brucutu soon, but the proceedings challenging our right to use the dams supporting our operations at Brucutu are still ongoing. The estimated impact of the suspension of these operations is a reduction of approximately 30 million metric tons of iron ore production per year for the Brucutu mine, 12.8 million metric tons of iron ore production per year for the Timbopeba mine and 10 million metric tons of iron ore production per year for the Alegria mine.

(iv) New regulations

Various governmental authorities have approved or proposed new regulations relating to licensing, use and operations of dams in response to the Dam I failure. Additional rules imposing restrictions on mining operations and ancillary activities are expected. Also, new taxes, contributions or other obligations may be imposed on us as a result of the failure of Dam I or its direct or indirect impacts. These rules may affect not only our iron ore operations, but also our base metals operations in Brazil and other operations that rely on dams.

Minas Gerais state law on licensing of dams. A new statute approved by the state of Minas Gerais in February 2019 prohibits the increase, modification or construction of any upstream dam, and provides for the full decommissioning of any upstream tailings dam by February

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2022. The statute also prohibits the increase, modification or construction of any dam if communities are established within its Self-Rescue Zone (*Zona de Autossalvamento* or "ZAS"), an area which encompasses the portion of the valley downstream of the dam where timely evacuation and intervention by the competent authorities in emergency situations is not possible. Although this statute permits the construction of new dams and the use of existing dams built using other techniques, it imposes significant restrictions on them as well. As a result, we may not be able to rely on tailings dams for new projects and expansion of existing operations.

ANM rules. In February 2019, the ANM, Brazil's national mining agency, issued a resolution on dam safety requiring companies that own upstream tailings dams to submit a technical decommissioning project by August 2019 and to fully decommission any inactive upstream tailings dam by August 2021, and any active upstream tailings dam by August 2023. In addition, the resolution requires the decommissioning of our facilities located within the Self-Rescue Zone of a tailings dam. This new resolution, which imposes more stringent safety requirements, is already in effect, but is under public consultation for potential adjustments until May 1, 2019. We are reviewing the impact of this resolution on our operations.

As a result of new regulations, the licensing process for our operations may become longer and more uncertain, and our costs of monitoring and compliance are expected to increase. These additional laws and regulations may impose restrictions on our operations, require additional investments or eventually require us to suspend additional operations.

We will need to rely on alternative methods to continue operating certain of our mines and plants, particularly those that rely on tailings dams. We have studies in progress, and we have developed a pilot project, to apply a waste disposal technology that consists of filtering and stacking of partially or totally dewatered tailings, which will reduce our reliance on tailings dams in the medium and long term. These alternative technologies will cause an increase in our production costs and require additional investments in our mines and plants.

(v) Impact on reserves

As a result of the dam failure and our decision to accelerate the decommissioning of our upstream tailings dams, we are not in a position to report reserves for the Feijão, Jangada and Capim Branco mines (in the Paraopeba complex).

We are reviewing the impact on our reported reserves of the ongoing investigations and legal proceedings involving the use of dams in our mining operations and of the new rules relating to licensing, use and operations of dams, which were adopted in response to the Dam I failure. These proceedings and regulations may impact our iron ore reserves and reserves for other products for which the production process involves dams. Because alternative methods are available, particularly the dry stockpiling and dry processing technologies, we currently believe that our iron ore reserves will not be materially impacted by these new rules, but we have not concluded our analysis.

(vi) Uncertainties arising from increased safety requirements and external expert certification

Brazilian state and federal authorities are strengthening regulations on dam safety. Many regulations applicable to our mines require us to obtain independent reports and certificates from external experts on the safety and stability of our dams. External experts may be unwilling to provide these reports and certificates as a result of the uncertainties regarding the causes of the Dam I failure, the increasing risk of liability and uncertainties about interpretation of new regulations. If any of our dams is unable to comply

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with safety requirements, we may need to evacuate the area surrounding this dam, relocate communities and take other emergency actions.

On February 8, 2019, we started emergency actions after an external consultant revoked a stability report relating to the Sul Superior dam at our Gongo Soco mine (in the Minas Centrais complex in the Southeastern System), in Barão de Cocais, Minas Gerais. As a result, we relocated about 500 residents of the Socorro, Tabuleiro and Piteiras neighborhoods of Barão de Cocais in the downstream area of the Sul Superior tailings dam. The Sul Superior dam has been inactive since April 2016, when we suspended iron ore production at the Gongo Soco mine. As an additional safety measure, we intensified inspections of the Sul Superior dam, installed new monitoring equipment and engaged additional consultants to perform a new safety assessment.

On February 16, 2019, the Emergency Action Plan for Mining Dams (PAEBM) for the B3/B4 dam at the Mar Azul mine, in the city of Nova Lima, Minas Gerais, triggered a preventive measure after data from analysis reports from specialized advisory firms indicated increased risk. As a result, we relocated about 200 people from the Macacos neighborhood in the downstream area of the B3/B4 tailings dam, which has been inactive.

On March 20, 2019, we temporarily suspended our operations at the Alegria mine, in the Mariana complex, because the results from a preliminary analysis of the stability of its structures under stress conditions were inconclusive.

On March 31, 2019, following an auditing process, external auditors renewed the certification of stability (Stability Condition Statements, or DCE) for 80 of our operational structures. We were not able to renew the DCE for 18 other operational structures, and, as a result, we suspended our activities in these structures.

(vii) Impacts on our financial performance and results of operations

We expect the failure of Dam I, and the consequences summarized above, to have extensive impact on our financial performance and results of operations. We have not yet determined the nature and amount of all the consequences. See *Operating and financial review and prospects Impact of the failure of Dam I at the Córrego do Feijão Mine.* These will include:

Reduced revenues, and increased costs and expenses, due to the suspension of operations.

Increased expenditures for assistance and remediation.

Impairments of fixed assets, which may result in the write-down and write-off of assets.

Provisions for costs of decommissioning and further remediation.

Provisions for legal proceedings.

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We may also need to incur additional debt to pay for assistance and remediation actions.

Temporary leave of executive officers

On March 1, 2019, our Board of Directors received a formal recommendation from the federal and state (Minas Gerais) public prosecution offices, the federal police and the civil police of Minas Gerais that we suspend certain of our employees and executive officers. In response to this recommendation, our CEO, Fabio Schvartsman, and our executive officer for Ferrous Minerals and Coal, Gerd Peter Poppinga, requested temporary leave from their positions. Our Board of Directors approved these requests on March 2, 2019, and appointed Eduardo de Salles Bartolomeo as interim chief executive officer and Claudio de Oliveira Alves as interim executive officer for Ferrous Minerals and Coal. Mark James Travers has been appointed executive officer for Base Metals, subject to obtaining the requisite visa and relocating to Brazil, as required under Brazilian law.

OPERATIONAL SUMMARY

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

	Year ended December 31,					
	2016		2017		2018	
	(US$ million)	(% of total)	(US$ million)	(% of total)	(US$ million)	(% of total)
Ferrous minerals:						
Iron ore	15,784	57.4%	18,524	54.5%	20,354	55.7%
Pellets	3,827	13.9	5,653	16.7	6,651	18.2
Ferroalloys and manganese	302	1.1	469	1.4	454	1.2
Other ferrous products and services	438	1.6	483	1.4	474	1.3
Subtotal	20,351	74.0	25,129	74.0	27,933	76.4
Coal	839	3.1	1,567	4.6	1,643	4.5
Base metals:						
Nickel and other products(1)	4,472	16.3	4,667	13.7	4,610	12.6
Copper(2)	1,667	6.1	2,204	6.5	2,093	5.7
Subtotal	6,139	22.3	6,871	20.2	6,703	18.3
Other(3)	159	0.6	400	1.2	296	0.8
Total net operating revenues from continuing operations	27,488	100%	33,967	100%	36,575	100%

(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:

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 currently operate eleven pellet plants in Brazil (the operations of two of these plants are currently

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suspended), and two in Oman. We also have a 50% stake in Samarco Mineração S.A. ("Samarco") and 25% stakes in two pellet companies in China.

Ferroalloys and manganese. We conduct our manganese mining operations through Vale S.A. and subsidiaries in Brazil, and we produce several types of manganese ferroalloys 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 control and operate nickel refining facilities in the United Kingdom, Japan and China, and have interests in a nickel refinery in 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 matte and copper cathodes in conjunction with our nickel mining operations at Sudbury and Voisey's Bay.

Cobalt, PGMs and other precious metals. We produce cobalt as a byproduct of our nickel mining and processing operations and refine it at our Port Colborne facilities, in the Province of Ontario, Canada. We began producing 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. 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 a minority interest in a Chinese coal 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 operate 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.

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BUSINESS STRATEGY

The year of 2019 has been a very challenging year for us. We know that there is much to be done to address the effects of the failure of the tailings dam at the Córrego do Feijão mine. We are committed to remediating the damages caused to the city of Brumadinho and the surrounding communities. We will manage the liabilities arising from this deeply regretted event, and we are committed to learning and sharing the lessons from the dam failure. With this purpose, we are dedicated to:

- Keeping our people and communities safe and restoring trust from our stakeholders;
- Capital discipline;
- Maintaining our value over volume approach for the iron ore business;
- Transforming our base metals business into a significant cash generator;
- Concluding the ramp-up of our coal business; and
- Enhancing corporate governance.

Below are the highlights of our major business strategies.

Keeping our people and communities safe and restoring trust from our stakeholders

We are fully committed in addressing the effects of the failure of Dam I at the Feijão mine, with three key initiatives: (i) assistance to victims and recovery of the area affected by the rupture of the dam, (ii) determination of the causes of the dam failure, and (iii) prevention of further accidents through adoption of the highest standards and accelerated decommissioning of all upstream dams. See *Business overview Failure of the tailings dam at the Córrego do Feijão mine*. We continue making every effort to provide relief and support to those affected by the dam failure and to restore the trust of our stakeholders on us. We are committed to rebuilding our reputation in Brazil and in the global mining industry.

Capital discipline

We reiterate our strong commitment to a sound balance sheet. In 2018, we completed our deleveraging process and achieved our net debt target of US$10 billion. We will allocate capital in a disciplined way, which will be key to enable us to address the effects of Dam I failure. In January 2019, our Board of Directors approved the suspension of our shareholder remuneration policy, so that no payment of dividends or interest on shareholders' equity will be made pursuant to this policy in excess of mandatory payments required by law, and we will not approve any share buyback for the time being.

Maintaining our value over volume approach for the iron ore business

In the iron ore business, we are committed to delivering the highest possible margins under the current circumstances, by managing our extensive supply chain and flexible product portfolio to cope with production constraints in the short-term. We will constantly seek better price realization, based on adjustments to our product portfolio according to market demand and supply chain optimization. We are 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

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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 overcome the immediate challenges and achieve this goal.

With the continuous increase of the share of dry processing production, from 45% in 2014 to 60% in 2018, and aimed at 70% by 2023, our reliance on new dams and dam raisings tend to reduce. To treat the tailings from wet processing, we are investing in studies and new technologies with a view to allowing us to operate certain of our mines and plants without having to rely on the use of tailings dams. In particular, we have studies in progress, and we have developed a pilot project, to apply a waste disposal technology that consists of filtering and stacking of partially or totally dewatered tailings, which will reduce our reliance on tailings dams in the medium and long term. These alternative technologies will cause an increase in our production costs and require additional investments in our mines and plants. In line with this goal, we acquired New Steel in January 2019, bringing innovative technologies for the dry beneficiation of iron ore.

We will continue to promote the Brazilian blend fines (BRBF), a product standard with silica (SiO2) content limited to 5% and lower alumina (1.5%), offering strong performance in any kind of sintering operation. We produce BRBF by 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, but also low concentration of alumina. It is produced in our Teluk Rubiah Maritime Terminal in Malaysia and in sixteen ports in China. This process reduces the time needed 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 from the Southern and Southeastern Systems, allowing more efficient mining plans and increasing the use of dry processing methods, which in turn reduce capital expenditures, extend the life of our mines and reduce the use of water in our operations: a key flexibility to cope with the short-term challenges.

Transforming our base metals business into a significant cash generator

Our strategy for our nickel business is to complete its turnaround, continuing to review our asset utilization and optimize our operations and aiming to increase productivity and improve returns, while preserving capacity for growth based on the prospects for an electric vehicle revolution. 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 sulfide and laterite sources using advanced technology.

We have transitioned to a smaller footprint in our nickel business by calibrating investments and production to reflect current market conditions, and our nickel turnaround plan is now based on three pillars: supply chain integration, operational excellence and digital transformation. In Canada, we are optimizing the flowsheet, running a cost reduction program and improving underground mine performance at Sudbury and finalizing the ramp-up of operations at Long Harbour. In Indonesia, we are renewing truck and mine equipment, increasing efficiency of the furnaces and increasing fuel efficiency through coal conversion. In New Caledonia, we are developing a mine plan revision and a study to increase efficiency of the VNC plant. In the long term, the battery segment shows important upside potential as electric vehicle production continues to attract significant investments, which could positively affect nickel price and our nickel premiums.

A key aspect of our strategy for our copper assets in the Carajás region is to improve efficiency and asset utilization while we evaluate opportunities to increase copper production. We have plans to develop a multi-year copper expansion plan, with Salobo III being the first approved project in the pipeline.

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Concluding the ramp-up of our coal business

We have been working to increase our coal production, mainly through the ramp-up of the Moatize operations and the ramp-up of the Nacala Logistics Corridor (NLC) in Mozambique and Malawi, where we have entered into a strategic partnership with Mitsui. As we complete the ramp-up in Moatize and the NLC, we expect our costs to diminish, enhancing the competitiveness of our coal operations. Key initiatives, such as knowledge transfer from our iron ore operations, opening of new mine sections and preparation of selected mining pits for future disposals are expected to lead to higher capacity utilization, mine productivity and yields.

Enhancing corporate governance

We are committed to continuing to improve our corporate governance. Following the conversion of our class A preferred shares into common shares, in December 2017, we completed our listing on the Novo Mercado segment of the B3 exchange (formerly BM&FBovespa), the special listing segment of B3 for companies committed to the highest standards of corporate governance. In 2018, our Board of Directors revised some of our policies, including our Corporate Integrity Policy, Code of Ethical Conduct, Socio-Environmental Investment Policy, Risk Management Policy, Remuneration to Shareholders Policy and Securities Trading Policy.

In 2018, as required under Brazilian rules, we started reporting our compliance with the Code of Best Practices for Corporate Governance of the Brazilian Corporate Governance Institute (IBGC). The code is based on the "comply or explain" principle, and we currently fully comply with 80% of the practices recommended by the IBGC and partially comply with 17% of practices recommended by the code.

SIGNIFICANT CHANGES IN OUR BUSINESS

We summarize below major events related to our acquisitions, divestitures and other significant developments in our business since the beginning of 2018.

Acquisitions

Ferrous Resources. On December 6, 2018, we entered into an agreement with IEP Ferrous Brazil LLC to buy Ferrous Resources Limited, a company that owns and operates iron ore mines near our operations in Minas Gerais, for US$550 million. The transaction is expected to be concluded in 2019, subject to certain conditions precedent, including approval by antitrust authorities in Brazil.

New Steel. On December 10, 2018 we entered into an agreement with Hankoe FIP to buy New Steel Global NV (New Steel), a company that develops innovative iron ore beneficiation technologies, for US$500 million. All conditions have been fulfilled, including approval by antitrust authorities in Brazil, and we concluded the transaction on January 24, 2019. New Steel currently owns patents in 56 countries for Fines Dry Magnetic Separation (FDMS), a dry processing concentration technique.

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 2018.

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Sale of Fertilizer Business In January 2018, we completed the sale to The Mosaic Company ("Mosaic") 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). We received US$1.080 billion in cash and approximately 34.2 million shares of Mosaic's common stock, which corresponds to approximately 8.9% (on a post-issuance basis) of Mosaic's outstanding common stock. Subject to limited exceptions, the Mosaic shares issued to us cannot be transferred for two years following closing. We have the right to appoint two members of Mosaic's board of directors, one of whom must be independent, 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. We appointed Mr. Luciano Siani and Mr. Oscar P. Bernardes to Mosaic's board of directors.

Sale of Cubatão assets In May 2018, we completed the sale to Yara International ASA of our wholly owned subsidiary, Vale Cubatão Fertilizantes Ltda., which owned and operated nitrogen and phosphate assets in Cubatão, Brazil. We received the purchase price of US$255 million in cash upon the closing of the transaction.

Sale of interest in coking coal project in Australia. In September 2018, we concluded the sale of our 50% interest in the Eagle Downs hard coking coal project (including all associated rights and obligations) in Central Queensland, Australia, to BS Coal Pty Ltd for a total consideration of: (i) US$90 million in cash upon completion, (ii) US$27 million in cash upon the third anniversary of closing and (iii) royalties to be paid over 50% of all coal produced and sold from the Eagle Downs Project tenements.

Project Financing for the Nacala Logistics Corridor

We have a partnership with Mitsui in coal assets in Mozambique. In February 2018, we concluded the agreements for a project financing for the Nacala Logistics Corridor, which connects the Moatize coal mine to the Nacala-à-Velha maritime terminal, located in Nacala, Mozambique, in the total amount of US$2.730 billion, as follows:

US$1.030 billion provided by Japan Bank for International Cooperation (JBIC);

US$1.000 billion loan insured by Nippon Export and Investment Insurance (NEXI), provided by Sumitomo Mitsui Banking Corporation, The Bank of Tokyo Mitsubishi UFJ Ltd; Mizuho Bank Limited, Sumitomo Mitsui Trust Bank Limited, Nippon Life Insurance Company and Standard Chartered Bank;

US$400 million loan insured by Export Credit Insurance of South Africa Limited (ECIC), provided by ABSA Bank Limited, Investec Bank Limited; Rand Merchant Bank and The Standard Bank of South Africa Limited;

US$300 million provided by the African Development Bank (AfDB).

Vale received US$2.6 billion in proceeds, in repayment of certain shareholders loans provided for construction of NLC, net of certain commissions paid by NLC. The project financing will be repaid in 14 years with the proceeds obtained from the tariff charged by NLC in connection with its provision of coal transportation services.

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Optimizing our base metals operations in Canada

We have optimized our nickel operations across Canada, as part of an overall strategy to prioritize value over volume, reduce our atmospheric emissions and comply with local regulations. In 2018, we phased out our smelting and refining activities in Thompson, focusing our operations on nickel concentrate production. The concentrate is then shipped to our Sudbury operation to be further processed. In Sudbury, we produce copper concentrate, copper matte, copper cathodes and refined nickel. In Long Harbour, we produce nickel rounds, copper cathodes and cobalt rounds. We successfully blended nickel intermediates from Sudbury and Asia in our refinery in Wales to make higher premium products.

We will now turn our focus to the optimization of the mining assets to ensure a sustainable and value-accretive ore supply to our three concentrators in Canada:

Sudbury, Ontario In the second half of 2017, we converted our two-furnace operation in Sudbury into a single furnace operation. As a result of this change, we increased the proportion of production of copper concentrate to total copper production from a rate of 66% in 2017 to 72% in 2018, maximizing the smelter capacity for nickel. In addition, we ceased production of copper anode and increased production of copper matte. At the end of 2018, 11% of our copper production was sold in the form of copper matte.

Thompson, Manitoba We changed our operations in Thompson, Manitoba, from an integrated operation to a mine-mill operation. We permanently shut down one of the two smelter furnaces at the site in 2017, and decommissioned the other furnace in 2018, therefore closing the remaining smelting and refining activities to focus the operation solely on nickel concentrate production. We currently send all nickel concentrate from Thompson to be refined in Sudbury.

Voisey's Bay and Long Harbour, Newfoundland and Labrador Starting in 2018, all Voisey's Bay nickel concentrate is being shipped to our Long Harbour refinery. Our Long Harbour processing facilities produce nickel rounds, copper cathode and cobalt rounds from the Voisey's Bay concentrate.

Cobalt streaming transaction

In June 2018, we sold to Wheaton Precious Metals Corp. (Wheaton) and Cobalt 27 Capital Corp. (Cobalt 27) a combined 75% of the cobalt produced as a byproduct at our Voisey's Bay mine from January 1, 2021, which includes the ramp-down of production from the existing mine and the life-of-mine production from our underground mine expansion project. In consideration, we received US$690 million in cash from Wheaton and Cobalt 27 upon closing of the transaction on June 28, 2018, and will receive additional payments of 20%, on average, of cobalt prices upon delivery. We remain exposed to approximately 40% of future cobalt production from Voisey's Bay, through our retained interest in 25% of cobalt production and the additional payments upon delivery. These transactions enabled the development of the Voisey's Bay underground mine extension project, which will extend the mine life of Voisey's Bay.

Resumption of operations of São Luis and Tubarão I and II pellet plants

In 2018, we resumed the operations of our Tubarão I, Tubarão II and São Luis pellet plants. The operations of these plants had been suspended since 2012 due to market conditions.

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FAILURE OF SAMARCO'S TAILINGS DAM IN MINAS GERAIS

In November 2015, the Fundão tailings dams owned by Samarco S.A. failed, releasing tailings downstream, flooding certain communities and causing impacts on communities and the environment along the Doce river. The failure resulted in 19 fatalities and caused property and environmental damage to the affected areas. Samarco is a joint venture equally owned by Vale S.A. and BHP Billiton Brasil Ltda. ("BHPB").

In June 2016, Samarco and its shareholders (Vale and BHPB) created the Fundação Renova, a not-for-profit private foundation, to develop and implement (i) social and economic remediation and compensation programs and (ii) environmental remediation and compensation programs in the region affected by the dam failure.

The creation of Fundação Renova was provided for under the agreement for settlement and conduct adjustment (the "Framework Agreement") signed in March 2016 by Vale, BHPB, Samarco, the Brazilian federal government, the two Brazilian states affected by the failure (Minas Gerais and Espírito Santo) and other governmental authorities. 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. The Framework Agreement provides that, within three years of the date of the agreement, the parties would review its terms to assessing the effectiveness of the ongoing remediation and compensation activities.

On June 25, 2018, Samarco, Vale and BHPB entered into a comprehensive agreement with the offices of the federal and state (Minas Gerais and Espírito Santo) prosecutors, public defenders and attorney general, among other parties, improving the governance mechanism of Fundação Renova and establishing, among other things, a process for potential revisions to the remediation programs provided under the Framework Agreement based on the findings of experts hired by Samarco to advise the MPF (Federal Prosecutor's Office) over a two-year period (the "June 2018 Agreement"). See *Additional information Legal proceedings.*

Under the Framework Agreement and the June 2018 Agreement, Fundação Renova must be funded by Samarco, but to the extent that Samarco is unable to fund, Vale and BHPB must ratably bear the funding requirements under the Framework Agreement. As Samarco is currently unable to resume its activities, we and BHPB have been funding the Fundação Renova and also providing funds directly to Samarco, to preserve its operations and to support Samarco's funding obligations. At this point, we cannot predict when Samarco will resume its operations.

Pursuant to the Framework Agreement, Fundação Renova and Samarco allocated R$2.1 billion to social and economic remediation and compensation programs in 2018 and have allocated R$5.3 billion to these programs since the dam failure. From 2019 to 2021, Samarco, or Vale and BHP, will provide to Fundação Renova funding based on the amounts needed to implement the projects approved for each year, subject to an annual minimum of R$800 million and an annual maximum of R$1.6 billion. Starting in 2022, Samarco will provide the necessary funding in order to complete remaining programs approved for each year.

Additionally, Fundação Renova must allocate a minimum annual amount of R$240 million over 15 years (from 2016) to the implementation of compensation programs. Under the terms of the Framework Agreement, Fundação Renova must spend an additional amount of at least R$500 million on sewage collection and treatment and solid waste disposal.

For a discussion of the legal proceedings resulting from the failure of Samarco's tailings dam, see *Additional information Legal proceedings.*

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SELECTED FINANCIAL DATA

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.

Consolidated statement of income data

	For the year ended December 31,				
	2014	2015	2016	2017	2018
	(US$ million)				
Net operating revenues	35,124	23,384	27,488	33,967	36,575
Cost of goods sold and services rendered	(22,790)	(18,751)	(17,650)	(21,039)	(22,109)
Selling, general, administrative and other operating expenses, net	(2,059)	(819)	(774)	(951)	(968)
Research and evaluation expenses	(662)	(395)	(319)	(340)	(373)
Pre-operating and operational stoppage	(975)	(942)	(453)	(413)	(271)
Impairment and other results on non-current assets	(266)	(8,708)	(1,240)	(294)	(899)
Operating income (loss)	8,372	(6,231)	7,052	10,930	11,955
Non-operating income (expenses):					
Financial income (expenses), net	(6,018)	(10,654)	1,843	(3,019)	(4,957)
Equity results and other results in associates and joint ventures	440	(794)	(911)	(82)	(182)
Net income (loss) before income taxes	2,794	(17,679)	7,984	7,829	6,816
Income taxes	(1,603)	5,249	(2,781)	(1,495)	172
Net income (loss) from continuing operations	1,191	(12,430)	5,203	6,334	6,988
Net income (loss) attributable to non-controlling interests	(308)	(501)	(8)	21	36
Net income (loss) from continuing operations attributable to Vale's stockholders	1,499	(11,929)	5,211	6,313	6,952
Net income (loss) from discontinued operations attributable to Vale's stockholders	(842)	(200)	(1,229)	(806)	(92)
Net income (loss) attributable to Vale's stockholders	657	(12,129)	3,982	5,507	6,860
Net income (loss)attributable to non-controlling interests	(304)	(491)	(6)	14	36
Net income (loss)	353	(12,620)	3,976	5,521	6,896
Total cash paid to stockholders(1)	4,200	1,500	250	1,456	3,313

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

Earnings (loss) per share

The table below shows our earnings (loss) per share. The earnings (loss) per share for 2014 to 2016 have been retrospectively adjusted to reflect the conversion of our Class A preferred shares into common shares, which was concluded in November 2017, as if the conversion had occurred at the beginning of the earliest year presented.

	For the year ended December 31,				
	2014	2015	2016	2017	2018
	(US$, except as noted)				
Earnings (loss) per common share from continuing operations	0.29	(2.30)	1.00	1.21	1.34
Earnings (loss) per common share from discontinued operations	(0.16)	(0.03)	(0.23)	(0.16)	(0.02)
Earnings (loss) per common share	0.13	(2.33)	0.77	1.05	1.32
Weighted average number of shares outstanding (in thousands)(1)(2)	5,197,453	5,197,453	5,197,453	5,197,453	5,182,445
Distributions to stockholders per share(2)(3)					
Expressed in US$	0.81	0.29	0.05	0.28	0.64
Expressed in R$	1.89	0.98	0.17	0.90	2.39

(1) Each common ADS represents one common share.

(2) Restated as if the conversion had occurred at the beginning of the earliest year presented.

(3) 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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Selected Financial Data

Balance sheet data

	As of December 31,				
	2014	2015	2016	2017	2018
	(US$ million)				
Current assets	16,594	11,429	13,978	15,367	15,292
Non-current assets held for sale	3,640	4,044	8,589	3,587	
Property, plant and equipment, net and intangible assets	84,942	59,426	62,290	63,371	56,347
Investments in associated companies and joint ventures	4,133	2,940	3,696	3,568	3,225
Non-current assets	7,180	10,653	10,461	13,291	13,326
Total assets	116,489	88,492	99,014	99,184	88,190
Current liabilities	10,626	10,438	10,142	11,935	9,111
Liabilities associated with non-current assets held for sale	111	107	1,090	1,179	
Long-term liabilities(1)	22,043	15,896	19,096	20,512	19,784
Long-term debt(2)	27,388	26,347	27,662	20,786	14,463
Total liabilities	60,168	52,788	57,990	54,412	43,358
Stockholders' equity:					
Capital stock	61,614	61,614	61,614	61,614	61,614
Additional paid-in capital	(601)	(854)	(851)	(1,106)	(1,122)
Retained earnings and revenue reserves	(5,891)	(27,171)	(21,721)	(17,050)	(16,507)
Total Vale shareholders' equity	55,122	33,589	39,042	43,458	43,985
Non-controlling interests	1,199	2,115	1,982	1,314	847
Total stockholders' equity	56,321	35,704	41,024	44,772	44,832
Total liabilities and stockholders' equity	116,489	88,492	99,014	99,184	88,190

(1)

Excludes long-term debt.

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

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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:

- the impact of the tailings dam failure at the Córrego do Feijão mine and related remediation measures on our operations, cash flows and financial position;
- the outcome of the various regulatory, governmental and legal proceedings in which we are involved;
- our direction and future operation;
- 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 implementation of our principal operating strategies, including our potential participation in acquisition, divestiture or joint venture transactions or other investment opportunities;
- 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 (i) economic, political and social issues in the countries in which we operate, (ii) the global economy, (iii) commodity prices, (iv) financial and capital markets, (v) the mining and metals businesses, which are cyclical in nature, and their dependence upon global industrial production, which is also cyclical, (vi) regulation and taxation, (vii) operational incidents or accidents, and (viii) 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 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.

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RISK FACTORS

RISKS RELATING TO DAM FAILURE

The failure of Dam I in Minas Gerais has adversely affected our business, financial condition and reputation, and the overall impact of the dam failure on us is still uncertain.

On January 25, 2019, Dam I failed, resulting in nearly 300 fatalities or presumed fatalities, in addition to personal, property and environmental damages. See *Business Overview Failure of the tailings dam at the Córrego do Feijão mine*. The causes of the dam failure are uncertain and are being investigated by us and by several governmental authorities. This event has adversely affected our operations, but the overall impact of the dam failure is still uncertain.

Liabilities and legal proceedings. Our potential liabilities resulting from the dam failure are significant, and the total amount cannot be estimated at this time. The dam failure resulted in fatalities and property and environmental damages. We are a defendant in a number of legal proceedings, in which plaintiffs claim significant amounts in damages resulting from the event. See *Additional Information Legal proceedings* and *Operating and financial review and prospects Impact of the failure of Dam I at the Córrego do Feijão Mine.* These liabilities may have a material adverse effect on our business and financial condition.

Liquidity. Brazilian courts have ordered the freezing of more than R$17.6 billion (US$4.5 billion) of our assets, including cash in our bank accounts, judicial deposits and common shares we held in treasury. Additional assets may be attached in the future. These pre-judgment attachments and asset freezes may adversely impact our business and liquidity.

Suspension of operations. Following the dam failure, we have suspended various operations, which will adversely impact our production and cash flows. We suspended our operations at the Córrego do Feijão and Jangada mines immediately following the event. We temporarily suspended various mining and pellet plant operations to be able to expedite the decommissioning of our upstream dams. We also suspended operations in response to judicial injunctions and new determinations by ANM, Brazil's national mining agency. Other developments resulting from the failure of Dam I or questioning the safety of our existing dams may result in the suspension of other operations. As of April 15, 2019, the estimated impact of the suspension of operations following the dam failure on our production is 92.8 million metric tons per year, (including the estimated annual impact of the suspension of the Brucutu mine), including the pellet feed needed for the production of 11 million metric tons of pellets per year. As a result of the suspended operations, we may need to purchase iron ore and iron ore pellets in the market to honor our obligations under existing commercial contracts, which may increase our overall costs and adversely impact our business and financial condition. It is possible that certain of these operations may not be resumed.

Increase in production costs. We may need to make investments or adjustments in the operations not impacted by the dam failure to increase production, mitigate the impact of suspended operations or comply with additional safety requirements. We may also have to use alternative disposal methods to continue operating certain of our mines and plants, particularly those that rely on tailings dams. These alternative methods may be more expensive or require significant capital investments in our mines and plants. As a result, we expect our costs to increase, which may have a material adverse effect on our business and financial condition.

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Increased taxation. We may be subject to new or increased taxes or other obligations to fund remediation measures and compensate direct and indirect impacts of the failure of Dam I. Also, we have entered into settlement agreements with the state of Minas Gerais and certain municipalities to minimize the impact of the shutdown of some of our operations in state and municipal tax revenues. Also, the state of Minas Gerais has proposed the adoption of a new fiscal framework, under which the state would be entitled to collect from us an additional R$107 million per year on ICMS (a state tax on the circulation of goods) starting in 2020. Retroactive amounts could also be applied over the last five years, with an estimated impact of R$550 million on us.

Additional regulation and restrictions on mining operations. Various governmental authorities have proposed and approved new rules relating to licensing, use and operations of dams in response to the Dam I failure. For instance, a new statute approved by the state of Minas Gerais in February 2019 precludes the use of upstream dams and imposes new obligations for design, construction and operation of any other type of tailings dams. This new statute also provides for the full decommissioning of any upstream tailings dam by February 2022, and a rule approved by ANM in February 2019 requires us to fully decommission any inactive upstream tailings dam by August 2021 and any active upstream tailings dam by August 2023. New rules imposing restrictions on mining operations and ancillary activities may be approved. The licensing process for our operations may become longer and subject to more uncertainties. These additional laws and regulations may impose restrictions on our operations, require additional investments or even require us to suspend additional operations, which may adversely affect our business.

Reserves. Developments resulting from the failure of Dam I, particularly new regulations applicable to dam licensing and use and the ongoing proceedings and investigations involving the use of dams in our mining operations, may result in decreases in our reported reserves or reclassification of proven reserves as probable reserves. We continuously review the impact of new regulations, proceedings and investigations on our reported reserves. These new regulations, proceedings and investigations may impact our iron ore reserves and the reserves for other products the production of which involve dams.

Inability to comply with additional safety requirements or to obtain required certifications. Rules on dam safety are getting stricter following the dam failure. Also, external experts may be reluctant to attest to the stability and safety of our dams, as a result of the uncertainties regarding the causes of the Dam I failure and the increasing risks of liability. If any of our dams is unable to comply with the safety requirements or if we are unable to obtain the required certification for any of our dams, we may need to suspend operations, evacuate the area surrounding this dam, relocate communities and take other emergency actions. These measures are costly, may adversely impact our business and financial condition and cause further damage to our reputation.

Inability to pay dividends. Reduced cash flows and increased liabilities may adversely affect our ability to pay dividends or make other distributions to our shareholders. Immediately after the dam failure, our Board of Directors determined the suspension of our shareholder remuneration policy.

Increased funding requirements. We may need to raise funds in the financial markets to meet our existing commitments and the potential liabilities and capital expenditures associated with the remediation of environmental damages. We may not be able to obtain funds at acceptable costs.

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Increased cost of insurance. Our cost of insurance is expected to rise, and we may not be able to obtain insurance for certain risks.

Management attention. Since the date of the dam failure, attention of our senior management and our Board of Directors is focused on the emergency actions and other measures in response to the crisis and diverted from our core business.

Management continuity. Following the dam failure, our CEO and our executive officer for Ferrous Minerals and Coal requested temporary leave from their positions, following the recommendation of Brazilian prosecutors. Other changes in our senior management may occur, which may have an adverse effect on our business. A shareholders' meeting is scheduled for April 30, 2019, and shareholders may approve changes in the composition of our Board of Directors, which may result in further changes to the composition of our senior management.

Impact on our financial performance. We expect the failure of Dam I to have a significant impact on our financial performance. We have not yet determined the nature and amount of the consequences, but they will include reduced revenues due to the suspension of operations, increased expenditures for assistance and remediation, impairments of fixed assets, provisions for costs of decommissioning and remediation, and provisions for legal proceedings. See *Operating and financial review and prospects Impact of the failure of Dam I at the Córrego do Feijão Mine.*

Additional impacts. The overall consequences of the dam failure remain uncertain. The contamination of the Paraopeba river and other water systems may affect the water supply of surrounding cities. If our preventive measures fail to contain the tailings and debris flow, other rivers may be contaminated, causing additional environmental damages. If the tailings and debris flow from the failure of Dam I reach interstate rivers, we may be subject to additional proceedings and investigations by federal authorities.

The failure of a tailings dam or similar structure may cause severe damages, and the decommissioning of our upstream tailings dams may be long and costly.

We own a number of tailings dams and similar structures. In addition, we own stakes in companies that own a number of dams or similar structures, including Samarco and Mineração Rio do Norte S.A. (MRN). The failure of any of these structures could cause losses of lives and severe personal, property and environmental damages, and could have adverse effects on our business and reputation, as evidenced by the consequences of the failure of Dam I at Córrego do Feijão. See *Business Overview Failure of the tailings dam at the Córrego do Feijão mine*. Some of our dams, and some of the dams owned by our investees, such as Samarco and MRN, were built using the "upstream" method, which presents specific stability risks.

Recently approved laws and regulations require us to decommission all of our upstream dams on a specified timetable. We are still determining the appropriate measures for decommissioning each upstream dam. This process will require significant expenditures, and the decommissioning process may take a long time. At this point, we cannot estimate the costs and timing for conclusion of the decommissioning process. We may not be able to conclude the decommissioning process for all of our upstream dams within the time-frame imposed by the new laws and regulations.

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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 sought injunctions to suspend certain of our operations or claimed substantial amounts, including several legal proceedings and investigations relating to the failure of our Dam I and the failure of Samarco's Fundão tailings dam. The outcomes of these proceedings are uncertain and may materially and adversely affect our business, our liquidity and the value of the securities issued by us or our subsidiaries. See *Additional information Legal proceedings*.

Our obligations and potential liabilities arising from the failure of a tailings dam owned by 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 fatalities and environmental damage in the surrounding area. The failure of Samarco's tailings dam has adversely affected and will continue to affect our business, and 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.

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 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 impact our liquidity and our financial condition. Brazilian federal tax authorities have tried to assert that we may be liable for certain tax obligations of Samarco, and other tax authorities or other creditors of Samarco may try to recover from us amounts due by Samarco. See *Additional information Legal proceedings*.

Reparation obligations and other undertakings. In March 2016, Samarco and its shareholders (Vale and BHPB) entered into the Framework Agreement with certain governmental authorities, pursuant to which Samarco, Vale and BHPB agreed to create a foundation (Fundação Renova) to develop and implement long-term remediation and compensation programs. Under the Framework Agreement, these programs shall be reviewed within 3 years. In June 2018, Samarco, Vale and BHPB entered into a comprehensive agreement with the offices of the federal and state (Minas Gerais and Espírito Santo) prosecutors, public defenders and attorneys general, among other parties, in line with these preliminary agreements and in order to improve the governance mechanism of Fundação Renova. The comprehensive agreement established, among other things, a process for potential revisions to the remediation programs provided under the Framework Agreement based on the findings of experts hired by Samarco to advise the MPF over a two-year period. As Samarco is currently unable to resume its activities, we and BHPB have been funding Fundação Renova to support certain remediation measures undertaken by Samarco and also providing funds directly to Samarco, to preserve its operations. At this point, we cannot predict when Samarco will resume its operations. 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 liquidity and financial conditions. See *Business overview Failure of Samarco's tailings dam in Minas Gerais*.

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Risk of additional environmental damages. Failure to contain the remaining tailings in Samarco's dams 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 and other licenses for our tailings dams and other facilities, 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.

EXTERNAL RISKS

Our business is exposed to the cyclicality 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, prevent fatalities and occupational hazards 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.

Also, 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 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 fines, iron ore pellets or nickel from joint ventures or unrelated parties processing 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.

The prices for our products are subject to volatility, which may adversely affect our business.

Global prices for metals are subject to significant fluctuations and are affected by many factors, including actual and expected global macroeconomic and political conditions, regional and sectorial factors, 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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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 73.8% of our 2018 net operating revenues, are used to produce carbon steel. Nickel, which accounted for 8.8% of our 2018 net operating revenues, is used mainly to produce stainless and alloy steels. 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.

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, 2018 by approximately US$340 million. Average iron ore prices significantly changed in the last five years, from US$97.0 per dmt in 2014, US$55.5 per dmt in 2015, US$58.5 per dmt in 2016, US$71.3 per dmt in 2017 and US$69.5 per dmt in 2018, according to the average Platts IODEX (62% Fe CFR China). On March 29, 2019, the year-to-date average Platts IODEX iron ore price was US$87.05 per dmt. See *Operating and financial review and prospects Overview Major factors affecting prices*.

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 2018, Chinese demand represented 72% of global demand for seaborne iron ore, 51% of global demand for nickel and 49% of global demand for copper. The percentage of our net operating revenues attributable to sales to customers in China was 41.7% in 2018. 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.

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, trade receivables 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 2018, we had net foreign exchange losses of US$2.247 million, while we had net foreign exchange losses of US$463 million in 2017 and net foreign exchange gains of US$3.252 billion in 2016. In addition, changing values of the Brazilian *real*, the Canadian dollar, the Euro, the Indonesian rupiah, the Chinese *yuan* 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* (50.9% in 2018) and the Canadian dollar (5.4% in 2018), 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.

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.

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FINANCIAL RISKS

Lower cash flows, resulting from suspension of operations or decreased prices of our products, may adversely affect our credit ratings and the cost and availability of financing.

The suspension of operations or a decline in the 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, including disbursements required to remediate and compensate damages resulting from the failure of Dam I, provide the financial assurances required to obtain licenses in certain jurisdictions, pay dividends and comply with the financial covenants in some of our long-term debt instruments. See *Operating and financial review and prospects Liquidity and capital resources.*

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, cyber-attacks, 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.

Political, social 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;
- pension, tax and other reforms;
- 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.

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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, downgrading of credit ratings of the Brazilian government and Brazilian issuers, and heightened volatility in the securities issued abroad by Brazilian companies. Political instability may aggravate economic uncertainties in Brazil and increase volatility of securities of Brazilian issuers.

Brazil held presidential and federal and state legislative elections in October 2018. We cannot predict whether the new administration will result in changes in Brazilian governmental and economic policies or in the Brazilian mining industry.

In the last years, Brazil faced an economic recession, adverse fiscal developments and political instability. Brazilian GDP grew by 1.1% in 2018 and 1.1% in 2017 but declined by 3.6% in 2016. Unemployment rate was 12.3% in 2018, 12.7% in 2017 and 11.5% in 2016. Inflation, as reported by the consumer price index (IPCA), was 3.75% in 2018, 2.95% in 2017 and 6.29% in 2016. The Brazilian Central Bank's base interest rate (SELIC) was 3.5% on December 31, 2018, 7.00% on December 31, 2017 and 13.75% on December 31, 2016. 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 could adversely impact our business and reputation.

Disputes with communities where we operate may arise from time to time. Accidents or incidents involving mines, industrial facilities and related infrastructure, such as the failure of Dam I, may significantly impact the communities where we operate. 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. In some jurisdictions, 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 communities and groups, including indigenous groups, organized social movements and local communities, could cause delays in obtaining licenses, increases in planned budget, delays or interruptions to our operations. These issues may adversely affect our reputation or otherwise hamper our ability to develop our reserves and conduct our operations. See *Information on the Company Regulatory matters* and *Additional information Legal proceedings*.

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, regulations and policies and audits and reassessments. 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. See *Information on the Company Regulatory matters* and *Additional information Royalties and other taxes on mining activities.*

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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.

As a supplier of iron ore, nickel and other raw materials to the global integrated steel industry, we are subject to additional risk from the imposition of duties, tariffs, import and export controls and other trade barriers impacting our products and the products our customers produce. Global trade is subject to a growing trend of increased trade barriers, which could exacerbate commodities' price volatility and in turn result in instability in the prices of our products.

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*.

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

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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.

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.

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Labor disputes that may disrupt our operations from time to time.

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 or unavailability of certain critical assets or infrastructure.

We rely on certain critical assets and infrastructure to produce and to transport our products to our customers. These critical assets include mines, industrial facilities, ports, railways, roads and bridges. The failure or unavailability of any critical asset, whether resulting from natural events or operational issues, could have a material adverse effect on our business.

Substantially all of our iron ore production from the Northern system is transported from Carajas, in the Brazilian state of Pará, to the port of Ponta da Madeira, in the Brazilian state of Maranhão, through the Carajás railroad (EFC). Any interruption of the Carajás railroad or of the port of Ponta da Madeira could significantly impact our ability to sell our production from the Northern system. With respect to the Carajás railroad, there is particular risk of interruption at the bridge over the Tocantins river, in which the trains run on a single line railway. In the port of Ponta da Madeira, there is particular risk of interruption at the São Marcos access channel, a deep-water channel that provides access to the port. Also, any failure or interruption of our long distance conveyor belt (TCLD) used to transport our iron ore production from the S11D mine to the beneficiation plant, could adversely impact our operations at the S11D mine.

Our business could be adversely affected by the failure of our counterparties, joint venture partners or joint ventures we do not control 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.

Important parts of our iron ore, pelletizing, nickel, coal, copper, energy and other businesses are held through joint ventures. This may reduce our degree of control, as well as our ability to identify and manage risks. 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

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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 have impact on people, assets and the environment. 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 damages, damages resulting from dams breaches, spills or leakage of hazardous substances and 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 may not be covered by insurance, and 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 11.1% of our total cost of goods sold in 2018. To fulfill our energy needs, we rely on the following sources: oil byproducts, which represented 31% of total energy needs in 2018, electricity (31%), natural gas (17%), coal (17%) and other energy sources (4%).

Electricity costs represented 4.1% of our total cost of goods sold in 2018. 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, operational technology, cybersecurity and telecommunications systems may adversely affect our business and reputation.

We rely heavily on information technology, operational technology and telecommunications systems for the operation of many of our business processes. Failures in those systems, whether caused by obsolescence, technical failures, negligence, accident or malicious acts, may result in the disclosure or theft of sensitive information, misappropriation of funds and disruptions to or interruption in our business operations. We may be the target of attempts to gain unauthorized access to information technology and operational technology systems through the internet, including sophisticated and coordinated attempts often referred to as advanced persistent threats. Disruption of critical information technology, operational technology, cybersecurity or telecommunications systems, or breaches of

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information security, may harm our reputation and have a material adverse effect on our operational performance, earnings and financial condition.

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, resulting in 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, as well as activities involving mobile equipment, vehicles or machinery and other potentially fatal incidents and accidents. Incidents may occur due to deficiencies in identifying and assessing risks or in implementing sound risk management, and once these risks materialize, they could result in significant environmental and social impacts, damage to or destruction of mines or production facilities, personal injury, illness and fatalities, involving employees, contractors or community members near our operations, as well as 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, controls and monitoring procedures, our operations remain subject to incidents or accidents that could adversely impact our business, stakeholders or reputation.

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

Nearly all aspects of our activities, products and services associated with capital projects and operations around the world are subject to social, environmental 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 and continuing operating. 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. Social, environmental and health and safety regulations also impose standards, procedures and monitoring controls on activities relating to mineral research, mining, beneficiation, pelletizing activities, railway and marine services, ports, decommissioning, distribution and marketing of our products. Such regulation may give rise to significant costs and liabilities. Litigation relating to these or other related matters may adversely affect our financial condition or cause harm to our reputation.

Social, environmental and health and safety regulations in many countries in which we operate have become stricter in recent years, and it is possible that more regulation or more stringent 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 and labor authorizations, resulting in licensing and operation delays, raising our costs or requiring us to engage in expensive reclamation efforts.

In response to the failure of Dam I, additional environmental and health and safety laws and regulations have been approved, and other may be forthcoming, and authorities may impose more stringent conditions in connection with the licensing process of our projects and operations. We will encounter more stringent requirements for and delays in the receipt of environmental operating license for other tailings dams.

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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, and our cost of international freight. In particular, consumption of thermal coal, one of the products we sell, 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. Regulations, mainly from the European Union and China, may impose additional requirements for our products related to the safety of downstream users.

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 the effect of severe weather on our mining and logistics activities.

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; more stringent regulations 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 and legally 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. Lower market prices of minerals and metals, more stringent regulations, 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. Also, our inability to obtain licenses for new operations, supporting structures or activities, or to renew our existing licenses, can cause a reduction of our reserves. Such a reduction could affect depreciation and amortization rates and have an adverse effect on our financial performance.

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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.

We face rising extraction costs and 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.

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RISKS RELATING TO OUR CORPORATE STRUCTURE

The shareholders that are party to our shareholders' agreement have significant power over Vale.

On August 14, 2017, Litel Participações S.A. ("Litel"), Bradespar S.A. ("Bradespar"), Mitsui & Co., Ltd. ("Mitsui") and BNDES Participações S.A. ("BNDESPAR") entered into a shareholders' agreement pursuant to which they undertook to vote jointly on certain key matters (the "Shareholders' Agreement"). The Shareholders' Agreement is expected to expire on November 9, 2020. See *Share ownership and trading Major shareholders*. On December 31, 2018, Litel, Bradespar, Mitsui and BNDESPAR together held 39.03% of our total capital stock. As long as no other shareholder or group of shareholders owns more shares than the parties to the Shareholders' Agreement, these major shareholders may elect a majority of the members of our Board of Directors and control the outcome of certain actions requiring shareholder approval.

The Brazilian Government has certain veto rights.

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 golden shares*.

Our governance and compliance processes may fail to prevent breaches of legal, accounting or governance standards.

We operate in a global environment, and our activities extend over multiple jurisdictions and complex regulatory frameworks, with increasing enforcement activities worldwide. Our governance and compliance processes, which include the review of internal control over financial reporting, may not timely identify or prevent future breaches of legal, accounting or governance standards. We may be subject to breaches of our code of ethical 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 investigations by authorities, litigation, fines, loss of operating licenses, disgorgement of profits, involuntary dissolution 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: (i) fulfills all formalities required for its enforceability under the laws of the country where it was issued; (ii) was issued by a competent court after due service of process on the defendant, as required under

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applicable law; (iii) is not subject to appeal; (iv) does not conflict with a final and unappealable decision issued by a Brazilian court; (v) 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; (vi) it does not cover matters subject to the exclusive jurisdiction of the Brazilian courts; and (vii) 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 permitting qualifying institutional foreign investors to buy and sell securities on the B3 and entitling the custodian 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. 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.

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 not have all the rights of our shareholders, and may be unable to exercise preemptive rights relating to the shares underlying their ADSs.

ADR holders may not have the same rights that are attributed to our shareholders by Brazilian law or our bylaws, and the rights of ADR holders may be subject to certain limitations provided in the deposit agreement or by the securities intermediaries through which ADR holders hold their securities. Also, 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.

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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 depositary. In practice, the ability of a holder of ADRs to instruct the depositary as to voting will depend on the timing and procedures for providing instructions to the depositary either directly or through the holder's custodian and clearing system. With respect to ADSs for which instructions are not received, the depositary 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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II. INFORMATION ON THE COMPANY

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
- 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
- 2.1.2 Production
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2.2 Copper
- 2.2.1 Operations
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2.3 PGMs and other precious metals

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3. Coal

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3.2 Production

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Lines of Business

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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, and 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 and shipping 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	Location	Description/History	Mineralization	Operations	Power source	Access/Transportation
Vale						
Northern System	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 mine and beneficiation plant in Serra Leste. Our operations in Serra Sul, where our S11D mine 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	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	Carajás railroad (EFC) 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 new 101-kilometers long railroad spur to the EFC railroad.

				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 mainly sinter feed.		
Southeastern System	Iron Quadrangle, state of Minas Gerais	Three mining complexes: Itabira (two mines, with three major beneficiation plants), Minas Centrais (two mines, with two major beneficiation plants and one secondary plant) and Mariana (three mines, with two major beneficiation plants).	Ore reserves with high ratios of itabirite ore relative to hematite ore 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.	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. For status of halted operations see *Business overview Failure of the tailings dam at the Córrego do Feijão mine*.	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	EFVM railroad connects these mines to the Tubarão port.

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Lines of Business

Company/Mining System	Location	Description/History	Mineralization	Operations	Power source	Access/Transportation
Southern System	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. For status of halted operations see *Business overview Failure of the tailings dam at the Córrego do Feijão mine*.	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.
Midwestern System	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 ore and sinter feed.	Supplied through the national electricity grid. Acquired through power purchase agreements.	Transported by barges traveling along the Paraguay and Paraná rivers to transhippers at the Nueva Palmira port in Uruguay, or delivered to customers at Corumbá.

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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, 2016 (million metric tons)	2017	2018(1)	2018 process recovery(2) (%)
Southeastern System					
Itabira	Open pit	33.4	37.8	41.7	50
Minas Centrais	Open pit	40.9	37.6	36.0	64
Mariana	Open pit	28.4	33.1	26.7	81
Total Southeastern System		102.7	108.6	104.4	
Southern System					
Minas Itabirito	Open pit	40.1	36.8	35.5	82
Vargem Grande	Open pit	29.2	23.3	21.4	68
Paraopeba	Open pit	26.4	26.3	27.3	98
Total Southern System		95.7	86.4	84.1	
Northern System					
Serra Norte	Open pit	143.6	142.7	131.5	95
Serra Leste	Open pit	4.2	4.3	4.1	100
Serra Sul	Open pit	0.4	22.2	58.0	100
Total Northern System		148.1	169.2	193.6	
Midwestern System					
Corumbà	Open pit	1.9	2.4	2.5	72
Urucum	Open pit	0.4	0.0	0.0	

Total Midwestern System	2.3	2.4	2.5
Total	348.8	366.5	384.6

(1) Production figures include third-party ore purchases, run of mine and feed for pelletizing plants.

(2) Percentage of the run-of-mine recovered in the beneficiation process. Process recovery figures do not include third-party ore purchases.

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1.1.3 Iron ore pellet operations

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 Zhuhai YPM. In 2018, we sold 102 thousand metric tons of pellet feed to Zhuhai YPM.

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Company/Plant	Description/History	Nominal capacity (Mtpy)	Power source	Other information	Vale's equity interest (%)	Partners
Brazil:						
Vale						
Tubarão (state of Espírito Santo)	Three wholly owned pellet plants (Tubarão I, II and VIII) and five leased plants (Itabrasco, Hispanobras, Kobrasco and two Nibrasco plants). These plants receive iron ore primarily from our Southeastern System mines and use our logistics infrastructure for distribution.	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 Tubarão II pellet plants started up in the first half of 2018 in response to market conditions. Operations at these plants had been suspended since 2012.	100.0	
Fábrica (state of Minas Gerais)	Part of the Southern System. Receives iron ore from the 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.	Operations at the Fábrica plant have been suspended since February 2019, following a determination of the ANM (see *Business overview Failure of the tailings dam at the Córrego do Feijão mine*).	100.0	
Vargem Grande (state of Minas Gerais)	Part of the Southern System. Receives iron ore from the Minas Itabirito and Vargem Grande mining complexes, more specifically from Sapecado, Galinheiro, Capitão do Mato and Tamanduá mines.	7.0	Supplied through the national electricity grid. Produced directly by Vale or acquired through power	Operations at the Vargem Grande plant have been suspended since February 2019, following a determination of the ANM (see *Business overview Failure of the tailings dam at*	100.0	

	Production is mostly transported by MRS.		purchase agreements.	*the Córrego do Feijão mine*).		
São Luís (state of Maranhão)	Part of the Northern System. Receives iron ore from the Carajás mines. Production is shipped to customers through our Ponta da Madeira maritime terminal.	7.5	Supplied through the national electricity grid. Produced directly by Vale or acquired through power purchase agreements.	Operation at the São Luís plant restarted in the second half of 2018 in response to market conditions. Operations at this plant had been suspended since 2012.	100.0	
Oman:						
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 of 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 and by iron ore from Carajás through the Ponta da Madeira maritime terminal.	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.

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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, 2016	2017	2018
	(million metric tons)		
Vale(1)	46.2	50.3	55.3
Total	46.2	50.3	55.3

(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 the Itabrasco, Nibrasco and Hispanobras pellet plants expire in 2019, and the operating leases for the Kobrasco pellet plant expire in 2033.

1.1.5 Customers, sales and marketing

We supply all of our iron ore and iron ore pellets 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 2018, China accounted for 56% of our iron ore and iron ore pellet shipments, and Asia as a whole accounted for 70%. Europe accounted for 22%, followed by Brazil with 8%. Our ten largest customers collectively purchased 146 million metric tons of iron ore and iron ore pellets from us, representing 40% of our 2018 iron ore and iron ore pellet sales volumes and 39% of our total iron ore and iron ore pellet revenues. In 2018, no individual customer accounted for more than 7% of our iron ore and iron ore pellet shipments.

Of our 2018 pellet production, 54% was blast furnace pellets and 46% 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 2018, the Asian market (mainly Japan), the European market and the Brazilian market were the primary markets for our blast furnace pellets, while the Middle East and North America 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 offices in St. Prex (Switzerland), Tokyo (Japan), Singapore, Dubai (UAE) and Shanghai (China), which support 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

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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.

In 2018, 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 and CFR international and domestic sales. The 2018 hedge program was settled in 2018.

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, 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 secure transport capacity and enhance our ability to offer our products in the Asian market at competitive prices on a CFR basis, despite higher freight 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 sixteen 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. In August 2018, Metal Bulletin launched a new index, the 62% Fe low-alumina index, which is based on our BRBF. During the remainder of 2018, the 62% Fe low-alumina index traded with a premium of US$4.50 per dmt over the 62% Fe index. The resulting blend offers strong performance in any kind of sintering operation. It is produced in our Teluk Rubiah Maritime Terminal in Malaysia and in sixteen 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, a subsidiary of Rio Tinto., Kumba Iron Ore Limited and Société Nationale Industrielle et Miniére. 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.

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

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, a raw material used 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 oxide-ores (24-46% manganese grade).	Crushing, scrubbing 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 concentration plant.	Medium- and low-grade silicocarbonate ores (an average content of 30% manganese grade).	Crushing, screening and dense-heavy medium separation DMS / HMS process producing lumps to the Barbacena and Ouro Preto ferroalloy plants.	Supplied through the national electricity grid. Acquired from regional utility companies.	Manganese ore is transported by truck to the Barbacena and Ouro Preto ferroalloy plants.
Urucum	MCR	State of Mato Grosso do Sul	Underground mining operations and on-site beneficiation plant.	High-and medium-grade oxide ores (an average content of 46% manganese	Crushing, scrubbing and classification steps, producing	Supplied through the national electricity grid. Acquired	Manganese ore is transported by barge traveling along the Paraguay and Paraná rivers to

	grade).	lumps and fines.	through power purchase agreements.	transhippers at the Nueva Palmira port in Uruguay.

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

Mine	Type	Production for the year ended December 31, 2016	2017	2018	2018 process recovery(1)
		(million metric tons)			(%)
Azul	Open pit	1.7	1.4	1.0	43
Morro da Mina	Open pit	0.0	0.1	0.1	82
Urucum	Underground	0.7	0.7	0.7	79
Total		2.4	2.2	1.8	

(1) Percentage of the run-of-mine recovered in the beneficiation process.

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.

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 seven furnaces, two of which are refining furnaces and a briquetting plant. Ouro Preto has three furnaces, two of which are currently not operating due to market conditions.	Barbacena: 66,000 metric tons per year (54,000 metric tons per year of ferro-silicon manganese and 12,000 metric tons per year of ferro-manganese medium carbon). Ouro Preto: 64,000 metric tons per year of ferro-silicon manganese.	Supplied through the national electricity grid. Acquired from Furnas Centrais Elétricas S.A. or through power purchase agreements.
Bahia Plant	City of Simões Filho	Four furnaces, two converters and a	135,000 metric tons per year (42,000	Supplied through the national

sintering plant.	metric tons per year of ferro-silicon manganese and 93,000 metric tons per year of high carbon ferro-manganese). The plant has a capacity to refine until 40,000 metric tons per year of ferro-manganese high carbon to produce ferro-manganese medium carbon alloy, according to market demand.	electricity grid. Acquired from Companhia Hidrelétrica do São Francisco (CHESF) or through power purchase agreements.

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

Plant	Production for the year ended December 31(1), 2016	2017	2018
	(thousand metric tons)		
Barbacena	48	58	55
Ouro Preto		3	10
Simões Filho	77	88	103
Total	124	149	168

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

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, especially ferromanganese, higher-grade manganese ores are required to achieve competitive quality and cost, while medium- to lower-grade ores may be used in silicomanganese production. 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, South Africa, Ghana, Kazakhstan, India and Mexico.

We compete in the seaborne market with both high- and medium-grade ores from the Azul and Urucum mines, where we benefit from extensive synergies with our iron ore operations, from mine to rail to port to vessel operations. Our main competitors in this segment are South32 (Australia and South Africa) and Eramet (Gabon). Our lower-grade ores, especially those from Morro da Mina, 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, which can occasionally shift their furnaces to manganese alloys, 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 and integrated producers.

Focusing mainly in the Brazilian, South and North 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 though medium-and long-term contracts. Competitors in the Brazilian market are about a dozen smelters with capacities from five to 90 thousand metric tons per year, most of which are not integrated and some of which are customers of our manganese ores. We have a distinctive advantage in comparison to them in producing ferroalloys with higher manganese content.

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2. BASE METALS

2.1 Nickel

2.1.1 Operations

We conduct our nickel operations primarily through our wholly owned subsidiary Vale Canada Limited, 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
North Atlantic:						
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. Mining operations in Sudbury began in 1885. We acquired the Sudbury operations in 2006.	*Nickel*. 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 Thompson operation. By the end of 2017, we ceased receiving Voisey's Bay feed in Sudbury. In addition to producing finished nickel in	Patented mineral rights with no expiration date; mineral leases expiring between 2018 and 2038; and mining licenses of occupation with indefinite expiration date(1).	Supplied by Ontario's provincial electricity grid and produced directly by Vale via hydro generation.	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.

Sudbury, we ship a nickel oxide intermediate product to our nickel refinery in Wales for processing to final products. In 2018, 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 modified our processes to capture SO2 emissions from the converters as the final major milestone of the emissions reduction project.

Copper. We produce two intermediate copper products, copper concentrate and copper matte, and

we also produce a finished electrowon copper cathode product. In September 2017, we switched to a single flash furnace in Sudbury, and as a result, we ceased copper anode production resulting in increased production of copper concentrate and copper matte.

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Lines of Business

mpany/Mining System	Location	Description/History	Operations	Mining title	Power source	Access/ Transportati
e Canada	Canada Thompson, Manitoba	Mining and milling operations to process ore into nickel concentrate. We phased out smelting and refining activities in Thompson during 2018. Thompson mineralization was discovered in 1956, and Thompson operations were acquired by us in 2006.	*Nickel*. Primarily underground mining operations with nickel sulfide ore bodies, which also contain some copper and cobalt. In 2017, we permanently shut down one of the two furnaces in Thompson and the other was shut down in 2018, permanently shutting down smelting and refining operations. By the end of 2017, we had ceased processing Voisey's Bay feed in Thompson, and since the second half of 2018, we have started sending the majority of the nickel concentrate from Thompson to be refined in Sudbury.	Order in Council leases expiring between 2020 and 2025; mineral leases expiring in 2034.	Supplied by Manitoba's provincial utility company.	Intermediate concentrates a delivered in Ontario.
e Newfoundland & rador 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	Comprised of the Ovoid open pit mine, and deposits for underground operations at a later stage. We mine nickel	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	The nickel an copper concentrates from Voisey's Bay are transported to the port by haulage truck

			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.	sulfide ore bodies, which also contain copper and cobalt. The Long Harbour facility continued to ramp up in 2018 while processing feed from Voisey's Bay concentrate exclusively. Copper concentrate from the open pit mine is sold directly to the market.		refinery is supplied by the Newfoundland and Labrador provincial utility company.	and then shipp by dry bulk vessels to eith overseas mark or to our Long Harbour operations for further refinin
e 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 t final custome the UK and continental Europe by tru Products for overseas customers are trucked to the ports of Southampton and Liverpool and shipped b ocean contain
a/Pacific							
Vale Indonesia Tbk TVI")	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 59.28% of PTVI's	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	Contract of work expiring in 2025, entitled to two consecutive ten-year extensions, in the form of a business license, subject to approval of the Indonesian government.(2)	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	Trucked approximately 55 km to the river port at Malili and the loaded onto barges in orde to load break-bulk vessels for onward shipment.

	share capital, Sumitomo Metal Mining Co., Ltd ("Sumitomo") holds 20.09%, Sumitomo Corporation holds 0.14% and the public holds 20.49%.(2) PTVI was established in 1968, commenced its commercial operations in 1978, was listed on the Indonesian stock exchange in 1990 and was acquired by us in 2006.	production to Sumitomo.	power supply with a source of energy that is not subject to hydrological factors.

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Lines of Business

Company/Mining System	Location	Description/History	Operations	Mining title	Power source	Access/ Transportation
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 Calédonien S.A.S. ("SPMSC"). SPMSC has an obligation to increase its stake in VNC to 10% within two years after the startup of commercial production.	The ongoing ramp-up of our nickel operation in New Caledonia is expected to continue in the coming years. VNC utilizes a high-pressure acid leach process to treat limonitic and saprolitic laterite ores. As part of the ramp-up, VNC is undertaking a review of the capacity of different units of the plant to identify and eliminate bottlenecks. We expect to continue to ramp up VNC over the next five to six years to reach nominal production capacity of 50,000 metric tons per year of nickel contained in nickel oxide, which is further processed in	Mining concessions expiring between 2022 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.

				our refineries in Asia, and hydroxide in cake form (IPNM) and cobalt in carbonate form.		
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.	Produced finished nickel for the stainless steel industry, primarily using intermediate products from our Matsuzaka and New Caledonian operations. We suspended operations at this plant in 2017 due to market conditions and it currently remains under care and maintenance.	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 equity interest 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.

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Lines of Business

Company/Mining System	Location	Description/History	Operations	Mining title	Power source	Access/ Transportation
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 to recover nickel from saprolitic ore deposit. The operation produces ferronickel via the rotary kiln-electric furnace process. We are currently operating a single line with one electric furnace and two lines of calcine and rotary kilns, 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. Operations at Onça Puma have been suspended since September 2017 due a public civil action. See *Additional information Legal proceedings Onça Puma Litigation*.	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)

We submitted applications for renewal of leases in Sudbury in 2017 and 2018 and the approval process is ongoing. All conditions required for the renewal have been fulfilled. This process usually takes a number of years, and we can continue to operate while the approval process is ongoing.

(2)

The contract of work between PTVI and the Indonesian government will expire in 2025, after which date PTVI will continue its operationin the form of a 10-year business license provided certain obligations are satisfied (and PTVI can apply for a further 10 year extension provided that PTVI is in compliance with predefined requirements). The contract of work also provides that PTVI agrees to further divest an additional 20% of its shares to Indonesian participants within five years of the issuance of a regulation dated October 2014 (approximately 20% of PTVI's shares are already publicly traded and listed on the Indonesian stock exchange).

(3)

VNC has requested the renewal of some concessions that were scheduled to expire before 2018. All conditions required for the renewal have been fulfilled. This process usually takes a number of years and we can continue to operate while the approval process is ongoing.

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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 our Onça Puma operation in Brazil and VNC operation in New Caledonia the production and average grade represents in-place ore production and does not include losses due to processing.

	2016(1)			**2017(1)**			**2018(1)**		
		Grade			**Grade**			**Grade**	
	Production	**Copper**	**Nickel**	**Production**	**Copper**	**Nickel**	**Production**	**Copper**	**Nickel**
Ontario operating mines									
Copper Cliff North	979	1.44	1.26	814	1.40	1.30	746	1.30	1.29
Creighton	832	2.17	2.76	595	2.91	3.17	608	2.77	2.55
Stobie	1,373	0.57	0.64	448	0.53	0.62			
Garson	711	1.34	1.91	635	1.48	1.93	655	1.35	2.00
Coleman	1,209	3.76	1.47	1,007	3.76	1.53	618	3.31	1.40
Ellen	75	0.42	0.88						
Totten	671	1.86	1.43	710	1.90	1.33	710	2.02	1.39
Total Ontario operations	5,850	1.84	1.47	4,210	2.18	1.65	3,337	2.10	1.70
Manitoba operating mines									
Thompson	1,140		1.97	1,229		1.94	1,034		2.05
Birchtree	503		1.36	329		1.30			
Total Manitoba operations	1,643		1.78	1,557		1.81	1,034		2.05
Voisey's Bay operating mines									
Ovoid	2,392	1.44	2.62	2,378	1.44	2.56	1,895	1.32	2.37
Sulawesi operating mines									
Sorowako	4,708		1.93	4,569		1.89	4,469		1.90
New Caledonia operating mines									
VNC	2,919		1.53	3,030		1.47	2,620		1.46

Brazil operating mines				
Onça Puma(2)	1,710	2.04	964	2.05

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

(2) Mining activities in Onça Puma have been suspended since September 2017, as a result of an injunction granted in a public civil action.

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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, 2016	2017	2018
		(thousand metric tons contained nickel)		
Sudbury	Underground	80.4	61.9	50.6
Thompson	Underground	26.5	23.0	14.8
Voisey's Bay(1)	Open pit	49.0	51.8	38.6
Sorowako(2)	Open cast	81.1	73.1	72.1
Onça Puma	Open pit	24.1	24.7	22.9
New Caledonia(3)	Open pit	34.3	40.3	32.5
External(4)		15.6	13.1	13.1
Total(5)		311.0	288.2	244.6

(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 59.27% 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 2018, 46% of our refined nickel sales were delivered to customers in Asia, 24% to Europe, 28% to North America and 2% 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 discrete or filamentary powders, pellets, discs, squares and strips);

size (from micron powder particles to large full-sized cathodes); and

packaging (such as bulk, 2 ton bags, 250 kg drums, 10 kg bags)

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In 2018, the principal first-use applications for primary nickel were:

- stainless steel (68% of global nickel consumption);
- non-ferrous alloys, alloy steels and foundry applications (19% of global nickel consumption);
- nickel plating (8% of global nickel consumption); and
- batteries (5% of global nickel consumption).

In 2018, 67% 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 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), Paramus, 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 customer technical support direct our products into applications and geographic regions that offer the highest margins for our products.

Our nickel deliveries represented 11% of global consumption for primary nickel in 2018. 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 BHP Billiton. Together with us, these companies accounted for about 37% of global refined primary nickel production in 2018.

The nickel market is based on the quality of the nickel products. Class I products, which have higher nickel content and lower levels of deleterious elements, are more suitable for high-end nickel applications, such as utilization in the specialties industries (e.g.: aircraft and spacecraft) and in batteries for electric vehicles. Class II products, which present lower nickel content and higher levels of deleterious elements, are mostly absorbed into the stainless steel market. The majority of the world nickel production is composed of Class II nickel products (57% of the global market in 2018), which include the increasingly relevant nickel pig iron (NPI, with nickel content under 15%). Most of our products are high quality nickel products, which makes Vale the producer of choice for specialty nickel applications. In 2018, 58% of our nickel products were Class I and 26% were battery-suitable Class II products, a product that does not fully satisfy the specifications of Class I, but has potential for use in electric vehicles. Looking forward, as a result of the worldwide lower availability of nickel sulfide reserves (the specific kind of orebodies that source Class I nickel) when compared to nickel laterite reserves (mainly producing Class II products), we expect the

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market for Class I nickel to be further tightened, creating more opportunities for our premium product portfolio.

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.

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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 approximately 93,000 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, 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 12 Mtpy of ore processed. The open pit mine and mill concluded their ramp up in the fourth quarter of 2016 to a capacity of 24 Mtpy of ore processed with the full implementation of Salobo II expansion. Salobo I and II have a total capacity of approximately 197,000 tpy of copper in concentrates.	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, state of Maranhão. We constructed a 90-kilometer road to link Salobo to Parauapebas.
Canada:						

Vale Canada	Canada	Sudbury, Ontario	See	*Base metals*	*Nickel*	*Operations*
Vale Canada/ Voisey's Bay	Canada	Voisey's Bay, Newfoundland and Labrador	See	*Base metals*	*Nickel*	*Operations*

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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.*

	2016(1)		**2017(1)**		**2018(1)**	
	Production	**Grade**	**Production**	**Grade**	**Production**	**Grade**
Brazil						
Sossego	12,687	0.82	12,380	0.81	15,664	0.72
Salobo	57,279	0.62	61,573	0.63	50,963	0.69
Total	69,966	0.66	73,953	0.66	66,627	0.70

(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,**		
		2016	**2017**	**2018**
		(thousand metric tons)		
Brazil:				
Salobo	Open pit	176	193	193
Sossego	Open pit	93	100	92
Canada: (as coproduct of nickel operations)				
Sudbury	Underground	122	98	72
Voisey's Bay	Open pit	32	34	26
Thompson	Underground	3	2	1
External(1)		21	12	11
Zambia:				
Lubambe(2)	Underground	8	7	
Total		453	446	395

(1)

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

(2) For financial reporting purposes, Lubambe is accounted for under the equity method. We have included production numbers from Lubambe, adjusted to reflect our 40% equity interest, as the level of production and operating performance from entities accounted for under the equity method impacts our Adjusted EBITDA. Our use of Adjusted EBITDA is explained in *Results of operations Results of operations by segment Adjusted EBITDA by segment*. Vale sold its stake in the Lubambe mine in December 2017.

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 domestic customer for part of the copper concentrates and copper matte 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 cathodes from Sudbury and Long Harbour in North America under short-term sales agreements.

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2.2.4 Competition

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"), Aurubis AG, Jiangxi Copper Corporation Ltd., Glencore, Tongling Non-Ferrous Metals Group Co. and Freeport McMoRan Copper & Gold Inc., each 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.

Copper concentrate and copper matte are intermediate products in the copper production chain. Both the concentrate and matte 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 Freeport McMoRan, Glencore, BHP Billiton, Codelco, Anglo American, Antofagasta plc, Rio Tinto and First Quantum; each operating at the parent-company level or through subsidiaries. Our market share in 2018 was about 2% of the total copper concentrate market.

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. The refinery in Acton, England, where our PGM intermediates and PGM feeds purchased from third parties were processed was closed in 2018 as part of business optimization, and the PGM concentrates from our Port Colborne operation are being sold to third parties. Gold and silver intermediates are also sold to third parties. 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 Wheaton Precious Metals Corp. (formerly Silver Wheaton) ("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 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 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, Wheaton received 282,879 oz. of gold in 2018.

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

Mine	Type	2016	2017	2018
		(thousand troy ounces of contained metal)		
Sudbury(1):				
Platinum	Underground	166	144	135
Palladium	Underground	322	214	218
Gold(2)	Underground	98	74	57
Salobo:				
Gold(2)	Open pit	317	346	361
Sossego:				
Gold	Open pit	67	65	59

(1) Includes metal produced from unrelated parties feed purchases. Includes production out of 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 Wheaton.

2.4 Cobalt

We recover significant quantities of cobalt as a byproduct of our nickel operations. In 2018, we produced 1,288 metric tons of refined cobalt metal (in the form of cobalt rounds) at our Port Colborne refinery, 1,630 metric tons of cobalt rounds at our Long Harbour refinery, 2,105 metric tons of cobalt in a cobalt-based intermediate product in New Caledonia, and our remaining cobalt production consisted of 70 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 will increase in the coming years. We sell cobalt on a global basis. The cobalt metal and the Long-Harbour cobalt rounds are electro-refined at our Port Colborne refinery and have 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 June 2018, we sold to Wheaton and Cobalt 27 Capital Corp. ("Cobalt 27") a combined 75% of the cobalt produced as a byproduct at our Voisey's Bay mine from January 1, 2021, which includes the ramp-down of production from the existing mine and the life-of-mine production from our underground mine expansion project. In consideration, we received US$690 million in cash from Wheaton and Cobalt 27 upon closing of the transaction on June 28, 2018, and will receive additional payments of 20%, on average, of cobalt prices upon delivery. Vale remains exposed to approximately 40% of future cobalt production from Voisey's Bay, through Vale's retained interest in 25% of cobalt production and the additional payments upon delivery. See *Business overview Significant changes in our business.* The following table sets forth information on our cobalt production.

Mine	Type	Finished production by ore source for the year ended December 31, 2016	2017	2018

				(contained metric tons)
Sudbury	Underground	882	840	520
Thompson	Underground	700	138	198
Voisey's Bay	Open pit	887	1,829	1,902
New Caledonia	Open pit	3,188	2,780	2,104
Others(1)		143	224	371
Total		5,799	5,811	5,093

(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 PTVI ore source 24 metric tons in 2016, 6 metric tons in 2017 and 173 metric tons in 2018.

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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").

Company/ Mining complex	Location	Description/History	Mineralization/ Operations	Mining title	Power source	Access/ Transportation
Vale Moçambique						
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 80.75% stake, Mitsui has an indirect 14.25% stake and the remaining is owned by Empresa Moçambicana de Exploração Mineira, S.A.	Produces metallurgical and thermal coal. Moatize's main branded products are the Chipanga premium hard coking coal and Moatize Low Vol 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 port at Nacala-à-Velha via the Nacala Logistics Corridor.

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3.2 Production

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

Operation	Mine type	Production for the year ended December 31, 2016	2017	2018
		(thousand metric tons)		
Metallurgical coal:				
Moatize(1)	Open-cut	3,480	6,953	6,161
Thermal coal:				
Moatize(1)	Open-cut	2,012	4,307	5,444

(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 metallurgical and thermal 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. Competitiveness in the coal industry is primarily based on the economics of production costs, coal quality, transportation costs and proximity to the market. Our key competitive strengths are a new and competitive transportation corridor and the size and quality of our reserves. The logistics facilities in Mozambique help us ensure that our products are delivered on time and at a relatively low cost in comparison to lengthy waits at the ports in Queensland, Australia and on the east coast of the United States.

Our main competitors in the metallurgical coal business are located in Australia and Canada and include subsidiaries, affiliates and joint ventures of BHP Billiton, Glencore, Anglo American, Peabody, Jellinbah Resources, among others. In the thermal coal business, our main competitors are located in Indonesia, South Africa, Australia, Colombia, USA, Russia and include subsidiaries affiliates and joint ventures of Glencore, Anglo American, Drummond Co, Pt Bumi Resources and PT Adaro, among others.

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Lines of Business

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 (%)	Our share of capital 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	47.1	48.2	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(2)	Port operations	Argentina	100	100	
Vale Logística Uruguay	Port operations	Uruguay	100	100	
Central East African Railways ("CEAR")(3)	Railroad	Malawi	46.2	46.2	Mitsui, investors
Corredor de Desenvolvimento do Norte ("CDN")(3)	Railroad	Mozambique	46.2	46.2	Mitsui, investors
Corredor de Desenvolvimento do Norte Porto ("CDN Porto")(3)	Port and maritime terminal operations	Mozambique	46.2	46.2	Mitsui, investors

Corredor Logístico Integrado de Nacala S.A. ("CLN")(4)	Railroad and port operations	Mozambique	50.0	50.0	Mitsui
Vale Logistics Limited ("VLL")(4)	Railroad operations	Malawi	50.0	50.0	Mitsui
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 6.88% if BNDES exercises its rights under those debentures.

(2) Vale Logística Argentina is no longer operational.

(3) Vale holds its interest in CEAR, CDN and CDN Porto through a 50.0% interest in Nacala Corridor Holding Netherlands B.V., which indirectly owns 92.4% of these operating companies that comprise the NLC.

(4) Vale holds its interest in CLN and VLL through a 50.0% interest in Nacala Corridor Holding Netherlands B.V., which indirectly owns 100% of these operating companies that comprise the NLC.

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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 888-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 584 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 purchase railroad transportation capacity on our EFVM railroad. In 2018, the EFVM railroad transported a daily average of 334.5 thousand metric tons of iron ore and 60.2 thousand metric tons of other cargo. The EFVM railroad also carried 1,135 million passengers in 2018. In 2018, we had a fleet of 322 locomotives and 19,413 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. Its main cargo is iron ore, principally carried for us. VLI has rights to purchase railroad transportation capacity on our EFC railroad. In 2018, the EFC railroad transported a daily average of 559.8 thousand metric tons of iron ore and 31.1 thousand metric tons of other cargo. EFC also carried 317.9 thousand passengers in 2018. EFC supports the largest train, in terms of capacity, in Latin America, which measures 3.5 kilometers, weighs 41.67 thousand gross metric tons when loaded and has 330 cars. In 2018, EFC had a fleet of 282 locomotives and 21,087 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 other criteria, subject to price caps set forth in the relevant concession agreements, and are regulated by the Brazilian transportation regulatory agency, ANTT (*Agência Nacional de Transportes Terrestres*).

VLI. VLI provides integrated logistics solutions through 7,940 kilometers of railroads in Brazil (FCA and FNS), eight inland terminals with a total storage capacity of 795,000 metric tons and three maritime

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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:

Ferrovia 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 7,220 kilometers of track, extending into the states of Sergipe, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, Goiás and the Federal District of Brazil;

Ferrovia 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 Açailandia, 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 purchase capacity of our EFVM and EFC railroads for general cargo; and

Right to purchase capacity of our Tubarão and Praia Mole terminals for general cargo.

In 2018, VLI transported a total of 38.4 billion ntk of general cargo, including 18.4 billion ntk from FCA and FNS and 8.0 billion ntk through operational agreements with Vale.

MRS Logística S.A. ("MRS"). The MRS railroad, in which we have a 48.2% equity interest, is 1,643 kilometers long and links the Brazilian states of Rio de Janeiro, São Paulo and Minas Gerais. The MRS railroad transports our iron ore products from the Southern System mines to our maritime terminals. In 2018, it transported a daily average of 317.4 thousand metric tons of iron ore and 160.0 thousand metric tons of other cargo.

Africa

The Nacala Logistics Corridor (NLC) connects the Moatize mine to the Nacala-à-Velha maritime terminal, located in Nacala, Mozambique, and crosses into the Republic of Malawi. The NLC 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 NLC transports our coal products from the Moatize mine to our maritime terminal and supports 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 2043, subject to renewal. We have also rehabilitated existing railroads under a concession held by our subsidiary, CDN, which will expire in 2035. In Malawi, we are operating under a concession held by our subsidiary, VLL, which will expire in 2046, subject to renewal, and we have also rehabilitated existing railroads under a concession held by our subsidiary, CEAR, which will expire in 2046. In 2018, the NLC transported a daily average of 32.42 thousand metric tons of coal and 1.48 thousand metric tons of other cargo. The NLC also carried 800,883 passengers in 2018. In 2018, we had a fleet of 101 locomotives and 2,677 wagons at NLC, which were operated by CLN.

In November 2017, the NLC companies obtained project financing in the total amount of US$2.730 billion. The transaction closed in March 2018. Vale received US$2.6 billion in proceeds, in repayment of certain shareholders loans provided for construction of NLC, net of certain commissions paid by NLC. The project financing will be repaid in 14 years with the proceeds obtained from the tariff charged by NLC in connection with the provision of coal transportation.

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4.1.2 Ports and maritime terminals

Brazil

We operate ports 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 ports and terminals to handle customers' cargo.

Tubarão and Praia Mole Ports. The Tubarão port, which covers an area of 18 square kilometers, is located 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 in the Brazilian state of Espírito Santo.

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. The iron ore maritime terminal has a storage yard with a capacity of 3.1 million metric tons. In 2018, 96.8 million metric tons of iron ore and iron ore pellets were shipped through the terminal for us.

The *Terminal de Produtos Diversos* handled 6.7 million metric tons of grains and fertilizers in 2018. VLI has the right to purchase the capacity of the *Terminal de Produtos Diversos*.

The *Terminal de Granéis Líquidos* handled 582 thousand metric tons of fuel in 2018. VLI has the right to purchase the capacity of the *Terminal de Granéis Líquidos*.

The Praia Mole terminal is principally a coal terminal and handled 12.7 million metric tons of coal and other related cargo in 2018. VLI has the right to purchase the capacity of the Praia Mole terminal.

Ponta da Madeira maritime terminal. Our Ponta da Madeira maritime terminal is located 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 metric 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 metric 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 metric tons per hour. In 2018, Vale received from the Brazilian tax authorities, the customs authorization for the operations of Pier IV (north berth). Cargo shipped through our Ponta da Madeira maritime terminal consists of the Northern system production of iron ore, pellets and manganese. In 2018, 198 million metric tons of iron ore were shipped through the terminal. The Ponta da Madeira maritime terminal has a storage yard with a static capacity of 7.2 million metric tons.

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

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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 2018, the terminal loaded 19.2 million metric tons of iron ore.

Guaíba Island maritime terminal. From this terminal we 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 2018, the terminal loaded 41.2 million metric tons of iron ore.

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 3,800 metric tons per hour for pig iron and of 3,000 metric tons per hour for grains.

Uruguay

Since October 2017, our subsidiary Vale Logística Uruguay S.A. ("VLU") contracts third-party services to operate the Corporación Navios port terminal in the Nueva Palmira Free Zone in Uruguay. The port terminal provides facilities for the unloading, storing, weighing and loading of bulk materials from Corumbá, Brazil, by river barge for transshipment to ocean-going vessels destined for Brazilian, Asian and European markets. In 2018, we handled 1.058 thousand metric tons of iron and manganese ore through the Corporación Navios port.

Canada

Vale Newfoundland & 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 throughput capacity to handle 40 Mtpy of iron ore and iron ore pellets per year. The loading nominal capacity is 10,000 metric tons per hour and the nominal unloading capacity is 9,000 metric 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.

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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 58,000 DWT can unload at a rate of 8,000 metric 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 metric tons of limestone, 95,000 metric tons of sulfur, and 60,000 metric tons of coal.

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 2018, the terminal unloaded 24 million metric tons of iron ore and loaded 24 million metric tons of iron ore.

4.1.3 Shipping

Maritime shipping of iron ore and pellets

In 2018, we shipped approximately 248 million metric tons of iron ore and pellets in transactions in which we were responsible for transportation. We ship 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 (VLOCs). These vessels reduce energy consumption and greenhouse emissions by carrying an increased amount of cargo in a single trip, offering lower shipping costs. In 2018, approximately 64 million metric tons of iron ore products were transported under long term contracts of affreightment on vessels of 400,000 DWT.

We also own three capesize vessels with capacities ranging from 150,000 to 180,000 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 carry 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, owning and operating the vessels. Since 2014, we have sold 19 of our VLOCs of 400,000 DWT for an aggregate amount of US$1.940 billion. In 2018, Vale concluded negotiations of long-term contracts of affreightment with shipowners to employ 47 new VLOCs of 325,000 DWT. These shipowners plan to build the new vessels in China, South Korea and Japan, with deliveries estimated to take place between 2019 and 2023. Vessels will be equipped with similar engines to the ones that are currently being used in the second generation of Valemax vessels, and which are much more fuel-efficient.

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Paraná Paraguay waterway system

Through our subsidiary, Transbarge Navegación, and other chartered convoys, we transport iron ore and manganese ores through the Paraná and Paraguay waterway system. The barges are unloaded in our local customers' terminals in Argentina or in a contracted terminal in the Nueva Palmira Free Zone in Uruguay, where we load the ore into ocean going vessels. We transported 2.1 million metric tons through the waterway system in 2018, including 1.046 thousand metric tons of ore through our local customers' terminals and 1.058 thousand metric tons of ore through a port in Uruguay.

Tugboats

We manage a fleet of 15 owned tugboats. 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 five tugboats in the port of São Luís in the Brazilian states of Maranhão. One additional tugboat is hired to and operated by third parties, under their responsibility, in other ports in Brazil. We also own two tugboats in New Caledonia.

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 2018, our installed capacity in Brazil was 1.6 GW, sourced from both 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 three 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 Mello, Glória and Nova Maurício are located in the Southeastern region. In 2018, we sold the Ituerê hydroelectric power plant, located in the Southeastern region, due to its high required investments, low capacity and high cash cost when compared to our other assets. Through our 55% participation in Aliança Geração de Energia S.A. ("Aliança Geração"), we also have indirect stakes in the hydroelectric power plants of Igarapava, Porto Estrela, Funil, Candonga, Aimorés, Capim Branco I, Capim Branco II, , located in the Southeastern Region and, additionally, we have indirect stake in Santo Inácio, a Wind Complex located in Ceará State, which started operations in December 2017. Part of the electricity generated by these assets is supplied to our operations through power purchase agreements with Aliança Geração.

In order to achieve electricity self-sufficiency in Brazil by 2030 and increase renewable energy sources, we signed a long-term energy supply contract for 20 years, which will be supplied by the Folha Larga Sul wind farm, a 151.2 MW project in Campo Formoso, Bahia, Brazil. This project is expected to begin commercial operation by the first half of 2020. The agreement also includes a future asset call option held by Vale.

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

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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.

Canada

In 2018, our wholly owned and operated hydroelectric power plants in Sudbury generated 19% of the electricity requirements of our Sudbury operations. The power plants consist of five separate generation stations with an installed generator nameplate capacity of 55 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 2018, average demand for electrical energy was 162 MW to all surface plants and mines in the Sudbury area.

In 2018, diesel generation provided 100% of the electric requirements of our Voisey's Bay operations. We have six diesel generators on-site, with output ranging from 12 to 14 MW, in order to meet seasonal demands.

Indonesia

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 Larona River: (i) the Larona 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 CO_2 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., and others. Korea Nickel Corporation produces finished nickel for the stainless steel industry using intermediate products from our Matsuzaka and New Caledonia operations.

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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. and Posco, two major steel producers in South Korea. CSP's annual production capacity is 3.0 million metric tons.

Bauxite. We own a 40% stake in Mineração Rio do Norte S.A. ("MRN"), a bauxite mining business located in Brazil.

Samarco. We own a 50% stake in Samarco, an 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. Samarco's mining and pelletizing 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*).

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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 (i) 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 (ii) 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 2018, we performed an analysis of our reserve estimates for certain projects and operations, which is presented in this report. Reserve estimates for each operation assume that we either have or expect to obtain all 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 proportional 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*.

As a part of Vale internal governance process, we have a Mineral Resources and Mineral Reserves Global Committee coordinated by our exploration and projects department and composed of representatives of all business units (Ferrous, Coal and Base Metals) and the accounting, investor relations and capital projects departments. The purpose of these committee is ensuring the transparency, consistency, professional competence and reliability of all information prepared for internal purposes and public reporting. It is also responsible for overseeing the governance of our estimation and reporting of mineral reserves, which include external audit when applicable.

We report our reserves in accordance with the SEC's Industry Guide 7, as summarized above. In 2018, the SEC adopted new rules governing disclosures on mining properties, including reporting of reserves and resources, which will take effect for our 2021 fiscal year (although earlier adoption is permitted). The new SEC rules will align SEC disclosure requirements more closely with global regulatory practices and standards, as embodied in standards developed by CRIRSCO (Committee for Mineral Reserves International Reporting Standards). We already estimate our reserves under CRIRSCO standards, therefore we do not expect material changes when the new SEC standards become effective.

Our reserve estimates are based on certain assumptions about prices. We have determined that our reported reserves could be economically produced if prices for the products identified in the following

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table were equal to the three-year average historical prices through December 31, 2018. 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
Iron ore:		
Vale(1)	US$66.4 per dry metric ton	Average Platts IODEX (62% Fe CFR China)
Coal:(2)		
Metallurgical Moatize	US$179.4 per metric ton	Platts PHCC (PLV)
Thermal Moatize	US$82.3 per metric ton	Richards Bay FOB
Base metals:		
Nickel(3)	US$11,037 per metric ton	LME Ni
Copper	US$5,850 per metric ton	LME Cu
Nickel and copper byproducts:		
Platinum	US$938 per oz	Average realized price
Palladium	US$838 per oz	Average realized price
Gold	US$1,258 per oz	Average realized price
Cobalt(3)	US$54,423 per metric ton	99.3% low cobalt metal (source: Metal Bulletin)
Manganese ore(4):		
Manganese	US$5.81 per dry metric ton	Average CRU (44% Mn CFR China)

(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 tables below 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 classify our iron ore reserves as proven reserves to the extent that they satisfy the requirements of the definition of proven (measured) reserves, as described above, and that we have obtained the environmental licenses for the corresponding pit operation and have at least a reasonable expectation of obtaining on a timely basis any additional licenses necessary to conduct the operations.

We periodically review the economic viability of our iron ore reserves in light of changes in the iron ore industry. We have determined that the Urucum and Corumbá mines, although at production stage, are not economically viable based on three-year average historical prices. Accordingly, we are not reporting reserves at those facilities since 2015.

Variations in iron ore reserves from 2017 to 2018 reflect depletion resulting from mine production for all mines. Our reserves for Fazendão, Fábrica Nova and Capanema (located at the Mariana complex in our Southeastern System), João Pereira, Galinheiro and Sapecado (located at the Minas Itabirito complex in our Southern System) and Capitão do Mato (located at the Vargem Grande complex in our Southern System) have been positively affected by new geological information and estimates. Also, we are no longer reporting reserves for the Conta História project, located at the Mariana complex in our Southeastern System, because we are reviewing our long term plan for Mariana complex.

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Reserves

Following the failure of Dam I tailing dam in January 2019 and the shutdown of the Feijão and Jangada mines and related infrastructure, all located in the Paraopeba Complex (Southern System), we are reviewing these operations and Capim Branco project. Under these circumstances, we are currently not in a position to report these reserves. For more information about the failure of Feijão tailing dam, see *Business overview Failure of the tailings dam at the Córrego do Feijão mine*.

On January 29, 2019, we announced our decision to accelerate the decommissioning of our upstream tailings dams. In order to proceed with the accelerated decommissioning of these upstream tailings dams, we will temporarily halt production at the units where the structures are located, namely: Abóboras, Capitão do Mato and Tamanduá (located at the Vargem Grande complex); Segredo and João Pereira (located at the Fábrica sub-complex in the Minas Itabirito complex). We will also suspend production at Fábrica and Vargem Grande pelletizing plants. The temporary halt of these operations does not impact our mineral reserves, because the upstream dams being decommissioned were no longer in use and are not necessary for these operations. We expect to resume these operations once the decommissioning work is completed.

Iron ore reserves(1)
(As of December 31, 2018)

	Proven		Probable		Total 2018		Total 2017	
	Tonnage	Grade	Tonnage	Grade	Tonnage	Grade	Tonnage	Grade
Southeastern System(2)								
Itabira(3)	687.5	45.7	173.9	45.8	861.4	45.9	920.2	45.6
Minas Centrais(4)	163.6	48.5	570.7	57.7	734.4	55.4	776.5	55.1
Mariana(5)	366.6	46.3	507.9	43.8	874.5	44.7	700.4	44.3
Total Southeastern System	**1,217.7**	**46.4**	**252.6**	**46.3**	**470.4**	**46.3**	**397.1**	**45.9**
Southern System(6)								
Minas Itabirito(7)	436.9	54.3	243.7	43.7	680.5	51.0	658.2	45.0
Vargem Grande(8)	368.9	44.0	170.5	47.5	539.3	47.0	962.5	48.3
Paraopeba(9)	42.9	63.2	123.2	60.6	166.1	61.3	308.5	60.4
Total Southern System	**848.6**	**50.4**	**537.3**	**45.3**	**385.9**	**46.4**	**129.2**	**46.7**
Northern System(10)								
Serra Norte(11)	576.2	66.1	443.6	65.7	019.9	65.9	969.2	66.0
Serra Sul(12)	1,969.0	66.2	319.1	66.2	288.1	66.2	395.3	65.5
Serra Leste	6.9	66.7	249.3	65.2	256.2	65.2	258.1	65.4
Total Northern System	**2,552.1**	**66.2**	**012.0**	**66.1**	**564.1**	**66.2**	**622.6**	**65.6**
Total Vale Systems	**4,618.4**	**58.2**	**802.0**	**57.4**	**420.4**	**57.8**	**148.9**	**53.5**

(1) Iron Ore Reserve estimates stated as metric million tonnes inclusive moisture and dry %Fe grade; following moisture contents: Itabira 1.66%; Minas Centrais 7,46%; Mariana 3.66%; Minas Itabirito 4.74%; Vargem Grande 5.17%; Paraopeba 6.29%; Serra Norte 6.39%; Serra Sul 4.47%; Serra Leste 3.18%.

(2) Approximate drill hole spacing used to classify the Reserves were: 100m × 100m to Proven Reserves and 200m × 200m to Probable Reserves. Average product recovery (tonnage basis) of the iron ore reserves are: 53% for Itabira, 78% for Minas Centrais and 62% for Mariana.

(3) Includes reserves for Conceição and Minas do Meio mines.

(4) Includes reserves for Brucutu mine and Apolo project. Our operations at the Brucutu mine have been suspended since February 4, 2019. On April 15, 2019, the court of appeals of the State of Minas Gerais reversed the last injunction that prevented us from operating the Brucutu mine. We expect to resume operations at Brucutu soon, but the proceedings challenging our right to use the dams supporting our operations at Brucutu are still ongoing.

(5) Includes reserves for Alegria, Fábrica Nova and Fazendão mines and Capanema. For 2017, we also reported reserves for Conta Histórica project.

(6) Approximate drill hole spacing used to classify the Reserves were: 100m × 100m to Proven Reserves and 200m × 200m to Probable Reserves. Average product recovery (tonnage basis) of the iron ore reserves are: 59% for Minas Itabirito, 58% for Vargem Grande and 96% for Paraopeba.

(7) Includes reserves for Sapecado, Galinheiro, João Pereira and Segredo mines.

(8) Includes reserves for Tamanduá, Capitão do Mato and Abóboras mines.

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(9) Paraopeba integrated operation includes Jangada, Córrego do Feijão, Mar Azul and Capão Xavier mines and the Capim Branco project. For 2018, we only report reserves for Mar Azul and Capão Xavier mines. We are not in a position to report reserves for the Jangada and Córrego do Feijão mines and the Capim Branco project, which are under review following the failure of Dam I at the Feijão mine.

(10) Approximate drill hole spacing used to classify the reserves were: 150m × 100m to proven reserves and 300m × 200m to probable reserves, except Serra Leste which is 100m × 100m to proven reserves and 200m × 200m to probable reserves. Average product recovery (tonnage basis) of the iron ore reserves are: 100% for Serra Norte, 100% for Serra Leste and 100% for Serra Sul.

(11) Includes reserves for N1, N2, N3, N4W, N4E and N5 mines.

(12) Includes reserves for S11C and S11D deposits.

The mine exhaustion schedule has been adjusted due to our new production plan and our revision of project capacity.

	Iron ore integrated operations			
	Type	**Operating since**	**Projected exhaustion date (1)**	**Vale interest (%)**
Southeastern System				
Itabira	Open pit	1957	2028	100.0
Minas Centrais	Open pit	1994	2054	100.0
Mariana	Open pit	1976	2106	100.0
Southern System				
Minas Itabirito	Open pit	1942	2120	100.0
Vargem Grande	Open pit	1993	2059	100.0
Paraopeba	Open pit	2001	2036	100.0
Northern System				
Serra Norte	Open pit	1984	2042	100.0
Serra Sul	Open pit	2016	2062	100.0
Serra Leste	Open pit	2014	2062	100.0

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

Manganese ore reserves

The following tables set forth manganese ore reserves and other information about our mines. The variation in the mine's ore reserves from 2017 to 2018 predominantly reflects depletion through mine production and update due to new geological information and estimates of ore reserves for Azul and Morro da Mina. Our manganese ore reserves information for Urucum are currently being reviewed to consider new economic assumptions and ongoing geotechnical studies, which are expected to be completed by 2020. Although the Urucum mine continues to operate, we are not in a position to report reserves for the Urucum mine until these studies are concluded.

	Manganese ore reserves(1)(2) (As of December 31, 2018)							
	Proven		**Probable**		**Total**		**Total**	
	2018 Tonnage	**2018 Grade**	**2018 Tonnage**	**2018 Grade**	**2018 Tonnage**	**2018 Grade**	**2017 Tonnage**	**2017 Grade**
Azul	10.3	26.5	4.4	27.5	14.7	26.8	15.0	26.6
Urucum							9.3	46.5
Morro da Mina	4.8	28.4	3.7	24.5	8.5	26.7	8.5	30.4
Total	15.1	27.1	8.1	26.1	23.2	26.7	32.7	33.2

(1) Manganese Ore Reserve estimates stated as metric million tonnes inclusive moisture and dry %Mn grade; following moisture contents: Morro da Mina (3.4%) and Mina do Azul (18.0%).

(2) Approximate drill hole spacing used to classify the reserves was: 100m × 100m for Proven Reserves and 200m × 200m for Probable Reserves. Average product recovery (tonnage basis) of the iron ore reserves are: Azul (40%) and Morro da Mina (70%).

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Reserves

The mine exhaustion schedule has been adjusted to reflect our new production plan.

	Manganese ore mines			
	Type	Operating since	Projected exhaustion date	Vale interest (%)
Azul	Open pit	1985	2026	100.0
Urucum	Underground	1976		100.0
Morro da Mina	Open pit	1902	2049	100.0

COAL RESERVES

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

We continue our exploration program in Moatize, targeting areas within the current mine plan and the extension of it, with the purpose of aggregating more reserves in the future. In 2018, we drilled 52% (approximately 92,000 meters) of the total 177,000 meter exploration drill campaign, which will continue in 2019. The results of this campaign are still under analysis and have not been reflected in our mineral reserve disclosure.

Coal ore reserves(1)
(As of December 31, 2018)

		ROM(2)					Marketable reserves(3)	
	Coal type	Proven 2018 Tonnage	Probable 2018 Tonnage	Total 2018 Tonnage	Total CV	2017 CV	2018 Tonnage	2017 Tonnage
Moatize	Metallurgical & thermal	194.8	798.7	993.5	26.0 (thermal)	26.0 (thermal)	403.0	415.0

(1) The reserve stated above is 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 and is reported on an *in situ* 4.0% moisture basis. Calorific Value (CV) for thermal coal is stated as the Gross Calorific Value (Mj/Kg) on air-dried basis.

(3) Tonnage is stated in millions of metric tons.

	Coal mines			
	Type	Operating since	Projected exhaustion date	Vale interest (%)
Moatize	Open pit	2011	2039	80.75

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Reserves

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) (As of December 31, 2018)									
	Proven Tonnage	Probable Grade	2018 Tonnage	Total Grade	2018 Tonnage	Total Grade	2018 Tonnage	Total Grade	2017 Recovery range	(%)
Canada										
Sudbury	20.9	1.65	40.8	1.27	61.7	1.40	64.9	1.43	75	85
Thompson									85	90
Voisey's Bay	15.5	2.24	15.5	2.00	31.0	2.12	32.4	2.13	80	90
Indonesia										
PTVI	101.8	1.76	14.7	1.64	116.4	1.74	95.1	1.79	85	90
New Caledonia										
VNC										
Brazil										
Onça Puma	60.7	1.66	53.1	1.38	113.8	1.51	106.5	1.53	85	90
Total	199.0	1.75	124.0	1.45	322.9	1.62	298.9	1.66		

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

In Canada, our Sudbury operation's mineral reserves decreased in 2018 due to depletion and minor adjustments due to re-evaluations of reserves at the Copper Cliff Mine. The Voisey's Bay operations mineral reserves decreased due to depletion. In Indonesia, the mineral reserves at the PTVI operations increased due to the conversion of resource to reserve, considering an extension of the mining rights until 2045. The mineral reserves at Onça Puma, in Brazil, increased due to the conversion of the Puma West resources to reserves and an update of the Puma block model.

We are not reporting the mineral reserves of VNC and Thompson as of December 31, 2018, 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.

	Nickel ore mines			
	Type	Operating since	Projected exhaustion date	Vale interest

				(%)
Canada				
Sudbury	Underground	1885	2042	100.0
Thompson	Underground	1961		100.0
Voisey's Bay(1)	Open pit/Underground	2005	2033	100.0
Indonesia				
PTVI	Open pit	1977	2040	59.27
New Caledonia				
VNC	Open pit	2011		95.0
Brazil				
Onça Puma	Open pit	2011	2071	100.0

(1) Voisey's Bay will transition from an open pit mine to an underground mine.

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Reserves

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) (As of December 31, 2018)								
	Proven		2018 Probable		2018 Total		2018 Total		2017 Recovery
	Tonnage	Grade	Tonnage	Grade	(%) Grade	Tonnage	Grade		range %
Canada									
Sudbury	20.9	2.43	40.8	1.44	61.7	1.78	64.9	1.80	90 95
Voisey's Bay	15.5	1.00	15.5	0.88	31.0	0.94	32.4	0.96	90 95
Brazil									
Sossego	103.1	0.66	5.9	0.69	109.0	0.66	120.1	0.68	90 95
Salobo	619.2	0.63	537.7	0.58	1,156.9	0.61	1,193.4	0.61	80 90
Total	758.7	0.69	599.9	0.63	1,358.5	0.67	1,410.8	0.68	

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

In Canada, our Sudbury operation's mineral reserves decreased in 2018 due to depletion and minor adjustments due to re-evaluations of mineral reserves at Copper Cliff Mine, and our Voisey's Bay operation's mineral reserves decreased due to mining depletion. In Brazil, the Sossego operations mineral reserves decreased due to depletion and stockpile reclamation. The mineral reserve estimates at the Salobo operation decreased due to depletion and re-evaluation work, partially offset by medium- and low-grade stockpile additions.

	Copper ore mines			
	Type	Operating since	Projected exhaustion date	Vale interest (%)
Canada				
Sudbury	Underground	1885	2042	100.0
Voisey's Bay	Open pit/Underground	2005	2033	100.0
Brazil				
Sossego	Open pit	2004	2027	100.0
Salobo	Open pit	2012	2051(1)	100.0

(1) Reduction in the number of years due to the approval of the Salobo III copper expansion project.

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Reserves

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 depletion and mining losses and recoveries, with no adjustments made for metal losses due to processing.

	Precious metals reserves(1) (As of December 31, 2018)							
	Proven Reserves		**Probable Reserves**		**Total 2018**		**Total 2017**	**Recovery**
	Tonnage	**Grade**	**Tonnage**	**Grade**	**Tonnage**	**Grade**	**Grade**	**range (%)**
Canada								
Sudbury								
Platinum	20.9	1.3	40.8	1.2	61.7	1.2	64.9	1.2 80 90
Palladium	20.9	1.5	40.8	1.5	61.7	1.5	64.9	1.4 80 90
Gold	20.9	0.6	40.8	0.4	61.7	0.5	64.9	0.5 80 90
Brazil								
Sossego								
Gold	103.1	0.2	5.9	0.2	109.0	0.2	120.1	0.2 75 80
Salobo								
Gold	619.2	0.3	537.7	0.3	1,156.9	0.3	1,193.4	0.3 60 70
Total Pt + Pd(2)	20.9	2.9	40.8	2.7	61.7	2.8	64.9	2.6
Total Gold	743.2	0.3	584.4	0.3	1,327.6	0.3	1,378.4	0.3

(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

	Type	Operating since	Projected exhaustion date	Vale interest (%)
Canada				
Sudbury	Underground	1885	2042	100.0
Brazil				
Sossego	Open pit	2004	2027	100.0
Salobo	Open pit	2012	2051	100.0

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Reserves

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) (As of December 31, 2018)							
	Proven		Probable		Total		2017	Recovery
	2018 Tonnage	2018 Grade	2018 Tonnage	2018 Grade	2018 Tonnage	2018 Grade	Grade	range
								%
Canada								
Sudbury	20.9	0.04	40.8	0.02	61.7	0.03	0.04	20 40
Voisey's Bay	15.5	0.13	15.5	0.12	31.0	0.13	0.13	70 80
New Caledonia								
VNC								
Total	36.4	0.08	56.3	0.05	92.7	0.06	97.3	0.07

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

Our cobalt reserve estimates decreased in 2018 for the same reasons discussed above in connection with the nickel mineral reserves.

	Cobalt ore mines			
	Type	Operating since	Projected exhaustion date	Vale interest (%)
Canada				
Sudbury	Underground	1885	2042	100.0
Voisey's Bay	Open pit/ Underground	2005	2033	100.0
New Caledonia				
VNC	Open pit	2011		95.0

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CAPITAL EXPENDITURES

The figures discussed in this section are for project execution and sustaining existing operations and replacement projects.

The 2019 investment budget approved by our Board of Directors is US$703 million for project execution, reflecting a 27.7% decrease compared to the 2018 investment budget, and US$3.731 billion for sustaining existing operations and replacement projects, reflecting a 30.2% increase compared to 2018. Most of the capital expenditures budget for project execution will be invested in Brazil (96%).

	2017 expenditures(1)	2018 expenditures(1)	2019 budget	
	(US$ million)		(US$ million)	(% of total)
Project execution (construction in progress)	1,617	888	703	15.9
Investments to sustain existing operations and replacement projects (property, plant and equipment)	2,231	2,896	3.731	84.1
Total	US$ 3,848	US$ 3,784	US$ 4.434	100%

(1) Executed capital expenditures comprise the sum of cash outflows.

We are developing a focused organic growth portfolio with fewer projects, but higher expected rates of return. Our main initiative, S11D, accounts for 44.2% of the US$703 million budgeted for project execution in 2019.

The following table sets forth total expenditures in 2018 for our main investment projects and expenditures budgeted for those projects in 2019, together with estimated total expenditures for each project and the actual or estimated start-up date of each project as of December 31, 2018.

			Executed CAPEX		Expected CAPEX	
Business area	Main projects(1)	Actual or estimated start-up	2018(2)	Total executed(3)	2019(4)	Total expected(5)
			(US$ million)			
Iron ore	CLN S11D(6)	1H14 to 2H19	578	7,146	209	7,679
Base Metals North Atlantic	VBME	1H21	163	223	311	1,694
Iron ore	Gelado	2H21	5	5	87	428
Base Metals South Atlantic	Salobo III	1H22	3	3	193	1,128

(1) Projects approved by our Board of Directors.

(2) Executed capital expenditures comprise the sum of cash outflows.

(3) Total executed CAPEX through December 31, 2018, including capital expenditures in prior periods.

(4) Figure presented corresponds to the amount approved in the US$4.434 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 CLN S11D was US$11.582 billion.

Our key investment projects are described in more detail below:

The largest ongoing capital expenditure project is the increase in the logistics capacity of the Northern System to support the S11D mine, including the expansion of approximately 570 km of railway, 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 95% of physical progress and the railway spur was totally completed. The port offshore started up in the last quarter

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of 2016. The project is 97% complete, with executed capital expenditures (total cash outflows) of US$7.146 billion. The start-up is expected to continue through the second half of 2019.

The Voisey's Bay underground mine extension project ("VBME") project is expected to extend the mine life of Voisey's Bay and to increase Voisey's Bay production to an estimated annual production of around 45 kt of nickel, on average, about 20 kt of copper and about 2.6 kt of cobalt, in total. VBME will replace existing Voisey's Bay mine production, thus being recorded as a sustaining investment for the purpose of the dividend policy. The project is 17% complete, with executed capital expenditures (total cash outflows) of US$223 million. Start-up is expected in the first half of 2021. In June 2018, we announced a cobalt streaming transaction that enabled the development of VBME.

In September 2018, our Board of Directors approved a sustaining investment in the Gelado project, which will recover approximately 10 Mtpy of pellet feed with 64.3% Fe content, 2.0% silica and 1.65% alumina from tailings dams in the Carajás Complex in order to feed the São Luís pellet plant. The project is 3% complete, with executed capital expenditures (total cash outflows) of US$5 million. Start-up is expected in the second half of 2021.

In October 2018, our Board of Directors approved investment in the Salobo III copper project, a brownfield expansion increasing processing throughput capacity. The project encompasses a third concentrator line, and will use Salobo's existing infrastructure. Salobo III will produce an average copper volume of approximately 50 ktpy in the first 5 years, 42 ktpy in the first 10 years and 36 ktpy throughout the life of mine. Start-up is scheduled for the first half of 2022 with a ramp-up of 15 months.

In December 2018, we announced an expansion of the S11D mine production by 10 Mtpy (from 90 Mtpy to 100 Mtpy) and of the Northern System's logistics from 230 Mtpy to 240 Mtpy, with start-up in 2022, given the expected increase in demand for high-grade ores.

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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.

Location	Mining title	Approximate area covered (in hectares)	Expiration date
Brazil	Mining concessions (including under applications)	595,523	Indefinite
Canada(1)	Mining concessions (terminology varies among provinces)	218,761	2018 2038
Indonesia(2)	Contract of work	118,017	2025
New Caledonia(3)	Mining concessions	21,077	2022 2051
Mozambique(4)	Mining concessions	23,780	2032

(1) The expiration date of our leases in Sudbury is subject to current renewal applications. The approval process for applications submitted in 2018 is in progress. All conditions required for the renewal were fulfilled. This process usually takes a number of years and we can continue to operate while the approval process is ongoing.

(2) The contract entered into by PTVI and the Indonesian government will expire in 2025. PTVI is entitled to two 10-year extensions in the form of a business license, subject to government approval.

(3) VNC has requested renewal of some concessions that were scheduled to expire before 2018. We may continue to operate while the approval process is ongoing.

(4) 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 3.6 million hectares in Brazil and 1.5 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. For instance, on June 12, 2018, the Brazilian President issued Decree 9,406 instituting a new legislative and

regulatory framework for the mining industry. This decree provides for an overhaul of the Brazilian mining code and the regulations of the ANM, the new national mining agency succeeding the DNPM, including the adoption of international standards of classification of mineral resources and reserves for the purpose of exploration reports and establishment of competitive proceedings for areas released from prior concessions. The ANM approved resolutions in 2018 confirming the stability of mining titles, including mining concessions, which had no impact on our disclosed reserves.

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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 are required to pay a royalty known as 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 calculation of the CFEM is done as follows: (i) for domestic sales, the basis for calculation of CFEM is the revenue from sales, net of sales taxes and contributions; (ii) for exports, the basis for calculation of CFEM is the amount equivalent to the transfer pricing in federal income tax legislation; and (iii) for a company's internal mineral consumption, the basis for calculation of CFEM is the value equivalent to the current price of the ore in the domestic market, the international markets or a reference value, as to be determined by the ANM. The current CFEM rates are: 3.5% for iron ore; 2% for copper, nickel, fertilizers and other materials; 3% for bauxite, potash and manganese ore; and 1.5% for gold.

Brazilian states. Several Brazilian states, including Minas Gerais, Pará and Mato Grosso do Sul, 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$3.593 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.

Mozambique. The mining agreement signed in June 2007 with the Mozambican government requires that we pay a royalty known as IPM (*Imposto sobre a Produção Mineira*) on revenues from sales of extracted coal, net of insurance and transportation costs incurred before sales. The royalty rate on coal mining activity in Mozambique is currently 3%.

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.

New Caledonia. The mining code of New Caledonia requires us to pay royalties linked to the ownership of mining concessions. The basis of calculation is (i) 800 Pacific *francs* per hectare when the owned surface is less than 15,000 hectares and (ii) 1,000 Pacific *francs* per hectare when the owned surface is greater than 15,000 hectare.

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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 construct and operate. In most jurisdictions, the development of new facilities requires us to submit environmental and social impacts assessments 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, funding research into new and alternative technologies to reduce environmental and social impacts, use and continuous improvement of a Best Practices Guide for Environmental Licensing and the Environment, the deployment of highly-skilled specialist teams and closer interaction with environmental regulators.

Environmental regulations affecting our operations relate, among other matters, to emissions of pollutants into the air, soil and water, including greenhouse gas and climate change regulations; recycling and waste management; protection and preservation of forests, coastlines, caves, cultural heritage sites, watersheds and other features of the ecosystem; water use; and financial provisions and closure plans required for mining licenses, including decommissioning and reclamation costs. 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. For instance, 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 2017, the federal government created new rules for the payment of environmental compensation for activities subjected to environmental assessment. As a result, in 2018 we recognized a liability related to regulatory obligations stemming from the new rules.

BRAZILIAN REGULATION OF MINING DAMS

In May 2017, the DNPM (predecessor to the ANM) created new obligations for companies operating mining dams in Brazil, primarily:

Audit: Companies operating mining dams must conduct two annual stability audits for each dam and prepare a stability condition report and the corresponding Stability Condition Statement (DCE). One of these audit must be conducted by external auditors.

Dam Periodic Safety Reviews (RPSB Revisão Periódica de Segurança de Barragem): The report must include detailed analysis of all dam's documentation, including projects and procedures, stability analysis of the structures and the impacts on surrounding communities, including hazards and failure impact studies. Companies operating mining dams classified as

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high associated potential damage (DPA) completed these studies in June 2018, while those for medium-DPA mining dams were completed in December 2018. Studies for low-DPA mining dams must be completed by June 2019. The RPSB reports must be renewed each 3, 5 and 7 years for high, medium and low DPA respectively, and whenever any structural modifications are made.

Emergency Action Plan of Mining Dams Training: Companies operating high-DPA mining dams must conduct two annual emergency action plan training sessions for their employees.

Monitoring: Additional video monitoring must be implemented for all high-DPA mining dams by June 2019.

In February 2019, the ANM issued a resolution on dam safety requiring companies that own upstream tailings dams to submit a technical decommissioning project by August 2019 and to fully decommission any inactive upstream tailings dam by August 2021, and any active upstream tailings dam by August 2023. In addition, the resolution requires the decommissioning of our facilities within the Self-Rescue Zone of a tailings dam. This new resolution is already in effect, but is under public consultation for potential adjustments until May 1, 2019.

In February 2019, a new statute approved by the state of Minas Gerais prohibits the increase, modification or construction of any upstream dam. The statute also prohibits the increase, modification or construction of any dam if communities are established within its Self-Rescue Zone, an area which encompasses the portion of the valley downstream of the dam where timely evacuation and intervention by the competent authorities in emergency situations is not possible. In general, it imposes certain restrictions on the use of any other type of tailings dams and significant restrictions on our ability to increase any existing dam.

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 Infrastructure 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 concessionaries in Brazil initiated discussions with ANTT regarding the possibility of early renewal of railways concession contracts, which are ongoing. Approval would require a formal analysis of the economic and technical conditions by the federal government, federal court of auditors (TCU) and the approval of our Board of Directors. As part of the process, nine public hearings took place in 2018 and the ANTT technical analysis is now in its final

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phase. If we agree to an earlier renewal of our concessions, we may have to agree with additional performance indicators, new investments obligations and new 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 Infrastructure through the Secretary of Ports (SNP), whose purpose is to formulate policies and guidelines. The agreements to operate our private terminals are valid until 2039, with the exception of the agreement with CPBS, which will expire in 2026.

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. We are compliant with the requirements of the REACH regulations. In addition, South Korea is currently implementing a regulation similar to REACH, and we anticipate further expansion of REACH-like regulations in other Asian countries.

Regulation of international maritime transportation. We are subject to health, safety and environmental regulation by the International Maritime Organization (IMO). IMO rules apply not only to the international shipping categories, but also to 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 and reducing its overall greenhouse gas emissions. In April 2018, reduction targets were defined as part of the IMO's initial strategy for curbing the sector's emissions. These targets include a 50% reduction in greenhouse gas emissions by 2050, based on 2008 levels. The organization will reach a final strategy, including the measures to be adopted, by 2023. These measures 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 sulfur content or to install additional pollutant control equipment to limit air emissions. Also, the International Convention for the Control and Management of Ships' Ballast Water and Sediments became effective in September 2017 for new ships (those with keels laid after that date). For existing ships, the convention will become effective in stages beginning in September 2019, following which date each vessel will have a specific deadline for compliance, with the global fleet required to be fully compliant by September 2024. Under this convention, all compliant ships during their international voyages are required to manage their ballast water and sediments in accordance with the defined requirements, which may also result in increases of freight and port operation costs.

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III. OPERATING AND FINANCIAL REVIEW AND PROSPECTS

OVERVIEW

Our performance in 2018 was overshadowed by the tragic event in Brumadinho in January 2019. For a discussion of the expected impact of the dam failure on our future results, see *Business overview Failure of the tailings dam at the Córrego do Feijão mine*.

In 2018, our net income from continuing operations in 2018 was US$6.988 billion, compared to US$6.334 billion in 2017, and our Adjusted EBITDA in 2018 was US$16.593 billion, 8.2% higher than in 2017, mainly as a result of higher realized prices (impact of US$977 million) and higher sales volumes (impact of US$975 million) for ferrous minerals, which were partially offset by higher costs and expenses for ferrous minerals (impact of US$616 million), driven by cost factors that are directly linked to iron ore prices. Adjusted EBITDA is a non-GAAP measure, which is calculated using net income or loss and adding back (i) depreciation, depletion and amortization, (ii) income taxes, (iii) financial results, net, (iv) equity results and other results in associates and joint ventures, net of dividends received, and (v) special events. For more information on the reconciliation of our Adjusted EBITDA to our net income, see note 4 to our consolidated financial statements.

IMPACT OF THE FAILURE OF DAM I AT THE CÓRREGO DO FEIJÃO MINE

The failure of Dam I represents an event subsequent to the financial statements as of and for the year ended December 31, 2018. Accounting impacts of the dam failure will consequently be reflected in the financial statements for 2019, beginning with the financial statements as of and for the quarter ended March 31, 2019. We expect the failure of Dam I and its consequences to have extensive impact on our financial performance and results of operations. We have not yet determined the full scope and amount of all the consequences, but some major expected impacts are summarized below.

Reduced revenues due to the suspension of operations. As of April 15, 2019, the estimated impact of the suspension of operations following the dam failure on our production is 92.8 million metric tons per year (including the estimated annual impact of the suspension of the Brucutu mine). The suspension of these operations may cause a decrease in our revenues for the year of 2019.

Increased expenditures for assistance and remediation. We expect to incur significant expenses as a result of assistance and remediation actions following the dam failure. As of the date hereof, we cannot estimate the impact of these increased expenditures in our financial statements.

Impairments of fixed assets. We expect to write off assets of the Córrego do Feijão mine and those related to the upstream dams in Brazil, resulting in a loss of US$124 million in 2019. Additional impairments, write-off or write-down of assets may be recognized in 2019.

Provisions for costs of decommissioning and further remediation. We expect to recognize provisions for the costs for decommissioning of our existing upstream dams. We are evaluating the measures to be taken to decommission our tailings dams, but cannot estimate the timing and costs associated with this process. At this point we cannot estimate the amounts of provisions to be recognized.

Provisions for legal proceedings. We are subject to a number of investigations and legal proceedings in connection with the failure of Dam I, which may result in significant liabilities. On February 15, 2019, we entered into a preliminary agreement with labor

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prosecutors in Minas Gerais pursuant to which we agreed to indemnify direct and indirect employees affected by the closure of our operations at Córrego do Feijão mine. We currently estimate that a provision of approximately US$220 million will be recognized in 2019 in connection with this proceeding. On February 20, 2019, we entered into a preliminary agreement with certain public authorities, pursuant to which we agreed to provide certain emergency indemnification payments to the residents of Brumadinho and the communities that are located in a certain region by the Paraopeba river. We estimate a provision ranging from US$260 million to US$520 million in connection with this settlement. Our potential liabilities resulting from the dam failure are significant, and additional provisions may be recognized during the year of 2019.

Freeze of assets. Various Brazilian courts have ordered the freezing of an aggregate of R$17.6 billion (US$4.5 billion) of our financial assets to secure the payment of damages resulting from the dam failure, including balances in our bank accounts, judicial deposits and common shares that we hold in treasury.

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.

In 2018, China's "supply-side reform" was broadened to include coke and iron ore operations, in addition to steel operations. As a result, supply constraints were observed in both industries. During the year, iron ore price levels were mainly sustained by these constraints, combined with firm steel consumption and higher steel prices. As a result, steel mills increased their productivity in response to the increase in demand and price, which supported the premium for high-grade ores, such as our iron ore from Carajás, and pellets.

China's steel sector outperformed in 2018, mainly driven by machinery, manufacturing and real estate. The infrastructure sector underperformed during the year, mainly driven by deleveraging and tighter public private partnership policies. Manufactured goods enjoyed healthy external demand driven by strong orders from the United States and developed countries, as well as robust internal demand driven by improvements in the industry's profit margins, all leading China to deliver a record-high steel production of 928.3 Mt in 2018, an increase of 6.6% year-on-year as per the World Steel Association.

Global steel production excluding China also posted strong growth in 2018 with 880.3 Mt, an increase of 2.5% year-on-year, as the world enjoys its first synchronized growth since the global financial crisis of 2008 and 2009 as consumption and job creation increased and investments resumed, reflecting in steel demand and production.

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As a results of the macroeconomic condition mentioned above, in 2018 there was an increase in the price spreads between high- and low-quality ores. Improved steel profitability, high coking coal price and the environmental restrictions imposed during 2018 led mills to source high-quality ores like the Carajás iron ore (IOCJ), with around 65% Fe, which provide higher productivity and lower emission levels. While the Metal Bulletin 58% average of US$40.5/dmt in 2018 was only 13% lower year-on-year, the Metal Bulletin 65% average of US$90.4/dmt in 2018 represented an increase of 3% year-on-year.

The price differentials between high- and low-grade iron ores are a structural change that should continue to impact the market in the coming years. The move towards a more efficient steel industry, with the enforcement of stricter environmental policies in China, should support the demand for high-quality ores that enable productivity and lower emission levels like pellets and IOCJ.

While the increased demand for higher grade ores should support the quality premiums, the relatively strong supply of ores with lower Fe and high contaminant levels should also maintain pressure on the discounts for such products. Iron ore Platts IODEX 62% averaged US$69.5/dmt in 2018, in line with the 2017 level of 71.3/dmt, as the steel sector outperformance led to higher steel prices and iron ore premiums across the world.

In 2019, we expect China's economic growth to moderate from 2018 with some downward risks from property, trade and certain manufacturing sectors (e.g. auto and home appliances). However, since the property stock level has been reduced, the investments and new starts should see only a small decrease. In addition, the Chinese government has showed clear signs to support infrastructure investment that should partly offset the headwinds from the property and trade sectors.

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, 70% of global primary nickel consumption in 2018.

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 2018, 67% 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 2018, stainless steel production in China represented 41% of total nickel demand. As a consequence, changes in Chinese stainless steel production have a large impact on global nickel demand. In 2018, Chinese stainless steel production grew 2% compared to 7% in 2017. 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 stainless steel series. We anticipate that demand will continue growing in 2019.

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. On average between 2014 and 2018, secondary nickel accounted for approximately 40% of total nickel used for stainless steel. Regional availability and consumption of secondary nickel varies. In China, due to low availability of scrap,

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the use of secondary nickel represents 22% of the total nickel used for stainless steel, while nickel pig iron, a relatively low grade nickel product made primarily in China from imported lateritic ores, accounts for approximately 36%.

In recent years, Chinese domestic production of nickel pig iron accounted for the majority of world nickel supply growth. In 2018, approximately 449kt thousand metric tons, representing 22% of world primary nickel supply was produced as nickel pig iron in China using nickel ore from the Philippines and Indonesia. Chinese nickel pig iron production was adversely affected by export restriction of unprocessed ores from Indonesia, beginning in 2014. 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 giving broad availability of ores for the production of nickel pig iron in China. As a result, the bottleneck for production has shifted away from ore availability to nickel pig iron capacity. Furthermore, Indonesia is emerging as a large producer of nickel pig iron. In 2018, 263kt of nickel as nickel pig iron was produced in Indonesia much of it integrated directly to produce stainless steel. We expect nickel pig iron production in Indonesia and China to continue to grow.

The nickel market was in deficit in 2018 by approximately 146kt. Global exchange inventories (London Metals Exchange and Shanghai Future Exchange) declined 188,239 metric tons from January 1, 2018 to December 31, 2018, implying some off-exchange inventory holding. We expect the market to remain in deficit in 2019, although less so than we estimated for 2018.

In the long term, the battery segment shows important upside potential as electric vehicle production continues to attract significant investments, which could positively affect nickel price and our nickel premiums. As currently foreseeable, commercially viable electric vehicle battery technologies utilize nickel; increasing nickel content in such batteries results in improved energy storage and lower cost. As a result, nickel demand is expected to surge, particularly given the expected increase in production of electric vehicles and the trends towards increased battery size and increased nickel content in batteries to improve performance and lower cost.

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, SHFE and COMEX, 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.

Demand for refined copper grew by approximately 3% in 2018, with China responsible for approximately 49% of worldwide consumption. Predominant use of copper in China was in construction and in the electrical grid. In 2018, supply disruptions due to labor negotiations were expected to continue in 2018, particularly from 2017. However, these disputes were averted, resulting in mine production increasing approximately 3% compared to 2017. In the first half of the year, demand in China as well as a positive macroeconomic environment helped improve copper prices. Yet, this trend reversed during the second half of the year where trade war disputes between China and the United States put downward pressure on copper prices. We anticipate that the market will reach a balance in 2019, as demand continues to grow and projects complete ramping up.

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Coal

Demand for metallurgical coal is fundamentally 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 coking coal imports decreased by 7% to almost 65 million metric tons in 2018 compared to approximately 70 million metric tons imported in 2017, mainly due to increased domestic coal consumption. In 2018, China accounted for approximately 20% of total metallurgical coal imports. Global demand excluding China has increased by approximately 2.1% in 2018, compared to 2017, mainly driven by India, and is expected to increase by 10% (to 55 million metric tons), mainly driven by South America and Southeast Asia.

The Chinese government has implemented a number of policies in order to conduct structural reforms and address oversupply capacity, while improving overall safety standards and the long-term competitiveness of its domestic coal industry. Between 2016 and 2018, total closures reached approximately 60Mt and the Chinese government set up plans to cut an additional 200Mt by 2020. In order to meet air quality rules implemented as part of new environmental measures, Chinese coal mines and coke makers have been inspected several times during 2018 and were shut down for not meeting safety and environmental standards in the Fenwei region. This has resulted in shortages of coke and premium coking coal, leading to higher prices.

In the international market, price volatility continued in 2018. Premium coking coal average price climbed 10.1% year-on-year from US$187 per metric ton in 2017 to US$207 per metric ton. Seaborne coking coal prices were strong at US$262 per metric in early January amid severe weather conditions and logistics constraints. Prices reached a bottom of US$179 per metric ton, mainly driven by weaker currency related to the trade war, steel production cuts and weak demand from India with ongoing monsoons. However, prices rebounded in the second half of 2018, mainly due to an increase in demand from China after the end of the winter cuts, logistic constraints and supply tightness in Queensland due to port maintenance, and tightness in the U.S. industry related to hurricane Florence, reaching a price of US$220 per metric ton at year-end. The price of metallurgical coal on January 10, 2019 was US$199 per metric 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 power demand increased 3.6% year on year and thermal coal demand increased 1.6% year on year. The Chinese seaborne thermal coal import posted a second year in a row increase, reaching approximately 220 million metric tons in 2018, up 9.7% year on year, as a result of increased power demand. Demand in Asian countries (excluding China) has been relatively stable, Coal consumption for power generation has fallen for the fifth consecutive year in Europe, and demand is estimated to drop by 6.5% year on year. The European seaborne import decrease was largely impacted by the decline in coal consumption in the UK and Germany, and continued competition against gas and renewables. However, short-term factors, such as low water levels in Europe reducing hydropower generation and nuclear and gas supply issues have kept demand volatile. In India, year-on-year thermal coal demand remained firm, and seaborne imports increased by 9% in 2018, compared to 2017, due to increased power generation and lower than expected domestic production. The power sector in India is expected to grow in the near term and domestic production plans set by the Indian government are unlikely to reach targets due to a number of land acquisition issues and infrastructure projects.

The Newcastle Index average in 2018 reached US$107.3 per metric ton, up 21% year on year, while the Richards Bay Coal Index increased by 21% to US$97.8 per metric ton. Thermal coal prices started the year on a strong note supported by healthy demand in India and in China. However, prices fell in the second half of 2018 due to weaker demand from China and improved renewables in Europe. Chinese import restrictions, improved Chinese domestic supply, and warmer winters have dented the high ash

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off-specification prices and the discounts of Richards Bay widened from US$7 per metric ton in the beginning of 2018 to US$23 per metric ton by year-end.

Climate change policies may 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 development is expected to impact supply and demand balance by 2020, at which point prices will be set by incentive prices.

FAILURE OF SAMARCO'S FUNDÃO TAILINGS DAM

We own a 50% interest in Samarco and account for it under the equity method. Below is a summary of the impact of the failure of Samarco's dam, which occurred in November 2015, in our 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 Fundação Renova 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 Fundação Renova in proportion to its 50% equity interest in Samarco. As a result of uncertainty related to the timing of Samarco's resumption of operations and expected cash flows, we recognized a provision for estimated costs.

The amount of provisions related to Samarco as of December 31, 2018 is US$1,121 million, 13% higher than in 2017, mainly due to the increase of the estimated costs driven by the revision of the plan to mitigate and compensate for the impacts of the disruption from Samarco's tailing dam, net of the contributions made to Fundação Renova. 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. At each reporting period, we reassess the key assumptions used by Samarco in the preparation of its projected future cash flows and adjust the provision, if required.

In 2018, we contributed R$1,379 million (US$374 million), which was allocated as follows: (i) R$1,065 million (US$290 million) contributed to Fundação Renova and Samarco to be used in the reparation programs in accordance with the Framework Agreement, and deducted from the provision, and (ii) R$315 million (US$84 million) was used by Samarco to fund its working capital. These contributions were made through the issuance by Samarco of non-convertible private debentures, which were equally subscribed by Vale and BHPB. We recognized an impairment in our statement of income for the year ended December 31, 2018 for the amount of these non-convertible private debentures.

We intend to make available short-term facilities up to US$88 million to support Samarco's operations during the first half of 2019, and for expenses related to the experts named pursuant to the preliminary agreements with the MPF, signed in January 2017. These funds will be released as needed, 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.

Upon creation of Fundação Renova, Samarco transferred to Fundação Renova most of the reparation and compensation programs. Therefore, we made contributions directly to Fundação Renova in the total amounts of R$239 million (US$71 million), R$941 million

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(US$294 million) and R$1,045 million (US$284 million) in 2016, 2017 and 2018, respectively, and we expect to contribute R$1,160 million (US$309 million) in 2019, to be used in the programs in accordance with the Framework Agreement.

EFFECT OF CURRENCY EXCHANGE VARIATION

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

In 2018, the Brazilian *real* depreciated 17.1% against the U.S. dollar, from an exchange rate of R$3.31 to US$1.00 on December 31, 2017 to R$3.87 to US$1.00 on December 31, 2018. The most important effects were non-cash losses, as described below.

We have intercompany transactions between Vale S.A. and Vale International which are denominated in U.S. dollar. Due to the different functional currency of our parent company, changes in the value of the U.S. dollar against the Brazilian *real* result in exchange gain or loss. In 2018, our net foreign exchange loss of US$2,247 million mainly relates to exchange losses on our net U.S. dollar-denominated liabilities, due to the depreciation of the Brazilian *real* against the U.S. dollar

We had *real*-denominated debt of US$3.432 billion as of December 31, 2018, excluding accrued charges. Since most of our revenues are in U.S. dollars, we used swaps to convert part of our debt service from Brazilian *reais* 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 depreciation of the Brazilian *real* against the U.S. dollar in 2018, we had fair value losses on our currency derivatives of US$279 million. For more information on our use of derivatives, see *Risk management*.

In 2018, the annual average exchange rate for Brazilian *reais* against the U.S. dollar depreciated by 13.0%, from an average exchange rate of R$3.19 to US$1.00 in 2017 to R$3.66 to US$1.00 in 2018. This had a positive impact on our operational result and cash flows. The most important effect is described below:

Most of our revenues are denominated in U.S. dollars, while our cost of goods sold are denominated in various currencies, including the Brazilian *real* (50.8% in 2018), the U.S. dollar (35.7% in 2018) and the Canadian dollar (11.2% in 2018). As a result, the depreciation of the Brazilian *real* and other currencies against the U.S. dollar decreased our costs and expenses by US$1.082 billion.

In January 2017, we implemented hedge accounting for the foreign currency risk arising from Vale S.A.'s net investments in Vale International and Vale Austria. Under the hedge accounting program, our debt denominated in U.S. dollars and Euros serves as a hedge instrument for these investments. With the program, the impact of exchange rate variations on debt denominated in U.S. dollars and Euros has been partially recorded under other comprehensive income, reducing the volatility of our financial performance.

Starting on January 1, 2019, we will treat certain long-term intercompany loans payable by Vale S.A. to Vale International, for which settlement is neither planned nor likely to occur in the foreseeable future, as part of Vale S.A.'s net investment in Vale International. Until December 31, 2018, the impact of the exchange variation on these intercompany loans was reflected on our consolidated income statement. With the change in the accounting treatment, the foreign exchange differences associated with our net

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investment in Vale International will be recognized in other comprehensive income in in our stockholders' equity. This amount would be reclassified from stockholders' equity to income statement in case of disposal or partial disposal of the net investment in Vale International. Upon implementation of this change, the effect of net foreign exchange gains or losses in the financial results reported in our consolidated income statement is expected to reduce.

CHANGES IN ACCOUNTING POLICIES

Certain new accounting standards became effective for the accounting period beginning on or after January 1, 2018. The key changes to accounting policies are described below:

IFRS 9 Financial Instruments ("IFRS 9") is applicable for annual periods beginning on or after January 1, 2018. This standard addresses the classification and measurement of financial assets and liabilities, and provides for new impairment model and new rules for hedge accounting. IFRS 9 did not cause a material impact on our financial statements for 2018.

IFRS 15 Revenue from Contracts with Customers ("IFRS 15") is applicable for annual periods beginning on or after January 1, 2018. IFRS 15 provides a single comprehensive accounting model for recognition of revenue arising from contracts with customers based on a core principle that revenue is recognized at the time the control of a good or service is transferred to a customer and in an amount that reflects the consideration expected to be received in exchange for the transfer of this good or service. IFRS 15 did not impact revenue recognition for most of our contracts, since usually the transfer of risks and rewards and the transfer of control are at the same point in time.

Under IFRS 15, for contracts in which we are responsible for providing shipping services after the date of transfer of control of goods to customers (sales under CFR or CIF Incoterms), the provision of shipping services is accounted for as a separate performance obligation, and a portion of the transaction price is allocated to such services and recognized over time. The impact on the timing of revenue recognition did not significantly impact our financial statements for 2018. Therefore, we did not present this revenue separately in our financial statements.

IFRS 16 Leases ("IFRS 16") is applicable for annual periods beginning on or after January 1, 2019. IFRS 16 eliminates the distinction between operating and finance leases for lessees, and requires that most leases be reflected on the lessee's balance sheet as a right-of-use asset and a lease liability.

As of December 31, 2018, we have non-cancellable operating lease commitments in the nominal amount of US$2.498 billion. We have reviewed these leasing commitments over the last year in light of the new lease accounting rules in IFRS 16. Of these commitments, we expect to recognize right-of-use assets and lease liabilities ranging from US$1.8 billion to US$2 billion on January 1, 2019, which corresponds to the net present value of these non-cancellable operating lease commitments.

The actual impact of adopting the standard is subject to further changes because we have not finalized the testing and assessment of controls over our new IT systems. Also, the new accounting policies are subject to change until we present our first financial statements from the date of initial application.

For more information, see note 2 to our consolidated financial statements.

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RESULTS OF OPERATIONS

CONSOLIDATED REVENUES

In 2018, our net operating revenues from continuing operations increased by 7.7% to US$36.575 billion, primarily resulting from higher realized prices for iron ore fines and pellets (an impact of US$980 million on our net revenues) and higher sales volumes of iron ore fines and pellets (an impact of US$1.848 billion on our net revenues). Our net operating revenues were also positively impacted by higher prices for base metals (positive impact of US$685 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. For more information on our production, see *Information on the Company Lines of Business.* 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 from continuing operations based on the geographical location of our customers.

	Net operating revenues by destination					
	2016		2017		2018	
	(US$ million)	(% of total)	(US$ million)	(% of total)	(US$ million)	(% of total)
North America						
Canada	1,172	4.3%	1,008	3.0%	656	1.8%
United States	1,005	3.7	1,310	3.9	1,353	3.7
	2,177	7.9	2,318	6.8	2,009	5.5
South America						
Brazil	2,064	7.5	3,475	10.2	3,248	8.9
Other	354	1.3	664	2.0	822	2.2
	2,418	8.8	4,139	12.2	4,070	11.1
Asia						
China	12,747	46.4	14,018	41.3	15,242	41.7
Japan	1,741	6.3	2,456	7.2	2,743	7.5
South Korea	880	3.2	1,399	4.1	1,299	3.6
Taiwan	621	2.3	700	2.1	513	1.4
Other	889	3.2	1,483	4.4	1,854	5.1
	16,878	61.4	20,056	59.0	21,651	59.2
Europe						
Germany	1,379	5.0	1,389	4.1	1,653	4.5
United Kingdom	326	1.2	346	1.0	327	0.9
Italy	435	1.6	521	1.5	553	1.5
France	429	1.6	551	1.6	655	1.8
Other	2,079	7.6	2,695	7.9	2,920	8.0

	4,648	16.9	5,502	16.2	6,107	16.7
Rest of the world	1,367	5.0	1,952	5.7	2,738	7.5
Total	27,488	100%	33,967	100%	36,575	100%

CONSOLIDATED OPERATING COSTS AND EXPENSES

Our cost of goods sold and services rendered from continuing operations totaled US$22.109 billion in 2018, increasing by 5.1%, or US$1.070 billion, from the US$21.039 billion recorded in 2017. Higher costs were mostly driven by higher freight costs (impact of US$589 million) and higher costs per metric ton on ferrous minerals (impact of US$997 million) due to external factors such as the increase in royalties' rate and raw material inflation. The increase in cost of goods sold was partially offset by the positive impact

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caused by the depreciation of the Brazilian *real* against U.S. dollar and other currencies (impact of US$946 million).

Our selling, general, administrative and other expenses from continuing operations totaled US$968 million in 2018, in line with US$951 million recorded in 2017. We decreased our pre-operating and stoppage expenses by US$142 million, as S11D ramp-up matured and began to be accounted for as costs in 2018. This reduction was partially offset by the increase by 9.7% in our research and evaluation expenses, to US$373 million in 2018 from US$340 million in 2017.

RESULTS OF OPERATIONS BY SEGMENT

Net operating revenue by segment

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

	Year ended December 31,				
	2016	**% change**	**2017**	**% change**	**2018**
	(US$ million, except for %)				
Ferrous minerals:					
Iron ore	15,784	17.4%	18,524	9.9%	20,354
Pellets	3,827	47.7	5,653	17.7	6,651
Ferroalloys and manganese	302	55.3	469	(3.2)	454
Other ferrous products and services	438	10.3	483	(1.9)	474
Subtotal	20,351	23.5	25,129	11.2	27,933
Coal	839	86.8	1,567	4.9	1,643
Base metals:					
Nickel and other products(1)	4,472	4.4	4,667	(1.2)	4,610
Copper concentrate(2)	1,667	32.2	2,204	(5.0)	2,093
Subtotal	6,139	11.9	6,871	(2.4)	6,703
Other products and services(3)	159	151.6	400	(26.0)	296
Net operating revenues	27,488	23.6%	33,967	7.7%	36,575

(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.

Sales volumes

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

	Year ended December 31,		
	2016	2017	2018
	(thousand metric tons, except where indicated)		
Ferrous minerals:			
Iron ore fines	289,940	288,692	307,433
Pellets	47,709	51,775	56,592
Manganese	1,851	1,826	1,572
Ferroalloys	127	132	141
ROM	3,496	2,637	1,548
Coal:			
Thermal coal	5,457	4,602	5,393
Metallurgical coal	4,907	7,178	6,240
Base metals:			
Nickel	311	295	236
Copper	430	424	379
PGMs (000' oz.)	507	350	374
Gold (000' oz.)	497	471	484
Silver (000' oz.)	2,578	2,179	2,169
Cobalt (metric tons)	4,734	5,013	4,974

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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,		
	2016	2017	2018
	(US$ per metric ton, except where indicated)		
Ferrous minerals:			
Iron ore	54.44	64.17	66.21
Pellets	80.26	109.18	117.52
Manganese	110.87	159.01	162.51
Ferroalloys	757.67	1,353.72	1,178.50
Coal:			
Thermal coal	46.17	71.05	84.19
Metallurgical coal	119.54	172.69	190.60
Base metals:			
Nickel	9,800.00	10,654.00	13,666.83
Copper	4,458.00	5,970.00	5,583.00
Platinum (US$/oz)	919.00	891.00	901.00
Gold (US$/oz)	1,260.49	1,247.00	1,254.15
Silver (US$/oz)	16.22	15.30	14.43
Cobalt	24,273.00	51,513.00	62,910.72

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,	
	2017	2018		2018	
	Cost of goods sold	Cost of goods sold	Variation as reported	Exchange rate impact in 2018	Variation without exchange rate impact	Variation on constant currency basis
				(US$ million, except for %)		
Ferrous minerals:						
Iron ore	7,950	9,048	13.8%	(534)	1,632	22.0%
Pellets	2,876	3,393	18.0	(208)	725	27.2
Ferroalloys and manganese	278	290	4.3	(29)	41	16.5
Other ferrous products and services	306	313	2.3	(34)	41	15.1

Subtotal	**11,410**	**13,044**	**14.3**	**(805)**	**2,439**	**23.0**
Coal	**1,354**	**1,575**	**16.3**		**221**	**16.3**
Base metals:								
Nickel and other products(1)	3,437	3,060	(11.0)	(14)	(363)	(10.6)
Copper(2)	979	960	(1.9)	(96)	77	8.7
Subtotal	**4,416**	**4,020**	**(9.0)**	**(110)**	**(286)**	**(6.6)**
Other	**375**	**269**	**(28.3)**	**(31)**	**(137)**	**(36.5)**
Total (excluding depreciation)	**17,555**	**18,907**	**7.7**	**(946)**	**2,293**	**13.8**
Depreciation	**3,484**	**3,203**	**(8.0)**	**(191)**	**(86)**	**(2.6)**
Total (including depreciation)	**21,039**	**22,109**	**5.1%**	**(1,137)**	**2,207**	**11.1%**

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

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

	Year ended December 31,					
	2016	2017		2017 Variation without exchange rate impact		
	Cost of goods sold	Cost of goods sold	Variation reported	Exchange rate impact 2017	Variation constant currency basis	
	(US$ million, except for %)					
Ferrous minerals:						
Iron ore	6,622	7,950	20.1%	330	998	14.4%
Pellets	2,002	2,876	43.7	110	764	36.2
Ferroalloys and manganese	231	278	20.3	14	33	13.5
Other ferrous products and services	269	306	13.8	36	1	0.3
Subtotal	**9,124**	**11,410**	**25.1**	**490**	**1,796**	**18.7**
Coal	**872**	**1,354**	**55.3**		**482**	**55.3**
Base metals:						
Nickel and other products(1)	3,204	3,437	7.3	64	169	5.2
Copper(2)	924	979	6.0	81	(26)	(2.6)
Subtotal	**4,128**	**4,416**	**7.0**	**145**	**143**	**3.3**
Other	**259**	**375**	**44.8**	**20**	**96**	**34.4**
Total (excluding depreciation)	**14,383**	**17,555**	**22.1**	**655**	**2,517**	**16.7**
Depreciation	**3,267**	**3,484**	**6.6**	**159**	**58**	**1.7**
Total (including depreciation)	**17,650**	**21,039**	**19.2%**	**814**	**2,575**	**13.9%**

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

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

Expenses by segment (excluding depreciation)

The following table summarizes, for each indicated period, our expenses (consisting of 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

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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. See *Impairment charges*.

	Year ended December 31,					
	2017	2018	2018			
	Expenses	Expenses	Variation as reported	Exchange rate impact in 2018	Variation without exchange rate impact	Variation on constant currency basis
	(US$ million, except for %)					
Ferrous minerals:						
Iron ore	258	301	16.7%	(34)	30	27.4%
Pellets	35	56	60.0	(5)	61	86.7
Ferroalloys and manganese	12	4	(66.7)	(1)	3	(75.0)
Other ferrous products and services	(9)	6	(166.7)		6	(166.7)
Subtotal	296	367	24.0	(40)	407	37.4
Coal	30	30			30	
Nickel and other products(1)	171	119	(30.4)	2	117	(31.6)
Copper(2)	28	22	(21.4)	(2)	20	(28.6)
Subtotal	199	141	(29.1)		137	(31.2)
Others	955	930	(2.6)	(96)	834	(12.7)
Total (excluding depreciation)	1,480	1,468	(0.8)	(136)	1,332	(10.0)
Depreciation	224	144	(35.7)	(25)	119	(46.9)
Total (including depreciation)	1,704	1,612	(5.4)%	(161)	1,451	(14.8)%

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

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

	Year ended December 31,					
	2016	2017	2017			
	Expenses	Expenses	Variation as reported	Exchange rate impact in	Variation without exchange rate	Variation constant

				2017	impact	currency basis
				(US$ million, except for %)		
Ferrous minerals:						
Iron ore	489	258	(47.2)%	38	(269)	(51.0)%
Pellets	70	35	(50.0)	5	(40)	(53.3)
Ferroalloys and manganese	12	12		1	(1)	(7.7)
Other ferrous products and services	10	(9)	(190.0)	1	(20)	(181.8)
Subtotal	581	296	(49.0)	45	(330)	(52.7)
Coal	(7)	30	(528.6)	1	36	(600.0)
Base metals:						
Nickel and other products(1)	191	171	(10.5)	(2)	(18)	(9.5)
Copper(2)	21	28	33.3	2	5	21.7
Other base metals	(150)		(100.0)		150	(100.0)
Subtotal	62	199	221.0		137	220.9
Others	690	955	38.4	37	228	31.4
Total (excluding depreciation)	1,326	1,480	11.6	83	71	5.0
Depreciation	220	224	1.8	10	(6)	(2.6)
Total (including depreciation)	1,546	1,704	10.2%	93	65	4.0%

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

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

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Adjusted EBITDA by segment

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 for this segment plus dividends received and interest from associates and joint ventures, and adding back the amounts charged as (i) depreciation, depletion and amortization and (ii) special events. For more information, see note 4 to our consolidated financial statements.

The table below shows a reconciliation of our consolidated Adjusted EBITDA from continuing operations with our net income (loss) from continuing operations for the periods indicated.

	Year ended December 31,		
	2016	2017	2018
	(US$ million)		
Income from continuing operations attributable to Vale's stockholders	5,211	6,313	6,952
Income (loss) attributable to noncontrolling interests	(8)	21	36
Income from continuing operations	5,203	6,334	6,988
Depreciation, depletion and amortization	3,487	3,708	3,351
Income taxes	2,781	1,495	(172)
Financial results, net	(1,843)	3,019	4,957
Equity results and other results in associates and joint ventures, net of dividends received	1,104	488	570
Special events	1,240	294	899
Adjusted EBITDA from continuing operations	11,972	15,338	16,593
Adjusted EBITDA from discontinued operations (Fertilizers)	209	4	(3)
Total Adjusted EBITDA	12,181	15,342	16,590

Special events are gains or losses recognized in our operating results that are not related to the performance of the business segments. We exclude special events from adjusted EBITDA to keep the segment performance analysis comparable with prior periods. The special events we identified are as follows:

	Year ended December 31,		
	2016	2017	2018
	(US$ million)		
Result in disposal of assets	(66)	(481)	(322)
Nacala Logistic Corridor		458	
Impairment and onerous contracts	(1,174)	(271)	(577)
Total	(1,240)	(294)	(899)

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	Year ended December 31,		
	2016	2017	2018
	Adjusted EBITDA	Adjusted EBITDA	Adjusted EBITDA
	(US$ million)		
Ferrous minerals:			
Iron ore	8,683	10,346	11,033
Pellets	1,858	2,823	3,356
Ferroalloys and manganese	59	179	160
Other ferrous products and services	159	205	162
Subtotal	10,759	13,553	14,711
Coal	(26)	362	181
Base metals:			
Nickel and other products(1)	1,081	1,059	1,431
Copper(2)	722	1,197	1,111
Other	150		
Subtotal	1,953	2,256	2,542
Other(3)	(714)	(833)	(841)
Total Adjusted EBITDA from continuing operations	11,972	15,338	16,593
Adjusted EBITDA from discontinued operations (Fertilizers)	209	4	(3)
Total Adjusted EBITDA	12,181	15,342	16,590

(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.

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

2018 compared to 2017.

Our net operating revenues from sales of ferrous minerals increased 11.2%, from US$25.129 billion in 2017 to US$27.933 billion in 2018, reflecting higher realized prices for iron ore and pellets (US$980 million) and higher volumes (US$1.822 billion). Our average prices in 2018 were 3.1% and 7.6% higher than our average realized prices in 2017 for iron ore and iron ore pellets, respectively. Our iron ore sales volume was 6.5% higher than in 2017, reaching 307.4 Mt in 2018 mainly due to the S11D ramp-up.

Our cost of goods sold from ferrous minerals, excluding depreciation, amortization and depletion, increased by 23.0% on a constant currency basis, mainly due to the negative effect of cost factors that are directly linked to iron ore prices, such as higher freight costs driven by higher bunker oil prices (US$589 million) and royalties.

Our net expenses from ferrous minerals, excluding depreciation, amortization and depletion, and excluding impairment charges, increased by US$111 million on a constant currency basis, mainly due to the recovery of the insurance associated with the destruction of the "Fábrica Nova Timbopeba" long distance belt conveyor in 2017, which was partially

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offset by lower pre-operating expenses in S11D as there was an increase in the production curve.

Our adjusted EBITDA from ferrous minerals was US$14.711 billion in 2018, 8.5% higher than the US$13.553 billion we reported in 2017. The increase was mainly as a result of (i) higher realized prices for iron ore and pellets (US$980 million), (ii) higher iron ore and pellets sales volumes (US$975 million) and (iii) the positive impact of BRL depreciation against USD and other currencies on costs and expenses (US$845 million), which were partially offset by higher costs and expenses (US$1.698 billion). Dividends received and interest from associates and joint ventures operating in the ferrous minerals segment totaled US$189 million in 2018, in line with the US$130 million received in 2017.

2017 compared to 2016

Our net operating revenues from sales of ferrous minerals increased by 23.5%, from US$20.351 billion in 2016 to US$25.129 billion in 2017, reflecting higher realized prices, higher premiums and lower discounts. Our average realized prices in 2017 were 17.9% and 36.0% higher than our average realized prices in 2016 for iron ore and iron ore pellets, respectively. Our iron ore sales volume reached 288.7 Mt in 2017, in line with 2016, mainly due to the S11D ramp-up, offset by the curtailment of high silica products in the Southern and Southeastern Systems and build-up of offshore inventories.

Our cost of goods sold from ferrous minerals, excluding depreciation, amortization and depletion, increased by 18.7% on a constant currency basis, mainly as a result of the negative effect of cost factors that are directly linked to iron ore prices, such as higher freight costs (US$642 million) driven by higher bunker oil prices.

Our net expenses from ferrous minerals, excluding depreciation, amortization and depletion, and excluding impairment charges, decreased by 52.7% on a constant currency basis, mainly due to lower pre-operating expenses in S11D.

Our adjusted EBITDA from ferrous minerals was US$13.192 billion in 2017, 25.9% higher than the US$10.476 billion we reported in 2016. The increase was mainly due to higher market prices, higher premiums and the initiatives of supply discipline, portfolio mix management, global supply chain management and focus on cost savings. Dividends received and interest from associates and joint ventures operating in the ferrous minerals segment totaled US$130 million in 2017, in line with the US$113 million received in 2016.

Coal

2018 compared to 2017.

Our net operating revenues from sales of coal increased by 4.8%, to US$1.643 billion in 2018 from US$1.567 billion in 2017. This increase primarily reflected higher realized prices, for both thermal and metallurgical coal, and higher sales volumes of thermal coal. Sales volumes of metallurgical coal totaled 6.240 Mt in 2018, decreasing 938 Mt as compared to 2017, while sales volumes of thermal coal totaled 5.393 Mt in 2018, increasing 791 Mt as compared to 2017.

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Our cost of goods sold from coal, excluding depreciation, amortization and depletion, increased by 16.3% on a constant currency basis, from US$1.354 billion in 2017 to US$1.575 billion in 2018, primarily due to the increase of US$204 million in services costs driven by the impact of the logistics tariff, which was in force for the full year in 2018, while in 2017 it was applied only after March, 2017, when we ceased to consolidate NLC in our financial statements.

Our net expenses from coal, excluding depreciation, amortization and depletion, and excluding impairment charges, totaled US$30 million in 2018, in line with 2017.

Our adjusted EBITDA from coal was US$181 million in 2018, 50.0% lower than the US$362 million we reported in 2017, this decrease was impacted by higher costs (US$221 million), was primarily reflected the impact of the logistics tariff.

2017 compared to 2016

Our net operating revenues from sales of coal increased by 86.8%, to US$1,567 million in 2017 from US$839 million in 2016. This increase primarily reflected higher realized prices, for both thermal and metallurgical coal, and higher sales volumes of metallurgical coal. Sales volumes of metallurgical coal totaled 7.178 Mt in 2017, increasing 2.271 Mt as compared to 2016, as a result of ramp-up of our new coal handling processing plant in Moatize and the Nacala Logistics Corridor.

Our cost of goods sold from coal, excluding depreciation, amortization and depletion, increased by 55.3% on a constant currency basis, from US$872 million in 2016 to US$1.354 billion in 2017, primarily due to the impact of the logistic tariff applied after we ceased to consolidate NLC in our financial statements.

Our net expenses from coal, excluding depreciation, amortization and depletion, and excluding impairment charges, totaled US$30 million in 2017, increasing US$37 million as compared to the gain of US$7 million recorded in 2016. This increase in net expenses in 2017 mainly derives from adjustments to the net realizable value of the thermal coal inventory in Mozambique.

Our adjusted EBITDA from coal was a gain of US$330 million in 2017, while in 2016 we had a loss of US$54 million, reflecting the higher realized prices (US$386 million) and higher sales volumes from Mozambique (US$129 million). These higher prices and sales volumes were partially offset by the higher costs and expenses (US$73 million), due to the impact of the logistics tariff.

Base metals

2018 compared to 2017.

Our net operating revenues from sales of base metals totaled US$6.703 billion in 2018, a 2.5% decrease from US$6.871 billion in 2017. The decrease was mainly driven by lower sales volumes for copper (US$264 million) and nickel (US$620 million), following the strategy to reduce our low grade nickel sales volume, which were partially offset by higher nickel prices (US$712 million).

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Our cost of goods sold from base metals, excluding depreciation, amortization and depletion, decreased 6,6% on a constant currency basis. After adjusting for the effects of lower volumes (US$631 million), costs increased by US$346 million compared to 2017 due to a lower fixed cost dilution and as a result of the extended maintenance at Coleman mine and Voisey's Bay decreased mine production.

Our net expenses from base metals, excluding depreciation, amortization and depletion, and excluding impairment charges, decreased 29.1% on a constant currency basis, mainly due to Long Harbour ramp-up resulting in a lower pre operating expenses in 2018 (US$42 million).

Our adjusted EBITDA from base metals was US$2.542 billion in 2018, a 12.7% increase from the US$2.256 billion recorded in 2017. The increase was mainly due to higher realized prices (US$685 million), lower expenses (US$59 million) and favorable effect of exchange rate variations (US$110 million). These price effects were partially offset by higher costs (US$346 million) and lower volumes (US$222 million).

2017 compared to 2016

Our net operating revenues from sales of base metals totaled US$6.871 billion in 2017, a 11.9% increase from US$6.139 billion in 2016. The increase was mainly driven by higher sales prices for nickel (US$257 million), copper (US$642 million) and cobalt (US$138 million).

Our cost of goods sold from base metals, excluding depreciation, amortization and depletion, increased 3.3% on a constant currency basis. After adjusting for the effects of lower volumes (US$94 million), costs increased by US$237 million compared to 2016 mainly as a result of higher nickel costs (US$353 million) due to the transition to a simpler and more efficient nickel flowsheet in the North Atlantic operations and the increase of nickel unit costs because of lower production volumes. The cost increase was partially offset by lower copper costs (US$116 million).

Our net expenses from base metals, excluding depreciation, amortization and depletion, and excluding impairment charges, increased 220,9% on a constant currency basis, mainly due to the one-off positive effects from goldstream transactions totaling US$150 million in 2016.

Our adjusted EBITDA from base metals was US$2.139 billion in 2017, a 15.7% increase from the US$1.848 billion recorded in 2016. The increase was mainly due to higher realized prices for copper, nickel and cobalt. These price effects were partially offset by higher costs (US$237 million), lower volumes (US$203 million), higher expenses (US$148 million), and the unfavorable effect of exchange rate variations (US$150 million).

IMPAIRMENT OF NON-CURRENT ASSETS AND ONEROUS CONTRACTS

2018 compared to 2017.

In 2018, we recorded an impairment of non-current assets and onerous contracts of US$577 million compared to US$271 million in 2017. In 2018 we recorded an impairment of US$184 million due to the review undertaken of the business plan related to our certain forestry assets, leading to a reduction in the

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expected operational capacity of these assets. We also recorded an additional provision of US$393 million in relation to onerous contracts in the Midwest system for fluvial transportation and port structure.

2017 compared to 2016.

In 2017, we recorded an impairment of non-current assets and onerous contracts of US$271 million compared to US$1,174 million in 2016. The most significant single impairment in 2017 was for an underground mine in Sudbury that was affected by seismic activities, for which the cost to repair the asset is deemed not recoverable in the current market conditions. We have placed this asset on care and maintenance and an impairment of US$133 was recognized in the income statement.

FINANCIAL RESULTS, NET

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

	Year ended December 31,		
	2016	2017	2018
	(US$ million)		
Financial income(1)	170	478	423
Financial expenses(2)	(2,677)	(3,273)	(2,345)
Gains (losses) on derivatives, net	1,256	454	(266)
Foreign exchange gains (losses), net	3,252	(467)	(2,247)
Indexation losses, net	(158)	(211)	(522)
Financial results, net	1,843	(3,019)	(4,957)

(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).

2018 compared to 2017.

In 2018, our financial results, net, were an expense of US$4,957 million compared to an expense of US$3,019 million in 2017. This mainly resulted from:

Net foreign exchange loss of US$2,247 million in 2018 compared to net foreign exchange loss of US$467 million in 2017, mainly due to the 17.1% depreciation of the Brazilian *real* against the U.S. dollar in 2018, compared to a 1.5% depreciation

of the Brazilian *real* in 2017.

The net effect of fair value changes in derivatives, which represented a loss of US$266 million in 2018 compared to a gain of US$454 million in the same period in 2017. This reflected the following main categories of derivatives transactions:

Currency and interest rate swaps. We recognized a net loss of US$279 million in 2018 from currency and interest rate swaps, compared to a net gain of US$313 million in 2017. 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.

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Nickel derivatives. We recognized a loss of US$25 million in 2018 compared to a gain of US$30 million in 2017. These derivatives are part of our nickel price protection program.

Bunker oil derivatives. We recognized a gain of US$6 million in 2018 compared to a loss of US$80 million in 2017. These gains or losses resulted from the fair value of the hedge contracts and the variation is due to volatility in the spot price of bunker oil.

A loss on inflation-indexed instruments of US$522 million in 2018 compared to a loss of US$211 million in 2017.

2017 compared to 2016.

In 2017, our financial results, net, was a loss of US$3.019 billion, compared to an income of US$1.843 billion in 2016. This principally resulted from:

Net foreign exchange losses of US$463 million in 2017 compared to net foreign exchange gains of US$3.252 billion in 2016, 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 gain of US$454 million in 2017 compared to a gain of US$1.256 billion in 2016. This reflected the following main categories of derivatives transactions:

Currency and interest rate swaps. We recognized gains of US$313 million in 2017 from currency and interest rate swaps, compared to a gain of US$959 million in 2016. 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 gain of US$30 million in 2017 compared to a loss of US$42 million in 2016. These derivatives are part of our nickel price protection program.

Bunker oil derivatives. We recognized a loss of US$80 million in 2017 compared to a gain of US$268 million in 2016. These gains or losses resulted from the fair value of the hedge contracts and the variation is due to the sharp volatility in the spot price of bunker oil.

A net indexation loss of US$211 million in 2017 compared to a net loss of US$158 million in 2016, mainly due to changes in discount rates on asset retirement obligation provisions.

EQUITY RESULTS AND OTHER RESULTS IN ASSOCIATES AND JOINT VENTURES

2018 compared to 2017.

Our equity results and other results in associates and joint ventures in 2018 were a loss of US$182 million, compared to a loss of US$82 million in 2017, mostly due to the US$487 million loss related to our investment in Samarco, driven by the additional provision recognized in 2018 (See *Business overview-Failure of Samarco's Fundão tailings dam* and note 22 to our consolidated financial statements), partially

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offset by positive results in 2018 from our equity positions in our joint venture pelletizing plants (US$305 million).

2017 compared to 2016.

Our equity results and other results in associates and joint ventures in 2017 were a loss of US$82 million, compared to a loss of US$911 million in 2016, mostly due to the US$180 million loss related to our investment in Samarco, driven by the write-downs of the debts instruments used to fund its working capital, partially offset by positive results in 2017 from our equity positions in our joint ventures (US$98 million). In 2016, we recognized an impairment of US$1.109 billion related to our investments in Samarco.

RESULTS OF DISCONTINUED OPERATIONS

2018 compared to 2017.

In 2018, we had a net loss from discontinued operations attributable to Vale's stockholders of US$92 million compared to a loss of US$806 million in 2017. In January 2018, we concluded the transaction with The Mosaic Company ("Mosaic"), and received US$1,080 million in cash and 34.2 million common shares, corresponding to 8.9% of Mosaic's outstanding common shares after the issuance of these shares (US$899 million, based on the Mosaic's quotation at closing date of the transaction) and recognized an additional loss of US$55 million in the income statement from discontinued operations. In May 2018, we concluded the transaction with Yara International ASA to sell our assets located in Cubatão and received US$255 million in cash and recognized a loss of US$69 million in the income statement from discontinued operations. For more information on our discontinued operations, see note 14 to our consolidated financial statements.

2017 compared to 2016.

In 2017, we had a net loss from discontinued operations attributable to Vale's stockholders of USS$806 million, compared to a loss of US$1,229 million in 2016. In December 2016, we entered into an agreement with Mosaic to sell a significant part of our fertilizer business. In January 2018, we concluded the transaction with Mosaic, which was preceded by final adjustments under the original terms and conditions of the negotiation. As consequence of these adjustments, an impairment loss of US$729 million was recognized in 2017. Additionally, in November 2017, we entered into an agreement with Yara International ASA to sell our nitrogen assets located in Cubatão, Brazil and an impairment loss of US$156 million was recognized in 2017.

INCOME TAXES

2018 compared to 2017.

In 2018, we recorded a net income tax benefit of US$172 million, compared to a net income tax expense of US$1.495 billion in 2017, principally because of a benefit related to the recognition of a tax loss carry forward from a foreign subsidiary. In 2018, our effective tax rate was 18.1%, excluding this benefit. The effective tax rate was different from the statutory rate mainly due to: unrecognized tax on current year losses, partially offset by the tax benefit from interest on stockholders' equity and 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

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specified for each product. In 2018, this tax incentive structure reduced our net income tax expense by US$1.449 billion.

2017 compared to 2016.

In 2017, we recorded net income tax expense of US$1.495 billion, compared to a net income tax expense of US$2.781 billion in 2016. In 2017, our effective tax rate was 19.1%. The effective tax rate was different from the statutory rate mainly due to US$432 million of unrecognized tax on current year losses, partially offset by the tax benefit from interest on stockholders' equity and 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 2017, this tax incentive structure reduced our net income tax expense by US$1.100 billion.

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LIQUIDITY AND CAPITAL RESOURCES

In the ordinary course of business, our principal funding requirements are for capital expenditures, dividend payments and debt service. We will also need funding for remediation and reparation measures in connection with the failure of Dam I at Córrego do Feijão mine. We expect to meet these requirements, in line with our historical practice, by using cash generated from operating activities and borrowings, supplemented by dispositions of assets.

For 2019, we have budgeted capital expenditures of US$4.334 billion, including US$703 million for project execution and US$3.731 billion for sustaining existing operations and replacement projects. A principal amount of US$773 million of our debt matures in 2019.

We have taken measures to reduce our capital expenditures, and we are constantly evaluating opportunities for additional cash generation. 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 2018, our operating activities generated cash flows from continuing operations of US$12.901 billion, in line with the US$12.450 billion generated in 2017.

In 2018, we borrowed US$1.225 billion in pre-export financing agreements with commercial banks.

In 2018, we received US$1.481 billion as a result of divestments and sales of interests in certain joint ventures and investments and sales of assets. The main divestment transactions in 2018 are described below:

In January 2018, we received US$1.080 billion from Mosaic following the conclusion of the sale of a substantial part of our fertilizer business (See *Results of Operations Results of discontinued operations* and note 14 to our consolidated financial statements).

In May 2018, we received US$255 million from Yara International ASA upon completion of the sale of our wholly owned subsidiary, Vale Cubatão Fertilizantes Ltda., which operated nitrogen and phosphate assets in Cubatão, Brazil.

We also received US$2.572 billion in proceeds from the project financing, in repayment of certain shareholders loans provided for construction of NLC (See *Business Overview Significant changes in our business- Partnership in coal assets in Mozambique*).

USES OF FUNDS

In the ordinary course of business, our principal funding requirements are for capital expenditures, dividend payments and debt service. We will also need funding for remediation and reparation measures in connection with the failure of Dam I at Córrego do Feijão mine.

Capital expenditures

Our capital expenditures in 2018 amounted to US$3.807 billion, including US$911 million for project execution and US$2.896 billion dedicated to sustaining existing operations. For more information about

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the specific projects for which we have budgeted funds, see *Information on the Company Capital expenditures*.

Distributions and repurchases

On March 15, 2018, we paid a second tranche of dividends on the results of the 2017 fiscal year of US$664 million and dividends on the results of the 2018 fiscal year of US$773 million, both classified as interest on stockholders' equity. We also repurchased 71,173,683 of our common shares (including common shares represented by ADSs), in the total amount of US$1 billion.

On September 20, 2018, we paid dividends on the results of the 2018 fiscal year of US$1.876 billion (US$1.659 billion and US$217 million as dividends, both classified as interest on stockholders' equity.

Tax payments

We paid US$676 million in income tax in 2018, excluding the payments in connection with REFIS, compared to US$563 million in 2017. In connection with our participation in the REFIS, our outstanding commitment totals US$4.349 billion, which will be paid in 118 monthly installments. In 2018, we paid a total of US$452 million in connection with the REFIS.

Liability Management

In 2018, we repaid US$6.479 billion in debt. Our main liability management transactions in the year are summarized below.

The full redemption of US$499 million of Vale Overseas Limited's ("Vale Overseas") outstanding 4.625% guaranteed notes due 2020.

Cash repurchases of US$969 million of Vale Overseas' outstanding 5.875% guaranteed notes due 2021, US$1,181 million of Vale Overseas' outstanding 4.375% guaranteed notes due 2022, US$600 million of Vale Overseas' outstanding 6.875% guaranteed notes due 2036 and US$980 million of our outstanding 5.625% notes due 2042. Combined, the tender offers allowed us to repay an aggregate principal amount of US$3.730 billion in debt.

The repayment of US$1.100 billion in pre-export payments facilities and US$259 million in Export Notes with commercial banks.

The repayment of US$891 million in loans with development agencies.

DEBT

As of December 31, 2018, our total outstanding debt was US$15.466 billion (including US$15.228 billion of principal and US$238 million of accrued interest) compared with US$22.489 billion at the end of 2017. As of December 31, 2018, US$233 million of our debt was secured by liens on some of our assets. As of December 31, 2018, the weighted average of the remaining term of our debt was 8.9 years, in line with 2017.

As of December 31, 2018, the short-term debt and the current portion of long-term debt was US$1.003 billion, including accrued interest.

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Liquidity and Capital Resources

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 interest.

U.S. dollar-denominated loans and financing (US$2.337 billion as of December 31, 2018). 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$8.219 billion as of December 31, 2018). We have issued in public offerings several series of fixed-rate debt securities, directly by Vale and through our finance subsidiary Vale Overseas, guaranteed by Vale, totaling US$7.819 billion. Our subsidiary Vale Canada has outstanding fixed-rate debt in the amount of US$400 million.

Euro-denominated loans and financing (US$229 million as of December 31, 2018). This category includes loans from export credit agencies.

Euro-denominated fixed rate notes (US$859 million as of December 31, 2018). We have issued in public offering this series of fixed rate debt securities denominated in Euro an amount of €750 million.

Other debt (US$3.584 billion as of December 31, 2018). We have outstanding debt, principally owed to BNDES, Brazilian commercial banks and holders of infrastructure debentures, denominated in Brazilian *reais* and other currencies.

We have a variety of credit lines available, including the following, as of December 31, 2018:

A R$10.050 billion (US$3.3 billion) financing agreement with BNDES to finance part of the implementation of the S11D project and its infrastructure (CLN S11D). As of December 31, 2018, the total amount available under this facility was R$834 million (US$215 million).

We have two revolving credit facilities with syndicates of international banks, which will mature in 2020 and 2022. The revolving credit lines allow more efficient cash management, consistent with our strategic focus on cost of capital reduction. As of December 31, 2018, we had not drawn any amounts under these facilities and the total amount available under these facilities was US$5.000 billion (with US$3.000 billion available until 2020), which can be drawn by Vale, Vale Canada and Vale International.

Some of our long-term debt instruments contain financial covenants. In particular, instruments representing approximately 18% of the aggregate principal amount of our total debt require that we maintain, as of the end of each quarter, (i) a consolidated ratio of total debt to adjusted EBITDA for the past 12 months not exceeding 4.5 to one and (ii) 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.

As of December 31, 2018, the corporate guarantees we provided (corresponding to our direct or indirect interest) for the companies Norte Energia S.A. and Companhia Siderúrgica do Pecém S.A. totaled US$331 million and US$1.404 billion, respectively.

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CONTRACTUAL OBLIGATIONS

The following table summarizes our contractual obligations as of December 31, 2018. 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	2020	2021	2022	Thereafter
	(US$ million)					
Debt less accrued interest	15,228	773	1,053	1,233	1,872	10,297
Interest payments(1)	8,950	831	799	732	662	5,926
Operating lease obligations(2)	2,497	250	201	189	165	1,692
Purchase obligations(3)	7,327	2,677	1,445	548	463	2,194
Total	34,002	4,531	3,498	2,702	3,162	20,109

(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, 2018 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 operating lease agreements in place with third parties for port structures and port operations, transportation services, energy plants and property leases for its operational facilities. We also have long-term agreements for the exploration and processing of iron ore with its joint ventures, such as the agreements to lease pelletizing plants in Brazil.

(3) The purchase obligations derive mainly from take-or-pay contracts, contracts for the acquisition of fuel and energy and the acquisition of raw materials and services. For more information, see note 32 to our consolidated financial statements.

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OFF-BALANCE SHEET ARRANGEMENTS

As of December 31, 2018, we did not have any off-balance sheet arrangements as defined in Form 20-F.

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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.

CONSOLIDATION

In some circumstances, our judgment is required to determine whether, after considering all relevant factors, we have either control, joint control or significant influence over an entity. Significant influence includes situations of collective control. We hold the majority of the voting capital in five joint arrangements (Aliança Geração de Energia S.A., Aliança Norte Energia Participações S.A., Companhia Hispano-Brasileira de Pelotização, Companhia Ítalo-Brasileira de Pelotização and Companhia Nipo-Brasileira de Pelotização), but our management has concluded that we do not have a sufficiently dominant voting interest to have the power to direct the activities of the entity, as the power to make relevant decisions shared with other parties, pursuant to the terms of shareholders' agreements. As a result, these entities are accounted for under the equity method.

MINERAL RESERVES AND MINES USEFUL LIFE

We regularly evaluate and update our estimates of proven and probable mineral reserves. These 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 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.

ASSET RETIREMENT OBLIGATIONS

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;

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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 the applicable discount rates that reflect the current market assessments of the time value of the money and the risks specific to the liability; 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 using applicable discount rates that reflect current market assessments of the time value of money and of the risks specific to the liability.

As of December 31, 2018, we estimated the fair value of our total asset retirement obligations to be US$3.115 billion.

IMPAIRMENT OF NON-CURRENT ASSETS AND ONEROUS CONTRACTS

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 ("FVLCD") and value in use ("VIU").

FVLCD 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 FVLCD calculation.

Assets that have an indefinite useful life and are not subject to amortization, such as goodwill, are tested annually for impairment.

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 CGUs or CGU 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, a provision is recognized for certain long-term contracts when the present value of the unavoidable cost to meet our obligation exceeds the economic benefits that could be received from those contracts.

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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 the statement of comprehensive income 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 do not recognize a tax asset when it is probable that it 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 of the Company 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 and our deferred tax assets and liabilities 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. Deferred tax assets recognized 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.

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.

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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, 2018, totaling US$1.357 billion, consists of provisions of US$496 million for labor, US$166 million for civil, US$692 million for tax and US$3 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$13.124 billion as of December 31, 2018, including claims of US$1.475 billion for labor claims, US$1.957 billion for civil claims, US$8.641 billion for tax claims and US$1.051 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 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. For each reporting period, we will reassess the key assumptions used by Samarco in the preparation of the projected cash flows and will adjust the provision, if required.

DEFERRED REVENUE

Defining the gain on sale of mineral interest and the deferred revenue portion of the transaction requires the use of critical accounting estimates as follows: (i) discount rates used to measure the present value of future inflows and outflows; (ii) allocation of costs between nickel or copper and gold based on relative prices; and (iii) expected margin for the independent elements (sale of mineral rights and service for gold extraction) based on our best estimate.

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RISK MANAGEMENT

The purpose of our risk management strategy is to promote company-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 associated with inadequate or failed internal processes, people, systems or external events (operational risk), risks arising from third-party obligations (credit risk), risks from exposure to legal penalties, fines or reputational losses associated with failure to act in accordance with applicable laws and regulations, internal policies or best practices (compliance risk), and risks associated with our business model, governance and political and regulatory conditions in countries in which we operate (strategic risk), among others. See note 33 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.

In order to achieve this objective and to further improve our corporate governance practices, our Board of Directors created the Governance, Compliance and Risk Committee. See *Management Advisory Committees to the Board of Directors*. In 2018, we approved a new Risk Management Policy with the purposes described below.

Supporting the strategic planning, budget and sustainability of our business.

Strengthening the capital structure and asset management of our business.

Strengthening our governance practices, based on lines of defense model described below.

Managing risks considering the concepts of international norms, such as ISO 31000 and COSO-ERM.

Measuring and monitoring our risks, on a consolidated basis, considering the effect of diversification, when applicable, of our entire business.

Assessing the impact of new investments, acquisitions and divestitures on our risk map and risk approach.

Adapting our risk approach to the needs of its growth plan, our strategic planning and our business continuity.

RISK GOVERNANCE STRUCTURE

Our integrated risk governance practice is based on lines of defense model described below. We reevaluate our risk practices from time to time to ensure the alignment between strategic decisions, performance and the risk approach determined by our Board of Directors.

First line of defense. Consists on the personnel in charge of addressing the specific risk and the process executors of business, project, support and administrative areas. This is the personnel directly responsible for identifying, evaluating, treating, monitoring and managing the risk events in an integrated way. This first line of defense must:

Take measures to maintain the risks under its responsibility within the defined levels, implement and execute effective preventive and mitigation controls, ensure appropriate

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definition and execution of action plans and establish corrective actions for the continuous improvement of risk management.

Continuously assess the applicability of risks in our integrated risk map to the activities and geographies under its responsibility.

Report to our Board of Executive Officers and the Board of Directors the potential impacts that are in the imminence to occur, following the existing governance mechanisms to address the treatment of mapped risks, as well as report on the risks under its responsibility to the Risk Executive Committee, Board of Executive Officers, Board of Directors or to one of our Advisory Committees, as applicable.

Establish and implement crisis management protocols and business continuity plans for the risk events under their responsibility, as applicable. For events with significant impacts, drills should be performed in order to verify the efficiency and effectiveness of the crisis management protocols. The frequency of the drills should be defined by the first line of defense according to the criticality, observing local rules and specific legislation.

Meet the guidelines defined by the second line of defense.

Second line of defense. Corresponds to risk management, internal controls, policies management, legal compliance and other specialist areas. The second line of defense is in charge of supervising and supporting the work of first line of defense, providing training and instruments for risk management. The second line of defense must identify and monitor new and emerging risks, ensure compliance with laws, regulations, internal norms and promote continuous improvement in risk management.

Our Board of Executive Officers is responsible for defining the responsibilities of Governance, Risk and Compliance (GRC) area, which includes:

Developing and implementing policies, methodologies, processes and infrastructure for integrated risk management.

Reporting to our Risk Executive Committee, periodically, the main risks to which we are exposed, within the defined scope, and how those risks are being monitored, controlled and treated.

Ensuring a compliance environment, not only addressing legal issues, but also including the compliance with internal policies and standards.

Ensuring compliance with risk governance model.

Some areas, such as Environment, Health and Safety, Corporate Integrity and Information Security, act as a second line of defense with respect to specific risks, monitoring risks and controls, and ensuring the compliance with regulations, policies and standards. The definition of the areas that will be the second line of defense specialist has been delegated to the Risk Executive Committee.

Based on our risk matrix, the Board of Executive Officers will define the scope and the operating model of GRC area, considering the combination of severity with probability whose occurrence could jeopardize the achievement of organization's objectives.

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Third line of defense. The third line of defense is composed of areas that are independent from our management. It includes the Internal Audit and the Ethics and Conduct Office, which perform, within their scopes of work, evaluations, inspections, control tests, risk analysis and investigations of complaints, providing independence assurance, including with respect to the effectiveness of risk management, internal controls and compliance.

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 also have debt instruments denominated in currencies other than U.S. dollars, mainly in Brazilian *reais* and euros. We may use swaps and forward transactions to convert into U.S. dollars a portion of the cash outflows 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.

Product prices and input costs. We are also exposed to market risks associated with commodities price volatilities. We may enact risk mitigation programs in situations such as the following: (i) where there is a risk of financial distress; (ii) to support commercial activities and specific needs of our business segments; and (iii) to protect from the increase of certain cost items, such as bunker oil and freight chartering. These programs include predominantly forward transactions, futures contracts and options.

OPERATIONAL AND CYBER RISK

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 and operational catastrophes caused by third parties.

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.

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Cyber risk

Cybernetic risk is the approach taken to manage information security risks such as theft and leakage of information, technology assets unavailability and compromising data integrity.

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 commercial credit 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.

COMPLIANCE RISK

Under our bylaws, we are prohibited from making, directly or indirectly through third parties, any contribution to political movements in Brazil or abroad, including those organized as political parties, and to their representatives or candidates.

STRATEGIC RISK

Strategic risk comprises governance, business model, external environment issues, regulatory, political, economic or social actions taken by governments or other stakeholders.

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IV. SHARE OWNERSHIP AND TRADING

MAJOR SHAREHOLDERS

Our corporate capital is currently composed of 5,284,474,770 common shares and 12 golden shares issued to the Brazilian government. The 12 golden shares 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. In July 2018, the Board of Directors approved a US$1 billion share buy-back program, which was concluded in November 2018.

The following table sets forth information regarding ownership of Vale shares by the shareholders we know beneficially own more than 5% of our outstanding capital stock, and by our directors and executive officers as a group, as of December 31, 2018.

	Common shares owned	% of class
Litel Participações S.A.(1).	1,075,773,534	20.4%
Capital Research and Management Company(2)	485,848,934	9.2%
BNDESPAR(3)	342,484,176	6.5%
Bradespar S.A.(4)	296,009,366	5.6%
Mitsui	286,347,055	5.4%
BlackRock, Inc.(5)	272,763,231	5.2%
Directors and executive officers as a group	960,191	Less than 1%

(1) Includes common shares owned by Litela Participações S.A.

(2) Capital Research and Management Company administers, through its independent investment divisions Capital Research Global Investors, Capital International Investors and Capital World Investors, respectively, 265,599,956 common shares, 14,405,939 common shares and 205,843,039 common shares, corresponding to, respectively, 5.0%, 0.3% and 3.9% of our share capital.

(3) BNDESPAR is a wholly owned subsidiary of BNDES. As reported in BNDESPAR's amended beneficial ownership report on Schedule 13D, filed with the SEC on September 25, 2018.

(4) 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.

(5) As reported in BlackRock, Inc.'s beneficial ownership report on Schedule 13G, filed with the SEC on February 4, 2019.

The table below sets forth information regarding ownership of Litel Participações S.A. as of December 31, 2018.

	Common shares owned	% of class
Litel Participações S.A. shareholders(1)		

BB Carteira Ativa	222,125,666	80.62%
Carteira Ativa II FIA	31,688,469	11.50%
PETROS	19,115,854	6.94%
Singular FIA	2,583,921	0.94%
Others	439	0.00%
Total	275,514,349	100.00%

(1) Each of BB Carteira Ativa, Carteira Ativa II and Singular FIA is a Brazilian investment fund. BB Carteira Ativa is 100% owned by Previ – Caixa de Previdência dos Funcionários do Banco do Brasil. Carteira Ativa II is 100% owned by Fundação dos Economiários Federais – FUNCEF. Singular FIA is 100% owned by Fundo de Investimentos em Cotas de Fundo de Investimento em Ações VRD, which in turn is 100% owned by Fundação CESP – Funcesp. Each of PREVI, Funcef, Petros and Funcesp is a Brazilian pension fund, managing pension plans of employees of Banco do Brasil, Caixa Econômica Federal, Petróleo Brasileiro S.A. and Cia. Energética do Estado de São Paulo, respectively.

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CHANGES IN OUR SHAREHOLDING STRUCTURE

In 2017, we successfully completed a series of measures to simplify our shareholding structure and enhance our corporate governance. These measures are summarized below:

In August and October 2017, we converted our preferred class A shares into common shares (and ADSs representing our preferred class A shares into ADSs representing our common shares). As a result, we removed our preferred class A shares from trading on the B3 and ADSs representing preferred class A shares from trading on the New York Stock Exchange ("NYSE").

In August and December 2017, we concluded a series of amendments to our bylaws in order to enhance our corporate governance and prepare the Company to join the Novo Mercado segment of the B3.

In August 2017, Valepar S.A. (Valepar), former controlling shareholders of Vale, merged into Vale at an exchange ratio that represented a dilution of approximately 3% of the shareholding interest held by the other shareholders of Vale. Consequently, the former shareholders of Valepar own 36.72% of our outstanding common stock after the merger of Valepar. See *Shareholders' Agreement* for more information on the new agreement among the former shareholders of Valepar.

In December 2017, Vale was listed on the Novo Mercado segment of the B3, the special listing segment for companies committed to the highest standards of corporate governance;

SHAREHOLDERS' AGREEMENT

On August 14, 2017, Litel, Bradespar, Mitsui and BNDESPAR executed the Shareholders' Agreement, by means of which they undertook to vote jointly on certain issues. The following are key provisions of the Shareholders' Agreement:

Term: The Shareholders' Agreement will be effective until November 9, 2020.

Shares subject to the agreement: The 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). However, in any general shareholders' meeting, common shares owned by the parties to the Shareholders' Agreement but not subject to the agreement must be voted in accordance with the shares subject to the agreement.

Shareholders' prior meetings: The 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 Shareholders' Agreement requires approval, in a prior meeting, 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;

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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;

the approval of the aggregate and individual compensation of members of the Board of Directors, Board of Executive Officers 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 (i) separately, 0.15% of Vale's total assets, or (ii) 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 B3; 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.

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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. The definition of related party is based on applicable accounting standards and on this internal policy, which may be more restrictive than applicable laws and regulations under certain circumstances. Pursuant to that policy and our bylaws, our Governance, Compliance and Risk 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. In addition, if we identify a conflict of interest with a member of the Board of Directors or an executive officer, then such member of the Board or executive officer may not participate in any discussions or have access to any information or document related to 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 16 and 31 to 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 principal shareholders.

BRADESCO

Bradespar 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. An affiliate of Bradesco owns preferred shares representing 36.4% of the total capital of our subsidiary MBR.

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 in turn holds 20.4% of the common shares of Vale. 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. Mitsui has direct investments in some of our subsidiaries, joint ventures and associated companies. Mitsui is also our joint venture partner at VLI. Mitsui has an indirect stake in Vale Mozambique and Nacala Corridor Holding, which controls the coal operations (mine, rail and port) in Mozambique (see *Information on the Company Business overview Significant changes in our business*).

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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.

BNDES has provided us with credit lines of 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$937 million (US$242 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 metric 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

Immediately following the failure of Dam I, our Board of Directors determined the suspension of our dividend policy, and therefore no payment of dividends or interest on shareholders' equity will be made pursuant to Vale's Distribution Policy, and no decision with respect to share buyback will be made until further determination of our Board of Directors.

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*. In September 2018, we paid dividends to our shareholders in the amount of US$1.876 billion, which exceeds the minimum dividends required by law for the year of 2018.

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 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*.

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.

		Reais per share			U.S. dollars per share(1)	
Year	Payment date	Dividends	Interest on equity	Total	Total	U.S. dollars total(1) (US$ million)
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
2017	April 28		0.91	0.91	0.28(2)	1,470(2)
2018	March 15		0.91	0.91	0.28(2)	1,451(2)
	September 20	0.17	1.31	1.48	0.36(2)	1.861(2)

(1) As approved by the Board of Directors.

(2)

Calculated based on the exchange rate for the US dollar (Ptax-Option 5) published by the Central Bank of Brazil (BCB), on the day prior to payment.

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TRADING MARKETS

Our publicly traded share capital consists of common shares, without par value. Our common shares are publicly traded in Brazil on the B3, under the ticker symbol VALE3. Our common shares also trade on the LATIBEX, under the ticker symbols XVALO. 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, are traded on the NYSE, under the ticker symbol VALE. Our common ADSs are traded on Euronext Paris under the ticker symbol VALE3. Citibank N.A. serves as the depositary for the common ADSs. On December 31, 2018, there were 1,211,272,764 common ADSs outstanding, representing 22.92% of our total share capital.

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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.

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.

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 (vi) certain fees and expenses incurred in connection with the delivery or servicing of deposited shares, as provided for under the deposit agreement.

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Depositary Shares

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. For the year ended December 31, 2018, Citibank N.A. reimbursed us US$4.673 million.

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PURCHASES OF EQUITY SECURITIES BY THE ISSUER AND AFFILIATED PURCHASERS

On December 11, 2018, we announced the completion of the US$1 billion share repurchase program approved by the Board of Directors on July 25, 2018. We acquired 71,173,683 common shares at an average price of US$14.05 per share (including common shares represented by ADSs), for a total aggregate purchase price of US$1.0 billion. The repurchased shares represent 1.37% of the free float of common shares outstanding before the launching of the program. See note 30 to our consolidated financial statements for further information.

The results of our share repurchase program for 2018 are set forth below.

	Total number of common shares purchased(1)	Average price paid per common share (US$)	Total number of common shares purchased as part of publicly announced programs	Maximum number of shares that may yet be purchased under the program
August 2018	32,353,894	13.35	32,353,894	
September 2018	6,802,524	13.80	6,802,524	
October 2018	13,136,543	14.78	13,136,543	
November 2018	18,880,722	14.83	18,880,722	
Total	71,173,683	14.05	71,173,683	

(1) Includes common shares represented by ADSs.

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V. 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 12 members and 12 alternates, each of whom serves on behalf of a particular director. Our bylaws provide that the chief executive officer cannot serve as chairman of the Board of Directors. In the shareholders' meeting scheduled for April 30, 2019, our shareholders will vote a proposal to increase the number of members of our Board of Directors to 13 members.

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.

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. The terms of all of our directors and alternate directors will expire at the Ordinary General Shareholder's meeting of 2019.

Eight of our eleven current directors (and seven of our eight alternate directors) were appointed by the parties to the Shareholders' Agreement. 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 may elect a member and an alternate to our Board of Directors. See *Memorandum and Articles of Association Voting Rights*.

New listing rules applicable to independence requirements for the Novo Mercado came into force in January 2018. Pursuant to the Novo Mercado listing rules and our bylaws, at least two directors or 20% of our directors, whichever number is higher, must be independent. We currently have two independent members. If the proposal to increase the number of board members to 13 is approved, we expect to have at least one additional independent member in our Board of Directors. To be considered independent under our bylaws and the Novo Mercado listing rules in effect in 2018, a director may not (i) have current professional ties to Vale other than as a member of the Board of Directors or be a significant shareholder of Vale; (ii) have been an employee or executive of Vale or of any party to the Shareholders' Agreement for at least the past three years; (iii) sell goods or services to or purchase goods or services from Vale; (iv) be affiliated with any party to the Shareholders' Agreement; (v) be a relative, to the second degree, of any director or executive of Vale; (vi) have been a member of Vale's audit committee in the past three years; and (vii) be an affiliate of any non-profit organization receiving significant financial resources from Vale.

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

Director	Year first elected	Alternate director	Year first elected
Gueitiro Matsuo Genso (chairman)	2015	Gilberto Antonio Vieira	2015
Fernando Jorge Buso Gomes (vice-chairman)	2015	Vacant	
Oscar Augusto de Camargo Filho	2003	Eduardo de Oliveira Rodrigues Filho	2011
Dan Antônio Marinho Conrado	2012	Arthur Prado Silva	2015
Marcel Juviniano Barros	2012	Gilmar Dalilo Cezar Wanderley	2017
Lucio Azevedo(1)	2015	Raimundo Nonato Alves Amorim(1)	2017
Eduardo Refinetti Guardia	2016	Robson Rocha	2011
Toshiya Asahi	2017	Yoshitomo Nishimitsu	2015
Vacant		Luiz Mauricio Leuzinger	2012
Sandra Maria Guerra de Azevedo(2)(3)	2017	Vacant	
Isabella Saboya de Albuquerque(3)	2017	Vacant	
Ney Roberto Ottoni de Brito	2018	Vacant	

(1) Appointed by our employees.

(2) Ms. Guerra was elected in a separate election by non-controlling shareholders.

(3) Independent directors.

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

Gueitiro Matsuo Genso, 47: Chairman of Vale's Board of Directors since February 2016 (Member of Vale's Board of Directors since March 2015); Member of the Personnel Committee since November 2017.

Professional experience: Coordinator of Vale's Finance Committee from May 2018 to December 2018; Chief Executive Officer of PREVI Caixa de Previdência dos Funcionários do Banco do Brasil S.A. from 2015 to 2018; Member of Vale's Executive Development Committee from April 2017 to October 2017 and of Vale's Strategic Committee from 2015 to 2017; Chief Executive Officer of Valepar from 2015 to August 2017; 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.

Fernando Jorge Buso Gomes, 62: Vice Chairman of Vale's Board of Directors since January 2017 (Member of Vale's Board of Directors since April 2015); Member of the Finance Committee since April 2015, Coordinator of the Sustainability Committee and Member of the Personnel Committee since November 2017.

Other current director or officer positions: Chief Executive Officer and Investor Relations Executive Officer of Bradespar since 2015 and 2015, respectively; Executive Officer of Millennium Security Holdings Corp. since 2015; and Vice Chairman of Bradespar's Board of Directors since April 2018.

Professional experience: Coordinator of Vale's Governance Sustainability Committee and Member of the Executive Development Committee from April 2015 to October 2017; Member of the Strategy Committee from April 2017 to October 2017; Executive Officer of Valepar from 2015 to 2017; Member of the Board of Directors of Valepar from 2015 to 2017 (and Vice-Chairman of Board of Directors from

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January to August 2017); 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; Executive Officer of Banco Bradesco BBI S.A. from 2006 to 2015; Member of the Board of Directors of 2b Capital S.A. from November 2014 to December 2018; Chief Executive Officer and Executive Officer of 2b Capital S.A. from May 2015 to June 2016 and from June 2016 to December 2018, respectively; Member of Vale's Board of Directors from April 2015 to January 2017; Chief Executive Officer of Antares Holding Ltda. from April 2015 to April 2017; Chief Executive Officer of Brumado Holdings Ltda from April 2015 to April 2017; and Member of the Investments Committee of Fundo de Investimento em Participações Sondas from May 2011 to April 2015.

Academic background: Degree in economic sciences from Faculdades Integradas Bennett.

Oscar Augusto de Camargo Filho, 81: Member of Vale's Board of Directors since October 2003 and Coordinator of the Personnel Committee since November 2017.

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; Member of Vale's Strategy Committee from March 2006 to October 2017; Coordinator of Vale's Executive Development Committee from November 2003 to October 2017; Secretary to Board and Commercial Executive Officer of Motores Perkins from 1963 to 1973; Commercial Executive Officer of MBR and Caemi Group from 1973 to 1981; Chief Executive Officer of Caemi International and Commercial Vice President of Caemi Group from 1981 to 1988; Chief Executive Officer of Caemi Mineração e Siderurgia from 1988 to 1992; Chief Executive Officer of Caemi Mineração e Siderurgia and Member of the Board of Directors of MRS Ferrovias from 1996 to 2002.

Academic background: Degree in law from Universidade de São Paulo; and Post-graduate degree in international marketing from Cambridge University.

Dan Antonio Marinho Conrado, 54: Member of Vale's Board of Directors since October 2012; Member of the Sustainability Committee since November 2017.

Professional experience: Member of Vale's Governance and Sustainability Committee from April 2017 to October 2017 and of Vale's Strategic Committee from October 2012 to April 2015; Chairman of Vale's Board of Directors from October 2012 to February 2016; Chairman of Valepar's Board of Directors from 2012 to 2017; Chief Executive Officer of Valepar from 2012 to 2015; Chief Executive Officer of PREVI Caixa de Previdência dos Funcionários do Banco do Brasil S.A. from 2012 to 2014, Alternate Member of the Board of Directors of Mapfre BB SH2 Participações S.A. from 2011 to 2017; and 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.

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.

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Marcel Juviniano Barros, 56: Member of Vale's Board of Directors since October 2012; Member of the Personnel Committee since November 2017.

Other current director or officer positions: Officer of Securities of PREVI Caixa de Previdência dos Funcionários do Banco do Brasil S.A. since 2012.

Professional experience: Member of the Executive Development Committee of Vale from February 2013 to October 2017; Member of the Board of Directors of Valepar from 2012 to August 2017; held several positions at Banco do Brasil S.A., including Union Auditor, between 1987 and 2012; and General Secretary of the National Confederation of Financial Branch Workers from 2008 to 2011.

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

Lucio Azevedo, 60: 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.

Eduardo Refinetti Guardia, 53: Member of Vale's Board of Directors since July 2016; Member of the Finance Committee since April 2017 and Coordinator of the Finance Committee since December 2018.

Professional experience: Coordinator of the Finance Committee from August 2017 to May 2018; Executive Officer of Products of BM&FBOVESPA (now B3) from 2013 to 2016; Executive Officer of Finance and Investor Relations of BM&FBOVESPA (now B3) from 2010 to 2013; Chairman of the Board of Directors of Banco do Brasil S.A. from June 2016 to April 2017; Executive Secretary of the Department of the Treasury from June 2016 to March 2018; Minister of the Department of Treasury from April 2018 to December 2018; and Manager of the Capital and Risk Committee of Banco do Brasil S.A. from September 2017 to December 2018.

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

Ney Roberto Ottoni de Brito, 73: Member of Vale's Board of Directors since January 2018; Coordinator of the Governance, Compliance and Risk Committee and Member of the Finance Committee since January 2018.

Other current director or officer positions: Chief Executive Officer of Ney O. Brito e Associados since 1978.

Academic background: Graduate degree in mechanical engineering from Escola Politécnica of the Universidade Federal do Rio de Janeiro; Master's degree in production engineering from COPPE of the Universidade Federal do Rio de Janeiro; PhD in finance from Stanford University.

Toshiya Asahi, 52: Member of Vale's Board of Directors since October 2017.

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Other current director or officer positions: Vice President of Mitsui & Co. (Brasil) S.A. since 2015; and Member of the Board of Directors of Gaspetro since October 2016.

Professional experience: Deputy General Manager of New Metals and Aluminum of Mitsui & Co. Ltd. from 2014 to 2015; Deputy Executive Officer of Mitsui & Co. Ltd. from 2012 to 2014.

Academic background: Graduate degree in metallurgical engineering from the University of Kyushu.

Sandra Maria Guerra de Azevedo, 63: Member of Vale's Board of Directors since October 2017 and Member of the Governance, Compliance and Risk Committee since November 2017.

Other current director or officer positions: Founding Partner of Better Governance Consulting Services since 2005; and Member of the Board of Directors of Global Reporting Initiative since January 2017.

Professional experience: Member of the Board of Directors of Companhia Paranaense de Energia from October 2016 to April 2017; Consulting counselor of Solvi Participações from 2011 to 2013; Consulting counselor of Solvi Valorização Energética from January 2013 to June 2013; Consulting counselor of Solvi Saneamento from June 2012 to December 2012; Consulting counselor of Grupo Itapemirim from 2009 to 2013; Co-founder of the Brazilian Institute of Corporate Governance (IBGC), serving as Chairman of its Board of Directors from 2012 to 2016; and Member of the Board of Directors of Vix Logística S.A. from April 2015 to April 2018.

Academic background: Graduate degree in social communications-journalism from Universidade Paulista; MBA from Universidade de São Paulo.

Isabella Saboya de Albuquerque, 48: Member of Vale's Board of Directors since October 2017

Other current director or officer positions: Member of the Board of Directors of Wiz Soluções e Corretagem de Seguros S.A. since April 2016; Vice-chairman of the Board of Directors of the Brazilian Institute of Corporate Governance (IBGC) since April 2017; Member of the State Governance Market Advisory Chamber of B3 since August 2017; Member of the Council of Autoregulation in Investment Governance Abrapp/Sindapp/ICSS since December 2016.

Professional experience: Member of the Fiscal Council of Bradespar S.A. from April 2016 to July 2016; Member of the Fiscal Council of Mills S.A. from April 2016 to April 2017; Member of the Board of Directors of BR Malls S.A. from May 2016 to March 2017; Partner at Jardim Botânico Investimentos S.A. from 2009 to 2015.

Academic background: Graduate degree in economics from Pontifícia Universidade Católica do Rio de Janeiro.

ADVISORY COMMITTEES TO THE BOARD OF DIRECTORS

Our bylaws provide for the following advisory committees to the Board of Directors, each governed by its own internal rules.

The *Personnel Committee*, which is responsible for evaluating the adequacy of the compensation model for members of the Board of Executive Officers and the proposed annual, global budget for the compensation of executives, supporting the Board of Directors in the setting and monitoring of goals for performance evaluation of our executive officers

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and certain other key managers, supporting the Board of Directors in determining disciplinary treatment of confirmed allegations against members of the Board of Executive Officers or other managers who report directly to the Chief Executive Officer or to the Board of Directors, supporting the Board of Directors in the process of selecting and appointing the Chief Executive Officer, monitoring the development of the succession plan for the Executive Board and other leaders who report directly to the Chief Executive Officer, evaluating and recommending adjustments to corporate governance best practices, identifying and recommending potential candidates to be directors and to be members of the Advisory Committees, among other matters. The current members of the Personnel Committee are Oscar Augusto de Camargo Filho, Gueitiro Matsuo Genso, Marcel Juviniano Barros, Fernando Jorge Buso Gomes and Ana Silvia Matte.

The *Finance Committee*, which is responsible for evaluating the structure and conditions of investment and divestment transactions, including mergers, consolidations and spin-offs in which Vale is involved, evaluating the compatibility and consistency between the compensation level of shareholders and the parameters established in the annual budget and financial scheduling, as well as Vale's general policy on dividends and capital structure, evaluating Vale's annual budget and annual investment plan, evaluating Vale's annual funding plan and indebtedness limits, evaluating current and capital investments, monitoring the financial execution of capital expenditure projects, ongoing budget and cash flow, monitoring financial risks and controls, preparing and approving the Finance Committee's annual work plan, among other matters. The current members of the Finance Committee are Eduardo Refinetti Guardia, Ney Brito, Fernando Jorge Buso Gomes, Eduardo de Oliveira Rodrigues Filho and Gilmar Dalilo Cezar Wanderley.

The *Governance, Compliance and Risk Committee*, which is responsible for monitoring the structure, processes, practices and systems in place to ensure compliance with all applicable legal and regulatory requirements, monitoring the suitability, strength and performance of all of Vale's internal control systems and proposing improvements, , supporting the Board of Directors in setting risk exposure limits, monitoring Vale's integrated risk map, as well as proposing improvements in risk mitigation plans, ensuring the effectiveness of mechanisms to handle conflicts of interests in Vale's transactions, as well as opining on related-party transactions, evaluating proposals for modifying the corporate governance documents, such as the By-Laws, the Code of Ethical Conduct and Internal Rules of Vale's Advisory Committees and Board of Directors, and other Policies, among other matters. The current members of the Governance, Compliance and Risk Committee are Ney Brito, Arthur Prado Silva, Yoshitomo Nishimitsu and Sandra Guerra.

The *Sustainability Committee,* which is responsible for evaluating Vale's sustainability strategy, and ensuring that it is considered when setting overall strategy, evaluating Vale's policies and conduct related to Safety, the Environment, Health, Social Actions, Communication and Institutional Relations, evaluating and proposing Vale's adherence to national or international initiatives or agreements related to socio-environmental responsibility matters, and monitoring the preparation and disclosure of the sustainability report, monitoring all operational risks and controls from the perspective of the integrated risk map, including risks to safety, the environment, health and social actions and reputational risks, as well as proposing improvements in risk mitigation plans, among other matters. The current members of the Sustainability Committee are Fernando Jorge Buso Gomes, Dan Antonio Marinho Conrado, Eduardo de Oliveira Rodrigues Filho and Clarissa Lins.

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INDEPENDENT AD HOC ADVISORY COMMITTEES TO THE BOARD OF DIRECTORS CREATED IN RESPONSE TO DAM I FAILURE

Independent Ad Hoc Consulting Committee for Investigation (CIAEA), established to investigate the causes of the dam failure. The committee is chaired by Dr. Ellen Gracie, former Justice of the Brazilian Supreme Court, and also includes Manuel Martins and Jose Francisco Compagno.

Independent Ad Hoc Consulting Committee for Support and Recovery (CIAEAR), established to monitor our measures to support the affected community and to remediate the impacted area, and our provision of resources for this purpose. The committee is also responsible for examining the action plans and recommending measures to our Board of Directors for effectively performing the support actions related to the dam failure, following up the progress of the action plans. The committee is chaired by Leonardo Pereira, former chair of the Brazilian Securities Commission, and also include Ana Cristina Barros and Márcio Gagliato.

Independent Ad Hoc Consulting Committee for Dam Safety (CIAESB), established to evaluate safety conditions of our dams, prioritizing upstream structures, structures in alert zones, among others, with purpose of identifying and recommending measures to strengthen safety at these structures, based on national and international advanced methodologies. The committee is responsible for examining the action plans proposed by the our management regarding the safety of the dams, governance related to security management plans and to recommend measures for their improvement. The committee is chaired by Flávio Miguez de Mello, and also includes Willy Lacerda and Pedro Repetto.

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
Eduardo de Salles Bartolomeo(1)(2)	2017	Interim Chief Executive Officer	55
Luciano Siani Pires	2012	Chief Financial Officer and Executive Officer for Investor Relations	49
Claudio de Oliveira Alves(2)	2019	Interim Executive Officer (Ferrous Minerals and Coal)	51
Vacant(3)	2019	Executive Officer (Base Metals)	
Luiz Eduardo Fróes do Amaral Osorio	2017	Executive Officer (Sustainability and Institutional Relations)	45
Alexandre Gomes Pereira	2017	Executive Officer (Business Support)	49
Fabio Schvartsman(2)	2017	Executive Officer (on leave)	65
Gerd Peter Poppinga(2)	2014	Executive Officer (on leave)	59

(1)

Eduardo de Salles Bartolomeo was Executive Officer for Base Metals from 2017 to March 2019, and was appointed Interim Chief Executive Officer in March 2019, during the temporary leave of Fabio Schvartsman.

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(2) In March 2019, the Board of Directors approved the requests from Fabio Schvartsman and Gerd Peter Poppinga for temporary leave from their positions. See *Business overview Failure of the tailings dam at the Córrego do Feijão mine*. Consequently, the Board approved the appointment of Eduardo de Salles Bartolomeo as Interim Chief Executive Officer and Claudio De Oliveira Alves as Interim Executive Officer of Ferrous Minerals and Coal.

(3) In March 2019, our Board of Directors appointed Mr. Mark James Travers as Executive Officer for Base Metals, subject to him obtaining a visa and relocating to Brazil, as required under Brazilian law.

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

Eduardo de Salles Bartolomeo, 55: Interim Chief Executive Officer of Vale since March 2019.

Other current director or officer positions: Chairman of the Board of Directors of Login Logística Intermodal since 2016.

Professional experience: Executive Officer for Base Metals from 2017 to March 2019; Member of Vale's Board of Directors from September 2016 to December 2017; Coordinator of Vale's Governance, Compliance and Risk Committee from November 2017 to December 2017; Member of Vale's Financial Committee from April to December 2017; Chief Executive Officer of Nova Transportadora do Sudeste from April to December 2017; Member of Vale's Strategic Committee from September 2016 to October 2017; Executive Officer of Vale for Integrated Operations from 2010 to 2012; Executive Officer of Vale for Logistics, Projects & Sustainability from 2007 to 2010; Member of the Board of Directors of Arteris S.A. from 2015 to 2017; Chief Executive Officer of BHG Brazilian Hospitality Group from 2013 to 2015; Member of the Board of Directors of MRS Logística S.A. from 2007 to 2009; Head of Vale's logistical operations from 2004 to 2006; and Chief Executive Officer of Petroflex from 2006 to 2007.

Academic background: Graduate degree in metallurgical engineering from Universidade Federal Fluminense; MBAs from Katholieke Universiteit Leuven and the Massachusetts Institute of Technology.

Luciano Siani Pires, 49: Chief Financial Officer and Executive Officer for Investor Relations of Vale since August 2012 and Member of the Executive Risk Management Committee since August 2012.

Other current director or officer positions: Member of the Board of Directors of The Mosaic Company since January 2018; and Chairman of the Board of Directors of VLI S.A since September 2017.

Professional experience: Alternate Member of the Board of Directors of Vale, from 2005 to 2007; Member of Vale's Financial Committee from 2012 to 2015; Global Officer of Strategic Planning, from 2008 to 2009 and in 2011, and Global Officer of Human Resources and Governance 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 export finance, from 1992 to 1999 and from 2001 to 2008, respectively; and Consultant at McKinsey & Company from 2003 to 2005.

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

Claudio de Oliveira Alves, 51: Interim Executive Officer for Ferrous Minerals and Coal of Vale since March 2019.

Professional experience: Chief Operating Officer of Pelletizing and Manganese Division of Vale from January 2017 to March 2019; Chief Global Officer of Iron Ore Marketing and Sales of Vale from August

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2013 to December 2016; Chief Marketing Officer from September 2011 to June 2013; and Chief Strategy Officer from July 2010 to September 2011.

Academic background: Degree in production engineering from Federal University of Rio de Janeiro; Post Graduate degree in Management from Fundação Dom Cabral; Specialization in Strategic Marketing from Darden School of Business; MBA in Management from University of São Paulo; Specialization in Industrial Marketing from INSEAD; Specialization in Transforming Leadership from Massachusetts Institute of Technology (MIT); Specialization in Leadership from IMD; and participation on Innovation and Sustainability Program from MIT.

Luiz Eduardo Fróes do Amaral Osorio, 45: Executive Officer for Sustainability and Institutional Relations of Vale since July 2017.

Other current director or officer positions: President of the Board of Directors of Instituto Brasileiro de Mineração IBRAM.

Professional experience: Executive Vice-President of Legal and Company Relations of CPFL Energia S.A. from 2014 to 2017; Member of the Board of Directors of CPFL Energias Renováveis S.A. from 2014 to 2017; Vice-Chairman of the Board of Directors of Instituto CPFL from 2015 to 2017; Executive Director of International Markets of Raízen from 2012 to 2014; Vice President, General Counsel and Chief Institutional Relations Officer of CPFL Energy Group from May 2014 to July 2017; Executive Director for International Markets, based in London, of Raízen from July 2012 to March 2014; Vice President for Sustainable Develompment and External Affairs of Raízen from March 2011 to June 2012.

Academic background: Law degree from Pontifícia Universidade Católica do Rio de Janeiro; Master's degree in development management from American University's School of International Service; Participated in coursework in corporate social responsibility at Harvard Business School, general management skills at INSEAD, strategy and leadership at the University of Pennsylvania and leadership in corporate counsel from Harvard Law School.

Alexandre Gomes Pereira, 49: Executive Officer for Business Support since August 2017.

Professional experience: Global Information Officer of Vale from 2011 to 2017; Head of Global IT Services of Vale from 2009 to 2011; Vice President and Chief Information Officer of Vale's global nickel business (Vale Canada) from 2007 to 2009; IT General Manager of Vale from 2002 to 2007.

Academic background: Degree in mathematics/computer science from State University of Rio de Janeiro (UERJ); Post-graduate degrees in business management from Fundação Dom Cabral and in computer networks from the Federal University of Espírito Santo (UFES); and MBA from São Paulo University (USP).

Fabio Schvartsman, 65: Executive officer (on leave since March 2019). See *Business overview Failure of the tailings dam at the Córrego do Feijão mine*.

Professional experience: Chief Executive Officer of Vale from May 2017 to March 2019; Coordinator of Vale's Strategic Committee from May 2017 to October 2017; Chief Executive Officer of Klabin S.A. from 2011 to 2017; Chief Executive Officer of SanAntonio Internacional from April 2008 to April 2010; Chief Executive Officer of Telemar Participações S.A. from April 2007 to February 2008; several executive positions at Grupo Ultra from May 1985 to April 2007, including Planning and Control Officer and Investor Relations Officer, Chief Financial Officer of Ultrapar Holding and managing partner of Ultra S.A.; and General Manager of the Economic Studies, Development and Planning areas of Duratex S.A. from February 1976 to April 1985.

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Academic background: 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.

Gerd Peter Poppinga, 59: Executive officer (on leave since March 2019). See *Business overview Failure of the tailings dam at the Córrego do Feijão mine*.

Professional experience: Executive Officer for Ferrous Minerals of Vale from November 2014 to March 2019; 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 Limited from November 2007 to April 2008; Several memberships on boards of directors and executive boards from 2005 to 2010 in connection with his roles at Vale; Member of the Board of Directors of Samarco Mineração S.A. from December 2014 to April 2016; and several positions at Mineração da Trinidade S.A. SAMITRI, a publicly held mining company acquired by Vale in 2001, from 1985 to 1999.

Academic Background: Degree in geology from Universität Clausthal Zellerfeld, Germany; Participated in coursework in geostatistics at Universidade Federal de Ouro Preto (UFOP), executive MBA at Fundação Dom Cabral, negotiation dynamics at INSEAD; senior leadership at the Massachusetts Institute of Technology and IMD Business School in Lausanne, Switzerland, and strategic megatrends (Asia-focused) at Kellogg Singapore.

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

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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.

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. Marcus Vinicius Dias Severini, is an audit committee financial expert. In addition, Mr. Marcus Vinícius Dias Severini 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 13, 2018. 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 the holders of our golden shares 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
Marcelo Amaral Moraes	2004	Vacant(3)	
Marcus Vinícius Dias Severini	2017	Vacant(4)	
Eduardo Cesar Pasa	2017	Sergio Mamede Rosa do Nascimento	2016
Raphael Manhães Martins(1)	2015	Gaspar Carreira Junior(1)	2017
Daniel Rodrigues Alves(2)	2018	Rodrigo Toledo Cabral Cota(2)	2018

(1) Appointed by minority shareholders of common shares.

(2) Appointed by the holder of golden shares.

(3)

Vacant since the General Ordinary Shareholders' meeting of 2014.

(4) Vacant since the General Ordinary Shareholders' meeting of 2017.

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Below is a summary of the business experience, activities and areas of expertise of the members of our Fiscal Council.

Marcelo Amaral Moraes, 51: 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; Member of the Board of Directors of Eternit S.A. since 2016; and Member of the Board of Directors of CPFL Energia S.A. since April 2017.

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 COPPEAD at the Universidade Federal do Rio de Janeiro; and Post-graduate Degree in corporate law and arbitration from Fundação Getúlio Vargas.

Marcus Vinícius Dias Severini, 61: Member of Vale's Fiscal Council since April 2017.

Other current director or officer positions: Member of the Fiscal Council of BRF S.A. since April 2015 and member of Valia's Audit Committee since January 2019.

Professional experience: Controller of Vale from 1994 to 2015. Member of the Fiscal Council of Mills Estruturas e Serviços de Engenharia S.A. from April 2015 to April 2018.

Academic background: Degree in accounting sciences from UniverCidade; Graduate degree in electrical engineering from Universidade Federal Fluminense; and a specialized degree in economic engineering from UniSUAW.

Eduardo Cesar Pasa, 48: Member of Vale's Fiscal Council since April 2017.

Other current director or officer positions: Accounting Management Officer of Banco do Brasil S.A. since April 2015; Member of the Deliberations Council of PREVI since 2010; Member of the Fiscal Council of Petrobras S.A. since April 2017; and Alternate Member of the Fiscal Council of Brasilprev Seguros e Previdência since March 2018.

Professional experience: Coordinator of Vale's Controlling Committee of Vale from 2014 to 2017; Member of the Fiscal Council of Centrais Elétricas Brasileiras S.A. (Eletrobras) from 2015 to 2017; Member of the Fiscal Council of Cateno Gestão de Contas de Pagamento S.A. from 2016 to 2017; General Accounting Manager of Banco do Brasil S.A. from 2009 to 2015; Member of the Fiscal Council of CASSI from 2010 to 2014; Alternate Member of the Fiscal Council of Banco Votorantim S.A. from 2009 to 2015; and Member of the Fiscal Council of BBTS-BB Tecnologia e Serviços from 2008 to 2015.

Academic background: Graduate degree in accounting sciences from Centro Universitário de Brasília UniCeub; Post-graduate degree in accounting sciences from the Post-Graduate School of Economics at Fundação Getúlio Vargas; Master's Degree in accounting sciences from the School of Economics, Administration and Accounting of the Universidade de São Paulo.

Raphael Manhães Martins, 36: 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 April 2015; Attorney for Faoro Advogados since April 2010; Member of the Board of Directors of Condor S.A.

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Indústria Química since May 2017; Member of the Board of Directors of Welser Itage Participações e Comércio S.A. since May 2017; and Member of the Board of Directors of Light S.A. since August 2018.

Professional experience: Attorney for Cr2 Empreendimentos from 2007 to 2009; and Member of the Fiscal Council of Light S.A. from 2014 to 2018.

Academic background: Degree in law from Universidade Estadual do Rio de Janeiro.

Daniel Rodrigues Alves, 76: Member of Vale's Fiscal Council since April 2018.

Other current director or officer positions: Executive Assistant Secretary of the Brazilian Ministry of Finance since 2016; and Alternate Member of the Board of Directors of BB MAPFRE SH1 Participações S.A. since 2017.

Professional experience: Managing partner at Rodrigues Alves e Soares Duarte Advogados from 2011 to 2014; Legal consultant at Empresa Gestora de Ativos EMGEA, a state-owned company connected to the Brazilian Ministry of Finance from 2015 to 2016.

Academic background: Degree in law from Associação de Ensino Unificado do Distrito Federal; and Specialized degree in international law from Fundação Getúlio Vargas in Rio de Janeiro.

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MANAGEMENT COMPENSATION

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. The Personnel Committee, composed of four members of the Board of Directors and one independent non-director, advises the Board of Directors on the distribution of the annual aggregate compensation among the directors and executive officers and in setting and monitoring goals for the performance evaluation of the Executive Board. See *Management and employees Management Advisory committees to the Board of Directors*.

As a global company, we require management with a deep knowledge of our business and market and unlimited dedication. Attracting and retaining talent, and engaging and motivating the professionals holding strategic positions, especially our executive officers, is critical for our success.

The compensation submitted by our Board of Directors for approval of our shareholders, and the distribution of the aggregate compensation among the members of our Board of Directors and our Board of Executive Officers, are based on benchmarking against the compensation policies and practices of the top global mining companies and other large global companies in other similar industries, and various other factors, such as the directors' and officers' responsibilities, time devoted to their duties, professional competence and reputation, market practices in the places where we operate, and the alignment of short- and long-term strategies, shareholder returns and the sustainability of the business.

One of the core principles for designing the compensation proposal is the alignment with our performance and return to our shareholders. The compensation package offered to our Board of Executive Officers, assuming the achievement of target average performance, is composed as follows: 27% fixed compensation, 27% short-term (performance target-based) variable compensation and 46% long-term (share-based incentives) variable compensation. The short-term variable compensation component is based on our cash generation, taking into account economic and financial targets that reflect operating performance, as well as health and safety targets, sustainability and accomplishment of strategic initiatives. Of the long-term variable portion, 20% of aggregate compensation is to be awarded under our Matching Program and 26% is to be awarded as Performance Shares Units (PSUs) under our phantom stock plan, for which payment is a direct function of our Total Shareholder Return (TSR) indicator's performance compared to a preselected group of comparable companies. As such, 73% of the executive compensation package is at risk, and the mix offered can vary according to the performance achieved and the return to our shareholders (pay-for-performance) in each year

In January 27, 2019, our Board of Directors determined the suspension of payments of all variable compensation to our executive officers, from that date until the Board of Directors decides to revert such determination based on the outcome of the investigations into the causes of the failure of Dam I. We made a payment under the PSU program on January 15, 2019, prior to the failure of Dam I, which represents approximately 24% of the variable compensation initially contemplated for 2019.

EXECUTIVE OFFICERS

As of December 31, 2018, we had six executive officers and all of them held their positions for the full year of 2018. For the year ended December 31, 2018, the average annual compensation paid to our executive officers was US$4.06 million, the highest annual compensation paid to an executive officer was US$6.20 million and the lowest annual compensation was US$1.44 million. The average annual compensation corresponds to the total aggregate compensation paid to executive officers in 2018, not including amounts paid in 2018 for executive officers who left in prior years, divided by the number of current officers. Including payments made in 2018 for executive officers who left in prior years, the average annual compensation paid to our executive officers was US$7.58 million.

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Management Compensation

For the year ended December 31, 2018, the total payments related to executive officers' compensation packages is set forth in the table below.

	For the year ended December 31, 2018 (US$ million)
Annual fixed compensation	5.63
In-kind benefits and pension plans	1.93
Variable compensation(1)	13.93
Total amount paid in 2018 to current executive officers	**21.49**
Severance	18.73
Total amount paid in 2018 to current and former executive officers	**40.22**
Social security contributions	5.29
Total expenditures related to executive officers' compensation packages	**45.51**

(1) Variable compensation includes bonus payments and payments under Matching Program and PSU Program in 2018.

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 and on Vale's global cash generation, both 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 Share Unit (PSU) Program.

Under our Matching Program, our executive officers are permitted to purchase a certain number of common 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 common shares or ADRs held through the end of the cycle. Participation in our Matching Program is mandatory for our Board of Executive Officers in the years in which we pay cash bonuses. Participants may sell or transfers their common shares or ADRs at any time during the vesting period, in which case they forfeit the right to receive any reward with respect to these common shares or ADRs. The Board of Executive Officers must observe the Securities Trading Policy in order to sell or transfer Matching Program shares. The 2019 cycle of our Matching Program to our executive officers is temporarily suspended since January 27, 2019, pending conclusion of investigations related to the failure of the Dam I and further resolution of the Board of Directors.

Under our PSU Program, our executive officers receive payments tied to Vale's performance, as compared to a selected group of mining companies, based on the total shareholder return (dividend or interest on equity payments and share appreciation) of the common shares of those companies during the vesting period. Starting in 2019, the PSU Programs will have three-year cliff vesting (instead of four-year scaled vesting) for each cycle. The 2019 cycle of our PSU Program to our executive officers is temporarily suspended since January 27, 2019, pending conclusion of investigations related to the failure of the Dam I and further resolution of the Board of Directors.

Pension, retirement or similar benefits consist of our contribution to Valia, the manager of pension plans sponsored by Vale.

Our severance packages for qualified terminations may comprise: (i) a lump-sum severance payment, corresponding to one-half the annual fixed compensation for executive officers and equal to the annual fixed compensation for the Chief Executive Officer, paid shortly after the termination date; (ii) non-compete agreement compensation corresponding to twice the annual fixed compensation, to be paid in eight equal quarterly installments after termination; (iii) pro-rated payment of any outstanding

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long-term variable compensation grants (Matching and PSU Programs), paid shortly after the termination date; and (iv) pro-rated payment of any outstanding short-term incentive plan (bonus), to be paid in April following the termination date. Severance expenditures in 2018 were related to seven former executive officers who left the company in 2016, 2017 and 2018.

Social security contributions are mandatory contributions we are required to make to the Brazilian government for our executive officers.

Vale has also entered into indemnification agreements with its officers.

BOARD OF DIRECTORS

As of December 31, 2018 our Board of Directors had 12 members and the monthly average number of members that received compensation during 2018 was 12.08. For the year ended December 31, 2018, the average annual compensation paid to the members of our Board of Directors was US$0.17 million, the highest annual compensation paid to a member of the Board of Directors was US$0.3 million and the lowest annual compensation was US$0.15 million.

In 2018, we paid US$2.09 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 February 28, 2019, the total number of common shares owned by our directors and executive officers was 1,009,690. None of our directors or executive officers beneficially owns 1% or more of any class of our shares. Vale has also entered into indemnification agreements with its directors.

FISCAL COUNCIL

As of December 31, 2018 our Fiscal Council had 5 members and the monthly average number of members that received compensation during 2018 was 5. For the year ended December 31, 2018, the average, the highest and the lowest annual compensation paid to a member of the Fiscal Council was US$ 0.11 million.

We paid an aggregate of US$0.56 million to members of the Fiscal Council in 2018. 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$0.48 million to members of our permanent advisory committees in 2018. Until May 2018, those members who were directors or officers of Vale were not entitled to additional compensation for participating on a committee. Since June 2018, directors who participate in advisory committees are entitled to receive, in addition to the compensation as a board member, compensation for participating in one or more committees limited to 50% of the amount of a directors' compensation. Members of our advisory committees are also reimbursed for travel expenses related to the performance of their duties.

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EMPLOYEES

The following tables set forth the number of our employees by business and by location as of the dates indicated.

	As of December 31,		
By business:	**2016**	**2017(1)**	**2018**
Ferrous minerals	42,579	42,734	43,504
Coal	2,039	2,258	2,350
Base metals	15,239	15,243	14,349
Fertilizer nutrients(1)	8,935	8,055	12
Energy(2)	NA	NA	4,058
Corporate activities	4,270	5,306	5,997
Total	73,062	73,596	70,270

(1) Discontinued operations.

(2) Consists of Biopalma employees.

	As of December 31,		
By location:	**2016**	**2017(1)**	**2018(1)**
South America	57,535	58,457	55,423
Brazil	56,576	57,513	55,230
North America	6,630	6,432	6,032
Europe	385	375	298
Asia	4,499	4,571	4,475
Oceania	1,521	1,364	1,378
Africa	2,492	2,397	2,664
Total	73,062	73,596	70,270

(1) Since January 2017, we include in our total workforce figures all fixed-term contract employees, trainees and employees hired through our affirmative action program for Persons with Disabilities.

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 and the United Kingdom.

WAGES AND BENEFITS

Wages and benefits for Vale and its subsidiaries are generally established on a company-by-company basis. Our benefits policy is aligned with our attraction and retention strategy, in accordance with applicable laws and market practice in the countries where we operate. We provide an attractive and competitive benefits package ensuring health, well-being, protection and life quality. Among the main benefits offered are medical and dental assistance, life insurance, private pension plans and short-and long-term disability benefits.

We establish our wage and benefits programs for Vale S.A. and its subsidiaries, other than Vale Canada. In November 2018, we reached a one-year agreement with the Brazilian unions providing for a salary increase of 6.0% beginning in November 2018. 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. No collective bargaining took place in 2018, as no contracts expired within the year. On January 1, 2018, Vale Canada implemented a flexible benefits program for employees represented by the technical and administrative union at our Sudbury operation; this plan was negotiated

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during the collective bargaining process in 2017. For non-unionized employees, Vale Canada undertakes an annual review of salaries and benefits. We also provide our employees and their dependents with other benefits, including supplementary medical assistance, and in 2017 Vale Canada introduced a new flexible benefits plan for its non-union employees.

PENSION PLANS

Brazilian employees of Vale and of most of its Brazilian subsidiaries are eligible to participate in pension plans managed by Valia. 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 participate in defined benefit pension plans and defined contribution pension plans. The defined benefit plans have been closed to new participants since 2009, and all new employees within our Base Metals operations are eligible to 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*.

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VI. 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, 2018. See note 28 to our consolidated financial statements for further information.

LEGAL PROCEEDINGS RELATED TO THE FAILURE OF DAM I

We are engaged in several investigations and legal proceedings relating to the failure of Dam I. These proceedings are all in early stages, and we cannot reasonably estimate the range of loss or the timing for decisions. Other proceedings or investigations relating to the failure of Dam I are expected. Our potential liabilities resulting from the dam failure are significant, and additional provisions are expected.

a) Public civil actions brought by the State of Minas Gerais and state public prosecutors for damages resulting from the failure of Dam I

We are party to public civil actions brought by the State of Minas Gerais and state prosecutors before various state courts in Minas Gerais claiming economic and environmental damages resulting from the dam failure and a broad range of injunctions ordering Vale to take specific remediation and reparation actions.

In January 2019, immediately after the failure of Dam I, state courts in Minas Gerais granted orders freezing R$11.0 billion in cash in our bank accounts and requesting us to take a number of emergency and reparation measures in connection with the failure of Dam I. These orders were granted in response to preliminary injunctions filed by the State of Minas Gerais and state prosecutors in preparation for these public civil actions.

In one of these proceedings, on February 20, 2019, we entered into a preliminary agreement with the State of Minas Gerais, and certain other authorities that joined this proceeding, in order to expedite payment of monetary damages resulting from the failure of Dam I. Under this preliminary agreement, we agreed to advance indemnification payments to the affected people and independent technical consulting services to affected individuals and to reimburse or direct payment of the expenses incurred by the State of Minas Gerais.

In one of these public civil actions, the state prosecutors have requested that Vale be ordered to contribute significant amounts to a fund, to be created and managed by state prosecutors with the purpose of funding remediation and reparation measures.

b) Public civil actions brought by state prosecutors and other authorities regarding safety requirements at other dams

We are party to more than ten public civil actions in which public prosecutors and other authorities seek the suspension of operations, the imposition of restrictions on operations, or injunctions compelling us to implement safety measures at other existing tailings dams.

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In various of these public civil actions, courts froze amounts in our bank accounts to secure payments of damages and costs in connection with the evacuation and relocation of communities. The aggregate amount frozen in these public civil actions is R$5 billion.

In March 2019, we suspended operations at our Timbopeba mine, following a decision of a state court in the city of Ouro Preto restraining us from using the Doutor dam and other structures at the Timbopeba mine.

In February 2019, a state court in Belo Horizonte ordered us to present emergency plans and documents certifying the stability and safety of dams and to suspend activities that may create risks to the Laranjeiras, Menezes II, Capitão do Mato, Dique B, Taquaras, Forquilha I, Forquilha II and Forquilha III dams. Of the dams named in the injunction, only the Forquilha I, Forquilha II and Forquilha III dams were built using the upstream method. Due to our inability to use the Laranjeiras dam for tailings disposal from our Brucutu mine in the Minas Centrais complex, we halted production at the Brucutu mine pending removal of the injunction. In March 2019, this court decision was reversed with respect to the Laranjeiras dam, and SEMAD reinstated our provisional license to use the Laranjeiras. On March 25, a state court in the city of Santa Barbara prohibited Vale from using the Sul dam, another tailings dam located at the Brucutu mine. This decision was reversed by the Court of Appeals of the State of Minas Gerais on April 15, 2019. The Laranjeiras dam receives tailings from Vale's mining operations at Brucutu mine, while the Sul dam receives discharges from Vale's concentration plant in emergency situations. These proceedings are still ongoing.

In October 2017, before the failure of Dam I, state prosecutors of the state of Minas Gerais had brought public civil actions challenging our environmental licenses for the construction of the Maravilhas III tailings dam, which is expected to support our operations in the Vargem Grande mining complex, in our Southern System. After the failure of Dam I, the prosecutors filed a request for preventive injunction seeking to discontinue the project, but the request was rejected by the court. This proceeding is still ongoing. If the construction of this dam is interrupted, our ability to resume operations in the mining complex of Vargem Grande could be adversely impacted.

In April 2018, state prosecutors brought a public civil action related to the Maravilhas II tailings dam, requesting injunctions ordering us to (i) refrain from disposing tailings, operating, constructing or making other interventions on the dam; (ii) refrain from increasing the risks of other structures in the mining complex where Maravilhas II is situated; (iii) review technical studies and other documents related to the dam, and conduct an external audit on the structure. The injunction requests were granted by the Court of Itabirito on April 11, 2019. The Maravilhas II tailings dam supports our operations in the Vargem Grande complex, which have been suspended since February 2019.

c) Public civil action brought by labor prosecutors

We are a party to a public civil action brought by labor prosecutors claiming, among other things, a pre-judgment attachment to secure the payment of monetary damages and costs including expert reports, wages, socio-economic relief, funeral expenses and other remediation measures to the workers affected by the failure of Dam I. The labor court in Belo Horizonte, Minas Gerais, granted pre-judgment attachments in the amount of R$1.6 billion million in cash in our bank accounts to secure the payment of damages and severance claims of employees affected by the closure of our operations in the Córrego do Feijão mine.

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On February 15, 2019, we entered into a preliminary agreement with the labor prosecutors pursuant to which we agreed to indemnify our direct and indirect employees affected by the closure of Córrego do Feijão mine. Under the terms of the agreement, we agreed to maintain the jobs of our direct employees until December 31, 2019 and will assist third party employees with a replacement or pay their salaries until December 31, 2019. We also agreed to keep paying wages regularly to the missing people until the authorities have considered them as fatal victims of the event and will pay to the families of the fatal victims an amount equivalent to two thirds of their wages until December 31, 2019 or until we reach the final agreement with the labor prosecutors. We will also provide a lifelong medical insurance benefit to the spouses of the victims and a similar benefit to the dependents of the victims until they are 22 years old. Our initial estimate is that this agreement will result in a provision of approximately US$220 million in 2019.

d) Putative class actions in the United States

We and certain of our officers have been named defendants in civil class action suits, under U.S. federal securities laws, brought before federal courts in New York by holders of our securities. The plaintiffs allege that we made false and misleading statements or omitted to make disclosures concerning the risks of the operations of Dam I and the adequacy of the related programs and procedures. The plaintiffs have not specified an amount of alleged damages in these actions.

We believe that the claims have no merit, and we will contest them. However, given the preliminary status of the actions, it is not possible at this time to determine a range of outcomes or to make reliable estimates of the potential exposure.

e) Criminal investigations

The Minas Gerais state police, the Brazilian federal police and state and federal prosecutors are conducting criminal investigations in connection with the failure of Dam I. In connection with the investigation conducted by the state prosecutors, the 2nd criminal court in Brumadinho ordered the temporary arrest of certain employees of Vale and of a company that had provided testing and certification services to us. These individuals have been released from detention and are still being investigated. We cannot estimate the timing for conclusion of the investigations and do not have precise information on the potential crimes being investigated. We do not have information on the names of all the individuals targeted by the investigation.

f) Investigation by Brazilian legislative bodies

In March 2019, the Brazilian Senate initiated an investigation (*Comissão Parlamentar de Inquérito, or "CPI"*) to determine the causes of and responsibilities for the failure of Dam I and to propose changes to the existing legal and regulatory regime applicable to the mining industry and other related matters. ln February 2019, the Brazilian House of Representatives created a commission to monitor tailings dams across the country, and to oversee the work of various public authorities in charge of monitoring such dams. In April 2019, the Brazilian House of Representatives announced that it will initiate a CPI, similar to the one conducted by the Senate. State and local legislative bodies have initiated other CPIs in response to the failure of Dam I, and other similar investigations and inquiries. These investigations may result in the approval of more stringent rules applicable to our business.

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g) Other proceedings

We are a defendant in a number of private actions, before state and federal courts in the state of Minas Gerais, brought by individuals, business entities, associations, non-governmental organizations and other entities seeking remediation and compensation for environmental, property and personal damages resulting from the Dam I failure. These proceedings include requests for significant amounts in damages, injunctions, pre-judgment attachment of assets and seizure of our bank accounts. We are also engaged in several other investigations and proceedings claiming damages resulting from the dam failure. These actions and proceedings are in early stages, and we cannot reasonably estimate their impact. Other proceedings and investigations relating to the failure of the tailings dam in Brumadinho are expected.

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. Most of these proceedings are in early stages, and we cannot reasonably estimate the possible loss or range of loss or the timing for a decision.

a) Public civil action filed by the Brazilian government and others and public civil action filed by the Federal Prosecution Office

In November 2015, the Brazilian federal government, the states of Minas Gerais and Espírito Santo, certain federal and state authorities and certain public entities collectively filed a public civil action before the 12th Federal Court in Belo Horizonte, state of 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.

In March 2016, we, together with Samarco and BHPB, entered into a framework agreement with the federal government, the state governments of Espírito Santo and Minas Gerais and certain other federal and state authorities. 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. The Framework Agreement provides that, within three years of the date of the agreement, the parties would review its terms to assessing the effectiveness of the ongoing remediation and compensation activities.

In May 2016, the MPF filed a public civil action before the 12th Federal Court in Belo Horizonte against Samarco, Vale, BHPB, BNDES and the governmental authorities that are parties to the Framework Agreement. 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. The MPF also claimed 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 failure 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

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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.

In June 2018, Vale, Samarco, BHPB and the offices of the federal and state (Minas Gerais and Espírito Santo) prosecutors, public defenders and attorneys general, among other parties entered into a comprehensive agreement to improve the governance mechanism of Fundação Renova and establish a process for potential revisions to the remediation programs provided under the Framework Agreement based on the findings of experts hired by Samarco to advise the MPF over a two-year period (the June 2018 Agreement). The June 2018 Agreement terminated certain lawsuits, including public civil actions filed by the Brazilian federal government and the states of Minas Gerais and Espírito Santo. It also contemplates the future termination of other public civil actions upon agreement over the remediation programs under experts' review, and confirmed the collateral provided by the parties to secure the payment of remediation measures in the amount of R$2.2 billion.

We expect the Framework Agreement and the June 2018 Agreement to represent the first steps for the settlement of the public civil action brought by the MPF and other related proceedings.

b) 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 Fundão dam.

The criminal charges were accepted by the judge in November 2016. The criminal proceedings is subject to challenge in separate proceedings in federal courts. We are not able to anticipate when a judgment will be issued or when the judge will correct the criminal process in accordance with the decision of the federal court.

c) Class actions in the United States

We and certain of our officers have been named as defendants in civil class action suits in federal courts in New York brought by holders of our securities and by holders of Samarco's bonds, each under U.S. federal securities laws. The plaintiffs allege that we made false and misleading statements or omitted to make disclosures concerning the risks 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.

We believe that the claims have no merit, and we will continue contesting them. However, given the preliminary status of the actions, 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 so far.

c.1) Related to Vale's American Depositary Receipts

Vale and certain of its officers were named as defendants in a securities class action in the U.S. Federal Court for the Southern District of New York brought by holders of Vale's ADRs under U.S. federal securities laws.

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In March 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 sustainability report concerning risk mitigation plans, policies and procedures, and certain statements made in a conference call in November 2015 concerning Samarco. This lawsuit is currently in the discovery phase.

c.2) Related to Samarco's bonds

Vale, together with Samarco and BHPB, was named as defendant in class action alleging violations of U.S. federal securities laws brought by holders of bonds issued by Samarco in the U.S. Federal Court for the Southern District of New York. The defendants filed a joint motion to dismiss the complaint, and a decision on this motion is still pending. Discovery will not commence until after the court rules on the defendants' pending motion to dismiss.

d) Tax proceeding

In September 2018, the federal tax authorities filed a request before the 27th federal court in Belo Horizonte for an order seizing Vale's assets to secure the payment of federal tax debts of the joint venture, in the amount of approximately R$10 billion. The court initially granted an order to freeze assets of Vale, but this decision was reversed, in all material respects, because these tax debts are currently suspended under Brazilian law. We were served in January 2019 and have submitted our defense immediately thereafter. We are vigorously contesting this action.

e) Other proceedings

Vale is a defendant in several public civil actions brought by state prosecutors of Minas Gerais and Espírito Santo, other authorities or civil associations claiming environmental damages as a result of the failure of Samarco's dam. The relief claimed in these proceedings are generally similar to the claims brought in the public civil action brought by the Brazilian government and others and the public civil action brought by the MPF. In 2017, The Superior Court of Justice (STJ) decided that the 12th Federal Court in Belo Horizonte is the competent court to rule on all these public civil actions. All these public civil actions have been suspended while we negotiate an agreement with the MPF, as discussed in item a) above.

Vale has been named as a defendant in a number of private actions, before different state and federal courts in the states of Minas Gerais and Espírito Santo, brought by individuals, business entities, municipalities and other entities seeking remediation and compensation for environmental, property and personal damages resulting from the Fundão dam failure. These proceedings include requests for significant amounts in damages, injunctions, pre-judgment attachment of assets and seizure of our bank accounts. Vale has settled part of these suits, and continues to defend itself in a number of these proceedings.

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 (currently, the ANM) commenced an investigation into the causes of the dam failure, and ordered 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 state of Espírito Santo ordered the suspension of our activities in Pier II and the coal

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pier of the Tubarão port due to potential environmental damages resulting from the release of iron ore in the sea area around the piers. Our operations in 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. In July 2016, the TRF confirmed the suspension of the effects of the injunction and ordered an expert investigation to confirm that we had properly implemented measures to monitor, control and mitigate the release of iron ore in the terminal. This expert investigation commenced in 2018 and the expert appointed by the court submitted its report in March 2019. Vale and the federal prosecutors will submit their comments on the expert report in April 2019. As a result of this proceeding, we may be required to suspend our activities in the Tubarão port or to implement additional measures to prevent or mitigate the release of iron ore in the sea.

In September 2017, the federal police concluded its environmental investigation and recommended that the MPF press charges against us for environmental crimes resulting from the release of iron ore in the sea around the Tubarão port. In June 2018, the MPF requested that the federal police reopen and continued the investigation. In September 2018, we entered into a settlement agreement with the MPF, state prosecutors and the environmental and water authority of the state of Espírito Santo (IEMA), pursuant to which we agreed to take additional measures to control emissions and to implement certain measures recommended by the environmental agency of the state of Sao Paulo (CETESB). The estimated investments required to comply with these measures are approximately R$1.27 billion. As part of this settlement, the MPF requested the suspension of the police investigation and the preliminary injunction. The federal court requested an opinion from the Attorney General in order to confirm such request. In the event that the Attorney General does not approve the request to ratify our settlement agreement, the federal prosecutors may seek other actions against us, including requests for suspension of our activities in the Tubarão port, or press charges for environmental crimes. We will vigorously contest any action against us resulting from the federal police's investigation.

ONÇA PUMA LITIGATION

In 2012, the MPF 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 prosecutors contend 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 November 2018, the TRF of the First Region (*Tribunal Regional Federal da Primeira Região*) affirmed the decision to suspend our nickel mining operations at Onça Puma until the conclusion of a number of expert evaluations of the impact of our activities in the Catete River and the surrounding communities. The court also ordered us to make a monthly payment to each member of the Xikrin and Kayapó tribes to compensate the affected indigenous communities. Our mining activities in Onça Puma have been suspended since September 2017, when the court first granted an injunction in favor of the federal prosecutor.

We have appealed this decision, but a decision on our appeal is still pending and we cannot anticipate when our mining activities in Onça Puma will resume. We believe that the MPF's claims have no merit. Three expert reports indicate that our activities do not cause harm to the Catete River and the surrounding indigenous communities, and two additional expert evaluations are pending. We will continue to vigorously contest this action.

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PUBLIC CIVIL ACTION SEEKING SUSPENSION OF S11D MINE

In May 2016, associations representing the indigenous community of Xikrin do Cateté 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 process of our S11D mine. The associations contend that FUNAI and IBAMA have failed to conduct the appropriate studies regarding the affected indigenous communities during the environmental permitting process, and consequently that the indigenous groups affected by this mine have not provided the required consent. The plaintiffs also requested a monthly payment of R$2 million for each association until the defendants conclude the studies.

Applicable law provides for mandatory consultation with the indigenous communities located within ten kilometers of the mine, and these indigenous communities are located more than 12 kilometers away from the mine. We have submitted our preliminary defense, and in January 2017 the court denied plaintiffs' request for an injunction suspending our S11D mine.

In July 2017, the judge of the Federal Court of Marabá partially modified the previous decision and ordered that we prepare a study of the impacts of the S11D operation on the Xikrin tribe within 180 days. Vale submitted a work plan for the study to FUNAI and the plan was approved. The court then ordered us to present the work plan to the indigenous community and we are awaiting approval to continue with its preparation.

This decision does not affect our operations in S11D. We appealed this decision and will continue to vigorously contest this action.

PUBLIC CIVIL ACTION SEEKING SUSPENSION OF SALOBO MINE

In July 2018, associations representing the indigenous community of Xikrin do Cateté brought a public civil action against Vale, the Federal Environmental Agency (IBAMA) and the Federal Indigenous Agency (FUNAI), seeking the suspension of the environmental permitting process of Salobo Mine. The associations contend that FUNAI and IBAMA have failed to conduct the appropriate studies regarding the affected indigenous communities during the environmental permitting process and contends that our operations would be contaminating the water of the Itacaiúnas River and consequently that the indigenous groups affected by this mine have not provided the required consent. The plaintiffs also requested a monthly payment of R$2 million for each association until the defendants conclude the studies.

Applicable law provides for mandatory consultation with the indigenous communities located within ten kilometers of the mine, and these indigenous communities are located more than 22 kilometers away from the mine. In October 2017 the court denied plaintiffs' request for an injunction suspending our Salobo Mine.

In February 2019, Vale, IBAMA, and the environmental agency Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) filed a joint answer in court, rebutting the plaintiff's claims, and reaffirming the legality of the environmental permitting process of Salobo Mine and the fulfillment of all conditions imposed by relevant authorities. In March 2019, the MPF presented an opinion for the suspension of the activities in the Salobo Mine. A decision by the federal court is pending.

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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$6.379 billion. An expert report favorable to Vale has been issued, but the court granted the municipality's request for additional expert evidence. The preparation of this additional expert evidence is pending. Both parties agreed to suspend the action until the presentation of an expert report, and to reconvene to discuss a potential settlement after such expert report is presented.

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$6.7 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. We believe these suits are without merits and will continue to vigorously contest them.

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 the state of 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 commenced two administrative proceedings against us, one alleging illegal outsourcing and another alleging that the illegally outsourced employees were working in conditions similar to slavery. In December 2018, the regional labor court upheld Vale's annulment action and confirmed that the outsourcing of the transportation services in this case was lawful. However, in March 2019 the courts confirmed administrative decision that determined that we had employees in conditions similar to slavery. We appealed this decision and will continue to vigorously contest this action.

TAX PROCEEDINGS

a) CFEM-related proceedings

We are engaged in numerous administrative and judicial proceedings related to the mining royalty known as 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 (currently, the ANM). The proceedings concern different interpretations of the agency'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$7.6 billion, including interest and penalties through December 31, 2018.

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We are contesting these 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.

The agency'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 the decisions of the Superior Court of Justice ("STJ"), and we expect that the ANM and the courts will exclude charges that are time barred under this legal opinion.

b) 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; (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 estimate our possible losses resulting from these proceedings in R$3.049 billion.

The tax authorities of the State of Minas Gerais contend that we should have paid ICMS in relation to the costs of transportation of iron ore, but we understand that ICMS is not applicable to this activity because the ore was transported directly by us. The judicial court has definitively decided in our favor with respect to tax assessments covering activities in 2009 and 2010 in an aggregate amount of R$632 million. With respect to activities in 2011, 2012 and 2013, the amount in dispute is R$959 million (included in the possible losses mentioned above). We also expect a favorable outcome in this case.

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 defense has presented its case in the criminal proceeding against these individuals and a decision is pending. The case has been extinguished for one of the members of management of our subsidiary MBR, but remains pending for the others. We believe that these allegations are without merit.

c) 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.

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 R$5.9 billion in 2013, and we agreed to pay the remaining R$16.3 billion in monthly installments, bearing interest at the SELIC rate. SELIC is a variable interest rate, established by the Brazilian central bank, used to update federal tax obligations in Brazil. On December, 31, 2018, the SELIC rate was 6.5% per annum (as compared to 7.0% per annum on December 31, 2017). As of December 31, 2018, the remaining balance was R$16.4 billion, to be paid in 118 further installments.

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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. At December 31, 2018, the total amount in dispute for the period between 1996 and 2002 was R$2.3 billion. In 2014, the Superior Court of Justice (STJ) ruled in our favor on certain of our arguments against those assessments. The tax authorities filed an appeal before the Federal Supreme Court and a decision is pending.

d) Assessments and legal proceedings related to PIS/COFINS

We have received several tax assessments from the Brazilian federal tax authority contending that we incorrectly claimed PIS and COFINS tax credits. 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 and judicial levels. The total amount in dispute is R$4.2 billion as of December 31, 2018, including disputes involving Vale's subsidiaries and divested companies for which we remain liable for taxes prior to divestment.

e) Income tax litigation

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. The total CSLL deducted from our taxable income between 2003 and 2018 was R$7.7 billion. 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 (TRF) of the Second Region. The tax authorities appealed to the Superior Court of Justice (STJ) and to the Supreme Court (STF), and the STJ determined that the TRF had not properly considered one of the questions raised by the federal government, and remanded the case for further decision of the TRF. 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.

f) Fines on the undue deduction of tax credits

We have received multiple assessments from the Brazilian federal tax authority imposing fines due to allegedly undue deduction of tax credits from our payments of income tax and contributions on the net income (CSLL).

In these cases, the tax authority challenged our right to set off certain tax credits and issued assessments imposing fines in the amount of 50% of the amount that was unduly deducted. As of December 31, 2018, the total amount of fines imposed under these assessments were R$1 billion, and new assessments are expected. We are challenging these assessments in administrative proceedings. These assessments cover only the fines resulting from the allegedly undue deductions, as the principal amount of unpaid taxes, interest and other penalties for late payment are being discussed in separate administrative proceedings. If we succeed in these separate administrative proceedings, the corresponding fines are expected to be cancelled. The legal grounds for these fines are currently being discussed by another company before the Federal Supreme Court (STF), and a favorable decision to this other company will applicable to other taxpayers, including us.

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UPDATES ON OTHER PROCEEDINGS

As reported in our annual report on form 20-F for prior years, we were a party to legal proceedings against Rede Ferroviária Federal S.A. ("RFFSA") relating to contracts to build two railway networks in the city of Belo Horizonte. In June 2012, a federal court rejected both the federal government's (as successor to RFFSA) claims against us and our contractual claim against RFFSA. All the appeals against these decisions have been rejected, and in March 2019 the courts certified that decisions are final and unappealable.

We are a party to certain other proceedings reported on our annual report on form 20-F for prior years, including (i) a proceeding in which the environmental authority of the Brazilian state of Minas Gerais seeks the suspension of part of our Jangada and Córrego do Feijão mines in the Southern System, in order to protect caves located near these mines; (ii) a public civil action filed by the MPF in 1997 seeking to annul the concession agreements for the Praia Mole maritime terminal; and (iii) a citizen suit (*ação popular*) brought by certain officers of FUNCEF (Caixa Econômica Federal's pension fund) and oil sector workers challenging the conversion of preferred class A shares into common shares. These proceedings are still ongoing, but we no longer believe that they may have significant effects on the our financial position or profitability.

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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 GOLDEN 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 7 billion common shares based solely on the approval of the Board of Directors without any additional shareholder approval.

The Brazilian government holds 12 golden shares of Vale. Our bylaws do not provide for the conversion of golden shares into common shares. In addition, the golden shares do not have any preference upon our liquidation and there are no redemption provisions associated with the golden shares.

Voting Rights

Pursuant to Brazilian corporate law, non-controlling shareholders holding common shares representing at least 15% of a company's voting capital have the right to appoint one member and an alternate to the board of directors. If no group of common shareholders meets this threshold, holders of golden shares may combine their holdings with those of holders of common shares, to reach at least 10% of the total

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share capital in order to appoint one member and an alternate to the Board of Directors. Non-controlling holders of common shares may also elect one member of the Fiscal Council and an alternate, pursuant to applicable CVM rules. Holders of the golden shares may elect one member of the permanent Fiscal Council and the respective alternate.

The golden shares are preferred shares that entitle the holder 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: mineral deposits, ore deposits, mines, railways, or 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.

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;
- 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;

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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.

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.

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 with greater privileges than the golden shares or changing a priority, preference, right, privilege or condition of redemption or amortization of the golden shares;

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.

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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 or other person 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. If the proxy document is in a foreign language, it must be accompanied by corporate documents or a power of attorney, as applicable, each duly translated into Portuguese by a sworn translator. Notarization and consularization of proxies and supporting documents is not required. Proxies and supporting documents in English or Spanish do not require translation.

Redemption rights

Our common shares and golden 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 (i) a merger, (ii) a stock merger as described above or (iii) 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.

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 the resolution is subject to confirmation by the holder of golden shares (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.

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.

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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.

Tag-along rights and mandatory tender offers

In accordance with Novo Mercado listing rules and our bylaws:

- in case of a transfer of control, the purchaser must conduct a tender offer to purchase any and all of our common shares for the same price paid for the voting shares representing control;

- in case of a proposed delisting from the Novo Mercado segment of B3, the controlling shareholder must conduct a public offer to acquire any and all of our common shares for a price corresponding to the economic value of the shares, as determined in an independent appraisal valuation; and

- any shareholder who acquires 25% of our outstanding capital stock must, within 30 days after the date in which such shareholder achieved the 25% stake, make a tender offer for any and all of our common shares (*oferta pública para aquisição*) for a price equal to the greatest of (i) the economic value of the shares, (ii) 120% of the weighted average price of our common shares in the 60 trading days preceding the announcement of the tender offer and (iii) 120% of the highest price paid by the purchaser in the 12 months before achieving the 25% stake.

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

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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.

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*.

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.

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Form and transfer of shares

Our common shares and golden 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 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 B3 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 all the relevant mineral resources are exhausted, sold or otherwise disposed of by us.

We made available for withdrawal by holders of shareholder debentures US$84 million in 2016, US$147 million in 2017 and US$148 million in 2018. See note 13 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 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 common shares represented by ADSs from converting dividends, distributions or the proceeds from any sale of 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 CMN Resolution 4,373 of 2014 ("Resolution 4,373"), foreign investors, defined to include individuals, legal entities, mutual funds and other collective investment entities, domiciled or headquartered outside Brazil, may invest in almost all financial assets and engage in almost all transactions available in the Brazilian financial and capital markets, provided that they:

i. appoint at least one representative in Brazil, with powers to perform actions relating to its investment,

ii. complete the appropriate foreign investor registration form,

iii. register as a foreign investor with the CVM, and register its foreign investment with the Central Bank of Brazil, and

iv. appoint a custodian, duly licensed by the Central Bank of Brazil, if the Brazilian representative in item (1) is not a financial institution.

Resolution 4,373 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 4,373 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 4,373 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 common shares, the holder must, within five business days, seek to obtain its own electronic registration with the Central Bank of Brazil under Law 4,131 of 1962 and Resolution 4,373. 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 common shares.

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

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Exchange Controls and Other Limitations Affecting Security Holders

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 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 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 common shares or ADSs.

Holders of common shares or ADSs should consult their own tax advisors to discuss the tax consequences of the purchase, ownership and disposition of 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 common shares or ADSs.

BRAZILIAN TAX CONSIDERATIONS

The following discussion summarizes the principal Brazilian tax consequences of the acquisition, ownership and disposition of 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 common shares or ADSs.

Shareholder distributions

For Brazilian corporations, such as Vale, 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:

i. the beneficiary is exempt from tax in Brazil, in which case the distribution will not be subject to withholding income tax;

ii. 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

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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

iii. the effective beneficiary is resident in Japan, in which case the applicable withholding income tax rate is 12.5%.

Interest on shareholders' equity is calculated as interest rate on the sum of the following accounts: (i) share capital, (ii) capital reserves, (ii) 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 4,373 (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. 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 do not 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.

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Taxation

Although there are arguments to the contrary, the deposit of 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 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 common shares were sold on that day, the average price on the Brazilian stock exchange in which the greatest number of common shares were sold in the 15 trading sessions immediately preceding such deposit.

The positive difference between the average price of the 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 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 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, 2018, any gain realized by a Non-Brazilian Holder on a sale or disposition of 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

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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 income tax at progressive rates ranging from 15% to 22.5%, 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.

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 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 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 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 common shares in Brazil will be subject to Brazilian income taxation in accordance with the same rules applicable to the sale or disposition of 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 common shares or ADSs by a Non-Brazilian Holder, except for gift and inheritance taxes

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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 common shares or ADS.

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 common shares or ADSs. This summary applies to U.S. holders, as defined below, who hold their 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 common shares or ADSs on a mark-to-market basis,
- persons holding 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 through attribution rules, 10% or more of our voting shares or the total value of all classes of 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.

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Taxation

For purposes of this discussion, you are a "U.S. holder" if you are a beneficial owner of common shares or ADSs that is, for U.S. federal income tax purposes:

a citizen or resident alien individual of the United States,

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 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 common shares represented by those ADSs for U.S. federal income tax purposes. Deposits and withdrawals of 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 common shares will be the same as your tax basis in such ADSs, and the holding period in such common shares will include the holding period in such ADSs.

Taxation of dividends

The gross amount of a distribution paid on ADSs 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 generally 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 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 depositary, in the case of ADSs, or by you, in the case of common shares. If the depositary 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 depositary.

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 2018 taxable year. In addition, based on Vale's audited financial statements and its current expectations regarding the value

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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 2019 taxable year.

Based on existing guidance, it is not entirely clear whether dividends received with respect to 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 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 or common shares 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 categories 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 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 common shares or ADSs. This gain or loss will be long-term capital gain or loss if your holding period in the 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 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 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.

Foreign financial asset reporting

Certain U.S. holders that own "specified foreign financial assets" with an aggregate value in excess of US$50,000 are generally required to file an information statement along with their tax returns, currently on IRS Form 8938, with respect to such assets. "Specified foreign financial assets" include any financial accounts held at a non-U.S. financial institution, as well as securities issued by a non-U.S. issuer that are not held in accounts maintained by financial institutions. The understatement of income attributable to

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"specified foreign financial assets" in excess of U.S.$5,000 extends the statute of limitations with respect to the tax return to six years after the return was filed. U.S. holders who fail to report the required information could be subject to substantial penalties. You are encouraged to consult with your own tax advisors regarding the possible application of these rules, including the application of the rules to your particular circumstances.

Information reporting and backup withholding

Information returns may be filed with the IRS in connection with distributions on the 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.

Backup withholding is not an additional tax. 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.

A holder that is a foreign corporation or a non-resident alien individual may be required to comply with certification and identification procedures in order to establish its exemption from information reporting and backup withholding.

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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, 2018. 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, 2018 based on the criteria established in "Internal Control Integrated Framework (2013)" issued by the Committee of Sponsoring Organizations of the Treadway Commission. Based on such assessment and criteria, our management has concluded that our internal control over financial reporting was effective as of December 31, 2018. The effectiveness of our internal control over financial reporting as of December 31, 2018 has been audited by KPMG Auditores Independentes, an independent registered public accounting firm, as stated in their report which appears herein.

The adoption of IFRS 15 (Revenue from Contracts with Customers) required the implementation of new controls and the modification of certain accounting processes related to revenue recognition. The impact of these changes was not material to our internal control over financial reporting. Our management identified no other changes in our internal control over financial reporting that occurred during our fiscal year ended December 31, 2018 that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

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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.

Since 2018, we also report our compliance with the Code of Best Practices for Corporate Governance of the Brazilian Corporate Governance Institute (IBGC), as required by Brazilian regulations. The code is based on the "comply or explain" principle, and we currently fully comply with 80% of the practices recommended by the IBGC and partially comply with 17% of practices recommended by the code

Section	NYSE corporate governance rule for U.S. domestic issuers	Our approach
303A.01	A listed company must have a majority of independent directors.	We do not have a majority of independent directors. At least 20% of our board of directors is composed of independent directors, as required under Novo Mercado listing rules and our bylaws.
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.	We do not have a nominating/corporate governance committee. However, we do have a Personnel Committee and a Governance, Compliance and Risk Committee, which are advisory committees to the Board of Directors (which may include members who are not directors) with written charters that cover similar specified duties. According to its charter, the Personnel Committee is responsible, among other matters, for: • supporting the Board of Directors in the process of selecting and appointing the Chief Executive Officer, and evaluating the Chief Executive Officer's appointment of other executives; • evaluating and recommending adjustments to corporate governance best practices concerning the structure, size and composition of the Board of Directors and the Advisory Committees, as well as the balance of experiences, knowledge and diversity of the profiles of their members; • identifying and recommending potential candidates to be directors and members of the Advisory Committees; and

	• supporting the Chairman of the Board of Directors in organizing the process for performance evaluation of the Board of Directors and Advisory Committees.

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Section	NYSE corporate governance rule for U.S. domestic issuers	Our approach
		According to its charter, the Governance, Compliance and Risk Committee is responsible, among other matters, for: • ensuring the adoption and improvement of good practices of compliance and integrity, including evaluating events of potential conflicts of interest; • monitoring the scope of activities and effectiveness of the departments in charge of our corporate governance, compliance, corporate integrity, risk management and controls and proposing improvements; • evaluating proposals for modifying the corporate governance documents, such as the By-Laws, the Code of Ethical Conduct and written charters of our Advisory Committees and Board of Directors, in addition to other policies and documents which are not the responsibility of other committees; • ensuring the effectiveness of mechanisms to handle conflicts of interests in our transactions, as well as opining on related party transactions submitted for resolution of the Board of Directors, pursuant to the Policy on Transactions with Related Parties; • promoting, monitoring and ensuring the development and efficacy of the governance model, assuring that all initiatives are in line with the best practices and are in synergy; and • annually reviewing and recommending changes necessary to improve Vale's corporate governance. These committees' charters allow for the inclusion of one independent member. For this purpose, an independent member is a person who: • Has no current link to Vale, except for membership on an Advisory Committee or a non-material shareholding in our share capital or investment in our bonds, and is not financially dependent on compensation from us;

	• Has not been an employee of the Company (or of its subsidiaries) or of a direct or indirect controlling shareholder, or a representative of any direct or indirect controlling shareholder for, at least, three years; • Does not provide, purchase or offer (trade), directly or indirectly, services and/or products to us on a scale that is material to that person or to us; • Is not linked to a controlling shareholder, member of the controlling group or of another group with material shareholding, the spouse or relative up to the second degree of the foregoing, or connected to entities related to a controlling shareholder; • Is not a spouse or relative up to the second degree of any officer or manager of Vale; • Has not been a partner, in the past three years, of an auditing firm that audits or has audited Vale in this same period; and

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Section	NYSE corporate governance rule for U.S. domestic issuers	Our approach
		• Is not a member of a non-profit entity that receives significant financial funds from us or from our related parties.
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.	We do not have a compensation committee. However, we have a Personnel Committee, which is an advisory committee to the Board of Directors (which may include an independent member who is not a director). This committee is responsible for: • evaluating our general human resources policies as submitted by the Executive Board to the Board of Directors; • evaluating and adjusting the compensation model of members of the Executive Board; • aiding the Board of Directors in setting and monitoring goals for the performance evaluation of the Executive Board and other leaders who report directly to the Chief Executive Officer, and of those in charge of Vale's Governance Office, Internal Auditing and Ethics and Conduct Office.
303A.06 303A.07	A listed company must have an audit committee with a minimum of three 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.	In lieu of appointing an audit committee composed of independent members of the Board of Directors, we have established a permanent *conselho fiscal*, 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: • 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;

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Section	NYSE corporate governance rule for U.S. domestic issuers	Our approach
		• 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.
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	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. 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. 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.	We are subject to (b) and (c) of these requirements, but not (a).

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CODE OF ETHICAL CONDUCT

We have a code of ethical 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 and the chief financial officer. We have posted this code of ethical conduct on our website, at: http://www.vale.com (under English Version/Investors/Corporate Governance/Policies). Copies of our code of ethical 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 ethical conduct since its adoption.

Ethics Channel

Any breaches of our policies and standards can be reported by anyone, including employees, contractors, suppliers, members of affected communities and other stakeholders, via our Ethics Channel.

Allegations presented to our Ethics Channel are communicated to Vale's Ethics and Conduct Office, an independent department reporting directly to the Board of Directors and responsible for handling complaints as well as disseminating Vale's Code of Ethical Conduct. In 2018, Vale's Board of Directors approved an updated version of the Code of Ethical Conduct, which is now available in 8 languages.

Allegations are investigated by the Ethics and Conduct Office, except in the event of (i) lack of information to initiate an examination, in which case the Office will request additional information to the person raising the concern and will proceed with the investigation provided it receives additional information within 15 days, and (ii) lack of pertinence to the Ethics and Conduct Office's scope of work. The Ethics and Conduct Office's scope of work includes not only alleged violation of Vale's Code of Ethics and Conduct, such as fraud and moral harassment cases, but also the resolution of issues that have not been properly addressed by other lines of reporting in the company, such as delay in payments to contractors.

In 2018, our Ethics and Conduct Office Channel received 2,709 complaints, 91% of which were investigated. Investigations confirmed violations in 45% of these complaints. All confirmed violations triggered correction plans, which are presented by company's managers and approved by the Ethics and Conduct Office. As a general rule, these plans contain measures to promote process improvements, training initiatives and feedback to employees. Depending on the seriousness of the allegations, employees involved may be subject to administrative measures, such as warnings, suspensions or terminations. Suppliers involved in serious violations of the Code of Ethical Conduct are also subject to punitive measures, such as fines or contract termination.

Investigations by the Ethics and Conduct Office in 2018 resulted in 2,007 corrective actions, including the termination of 214 employees.

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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 2017 and 2018:

	Year ended December 31,	
	2017	2018
	(US$ thousand)	
Audit fees	6,159	4,490
Audit-related fees	90	15
Other fees	18	13
Total fees	6,267	4,518

"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."

On September 27, 2018, our Board of Directors approved the hiring of PricewaterhouseCoopers Auditores Independentes, in replacement of KPMG Auditores Independentes, for the provision of audit services for a period of five years. These services will begin in the fiscal year starting on January 1, 2019.

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CHANGE IN REGISTRANT'S CERTIFYING ACCOUNTANT

PricewaterhouseCoopers Auditores Independentes ("PwC") replaced KPMG Auditores Independentes ("KPMG") as our independent public accountants and will audit our financial statements for the fiscal year starting on January 1, 2019. The change in auditors is being made pursuant independent auditor´s rotation regulation established by CVM that limits the consecutive terms of the engagement to five years. Because of the limitations set forth in this regulation, KPMG's contract was not renewed. The replacement of KPMG by PwC was approved by our Board of Directors on September 27, 2018. KPMG is engaged as our independent auditor for the fiscal years ended December 31, 2017 and 2018 until the filing of this Form 20-F with the SEC.

KPMG audited our financial statements for the fiscal years ended December 31, 2016, 2017 and 2018. None of the reports of KPMG on our financial statements for either of such fiscal years contained an adverse opinion or disclaimer of opinion, or was qualified or modified as to uncertainty, audit scope or accounting principles. There were no disagreements with KPMG, whether or not resolved, on any matter of accounting principles or practices, financial statement disclosure, or auditing scope or procedure, which, if not resolved to KPMG's satisfaction, would have caused it to make reference to the subject matter of the disagreement in connection with any reports it would have issued, and there were no "reportable events" as that term is defined in Item 16F(a)(1)(v) of Form 20-F. KPMG did not audit any of our financial statements for any period subsequent to December 31, 2018.

We have provided KPMG with a copy of the foregoing disclosure, and have requested that it furnish us with a letter addressed to the SEC stating whether or not it agrees with such disclosure. We are including as Exhibit 15.2 to this Form 20-F a copy of the letter from KPMG as required by Item 16F(a)(3) of Form 20-F.

During the fiscal years ended December 31, 2016, 2017 and 2018, we did not consult with PwC regarding the application of accounting principles to a specific completed or contemplated transaction or regarding the type of audit opinion that might be rendered by PwC on our financial statements. Further, PwC did not provide any written or oral advice that was an important factor considered by us in reaching a decision as to any such accounting, auditing or financial reporting or any matter being the subject of disagreement or "reportable event" or any other matter as defined in Item 16F(a)(v) of Form 20-F.

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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, B3, the SEC and the French securities regulator Autorité des Marchés Financiers.

Brazil. Vale's Common Shares are listed on B3 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 B3's "Novo Mercado" Corporate Governance Requirements. Our CVM filings are available from the CVM at http://www.cvm.gov.br or from B3 at http://www.b3.com.br. In addition, 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 available to the public from the SEC at http://www.sec.gov. In addition, as with all of our security filings, they may be accessed at our website, http://www.vale.com. 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. 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 April 13, 2018 incorporated by reference to the current report on Form 6 K furnished to the Securities and Exchange Commission on April 16, 2018 (File No. 001-15030, Accession No. 0001104659-18-024067)
4.1	Framework Agreement, dated March 2, 2016, by and among Vale S.A., BHP Billiton Brasil Ltda, Samarco Mineração S.A., the Federal Government of Brazil, the states of Espirito Santo and Minas Gerais and certain other public authorities in Brazil, incorporated by reference to Exhibit 4.12 to BHP Billiton Ltd.'s annual report on Form 20-F dated September 21, 2016 (File Nos. 001-09526 and 001-31714, Accession No. 0001193125-16-715037)
8	List of subsidiaries
10.24	Shareholders' Agreement, dated August 14, 2017, among Litel Participações S.A., Litela Participações S.A., Bradespar S.A., Mitsui & Co., Ltd. and BNDES Participações S.A. BNDESPAR incorporated by reference to the current report on Form 6-K furnished to the Securities and Exchange Commission on August 15, 2017 (File No. 001-15030, Accession No. 0001104659-17-051910)
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
15.2	Letter from KPMG Auditores Independentes required by Item 16F(a)(3)
101	Interactive Data File

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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GLOSSARY

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.
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.
B3	B3 S.A. Brasil, Bolsa, Balcão (formerly BM&FBOVESPA), a stock exchange located in São Paulo, Brazil.
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.
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.
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 *Comissão de Valores Mobiliários (*Brazilian Securities and Exchange Commission).

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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 its maximum permitted 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.
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.
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(s)	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.

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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.
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 (i) 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 (ii) 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.
Real, *reais* or R$	The official currency of Brazil is the *real* (singular) (plural: *reais*).
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.
Slab	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/ EDUARDO DE SALLES BARTOLOMEO

Name: Eduardo de Salles Bartolomeo
Title: Interim Chief Executive Officer

By: /s/ LUCIANO SIANI PIRES

Name: Luciano Siani Pires
Title: Chief Financial Officer

Date: April 18, 2019

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Vale S.A. Financial Statements

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Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors
Vale S.A.
Rio de Janeiro RJ

Opinions on the Consolidated Financial Statements and Internal Control Over Financial Reporting

We have audited the accompanying consolidated statements of financial position of Vale S.A. and subsidiaries ("Vale" or "the Company") as of December 31, 2018 and 2017, 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, 2018, and the related notes (collectively, the "*consolidated* financial statements"). We also have audited the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in *Internal Control Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2018, in conformity with International Financial Reporting Standards as issued by the International Accounting Standards Board. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on criteria established in *Internal Control Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

KPMG Auditores Independentes, uma sociedade simples brasileira e firma-membro da rede KPMG de firmas-membro independentes e afiliadas à KPMG International Cooperative ("KPMG International"), uma entidade suíça.

KPMG Auditores Independentes, a Brazilian entity and a member firm of the KPMG network of independent member firms affiliated with KPMG International Cooperative ("KPMG International"), a Swiss entity.

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Basis for Opinions

The Company'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 the Company's consolidated financial statements and an opinion on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. 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 provide a reasonable basis for our opinions.

Emphasis of matter Subsequent Event

We draw attention to Note 3 to the consolidated financial statements of the Company, which describes the Brumadinho dam failure occurred at the Company's operating facilities on January 25, 2019. The Company's management considered that the event is not a condition that existed at the end of the reporting period, and therefore does not require adjustments to the financial statements as of December 31, 2018. The amounts disclosed in the mentioned Note related to this event are based on management's best estimates, however, at the current stage of the investigations, assessments of causes and possible third parties lawsuits, it is not possible to reliably measure all potential costs that the Company may incur for the purposes of disclosure in the financial statements.

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Definition and Limitations of Internal Control Over Financial Reporting

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.

/s/ KPMG AUDITORES INDEPENDENTES

KPMG Auditores Independentes
We have served as the Company's auditor since 2014
Rio de Janeiro, RJ
April 18, 2019

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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, 2018 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, 2018.

The effectiveness of the company's internal control over financial reporting as of December 31, 2018 has been audited by KPMG Auditores Independentes, an independent registered public accounting firm, as stated in their report which appears herein.

April 18th, 2019.

/s/ EDUARDO DE SALLES BARTOLOMEO

Eduardo de Salles Bartolomeo
Chief Executive Officer

/s/ LUCIANO SIANI PIRES

Luciano Siani Pires
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	2018	2017	2016
Continuing operations				
Net operating revenue	4(e)	36,575	33,967	27,488
Cost of goods sold and services rendered	5(a)	(22,109)	(21,039)	(17,650)
Gross profit		**14,466**	**12,928**	**9,838**
Operating expenses				
Selling and administrative expenses	5(b)	(523)	(531)	(507)
Research and evaluation expenses		(373)	(340)	(319)
Pre operating and operational stoppage		(271)	(413)	(453)
Other operating expenses, net	5(c)	(445)	(420)	(267)
		(1,612)	**(1,704)**	**(1,546)**
Impairment and disposal of non-current assets	16, 19 and 20	(899)	(294)	(1,240)
Operating income		**11,955**	**10,930**	**7,052**
Financial income	6	423	478	170
Financial expenses	6	(2,345)	(3,273)	(2,677)
Other financial items	6	(3,035)	(224)	4,350
Equity results and other results in associates and joint ventures	16 and 22	(182)	(82)	(911)
Income before income taxes		**6,816**	**7,829**	**7,984**
Income taxes	8			
Current tax		(752)	(849)	(943)
Deferred tax		924	(646)	(1,838)
		172	**(1,495)**	**(2,781)**
Net income from continuing operations		**6,988**	**6,334**	**5,203**
Net income (loss) attributable to noncontrolling interests		36	21	(8)
Net income from continuing operations attributable to Vale's stockholders		**6,952**	**6,313**	**5,211**
Discontinued operations	14			
Loss from discontinued operations		(92)	(813)	(1,227)
Net income (loss) attributable to noncontrolling interests			(7)	2
Loss from discontinued operations attributable to Vale's stockholders		**(92)**	**(806)**	**(1,229)**

Net income		**6,896**	**5,521**	**3,976**
Net income (loss) attributable to noncontrolling interests		36	14	(6)
Net income attributable to Vale's stockholders		**6,860**	**5,507**	**3,982**
Earnings per share attributable to Vale's stockholders:				
Basic and diluted earnings per share:	9			
Common share (US$)		1.32	1.05	0.77

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		
	2018	**2017**	**2016**
Net income	**6,896**	**5,521**	**3,976**
Other comprehensive income (loss):			
Items that will not be reclassified subsequently to the income statement			
Translation adjustments	(6,762)	(717)	6,460
Retirement benefit obligations	41	(46)	(70)
Fair value adjustment to investment in equity securities	60		
Transfer to reserve	(16)		
Total items that will not be reclassified subsequently to the income statement, net of tax	**(6,677)**	**(763)**	**6,390**
Items that may be reclassified subsequently to the income statement			
Translation adjustments	3,899	1,026	(3,677)
Fair value adjustment to debt instruments			1
Cash flow hedge			10
Net investments hedge	(543)	(95)	
Transfer of realized results to net income	(78)	(11)	(78)
Total of items that may be reclassified subsequently to the income statement, net of tax	**3,278**	**920**	**(3,744)**
Total comprehensive income	**3,497**	**5,678**	**6,622**
Comprehensive income (loss) attributable to noncontrolling interests	(84)	13	111
Comprehensive income (loss) attributable to Vale's stockholders	**3,581**	**5,665**	**6,511**
From continuing operations	3,589	5,696	6,642
From discontinued operations	(8)	(31)	(131)
	3,581	**5,665**	**6,511**

Items above are stated net of tax and the related taxes are disclosed in note 8.

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		
	2018	**2017**	**2016**
Cash flow from operating activities:			
Income before income taxes from continuing operations	6,816	7,829	7,984
Adjusted for:			
Equity results and other results in associates and joint ventures	182	82	911
Impairment and disposal of non-current assets	899	294	1,240
Depreciation, amortization and depletion	3,351	3,708	3,487
Financial results, net	4,957	3,019	(1,843)
Changes in assets and liabilities:			
Accounts receivable	(156)	1,277	(2,744)
Inventories	(817)	(339)	288
Suppliers and contractors	(376)	232	243
Provision Payroll, related charges and others remunerations	(11)	372	133
Proceeds from cobalt and gold stream transactions	690		524
Other assets and liabilities, net	(205)	(912)	332
	15,330	**15,562**	**10,555**
Interest on loans and borrowings paid (note 21)	(1,121)	(1,686)	(1,663)
Derivatives paid, net	(67)	(240)	(1,602)
Interest on participative stockholders' debentures paid	(113)	(135)	(84)
Income taxes (including settlement program)	(1,128)	(1,051)	(805)
Net cash provided by operating activities from continuing operations	**12,901**	**12,450**	**6,401**
Cash flow from investing activities:			
Capital expenditures	(3,784)	(3,831)	(4,951)
Additions to investments	(23)	(93)	(239)
Proceeds from disposal of assets and investments	1,481	922	543
Dividends and interest on capital received from associates and joint ventures	245	227	193
Others investments activities, net(1)	2,240	(583)	(239)
Proceeds from gold stream transaction			276
Net cash provided by (used in) investing activities from continuing operations	**159**	**(3,358)**	**(4,417)**
Cash flow from financing activities:			
Loans and borrowings from third-parties (note 21)	1,225	1,976	6,994
Payments of loans and borrowings from third-parties (note 21)	(7,841)	(8,998)	(7,717)
Dividends and interest on capital paid to stockholders	(3,313)	(1,456)	(250)
Dividends and interest on capital paid to noncontrolling interest	(182)	(126)	(291)
Share buyback program (note 30)	(1,000)		
Transactions with noncontrolling stockholders	(17)	(98)	(17)
Net cash used in financing activities from continuing operations	**(11,128)**	**(8,702)**	**(1,281)**
Net cash used in discontinued operations (note 14)	**(46)**	**(252)**	**(118)**
Increase in cash and cash equivalents	**1,886**	**138**	**585**

Cash and cash equivalents in the beginning of the year	4,328	4,262	3,591
Effect of exchange rate changes on cash and cash equivalents	(313)	(60)	86
Effects of disposals of subsidiaries and merger, net of cash and cash equivalents	(117)	(12)	
Cash and cash equivalents at end of the year	**5,784**	**4,328**	**4,262**
Non-cash transactions:			
Additions to property, plant and equipment capitalized loans and borrowing costs	194	370	653

(1) Includes loans and advances from/to related parties. For the year ended December 31, 2018, includes proceeds received from Nacala project finance (note 31b) in the amount of US$2,572.

The accompanying notes are an integral part of these financial statements.

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Consolidated Statement of Financial Position
In millions of United States dollars

	Notes	December 31, 2018	December 31, 2017
Assets			
Current assets			
Cash and cash equivalents		5,784	4,328
Accounts receivable	10	2,648	2,600
Other financial assets	13	435	2,022
Inventories	11	4,443	3,926
Prepaid income taxes		543	781
Recoverable taxes	12	883	1,172
Others		556	538
		15,292	**15,367**
Non-current assets held for sale	14		3,587
		15,292	**18,954**
Non-current assets			
Judicial deposits	28(c)	1,716	1,986
Other financial assets	13	3,144	3,232
Prepaid income taxes		544	530
Recoverable taxes	12	751	638
Deferred income taxes	8(a)	6,908	6,638
Others		263	267
		13,326	**13,291**
Investments in associates and joint ventures	16	3,225	3,568
Intangibles	18	7,962	8,493
Property, plant and equipment	19	48,385	54,878
		72,898	**80,230**
Total assets		**88,190**	**99,184**
Liabilities			
Current liabilities			
Suppliers and contractors		3,512	4,041
Loans and borrowings	21	1,003	1,703
Other financial liabilities	13	1,604	986
Taxes payable	8(d)	650	697
Provision for income taxes		210	355
Liabilities related to associates and joint ventures	22	289	326

Provisions	26	1,363	1,394
Dividends and interest on capital	30(d)		1,441
Others		480	992
		9,111	**11,935**
Liabilities associated with non-current assets held for sale	14		1,179
		9,111	**13,114**
Non-current liabilities			
Loans and borrowings	21	14,463	20,786
Other financial liabilities	13	2,711	2,894
Taxes payable	8(d)	3,917	4,890
Deferred income taxes	8(a)	1,532	1,719
Provisions	26	7,095	7,027
Liabilities related to associates and joint ventures	22	832	670
Deferred revenue Gold stream		1,603	1,849
Others		2,094	1,463
		34,247	**41,298**
Total liabilities		**43,358**	**54,412**
Stockholders' equity	30		
Equity attributable to Vale's stockholders		43,985	43,458
Equity attributable to noncontrolling interests		847	1,314
Total stockholders' equity		**44,832**	**44,772**
Total liabilities and stockholders' equity		**88,190**	**99,184**

The accompanying notes are an integral part of these financial statements.

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Consolidated Statement of Changes in Equity
In millions of United States dollars

	Share capital	Results on conversion of shares	Capital reserves	Net ownership changes in subsidiaries	Profit reserves	Treasury stock	Unrealized fair value adjustments	Cumulative translation adjustments	Retained earnings	Equity attributable to Vale's stockholders	Equity attributable to noncontrolling interests	Total stockholders' equity
Balance at December 31, 2015	**61,614**	**(152)**		**(702)**	**985**	**(1,477)**	**(99)**	**(25,687)**		**33,589**	**2,115**	**35,704**
Net income (loss)									**3,982**	**3,982**	**(6)**	**3,976**
Other comprehensive income:												
Retirement benefit obligations							(70)			(70)		(70)
Cash flow hedge							7			7		7
Available-for-sale financial instruments							1			1		1
Translation adjustments				195			(93)	2,387	102	2,591	117	2,708
Transactions with stockholders:												
Dividends and interest on capital of Vale's stockholders									(1,061)	(1,061)		(1,061)
Dividends of noncontrolling interest											(268)	(268)
Acquisitions and disposal of noncontrolling interest				3						3	(1)	2
Capitalization of noncontrolling interest advances											25	25
Appropriation to undistributed retained earnings					3,023				(3,023)			
Balance at December 31, 2016	**61,614**	**(152)**		**(699)**	**4,008**	**(1,477)**	**(154)**	**(23,300)**		**39,042**	**1,982**	**41,024**
Net income									**5,507**	**5,507**	**14**	**5,521**
Other comprehensive income:												
Retirement benefit obligations							(46)			(46)		(46)
Net investments hedge								(95)		(95)		(95)
Translation adjustments				(158)			10	447		299	(1)	298

The accompanying notes are an integral part of these financial statements.

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Consolidated Statement of Changes in Equity (Continued)
In millions of United States dollars

	Share capital	Results on conversion of shares	Capital reserves	Net ownership changes in subsidiaries	Profit reserves	Treasury stock	Unrealized fair value adjustments	Cumulative translation adjustments	Retained earnings	Equity attributable to Vale's stockholders	Equity attributable to noncontrolling interests	Total stockholders' equity
Transactions with stockholders:												
Dividends and interest on capital of Vale's stockholders					(658)				(1,475)	(2,133)		(2,133)
Dividends of noncontrolling interest											(202)	(202)
Acquisitions and disposal of noncontrolling interest				(255)						(255)	(512)	(767)
Capitalization of noncontrolling interest advances											33	33
Appropriation to undistributed retained earnings					4,032				(4,032)			
Merger of Valepar (note 30)		1,139								1,139		1,139
Balance at December 31, 2017	**61,614**	**(152)**	**2,139**	**(954)**	**7,419**	**(1,477)**	**(1,183)**	**(22,948)**		**43,458**	**1,314**	**44,772**
Net income									**6,860**	**6,860**	**36**	**6,896**
Other comprehensive income:												
Retirement benefit obligations							(16)	41		25		25
Fair value adjustment to investment in equity securities								60		60		60
Net investments hedge								(543)		(543)		(543)
Translation adjustments							(1,257)	49	(1,613)	(2,821)	(120)	(2,941)
Transactions with stockholders:												
Dividends and interest on capital of Vale's stockholders									(2,054)	(2,054)		(2,054)
Dividends of noncontrolling interest											(166)	(166)
Acquisitions and disposal of noncontrolling interest											(229)	(229)
Capitalization of noncontrolling interest advances											12	12
Appropriation to undistributed retained earnings					4,806				(4,806)			
Share buyback program						(1,000)				(1,000)		(1,000)
Balance at December 31, 2018	**61,614**	**(152)**	**2,139**	**(970)**	**10,967**	**(2,477)**	**(1,033)**	**(25,104)**		**43,985**	**847**	**44,832**

The accompanying notes are an integral part of these financial statements.

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Notes to the Financial Statements

Expressed in millions of United States dollar, unless otherwise stated

1. Corporate information

Vale S.A. and its direct and indirect subsidiaries ("Vale" or "Company") are global producers of iron ore and iron ore pellets, key raw materials for steelmaking, and producers of nickel, which is used to produce stainless steel and metal alloys employed in the production of several products. The Company also produces copper, metallurgical and thermal coal, manganese ore, ferroalloys, platinum group metals, gold, silver and cobalt. The information by segment is presented in note 4.

Vale S.A. (the "Parent Company") is a public company headquartered in the city of Rio de Janeiro, Brazil with securities traded on the stock exchanges of São Paulo B3 S.A. (VALE3), New York NYSE (VALE), Paris NYSE Euronext (VALE3) and Madrid LATIBEX (XVALO).

On December 22, 2017 after the conversion of the class "A" preferred shares into common shares, the Company migrated to the special listing segment of B3 S.A. ("*Novo Mercado*") (further details in note 30).

2. Basis for preparation of the financial statements

a)

Statement of compliance

The consolidated financial statements of the Company ("financial statements") have been prepared and are being presented in accordance with the International Financial Reporting Standards ("IFRS") as issued by the International Accounting Standards Board ("IASB").

b)

Basis of presentation

The financial statements have been prepared under the historical cost convention as adjusted to reflect: (i) the fair value of financial instruments measured at fair value through income statement or at fair value through the statement of comprehensive income; and (ii) impairment of assets.

The issue of these financial statements was authorized on April 18, 2019.

c)

Functional currency and presentation currency

The financial statements of the Company and its associates and joint ventures are measured using the currency of the primary economic environment in which the entity operates ("functional currency"), which in the case of the Parent Company is the Brazilian real ("R$"). For presentation purposes, these financial statements are presented in United States dollar ("US$") as the Company believes that this is how international investors analyze the financial statements.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

2. Basis for preparation of the financial statements (Continued)

The exchange rates used by the Company to translate its foreign operations are as follows:

	Closing rate			Average rate for the year ended		
	2018	2017	2016	2018	2017	2016
US Dollar ("US$")	3.8748	3.3080	3.2591	3.6558	3.1925	3.4833
Canadian dollar ("CAD")	2.8451	2.6344	2.4252	2.8190	2.4618	2.6280
Euro ("EUR" or "€")	4.4390	3.9693	3.4384	4.3094	3.6088	3.8543

d)

Significant accounting policies

Significant and relevant accounting policies for the understanding of the recognition and measurement basis used in the preparation of these financial statements were included in the respective notes. The accounting polices applied in the preparations of these financial statements are consistent with those adopted and disclosed in the financial statements of prior years, except for new accounting policies related to the application of IFRS 9 Financial Instruments and IFRS 15 Revenue from Contracts with Customers, which were adopted by the Company from January 1, 2018.

The nature and effect of the changes as a result of adoption of these new accounting standards are described below:

IFRS 9 Financial Instrument This standard addresses the classification and measurement of financial assets and liabilities, new impairment model and new rules for hedge accounting. The Company applied IFRS 9 prospectively, with an initial application date of January 1, 2018. The Company has not restated the comparative information, which continues to be reported under IAS 39 Financial Instruments. The main changes are described below:

Classification and measurement Under IFRS 9, debt instruments are subsequently measured at fair value through profit or loss ("FVTPL"), through amortized cost, or fair value through other comprehensive income ("FVOCI"). The classification is based on the Company's business model for managing the assets and whether the instruments' contractual cash flows represent 'solely payments of principal and interest' ("SPPI") on the principal amount outstanding.

On the date of initial application of IFRS 9, the Company has assessed which business models apply to the financial assets held by the Company and has classified its financial instruments into the appropriate

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

2. Basis for preparation of the financial statements (Continued)

IFRS 9 categories. The reclassification of the financial instruments of the Company on January 1, 2018 were as follows:

	Measurement category		Carrying amount		
	IAS 39	IFRS 9	IAS 39	IFRS 9	Difference
Financial assets					
Current					
Financial investments	Loans and receivables	FVTPL	18	18	
Derivative financial instruments	FVTPL	FVTPL	106	106	
Accounts receivable	Loans and receivables	Amortized cost	2,600	2,600	
Related parties	Loans and receivables	Amortized cost	1,898	1,898	
Non-current					
Derivative financial instruments	FVTPL	FVTPL	453	453	
Loans	Loans and receivables	Amortized cost	151	151	
Related parties	Loans and receivables	Amortized cost	2,628	2,628	
Financial liabilities					
Current					
Suppliers and contractors	Loans and receivables	Amortized cost	4,041	4,041	
Derivative financial instruments	FVTPL	FVTPL	104	104	
Loans and borrowings	Loans and receivables	Amortized cost	1,703	1,703	
Related parties	Loans and receivables	Amortized cost	882	882	
Non-current					
Derivative financial instruments	FVTPL	FVTPL	686	686	
Loans and borrowings	Loans and receivables	Amortized cost	20,786	20,786	
Related parties	Loans and receivables	Amortized cost	975	975	

Participative stockholders' debentures	Loans and receivables	Amortized cost	1,233	1,233

These reclassifications have no impact on the measurement categories. The financial instruments that were classified as "Loans and receivables" under IAS 39 did meet the IFRS 9 criteria for classification at amortized cost, because these financial instruments are held within a business model whose objective is to hold to collect the cash flows, which represent solely payments of principal and interest. The derivatives held for trading are required to be held as FVTPL under IFRS 9, therefore there were no changes in relation to these instruments from the adoption of IFRS 9.

Impairment IFRS 9 has replaced the IAS 39's incurred loss approach with a forward-looking expected credit loss ("ECL") approach.

For accounts receivables, the Company has applied the standard's simplified approach and has calculated ECLs based on lifetime expected credit losses and the identified loss is deemed not significant. The Company has established a provision matrix that is based on its historical credit loss experience, adjusted for forward-looking factors specific to the economic environment and by any financial guarantees related to these accounts receivables.

At each reporting date, the Company assesses whether financial assets carried at amortized cost are credit-impaired. Information about the Company's exposure to credit risk is set out in note 33.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

2. Basis for preparation of the financial statements (Continued)

The new impairment approach of IFRS 9 did not have a significant impact to the Company for the year ended December 31, 2018.

Hedge accounting The Company has elected to adopt the new general hedge accounting model in IFRS 9. The changes introduced by IFRS 9 relating to hedge accounting currently have no impact, as the Company does not currently apply cash flow or fair value hedge accounting. The Company currently applies the net investment hedge for which there are no changes introduced by this new standard (note 25).

IFRS 15 Revenue from Contracts with Customers This standard establishes a comprehensive framework for determining whether, how much and when revenue is recognized. It replaced IAS 18 Revenue, IAS 11 Construction Contracts and related interpretations. The Company has adopted the new standard using the modified retrospective method. Accordingly, the comparative information presented has not been restated.

The Company has assessed its revenue streams and the nature and effect of the changes as a result of adoption of IFRS 15 is described below:

Sales of products Under IFRS 15, there is no significant impact on the timing of products revenue recognition since usually the transfer of risks and rewards and the transfer of control under the sales contracts are at the same point in time.

Shipping services A proportion of Vale's sales are under Cost and Freight ("CFR") and Cost, Insurance and Freight ("CIF") Incoterms, in which the Company is responsible for providing shipping services after the date that Vale transfers control of the goods to the customers. According to the previous standard (IAS 18), the revenue from shipping services was recognized upon loading, as well as the related costs, and was not considered a separate service.

Under IFRS 15, the provision of shipping services for CFR and CIF contracts should be considered as a separate performance obligation in which a proportion of the transaction price would be allocated and recognized over time as the shipping services are provided. The impact on the timing of revenue recognition of the proportion that would have been allocated to the shipping service to the Company's income statement for the year ended December 31, 2018 is deemed not significant. Therefore, such revenue has not been presented separately in these financial statements.

Provisionally priced commodities sales Under IFRS 9 and 15, the treatment of the provisional pricing mechanisms embedded within the provisionally priced commodities sales remains unmodified. Therefore, these revenues are recognized based on the estimated fair value of the total consideration receivable, and the provisionally priced sales mechanism embedded within these sale arrangements has the character of a derivative. The fair value of the sales price adjustment is recognized as operational revenue in the income statement.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

2. Basis for preparation of the financial statements (Continued)

Overall, there was no material impact on the Company's financial statement from the IFRS 15 adoption for the year ended December 31, 2018.

e)

Accounting standards issued but not yet effective

IFRS 16 Lease IFRS 16 was issued in January 2016. It will result in vast majority of leases being recognized in the balance sheet by lessees, as the distinction between operating and finance leases is removed. Under the new standard, an asset (the right to use the leased item) and a financial liability to pay rentals are recognized. There are recognition exemptions for short-term leases and leases of low-value items.

The Company will apply the standard from its mandatory adoption date of January 1, 2019. Vale will apply the simplified transition approach and will not restate comparative amounts for the year prior to first adoption. Right-of-use assets will be measured at the amount of the lease liability on adoption.

As at December 31, 2018, the Company has non-cancellable operating lease commitments in the nominal amount of US$2,498 (note 32). The Company has set up a project team which has reviewed these leasing commitments over the last year in light of the new lease accounting rules in IFRS 16. Of these commitments, the Company expects to recognize right-of-use assets and lease liabilities an amount ranging from US$1.8 billion to US$2 billion at present value on January 1, 2019, an amount ranging from US$240 to US$260 on current liabilities and US$1,560 to US$1,740 on non-current liabilities.

The actual impacts of adopting the standard may be subject to further changes because the Company has not finalized the testing, assessment of controls over its new IT systems and the new accounting policies are subject to change until the Company presents its first financial statements from the date of initial application.

The Company has not early adopted any standards and interpretations that have been issued or amended but are not yet effective for the year ended December 31, 2018. Therefore, there are no other standards that are not yet effective and that would be expected to have a material impact on the entity in the current or future reporting periods.

f)

Critical accounting estimates and judgments

The preparation of financial statements requires the use of critical accounting estimates and the application of judgment by management in applying the Company's accounting policies. These estimates are based on the experience, best knowledge, information available at the statement of financial position date and other factors, including expectations of future events that are believed to be reasonable under the circumstances. Changes in facts and circumstances may lead to the revision of these estimates. Actual future results may differ from the estimates.

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Notes to the Financial Statements

Expressed in millions of United States dollar, unless otherwise stated

2. Basis for preparation of the financial statements (Continued)

The significant estimates and judgments applied by Company in the preparation of these financial statements are as follows:

Note	Significant estimates and judgments
7	Deferred revenue
8	Deferred income taxes
16	Consolidation
19	Mineral reserves and mines useful life
20	Impairment of non-current assets
22	Liabilities related to associates and joint ventures
24	Fair values estimate
27	Asset retirement obligations
28	Litigation
29	Employee post-retirement obligations

3. Brumadinho's dam failure

On January 25, 2019 (subsequent event), a breach has been experienced in the Dam I of the Córrego do Feijão mine, which belongs to the Paraopebas Complex in the Southern System, located in Brumadinho, Minas Gerais, Brasil ("Brumadinho dam"). This dam was inactive since 2016 (without additional tailings disposal) and there was no other operational activity in this structure.

Due to the dam failure, 306 people lost their lives or are missing and ecosystems were affected. Around 11.7 million metric tons of iron ore waste were contained in the Brumadinho dam. It is not yet known the exact volume of iron ore waste that was released due to the dam failure. The tailings contained in the Dam I have caused an impact of around 270 km in extension, destroying some of Vale's facilities, affecting local communities and disturbing the environment. The Paraopeba river and its ecosystems have also been impacted by the event.

The Company has not been sparing efforts to support the victims and to mitigate and recover the social and environmental damages resulting from the breach of the dam. Vale has provided support in multiple ways, aiming to ensure the humanitarian assistance to those affected by the dam breach.

To determine the causes for the event, Vale has engaged a panel of independent experts. Furthermore, the Company established three Extraordinary Independent Consulting Committees to support the Board of Directors, which are composed by independent members that are unrelated to the management or to the Company's operations to ensure that the initiatives by the committees be unbiased. Following are the committees:

(i) The Extraordinary Independent Consulting Committee for Investigation ("CIAEA"), dedicated to investigating the causes and responsibilities for the Brumadinho dam breach;

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

3. Brumadinho's dam failure (Continued)

(ii) The Extraordinary Independent Consulting Committee for Support and Recovery ("CIAEAR"), dedicated to follow-up on the measures taken to support the victims and the recovery of the areas affected by the breach of the Brumadinho dam, assuring that all necessary resources will be applied; and

(iii) The Extraordinary Independent Consulting Committee for Dam Safety ("CIAESB"), which will provide support to the Board of Directors in questions related to the diagnosis of safety conditions, management and risk mitigation related to Vale's tailings dams, also providing recommendations of actions to strengthen safety conditions of those dams.

In addition, Vale has determined the suspension (i) of the variable remuneration of its executives; (ii) the Shareholder's Remuneration Policy and (iii) any other resolution related to shares buyback. The Company paid the shareholders in anticipation of the remuneration for the year, the amount of US$1,876 in September 2018, approved by the Board of Directors on July 25, 2018. This payment was higher than the minimum mandatory remuneration for the year ended December 31, 2018 and consequently no additional dividends to shareholders is required (note 30).

a) Financial impacts arising from the dam failure

The Company has concluded for the purpose of these financial statements that the dam breach and the following events are not a condition that existed at the end of the reporting period, and therefore does not require adjustments in the book values recognized in the financial statements prepared for the year ended December 31, 2018. Therefore, all accounting impacts will be recorded in 2019.

At the current stage of the investigations, assessments of the causes and possible third parties lawsuits, it is not possible to have a reliable measure of all cost that the Company may incur for the purpose of disclosure in the financial statements. The amounts that are being disclosed took into consideration the best estimates by the Company´s management.

i) Operation stoppages and de-characterization of the upstream dams

On January 29, 2019 the Company has informed the market and Brazilian authorities its decision to speed up the plan to "de-characterize" all of its tailings dams built by the upstream method (same method as Brumadinho dam), located in Brazil. The "de-characterizing" means that the structure will be dismantled and will no longer have its original operational characteristics.

The Company is developing specific studies for the de-characterization of these dams which will be submitted for approval by the relevant authorities when concluded, in accordance with regulations and legal requirements. The estimate on January 29, 2019, based on a preliminary assessment, resulted in a total amount of US$1.3 billion (R$5 billion) assuming the removal and reprocessing of all tailings contained in the upstream dams, followed by the fully recovery of the sites in the "de-characterization" method.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

3. Brumadinho's dam failure (Continued)

Before the event, the decommissioning plans of these dams were based on a method which aimed to ensure the physical and chemical stability of the structures, not necessarily, in all cases, removing and reprocessing the tailings contained in the dams. Since the event, the Company has been working on an individual detailed engineering plans to each of these dams to allow the total de-characterization of the structures. The Company is still developing the revised estimate for the costs to de-characterize the upstream dams and, therefore, the additional amount to the provision that will be recognized and disclosed in 2019 could not be reliably estimated.

In order to carry out safely the de-characterization of the dams, the Company has temporarily stopped the production of the units where the upstream dams are located, as already disclosed to the market. The stoppage results in a reduction in production of approximately 40 million tons of iron ore on annual basis.

In addition, the Company has other operations that are temporarily suspended due to judicial decisions or technical analysis performed by the Company on the dams, which represents a potential reduction in sales of 52.8 million tons of iron ore. The Company is working on legal and technical measures to resume these operations.

For reference, the Company sold 365 million tons of iron ore and pellets in 2018.

Due to the dam failure and review undertaken on the safety requirements for other dams in the Minas Gerais region, when necessary people were placed in temporary accommodation.

ii)

Assets write-offs

Following the event and the decision to speed up the de-characterization of the upstream dams, the Company will write-off assets of the Córrego do Feijão mine and those related to the upstream dams in Brazil, resulting in a loss of US$124 (R$480 million) in 2019, which will impact the Company's balance sheet and income statement.

iii)

Framework Agreements

The Company has been working together with the authorities and society to remediate the environmental and social impacts of the event. As a result, the Company has started negotiations and entered into agreements with the relevant authorities and affected people.

Public Ministry of Labor

On February 15, 2019, Vale entered into a preliminary agreement with the Public Ministry of Labor to indemnify the direct and third-party employees of the Córrego do Feijão mine who were affected by the termination of this operation. Under the terms of the agreement, Vale will maintain the jobs of its direct employees until December 31, 2019 and will either assist terminated third party employees with a replacement or pay their salaries until December 31, 2019.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

3. Brumadinho's dam failure (Continued)

The Company will also keep paying wages regularly to the missing people until the authorities have considered them as fatal victims of the event and will pay to the families of the fatal victims an amount equivalent to two thirds of their wages until December 31, 2019 or until Vale reaches the final agreement with the Public Ministry of Labor.

Under the terms proposed by Vale and considering the uncertainties related to the necessary procedures to estimate the amount to be spent, including the number of individuals entitled to indemnification, the Company has estimated that this agreement will result in a provision of approximately US$220 (R$850 million) in 2019.

Moreover, the Company will provide a lifelong medical insurance benefit to the widows and widowers and a similar benefit to the dependents of the victims until they are 22 years old. Due to the preliminary stage of this agreement and considering the complexity of an actuarial estimate, it is not possible yet to determine a range of outcomes or reliable estimates and, therefore, the amount of the provision related to this obligation could not be estimated. The Company expects to have this information during the course of 2019.

Brazilian Federal Government, State of Minas Gerais, Public Prosecutors and Public Defendants

On a judicial hearing that took place on February 20, 2019, in the scope of the public civil action n° 5010709-36.2019.8.13.0024, in process of the 6th Public Treasury Lower Court of Belo Horizonte, Vale entered into a preliminary agreement with the State of Minas Gerais, Federal Government and representatives of Public Authorities in which the Company commits to make emergency indemnification payments to the residents of Brumadinho and the communities that are located up to one kilometer from the Paraopeba river bed, from Brumadinho to the city of Pompéu, subject to registration.

Due to this agreement, the Company will anticipate indemnification to each family member through monthly payments during a 12-month period, which changes based, among other factors, on the age of the beneficiary. The Company has initially estimated a provision ranging from US$260 (R$1 billion) to US$520 (R$2 billion) related to these payments, depending on the number of beneficiaries that will be registered.

The agreement also includes the following measures: (i) independent technical assistance to support on the individual indemnities of those affected, if requested; and (ii) reimbursement or direct funding of the extraordinary expenses of the State of Minas Gerais and its governmental bodies due to the dam failure, including transportation, accommodation and food expenses of the employees involved in the rescue and other emergency actions. The respective amounts are still being estimated by the State of Minas Gerais and will be presented in Court.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

3. Brumadinho's dam failure (Continued)

iv)

Donations and other incurred expenses

Donations

Vale has offered donations of US$26 thousand (R$100 thousand) to each of the families with missing members or affected by fatalities, US$13 thousand (R$50 thousand) to families that resided in the Self-Saving Zone ("ZAS") near to Brumadinho dam, US$4 thousand (R$15 thousand) to business owners of the region and US$1 thousand (R$5 thousand) for each family that resided in the ZAS of Sul Superior dam, which belongs to the Gongo Soco mine, in Barão de Cocais. The estimated amount spent to date is around US$16 (R$62 million). These humanitarian donations will not be subject to any compensation with eventual indemnification obligations that the Company may have with its beneficiaries.

Vale also entered into an agreement with the Brumadinho city, in which the Company will donate to the city an amount of approximately US$21 (R$80 million) over the next 2 years.

Environment and fauna

The Company is building a retention dike for the tailings on the affected areas. The Company has also installed anti-turbidity barriers for sediment retention alongside the Paraopeba River. In addition, Vale has mobilized cleaning, de-sanding and dredging the Paraopeba river channel.

Daily collection points of water and barriers for sediment retention were installed alongside the Paraopeba River, Três Maias reservoir and São Francisco river.

Vale also has set up an exclusive structure for treatment of the rescued animals, enabling emergency care and recovery before the animals are authorized, after veterinarian assessment, to be returned to their tutors.

Furthermore, the Company has agreed to pay the administrative fines imposed by the State Secretary for Environment and Sustainable Development SEMAD MG, in the total approximated amount of US$26 (R$99 million).

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

3. Brumadinho's dam failure (Continued)

The Company has incurred the following expenses up to the present moment:

	2019
Incurred expenses	
Administrative sanctions	26
Donations to the affected people and to the city	16
Drilling and infrastructure	5
Environmental recovery	4
Medical aid and other materials	2
Fuel and transportation	2
Others(*)	22
	78

(*) Includes expenses with communication, accommodation, humanitarian assistance, equipment, legal services, water, food aid, taxes, among others.

Off the events identified at this stage, a significant portion has not been disbursed or measured. The total costs incurred with Vale's employees dedicated to providing support with matters related to the event (including wages), equipment and materials were not measured yet.

b) Contingencies and other legal matters

Vale is subject to significant contingencies due to the Brumadinho dam failure. Vale has already been named on several judicial and administrative proceedings brought by authorities and affected people and is currently under investigations. New contingencies are expected to come in the future. Vale is still evaluating these contingencies and will recognize a provision based on the stage of these claims. Due to the preliminary stage of the investigations and claims, it is not possible to determine a range of reliable results or estimates of potential exposure related to dam breach at this point in time.

Lawsuits

On January 27, 2019, following the injunctions granted upon the requests of the Public Prosecutors of the State of Minas Gerais and the State of Minas Gerais, the Company had restricted US$2.8 billion (R$11 billion) on its bank accounts to take the necessary measures to reassure the stability of the other dams of the Córrego do Feijão Mine Complex, provide accommodation and assistance to the affected people, remediate environmental impacts, among other obligations.

On January 31, 2019, the Public Ministry of Labor filed a Public Civil Action and a couple of preliminary injunctions were granted determining the freezing of US$400 (R$1.6 billion) on the Company's bank accounts to secure the indemnification of direct and third-party employees that worked in the Córrego de Feijão mine at the time of the Brumadinho dam breach.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

3. Brumadinho's dam failure (Continued)

On March 18, 2019 the Public Prosecutor of the State of Minas Gerais filed a Public Civil Action and a preliminary injunction was granted to freeze US$258 (R$1 billion) of the Company's assets, aiming to grant funds that could be required to indemnify for losses that may arise from the evacuation of the community of Sebastião de Águas Claras Macacos community.

On March 25, 2019, the Public Prosecutor of the State of Minas Gerais filed a Public Civil Action and a preliminary injunction was granted to freeze US$761 (R$2.95 billion) of the Company's assets, to grant funds that might be required to indemnify for losses that may arise from evacuation of the communities in Gongo Soco, Barão de Cocais.

In total, approximately US$4.4 billion (R$16.9 billion) of the Company's assets were blocked, of which approximately US$121 (R$468 million) were freeze on the Company's bank accounts, US$3.3 billion (R$12.6 billion) were converted into judicial deposits and US$1 billion (R$3.75 billion) was guaranteed using 75,312,728 treasury shares out of the 158,216,372 treasury shares held by Vale as at December 31, 2018.

Other collective and individual claims related to the Brumadinho dam breach were filed. Some collective claims were extinguished by the applicable court.

Administrative sanctions

In addition, the Company was notified of the imposition of administrative fines by Brazilian Institute of the Environment and Renewable Natural Resources ("IBAMA"), in the amount of US$65 (R$250 million) and a daily fine of US$26 thousand (R$100 thousand), drawn up on February 7, 2019, which Vale has presented defenses against all of them. In addition, the Brumadinho Municipal Department of the Environment has also imposed fines totaling approximately US$28 (R$108 million), which the Company has also presented a defense.

U.S. Securities class action suits

Vale and certain of its current officers have been named as defendants in securities class action complaints in Federal Courts in New York brought by holders of Vale's securities under U.S. federal securities laws. The complaints allege that Vale made false and misleading statements or omitted to make disclosures concerning the risks and potential damage of a breach of the dam in the Córrego de Feijão mine. The plaintiffs have not specified an amount of alleged damages in these complaints. Vale intends to defend these actions and mount a full defense against these claims. As a consequence of the preliminary nature of these proceedings, it is not possible to determine a range of outcomes or reliable estimates of the potential exposure at this time, and the amount of provision that will be recognized in 2019 could not be estimated.

The Company is negotiating with insurers under its operational risk, general liability and engineering risk policies, but these negotiations are still at a preliminary stage. Any payment of insurance proceeds will depend on the coverage definitions under these policies and assessment of the amount of loss. In light of the uncertainties, no indemnification to the Company was recognized in Vale's financial statements.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

4. Information by business segment and by geographic area

The Company operated the following reportable segments during this year: Ferrous Minerals, Coal, Base Metals and Fertilizers (presented as discontinued operations). The segments are aligned with products and reflect the structure used by Management to evaluate Company's performance. The responsible bodies for making operational decisions, allocating resources and evaluating performance are the Executive Boards and the Board of Directors. The performance of the operating segments is assessed based on a measure of adjusted EBITDA.

The information presented to the Executive Board on the performance of each segment is derived from the accounting records, adjusted for reallocations between segments.

The main activities of the operating segments are as follows:

Ferrous minerals comprise of the production and extraction of iron ore, iron ore pellets, manganese, ferroalloys, other ferrous products and its logistic services.

Coal comprise of the production and extraction of metallurgical and thermal coal and its logistic services.

Base metals include the production and extraction of nickel and its by-products (copper, gold, silver, cobalt, precious metals and others) and copper, as well as their by-products (gold and silver).

Fertilizers (Discontinued operations) include the production of potash, phosphate, nitrogen and other fertilizer products (note 14).

a) Adjusted EBITDA

The definition of adjusted EBITDA for the Company is the operating income or loss plus dividends received and interest from associates and joint ventures, and excluding the amounts charged as (i) depreciation, depletion and amortization and (ii) special events (note 4b).

The Company allocate in "Others" the sales and expenses of other products, services, research and development, investments in joint ventures and associates of other business and unallocated corporate expenses.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

4. Information by business segment and by geographic area (Continued)

In 2018, the Company has allocated general and corporate expenses to "Others" as these are not directly related to the performance of each business segment. The comparative periods were restated to reflect this change in the allocation criteria.

	Year ended December 31, 2018						
	Net operating revenue	Cost of goods sold and services rendered	Selling, administrative and other operating expenses	Research and operational stoppages	Pre operating and evaluation	Dividends received and interest from associates and joint ventures	Adjusted EBITDA
Ferrous minerals							
Iron ore	20,354	(9,048)	(76)	(110)	(115)	28	11,033
Iron ore Pellets	6,651	(3,393)	(11)	(26)	(19)	154	3,356
Ferroalloys and manganese	454	(290)	(3)	(1)			160
Other ferrous products and services	474	(313)	(4)	(1)	(1)	7	162
	27,933	**(13,044)**	**(94)**	**(138)**	**(135)**	**189**	**14,711**
Coal	**1,643**	**(1,575)**	**(9)**	**(21)**		**143**	**181**
Base metals							
Nickel and other products	4,610	(3,060)	(47)	(39)	(33)		1,431
Copper	2,093	(960)	(4)	(18)			1,111
	6,703	**(4,020)**	**(51)**	**(57)**	**(33)**		**2,542**
Others	296	(263)	(752)	(157)	(21)	56	(841)
Total of continuing operations	**36,575**	**(18,902)**	**(906)**	**(373)**	**(189)**	**388**	**(16,593)**
Discontinued operations (Fertilizers)	**121**	**(120)**	**(4)**				**(3)**
Total	**36,696**	**(19,022)**	**(910)**	**(373)**	**(189)**	**388**	**(16,590)**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

4. Information by business segment and by geographic area (Continued)

	Year ended December 31, 2017						
	Net operating revenues	Cost of goods sold and services rendered	Selling, administrative and other operating expenses	Research and evaluation	Pre-operational and stoppage	Dividends received and interest from associates and joint ventures	Adjusted EBITDA
Ferrous minerals							
Iron ore	18,524	(7,950)	11	(88)	(181)	30	10,346
Iron ore Pellets	5,653	(2,876)	(9)	(19)	(7)	81	2,823
Ferroalloys and manganese	469	(278)	(8)		(4)		179
Other ferrous products and services	483	(306)	11	(2)		19	205
	25,129	**(11,410)**	**5**	**(109)**	**(192)**	**130**	**13,553**
Coal	**1,567**	**(1,354)**	**(12)**	**(14)**	**(4)**	**179**	**362**
Base metals							
Nickel and other products	4,667	(3,437)	(47)	(49)	(75)		1,059
Copper	2,204	(979)	(15)	(13)			1,197
	6,871	**(4,416)**	**(62)**	**(62)**	**(75)**		**2,256**
Others	400	(375)	(791)	(155)	(9)	97	(833)
Total of continuing operations	**33,967**	**(17,555)**	**(860)**	**(340)**	**(280)**	**406**	**15,338**
Discontinued operations (Fertilizers)	**1,746**	**(1,606)**	**(102)**	**(12)**	**(25)**	**3**	**4**
Total	**35,713**	**(19,161)**	**(962)**	**(352)**	**(305)**	**409**	**15,342**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

4. Information by business segment and by geographic area (Continued)

	Year ended December 31, 2016						
	Net operating revenues	Cost of goods sold and services rendered	Selling, administrative and other operating expenses	Research and evaluation	Pre-operational and stoppage	Dividends received and interest from associates and joint ventures	Adjusted EBITDA
Ferrous minerals							
Iron ore	15,784	(6,622)	(248)	(91)	(150)	10	8,683
Iron ore Pellets	3,827	(2,002)	(35)	(13)	(22)	103	1,858
Ferroalloys and manganese	302	(231)	(1)		(11)		59
Other ferrous products and services	438	(269)	(4)	(2)	(4)		159
	20,351	**(9,124)**	**(288)**	**(106)**	**(187)**	**113**	**10,759**
Coal	**839**	**(872)**	**63**	**(15)**	**(41)**		**(26)**
Base metals							
Nickel and other products	4,472	(3,204)	1	(78)	(114)	4	1,081
Copper	1,667	(924)	(16)	(5)			722
Other base metals products			150				150
	6,139	**(4,128)**	**135**	**(83)**	**(114)**	**4**	**1,953**
Others	159	(259)	(573)	(116)	(1)	76	(714)
Total of continuing operations	**27,488**	**(14,383)**	**(663)**	**(320)**	**(343)**	**193**	**11,972**
Discontinued operations (Fertilizers)	1,875	(1,545)	(87)	(22)	(16)	4	**209**
Total	**29,363**	**(15,928)**	**(750)**	**(342)**	**(359)**	**197**	**12,181**

Adjusted EBITDA is reconciled to net income (loss) as follows:

From continuing operations

	Year ended December 31		
	2018	**2017**	**2016**
Net income from continuing operations	**6,988**	**6,334**	**5,203**
Depreciation, depletion and amortization	3,351	3,708	3,487
Income taxes	(172)	1,495	2,781
Financial results, net	4,957	3,019	(1,843)
Equity results and other results in associates and joint ventures, net of dividends received	570	488	1,104
Special events (note 4b)	899	294	1,240
Adjusted EBITDA from continuing operations	**16,593**	**15,338**	**11,972**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

4. Information by business segment and by geographic area (Continued)

From discontinued operations

	Year ended December 31		
	2018	**2017**	**2016**
Loss from discontinued operations	**(92)**	**(813)**	**(1,227)**
Depreciation, depletion and amortization		1	347
Income taxes	(40)	(102)	(630)
Financial results, net	5	28	(20)
Equity results in associates and joint ventures, net of dividends received		5	1
Impairment of non-current assets	124	885	1,738
Adjusted EBITDA from discontinued operations	**(3)**	**4**	**209**

b) Special events occurred during the year

Special events are gains or losses recognized in the Company's operating results that are not related to the performance of the business segments. The Company excludes special events from adjusted EBITDA to keep the segment performance analysis comparable with prior periods.

The special events identified by the Company are as follows:

	Year ended December 31		
	2018	**2017**	**2016**
Result in disposal of assets (note 19)	(322)	(481)	(66)
Nacala Logistic Corridor (note 16)		458	
Impairment and onerous contracts (note 20)	(577)	(271)	(1,174)
Total	**(899)**	**(294)**	**(1,240)**

c) Assets by segment

	December 31, 2018	**December 31, 2017**

	Product inventory	Investments in associates and joint ventures	Property, plant and equipment and intangible(i)	Product inventory	Investments in associates and joint ventures	Property, plant and equipment and intangible(i)
Ferrous minerals	2,210	1,814	31,377	1,770	1,922	36,103
Coal	119	317	1,589	82	317	1,719
Base metals	1,147	14	21,295	1,009	13	23,603
Others	11	1,080	2,086	6	1,316	1,946
Total	**3,487**	**3,225**	**56,347**	**2,867**	**3,568**	**63,371**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

4. Information by business segment and by geographic area (Continued)

	Year ended December 31								
	2018			2017			2016		
	Capital expenditures(ii)		Depreciation, depletion and amortization	Capital expenditures(ii)		Depreciation, depletion and amortization	Capital expenditures(ii)		Depreciation, depletion and amortization
	Sustaining capital	Project execution		Sustaining capital	Project execution		Sustaining capital	Project execution	
Ferrous minerals	1,569	823	1,672	1,194	1,485	1,709	891	2,355	1,533
Coal	132	24	252	73	45	296	149	463	185
Base metals	1,189	34	1,351	960	50	1,590	1,045	12	1,636
Others	6	7	76	4	20	113	3	33	133
Total	**2,896**	**888**	**3,351**	**2,231**	**1,600**	**3,708**	**2,088**	**2,863**	**3,487**

(i) Goodwill is allocated mainly to ferrous minerals and base metals segments in the amount of US$1,841 and US$1,812 in December 31, 2018 and US$2,157 and US$1,953 in December 31, 2017, respectively.

(ii) Cash outflows.

d) Investment in associates and joint ventures, intangible and property, plant and equipment by geographic area

	December 31, 2018				December 31, 2017			
	Investments in associates and joint ventures	Intangible	Property, plant and equipment	Total	Investments in associates and joint ventures	Intangible	Property, plant and equipment	Total
Brazil	2,604	5,875	29,226	37,705	2,993	6,231	34,209	43,433
Canada		1,956	9,905	11,861		2,118	10,967	13,085

Americas, except Brazil and Canada	247			247	200			200
Europe			366	366			394	394
Indonesia		1	2,776	2,777			2,787	2,787
Asia, except Indonesia	374		1,025	1,399	375		1,100	1,475
Australia							45	45
New Caledonia			2,796	2,796			2,965	2,965
Mozambique		130	1,459	1,589		143	1,532	1,675
Oman			829	829		1	868	869
Other regions			3	3			11	11
Total	**3,225**	**7,962**	**48,385**	**59,572**	**3,568**	**8,493**	**54,878**	**66,939**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

4. Information by business segment and by geographic area (Continued)

e) Net operating revenue by geographic area

	Year ended December 31, 2018				
	Ferrous minerals	Coal	Base metals	Others	Total
Americas, except United States and Brazil	820		658		1,478
United States of America	388		952	13	1,353
Germany	1,130		523		1,653
Europe, except Germany	2,218	436	1,800		4,454
Middle East/Africa/Oceania	2,562	151	25		2,738
Japan	2,072	163	508		2,743
China	14,381		861		15,242
Asia, except Japan and China	1,798	767	1,101		3,666
Brazil	2,564	126	275	283	3,248
Net operating revenue	**27,933**	**1,643**	**6,703**	**296**	**36,575**

	Year ended December 31, 2017				
	Ferrous minerals	Coal	Base metals	Others	Total
Americas, except United States and Brazil	593		1,009	70	1,672
United States of America	355		872	83	1,310
Germany	1,097		292		1,389
Europe, except Germany	1,721	396	1,985	11	4,113
Middle East/Africa/Oceania	1,768	171	13		1,952
Japan	1,927	130	399		2,456
China	13,442		576		14,018
Asia, except Japan and China	1,332	711	1,539		3,582
Brazil	2,894	159	186	236	3,475
Net operating revenue	**25,129**	**1,567**	**6,871**	**400**	**33,967**

	Year ended December 31, 2016				
	Ferrous minerals	Coal	Base metals	Others	Total
Americas, except United States and Brazil	334	20	1,172		1,526
United States of America	232		749	24	1,005
Germany	1,077		302		1,379
Europe, except Germany	1,482	218	1,552	17	3,269
Middle East/Africa/Oceania	1,252	95	20		1,367
Japan	1,292	121	328		1,741
China	11,985	63	699		12,747
Asia, except Japan and China	912	305	1,173		2,390
Brazil	1,785	17	144	118	2,064
Net operating revenue	**20,351**	**839**	**6,139**	**159**	**27,488**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

4. Information by business segment and by geographic area (Continued)

Accounting policy

Vale recognizes revenue when the control of a good or service transfers to a customer of an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. Net revenue excludes any applicable sales taxes.

Depending on the contract, sales revenue can be recognized when the product is available at the loading port, loaded on the ship, at the port of discharge or at the customer's warehouse. Service revenues are recognized in the amount by which the services are rendered and accepted by the customer.

Generally, the contract payment terms consider the upfront payments or the use of credit letters. The payment terms do not have a significant financing component and were not changed from previous years. In some cases, the sale price is determined on a provisional basis at the date of sale and adjustments to the sale price subsequently occur based on movements in the quoted market or contractual prices up to the date of final pricing. Revenue is recognized based on the estimated fair value of the total consideration receivable, and the provisionally priced sale mechanism embedded within these sale arrangements has the character of a derivative. Accordingly, the fair value of the final sale price adjustment is re-estimated continuously and changes in fair value are recognized as operational revenue in the income statement.

Commodity price risk The commodity price risk arises from volatility of iron ore, nickel, copper and coal prices. The Company is mostly exposed to the fluctuations in the iron ore and copper price. The selling price of these products can be measured reliably at each period, since the price is quoted in an active market.

As of December 31, 2018, the Company had 27 million tons (2017: 33 million tons) provisionally priced based on iron ore forward prices and 78 thousand tons (2017: 106 thousand tons) provisionally priced based on copper forward prices. The final price of these sales will be determined during the first quarter of 2019. A 10% change in the price of iron ore realized on the provisionally priced sales, with all other factors held constant, would increase or reduce net income by US$185. A 10% change in the price of copper realized on the provisionally priced sales, with all other factors held constant, would increase or reduce net income by US$56.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

5. Costs and expenses by nature

a) Cost of goods sold and services rendered

	Year ended December 31		
	2018	**2017**	**2016**
Personnel	2,278	2,295	2,087
Materials and services	3,957	3,814	3,108
Fuel oil and gas	1,538	1,313	1,233
Maintenance	2,807	3,096	2,747
Energy	906	963	694
Acquisition of products	513	543	511
Depreciation and depletion	3,207	3,484	3,267
Freight	4,306	3,346	2,509
Others	2,597	2,185	1,494
Total	**22,109**	**21,039**	**17,650**
Cost of goods sold	21,526	20,426	17,148
Cost of services rendered	583	613	502
Total	**22,109**	**21,039**	**17,650**

b) Selling and administrative expenses

	Year ended December 31		
	2018	**2017**	**2016**
Personnel	212	234	209
Services	92	77	72
Depreciation and amortization	62	91	120
Others	157	129	106
Total	**523**	**531**	**507**

c) Other operating expenses, net

	Year ended December 31		
	2018	**2017**	**2016**
Provision for litigation	185	169	137
Profit sharing program	187	149	76
Others	73	102	54
Total	**445**	**420**	**267**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

6. Financial result

	Year ended December 31		
	2018	**2017**	**2016**
Financial income			
Short-term investments	177	176	92
Others	246	302	78
	423	**478**	**170**
Financial expenses			
Loans and borrowings gross interest	(1,185)	(1,697)	(1,768)
Capitalized loans and borrowing costs	194	370	653
Participative stockholders' debentures	(550)	(625)	(417)
Interest on REFIS	(202)	(397)	(514)
Others	(602)	(924)	(631)
	(2,345)	**(3,273)**	**(2,677)**
Other financial items			
Net foreign exchange gains (losses) on loans and borrowings	(2,666)	(249)	3,314
Derivative financial instruments	(266)	454	1,256
Other net foreign exchange gains (losses)	419	(218)	(62)
Net indexation losses	(522)	(211)	(158)
	(3,035)	**(224)**	**4,350**
Financial results, net	**(4,957)**	**(3,019)**	**1,843**

a) Hedge in foreign operations

As at January 1, 2017, Vale S.A., which the functional currency is Reais, designated its debts in US$ and Euro, as an instrument in a hedge of its investment in foreign operations (Vale International S.A. and Vale International Holding GmbH; hedging objects) to mitigate part of the foreign exchange risk on financial statements. Further details are disclosed in note 25.

b) Net investment in the foreign operation

From January 1, 2019 (subsequent event), the Company will consider certain long-term loans payable to Vale International S.A., for which settlement is neither planned nor likely to occur in the foreseeable future, as part of its net investment in the foreign operation. The foreign exchange differences arising on the monetary item, forming part of the net investment in the foreign operation, will be recognized in other

comprehensive income and reclassified from stockholders' equity to income statement on disposal or partial disposal of the net investment. Therefore, upon adoption the effect of net foreign exchange gains or losses in the income statement is expected to reduce.

Accounting policy

Transactions in foreign currencies Transactions in foreign currencies are translated into the functional currency using the exchange rate prevailing at the transaction date. The foreign exchange gains and losses resulting from the translation at the exchange rates prevailing at the end of the year are recognized in the income statement as "financial income or expense". The exceptions are transactions related to

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

6. Financial result (Continued)

qualifying net investment hedges or items that are attributable to part of the net investment in a foreign operation, for which gains and losses are recognized in the statement of comprehensive income.

7. Streaming transactions

Cobalt streaming

In June 2018, the Company entered into two different agreements, one with Wheaton Precious Metals Corp ("Wheaton") and the other with Cobalt 27 Capital Corp. ("Cobalt 27"), to sell a stream equivalent to 75% of the cobalt extracted as a by-product from the Voisey's Bay mine, in Canada, starting on January 1, 2021. Furthermore, the Company restarted the Voisey's Bay underground mine expansion project, which is going to increase the expected useful life of Voisey's Bay mine from 2023 to 2034. The first year of underground production is expected to be 2021, when the current operations on the open pit mine begin to ramp down.

Upon completion of the transaction, the Company received an upfront payment of US$690 in cash, US$390 from Wheaton and US$300 from Cobalt 27, which has been recorded as other non-current liabilities. Vale will receive additional payments of 20%, on average, of the market reference price for cobalt, for each pound of finished cobalt delivered.

Thus, from January 1, 2021 onwards, Wheaton and Cobalt 27 will be entitled to receive 42.4% and 32.6%, respectively, of cobalt equivalent to the production from the Voisey's Bay mine, while Vale remains exposed to approximately 40% of the cobalt economic exposure, as Vale retains the rights to 25% of the future cobalt production and will receive 20% additional payments for the cobalt stream. The estimated result of the sale of the mineral rights is not expected to be significant and it will be accounted for once certain production thresholds have been met at Voisey's Bay mine.

Gold streaming

In August 2016, the Company made an amended to the gold transaction entered into to 2013 with Wheaton Precious Metals Corp ("Wheaton") to include in each contract an additional 25% of the gold extracted as by-product over a lifetime of the Salobo copper mine. Hence, Wheaton holds the rights to 75% of the contained gold in the copper concentrated from the Salobo mine and 70% of the gold extracted as a by-product of the Sudbury nickel mines.

The transactions were bifurcated into two identifiable components (i) the sale of the mineral rights recognized in the income statement under "Other operating income (expenses), net" and, (ii) the deferred revenue (liability) related to the services for gold extraction on the portion in which Vale operates as an agent for Wheaton gold extraction.

The Company recognized US$150 in the income statement for the year ended December 31, 2016, related to the sale of mineral rights from the additional transaction in August 2016.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

7. Streaming transactions (Continued)

Critical accounting estimates and judgments

Defining the gain on sale of mineral interest and the deferred revenue portion of the gold transaction requires the use of critical accounting estimates as follows:

- Discount rates used to measure the present value of future inflows and outflows;
- Allocation of costs between nickel or copper and gold based on relative prices;
- Expected margin for the independent elements (sale of mineral rights and service for gold extraction) based on Company's best estimate.

8. Income taxes

a) Deferred income tax assets and liabilities

	December 31, 2018	December 31, 2017
Taxes losses carryforward	**4,882**	**4,471**
Temporary differences:		
Employee post retirement obligations	674	684
Provision for litigation	409	457
Timing differences arising on assets	1,253	1,268
Fair value of financial instruments	538	549
Allocated goodwill	(2,328)	(2,433)
Others	(52)	(77)
	494	**448**
Total	**5,376**	**4,919**
Assets	6,908	6,638
Liabilities	(1,532)	(1,719)
	5,376	**4,919**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

8. Income taxes (Continued)

Changes in deferred tax are as follows:

	Assets	Liabilities	Deferred taxes, net
Balance at December 31, 2016	**7,343**	**1,700**	**5,643**
Utilization of taxes losses carryforward	(2,143)		(2,143)
Timing differences arising on assets	103		103
Fair value of financial instruments	388		388
Allocated goodwill		(109)	109
Others	897		897
Effect in income statement	**(755)**	**(109)**	**(646)**
Transfers between asset and liabilities	40	40	
Translation adjustment	(24)	75	(99)
Other comprehensive income	(68)	13	(81)
Effect of discontinued operations			
Effect in income statement	102		102
Balance at December 31, 2017	**6,638**	**1,719**	**4,919**
Taxes losses carryforward	665		665
Timing differences arising on assets	152		152
Fair value of financial instruments	147		147
Allocated goodwill		(37)	37
Others	(77)		(77)
Effect in income statement	**887**	**(37)**	**924**
Transfers between asset and liabilities	(70)	(70)	
Translation adjustment	(673)	(102)	(571)
Other comprehensive income	123	22	101
Effect of discontinued operations			
Effect in income statement	14		14
Transfer to net assets held for sale	(11)		(11)
Balance at December 31, 2018	**6,908**	**1,532**	**5,376**

The tax loss carryforward does not expire in the Brazilian jurisdiction and their compensation is limited to 30% of the taxable income for the year. The local profits of subsidiaries abroad are also taxed in Brazil and there is no restriction on their offset against tax losses generated previously by the foreign entity or by the Parent Company.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

8. Income taxes (Continued)

b) Income tax reconciliation Income statement

The total amount presented as income taxes in the income statement is reconciled to the statutory rate, as follows:

	Year ended December 31		
	2018	**2017**	**2016**
Income before income taxes	**6,816**	**7,829**	**7,984**
Income taxes at statutory rates 34%	**(2,317)**	**(2,662)**	**(2,715)**
Adjustments that affect the basis of taxes:			
Income tax benefit from interest on stockholders' equity	873	728	87
Tax incentives	576	372	344
Equity results	104	35	107
Additions (reversals) of tax loss carryforward(i)	1,510	99	(273)
Unrecognized tax losses of the year	(458)	(432)	(708)
Nondeductible effect of impairment	(24)	(43)	(97)
Others	(92)	408	474
Income taxes	**172**	**(1,495)**	**(2,781)**

(i) In 2018, the Company recognized tax loss carryforward from tax losses of subsidiary abroad.

c) Tax incentives

In Brazil, Vale has tax incentives to partially reduce the income tax generated by the operations conducted in the North and Northeast regions that includes iron ore, manganese, copper and nickel. The incentive is calculated based on the taxable income of the incentive activity (tax operating income) and takes into account the allocation of tax operating income into different incentives applicable to different tranches of production during the periods specified for each product, usually 10 years. Most of our incentives are expected to expire up to 2024 and the last recognized tax incentive will expire in 2027. An amount equal to that obtained with the tax saving must be appropriated in retained earnings reserve account in stockholders' equity, and cannot be distributed as dividends to stockholders.

In addition to those incentives, the amount equivalent to 30% of the income tax due, can be reinvested in the acquisition of new machinery and equipment, subject to subsequent approval by the regulatory agency responsible, Superintendência de Desenvolvimento da Amazônia ("SUDAM") and/or the Superintendência de Desenvolvimento do Nordeste ("SUDENE"). The reinvestment subsidy is accounted in retained earnings reserve account, which restricts the distribution as dividends to stockholders. This tax incentive will expire in 2023.

Vale is subject to the revision of income tax by local tax authorities in a range up to 10 years depending on jurisdiction where the Company operates.

d) Income taxes Settlement program ("REFIS")

The balance mainly relates to REFIS to settle most of the claims related to the collection of income tax and social contribution on equity gains of foreign subsidiaries and affiliates from 2003 to 2012. As

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

8. Income taxes (Continued)

December 31, 2018, the balance of US$4,349 (US$432 as current and US$3,917 as non-current) is due in 118 remaining monthly installments, bearing interest at the SELIC rate (Special System for Settlement and Custody), while at December 31, 2017, the balance was US$5,375 (US$485 as current and US$4,890 as non-current).

As at December 31, 2018, the SELIC rate was 6.50% per annum (7.00% per annum at December 31, 2017).

Accounting policy

The recognition of income taxes as deferred taxes is based on temporary differences between carrying amount and the tax basis of assets and liabilities as well as tax losses carryforwards. The deferred income tax assets and liabilities are offset when there is a legally enforceable right on the same taxable entity.

The deferred tax assets arising from tax losses and temporary differences are not recognized when is not probable that future taxable profit will be available against which temporary differences and/or tax losses can be utilized.

Income taxes are recognized in the income statement, except for items recognized directly in stockholders' equity. The provision for income tax is calculated individually for each entity of the Company based on Brazilian tax rates, on an accrual basis, by applying the differential between the nominal local tax rates (based on rules enacted in the location of the entity) and the Brazilian tax rate.

Critical accounting estimates and judgments

Deferred tax assets arising from tax losses, negative social contribution basis and temporary differences are registered taking into account the analysis of future performance, considering economic and financial projections, prepared based on internal assumptions and macroeconomic environment, trade and tax scenarios that may be subject to changes in the future. The assumptions of future profits are based on production and sales planning, commodity prices, operational costs and planned capital costs.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

9. Basic and diluted earnings per share

The basic and diluted earnings per share are presented below:

	Year ended December 31		
	2018	**2017**	**2016**
Net income (loss) attributable to Vale's stockholders:			
Net income from continuing operations	6,952	6,313	5,211
Loss from discontinued operations	(92)	(806)	(1,229)
Net income	**6,860**	**5,507**	**3,982**
Thousands of shares			
Weighted average number of shares outstanding common shares	5,182,445	5,197,432	5,197,432
Basic and diluted earnings per share from continuing operations:			
Common share (US$)	1.34	1.21	1.00
Basic and diluted loss per share from discontinued operations:			
Common share (US$)	(0.02)	(0.16)	(0.23)
Basic and diluted earnings per share:			
Common share (US$)	1.32	1.05	0.77

The Company does not have potential outstanding shares or other instruments with dilutive effect on the earnings per share.

10. Accounts receivable

	December 31, 2018	**December 31, 2017**
Accounts receivable	2,710	2,660
Expected credit loss	(62)	(60)
	2,648	**2,600**
Revenue related to the steel sector %	**85.50%**	**82.90%**

	Year ended December 31		
	2018	2017	2016
Impairment of accounts receivable recorded in the income statement	(7)	(4)	(5)

There is no customer that individually represents over 10% of accounts receivable or revenues.

Accounting policy

Accounts receivable is the total amount due from sale of products and services rendered by the Company. Accounts receivable consists of financial assets initially recognized at fair value and subsequently measured at amortized cost, except for component of provisionally priced commodities sales that are subsequently measured at fair value through profit or loss ("FVTPL").

The portion of accounts receivables measured at amortized cost is subsequently measured using the effective interest ("EIR") method and it is subject to impairment. The Company has established a provision

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

10. Accounts receivable (Continued)

matrix that is based on its historical credit loss experience, adjusted for forward-looking factors specific to the economic environment and by any financial guarantees related to these accounts receivables.

Commercial credit risk management For the commercial credit exposure, which arises from sales to final customers, the risk management area, in accordance with the current delegation level, approves or requests the approval of credit risk limits for each counterparty.

Vale attributes an internal credit risk rating for each counterparty using its 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 the Company`s credit risk. The main credit risk mitigation strategies include non-recourse sale of receivables, insurance instruments, letters of credit, corporate and bank guarantees, mortgages, among others.

Vale has a diversified accounts receivable portfolio from a geographical standpoint, with Asia, Europe and Brazil the regions with more significant exposures. According to each region, different guarantees can be used to enhance the credit quality of the receivables.

11. Inventories

	December 31, 2018	December 31, 2017
Finished products	2,797	2,219
Work in progress	690	648
Consumable inventory	956	1,059
Total	**4,443**	**3,926**

	Year ended December 31		
	2018	**2017**	**2016**
Reversal (provision) for net realizable value	4	(86)	(199)

Finished and work in progress product inventory by segments is presented in note 4(c).

Accounting policy

Inventories are stated at the lower of cost and the net realizable value. The inventory production cost is determined on the basis of variable and fixed costs, direct and indirect costs of production, using the average cost method. At each statement of financial position date, inventories are

assessed for impairment and a provision for losses on obsolete or slow-moving inventory may be recognized. The write-downs and reversals are included in "Cost of goods sold and services rendered".

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

12. Recoverable taxes

Recoverable taxes are presented net of provisions for losses on tax credits.

	December 31, 2018	December 31, 2017
Value-added tax	813	887
Brazilian federal contributions	808	880
Others	13	43
Total	**1,634**	**1,810**
Current	883	1,172
Non-current	751	638
Total	**1,634**	**1,810**

13. Other financial assets and liabilities

	Current		Non-Current	
	December 31, 2018	December 31, 2017	December 31, 2018	December 31, 2017
Other financial assets				
Financial investments	32	18		
Loans			153	151
Derivative financial instruments (note 25)	39	106	392	453
Investments in equity securities (note 14)			987	
Related parties Loans (note 31)	364	1,898	1,612	2,628
	435	**2,022**	**3,144**	**3,232**
Other financial liabilities				
Derivative financial instruments (note 25)	470	104	344	686
Related parties (note 31)	1,134	882	960	975

Participative stockholders' debentures			1,407	1,233
	1,604	**986**	**2,711**	**2,894**

Participative stockholders' debentures

At the time of its privatization in 1997, the Company issued debentures to then-existing stockholders, including the Brazilian Government. The debentures' terms were set to ensure that pre-privatization stockholders would participate in potential future benefits that might be obtained from exploration of mineral resources.

A total of 388,559,056 debentures were issued with a par value of R$0.01 (one cent of Brazilian Real) and are inflation-indexed to the General Market Price Index ("IGP-M"), as set forth in the Issue Deed. The Company paid as remuneration the amount of US$148 and US$147, respectively, for the year ended December 31, 2018 and 2017.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

14. Non-current assets and liabilities held for sale and discontinued operations

	December 31, 2017 Fertilizers
Assets	
Accounts receivable	90
Inventories	460
Other current assets	110
Investments in associates and joint ventures	83
Property, plant and equipment and Intangible	2,149
Other non-current assets	695
Total assets	**3,587**
Liabilities	
Suppliers and contractors	324
Other current liabilities	215
Other non-current liabilities	640
Total liabilities	**1,179**
Net non-current assets held for sale	**2,408**

a) Fertilizers (discontinued operations)

In January 2018, the Company and The Mosaic Company ("Mosaic") concluded the transaction entered in December 2016, to sell (i) the phosphate assets located in Brazil, except for those located in Cubatão, Brazil; (ii) the control of Compañia Minera Miski Mayo S.A.C., in Peru; (iii) the potassium assets located in Brazil; and (iv) the potash projects in Canada. The Company received US$1,080 in cash and 34.2 million common shares, corresponding to 8.9% of Mosaic's outstanding common shares after the issuance of these shares totaling US$899, based on the Mosaic's quotation at closing date of the transaction and a loss of US$55 was recognized in the income statement from discontinued operations.

Mosaic's shares received were accounted for as a financial investment measured at fair value through other comprehensive income. The Company recognized a gain of US$90 (US$60, net of tax) for the year ended December 31, 2018, in other comprehensive income as "Fair value adjustment to investment in equity securities".

b) Cubatão (part of the fertilizer segment)

In November 2017, the Company entered into an agreement with Yara International ASA to sell its assets located in Cubatão, Brazil. In May 2018, the transaction was concluded and the Company received US$255 in cash and a loss of US$69 was recognized in the income statement

from discontinued operations.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

14. Non-current assets and liabilities held for sale and discontinued operations (Continued)

The results for the years and the cash flows of discontinued operations are presented as follows:

Income statement

	Year ended December 31		
	2018	**2017**	**2016**
Discontinued operations			
Net operating revenue	121	1,746	1,875
Cost of goods sold and services rendered	(120)	(1,605)	(1,887)
Operating expenses	(4)	(141)	(130)
Impairment of non-current assets	(124)	(885)	(1,738)
Operating loss	**(127)**	**(885)**	**(1,880)**
Financial Results, net	(5)	(28)	20
Equity results in associates and joint ventures		(2)	3
Loss before income taxes	**(132)**	**(915)**	**(1,857)**
Income taxes	40	102	630
Loss from discontinued operations	**(92)**	**(813)**	**(1,227)**
Net income (loss) attributable to noncontrolling interests		(7)	2
Loss attributable to Vale's stockholders	**(92)**	**(806)**	**(1,229)**

Statement of cash flow

	Year ended December 31		
	2018	**2017**	**2016**
Discontinued operations			
Cash flow from operating activities			
Loss before income taxes	(132)	(915)	(1,857)
Adjustments:			
Equity results in associates and joint ventures		2	(3)
Depreciation, amortization and depletion		1	347

Impairment of non-current assets	124	885	1,738
Others	5		(20)
Increase (decrease) in assets and liabilities	(34)	114	(25)
Net cash provided by (used in) operating activities	**(37)**	**87**	**180**
Cash flow from investing activities			
Additions to property, plant and equipment	(9)	(305)	(292)
Others			11
Net cash used in investing activities	**(9)**	**(305)**	**(281)**
Cash flow from financing activities			
Loans and borrowings			
Repayments		(34)	(17)
Net cash used in financing activities		**(34)**	**(17)**
Net cash used in discontinued operations	**(46)**	**(252)**	**(118)**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

14. Non-current assets and liabilities held for sale and discontinued operations (Continued)

Accounting policy

A non-current asset is classified as held for sale if its carrying amount will be recovered principally through a sale transaction rather than through continuing use.

The criteria for recognition of the non-current assets as held for sale are only considered satisfied when the sale is highly probable and the asset (or group of assets) is available for immediate sale in its present condition.

The Company measures the assets held for sale (or group of assets) at the lower of its carrying amount and fair value less costs to sell. If the carrying amount exceeds the fair value less costs to sell an impairment loss is recognized against income statement. Any subsequent reversal of impairment is recognized only to the extent of the loss previously recognized.

The assets and liabilities classified as held for sale are presented separately in the statement of financial position.

The classification as a discontinued operation occurs through disposal, or when the operation meets the criteria to be classified as held for sale if this occurs earlier. A discontinued operation is a component of a Company business comprising cash flows and operations that may be clearly distinct from the rest of the Company and that represents an important separate line of business or geographical area of operations.

The result of discontinued operations is presented in a single amount in the income statement, including the results after income tax of these operations less any impairment loss. Cash flows attributable to operating, investing and financing activities of discontinued operations are disclosed in a separate note.

When an operation is classified as a discontinued operation, the income statements of the prior periods are restated as if the operation had been discontinued since the beginning of the comparative period.

Any noncontrolling interest relating to a group disposal held for sale is presented in the stockholders' equity and is not reclassified in the statement of financial position.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

15. Subsidiaries

The significant consolidated entities in each business segment are as follows:

	Location	Main activity/Business	% Ownership	% Voting capital	% Non-controlling interest
Direct and indirect subsidiaries					
Companhia Portuária da Baía de Sepetiba	Brazil	Iron ore	100.0%	100.0%	0.0%
Mineração Corumbaense Reunida S.A.	Brazil	Iron ore and manganese	100.0%	100.0%	0.0%
Minerações Brasileiras Reunidas S.A. ("MBR")	Brazil	Iron ore	62.5%	98.3%	37.5%
Salobo Metais S.A.	Brazil	Copper	100.0%	100.0%	0.0%
PT Vale Indonesia	Indonesia	Nickel	59.2%	59.2%	40.8%
Vale International Holdings GmbH	Austria	Holding and research	100.0%	100.0%	0.0%
Vale Canada Limited	Canada	Nickel	100.0%	100.0%	0.0%
Vale International S.A.	Switzerland	Trading and holding	100.0%	100.0%	0.0%
Vale Malaysia Minerals Sdn. Bhd.	Malaysia	Iron ore	100.0%	100.0%	0.0%
Vale Manganês S.A.	Brazil	Manganese and ferroalloys	100.0%	100.0%	0.0%
Vale Moçambique S.A.	Mozambique	Coal	80.7%	80.7%	19.3%
Vale Nouvelle Caledonie S.A.S.	New Caledonia	Nickel	95.0%	95.0%	5.0%
Vale Oman Distribution Center LLC	Oman	Iron ore and pelletizing	100.0%	100.0%	0.0%
Vale Oman Pelletizing Company LLC	Oman	Pelletizing	70.0%	70.0%	30.0%

As explained in note 14, the Fertilizer Segment is presented as discontinued operations, which includes the following subsidiaries:

	Location	Main activity/Business	% Ownership	% Voting capital	% Non-controlling interest
Direct and indirect subsidiaries					
Compañia Minera Miski Mayo S.A.C.	Peru	Fertilizers	40.0%	51.0%	60.0%
Vale Fertilizantes S.A.	Brazil	Fertilizers	100.0%	100.0%	0.0%
Vale Cubatão Fertilizantes Ltda.	Brazil	Fertilizers	100.0%	100.0%	0.0%

Accounting policy

Consolidation and investments in associates and joint ventures The financial statements reflect the assets, liabilities and transactions of the Parent Company and its direct and indirect controlled entities ("subsidiaries"). The subsidiaries are consolidated when the Company is exposed or has rights to variable returns from its involvement with the investee and has the ability to direct the significant activities of the investee. Intercompany balances and transactions, which include unrealized profits, are eliminated.

The entities over which the Company has joint control ("joint ventures") or significant influence, but not control ("associates") are presented in note 16. Those investments are accounted for using the equity method. For interests in joint arrangements not classified as joint ventures ("joint operations"), the Company recognizes its share of assets, liabilities and net income.

Unrealized gains on downstream or upstream transactions between the Company and its associates and joint ventures are eliminated proportionately to the Company's interest.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

15. Subsidiaries (Continued)

Investments held by other investors in Vale's subsidiaries are classified as noncontrolling interests ("NCI"). The Company treats transactions with noncontrolling interests as transactions with equity owners of the Company as described in note 17.

For purchases or disposals from noncontrolling interests, the difference between the consideration paid and the proportion acquired of the carrying value of net assets of the subsidiary is directly recorded in stockholders' equity in "Results from operation with noncontrolling interest".

Translation from the functional currency to the presentation currency The income statement and statement of financial position of the subsidiaries for which the functional currency is different from the presentation currency are translated into the presentation currency as follows: (i) assets, liabilities and stockholders' equity, except for the components described in item (iii) are translated at the closing rate at the statement of financial position date; (ii) income and expenses are translated at the average exchange rates, except for specific significant transactions that are translated at the rate at the transaction date and; (iii) capital, capital reserves and treasury stock are translated at the rate at each transaction date. All resulting exchange differences are recognized directly in the comprehensive income as "translation adjustments". When a foreign operation is disposed of or sold, foreign exchange differences that were recognized in equity are recognized in the income of statement.

16. Investments in associates and joint ventures

The significant non-consolidated entities of the Company are as follows:

	Location	Main activity/Business	% Ownership	% Voting capital	% Noncontrolling interest
Joint ventures					
Aliança Geração de Energia S.A.	Brazil	Energy	55.0%	55.0%	45.0%
Companhia Coreano-Brasileira de Pelotização	Brazil	Pelletizing	50.0%	50.0%	50.0%
Companhia Hispano-Brasileira de Pelotização	Brazil	Pelletizing	50.9%	51.0%	49.1%
Companhia Ítalo-Brasileira de Pelotização	Brazil	Pelletizing	50.9%	51.0%	49.1%
Companhia Nipo-Brasileira de Pelotização	Brazil	Pelletizing	51.0%	51.1%	49.0%
Companhia Siderúrgica do Pecém ("CSP")	Brazil	Steel	50.0%	50.0%	50.0%
MRS Logística S.A.	Brazil	Logistics	48.2%	46.8%	51.8%
Nacala Corridor Holding Netherlands B.V.	Netherlands	Coal	50.0%	50.0%	50.0%
Samarco Mineração S.A.	Brazil	Pelletizing	50.0%	50.0%	50.0%
Direct and indirect associates					
Henan Longyu Energy Resources Co., Ltd.	China	Coal	25.0%	25.0%	75.0%
VLI S.A.	Brazil	Logistics	37.6%	37.6%	62.4%

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

16. Investments in associates and joint ventures (Continued)

a) Changes during the year

Changes in investments in associates and joint ventures as follows:

	2018			2017		
	Associates	Joint ventures	Total	Associates	Joint ventures	Total
Balance at January 1st,	**1,441**	**2,127**	**3,568**	**1,437**	**2,259**	**3,696**
Additions(i)		23	23	1	92	93
Translation adjustment	(184)	(272)	(456)	(2)	(28)	(30)
Equity results in income statement	44	261	305	57	41	98
Equity results in statement of comprehensive income					(152)	(152)
Dividends declared		(291)	(291)	(57)	(226)	(283)
Transfer from non-current assets held for sale(ii)	87		87			
Others	4	(15)	(11)	5	141	146
Balance at December 31,	**1,392**	**1,833**	**3,225**	**1,441**	**2,127**	**3,568**

(i) Refers to the Coal segment and others in the amounts of US$11 and US$12, respectively, on December 31, 2018 and US$75 and US$18, respectively, on December 31, 2017.

(ii) Refers to 18% interest held by Vale Fertilizantes at Ultrafertil which was transferred to Vale as part of the settlement in January 2018 (note 14).

The investments by segments are presented in note 4(c).

b) Acquisitions and divestitures

2018

Ferrous Resources Limited In December 2018, the Company entered into an agreement to purchase the control of Ferrous Resources Limited, a company that currently owns and operates iron ore mines closely located to Company's operations in Minas Gerais, Brazil. The purchase price is US$550 and the conclusion of transaction is expected to occur in 2019, subject to conditions precedent.

New Steel In January 2019 (subsequent event), the Company acquired for the total consideration of US$500 the control of New Steel Global NV, a company that develops innovative iron ore beneficiation technologies and currently owns patents of dry processing concentration in 56 countries.

2017

Nacala Logistic Corridor In March 2017, the Company concluded the transaction with Mitsui & Co., Ltd. ("Mitsui") to transfer 50% of its stake of 66.7% in Nacala Logistic Corridor, which comprises entities that holds railroads and port concessions located in Mozambique and Malawi, and sell 15% participation in the holding entity of Vale Moçambique, which holds the Moatize Coal Project, for the amount of US$690.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

16. Investments in associates and joint ventures (Continued)

After the completion of the transaction, the Company (i) holds 81% of Vale Moçambique and retains the control of the Moatize Coal Project and (ii) shares control of the Nacala Logistic Corridor structure (Nacala BV), with Mitsui.

As a consequence of sharing control of Nacala BV, the Company:

(i) derecognized the assets and liabilities classified as held for sale in the total amount of US$4,144, from which US$4,063 refers to property, plant and equipment and intangibles;

(ii) derecognized US$14 related to cash and cash equivalents;

(iii) recognized a gain of US$447 in the income statement related to the sale and the re-measurement at fair value, of its remaining interest at Nacala BV based on the consideration received;

(iv) reclassified the gain related to the cumulative translation adjustments on to income statements in the amount of US$11;

The result of the transaction regarding the assets from Nacala's logistic corridor was recognized in the income statement as "Impairment and disposal of non-current assets".

The results of the transaction with the coal holding entity was recognized in "Results from operation with noncontrolling interest" in the amount of US$105, directly in Stockholders' Equity.

The consideration received was recognized in the statement of cash flows in "Proceeds from disposal of assets and investments" in the amount of US$435 and "Transactions with noncontrolling stockholders" in the amount of US$255.

After the conclusion of the transaction, Vale has outstanding loan balances with the related parties Nacala BV and Pangea Emirates Ltd due to the deconsolidation of Nacala Logistic Corridor as disclosed in note 31.

2016

Thyssenkrupp Companhia Siderúrgica do Atlântico Ltd ("CSA") In April 2016, the Company sold 100% of its interest at CSA (26.87%) for a non-significant amount. The transaction resulted in a loss of US$75 due to recycling the "Cumulative translation adjustments" recognized in the income statement as "Equity results and other results in associates and joint ventures".

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

16. Investments in associates and joint ventures (Continued)

Associates and joint ventures	Direct ownership	% voting capital	Investments in associates and joint ventures December 31, 2018	2017	Equity results in the income statement Year ended December 31 2018	2017	2016	Dividends received Year ended December 31 2018	2017	2016
Ferrous minerals										
Baovale Mineração S.A.	50.00	50.00	23	26	5	7	9	1	1	
Companhia Coreano-Brasileira de Pelotização	50.00	50.00	104	89	69	50	17	32	19	26
Companhia Hispano-Brasileira de Pelotização(i)	50.89	51.00	83	82	55	41	15	23	16	27
Companhia Ítalo-Brasileira de Pelotização(i)	50.90	51.00	81	80	60	40	16	32	17	9
Companhia Nipo-Brasileira de Pelotização(i)	51.00	51.11	148	137	126	93	29	67	29	41
MRS Logística S.A.	48.16	46.75	496	517	72	69	57	27	29	10
VLI S.A.	37.60	37.60	857	968	30	29	36	7	19	
Zhuhai YPM Pellet Co.	25.00	25.00	22	23						
			1,814	**1,922**	**417**	**329**	**179**	**189**	**130**	**113**
Coal										
Henan Longyu Energy Resources Co., Ltd.	25.00	25.00	317	317	16	20	(4)			
			317	**317**	**16**	**20**	**(4)**			
Base metals										
Korea Nickel Corp.	25.00	25.00	14	13	1	1	(1)			4
Others							(3)			
			14	**13**	**1**	**1**	**(4)**			**4**
Others										
Aliança Geração de Energia S.A.(i)	55.00	55.00	486	571	25	27	46	25	29	39
Aliança Norte Energia Participações S.A.(i)	51.00	51.00	162	160	15	(2)	(6)			
California Steel Industries, Inc.	50.00	50.00	247	200	77	42	33	31	27	4
Companhia Siderúrgica do Pecém	50.00	50.00		262	(243)	(264)	25			
Mineração Rio do Norte S.A.	40.00	40.00	93	101	2	13	48		41	32
Others			92	22	(5)	(68)	(8)			1
			1,080	**1,316**	**(129)**	**(252)**	**138**	**56**	**97**	**76**

Total	**3,225**	**3,568**	**305**	**983**	**92**	**45**	**227**	**193**

(i) Although the Company held a majority of the voting capital, the entities are accounted under equity method due to the stockholders' agreement where relevant decisions are shared with other parties.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

16. Investments in associates and joint ventures (Continued)

c) Summarized financial information

The summarized financial information about relevant associates and joint-ventures for the Company are as follows:

	December 31, 2018					
	Joint ventures				Associates	
	Aliança Geração de Energia	CSP	Petizing(i)	MRS Logística	Hanan Longyu	VLI S.A.
Current assets	186	693	964	263	1,104	679
Non-current assets	938	3,062	296	1,826	392	3,938
Total assets	**1,124**	**3,755**	**1,260**	**2,089**	**1,496**	**4,617**
Current liabilities	83	970	437	359	203	544
Non-current liabilities	158	2,785	2	699	26	1,795
Total liabilities	**241**	**3,755**	**439**	**1,058**	**229**	**2,339**
Stockholders'equity	**883**		**821**	**1,031**	**1,267**	**2,278**
Net income (loss)	**45**	**(486)**	**609**	**150**	**65**	**79**

	December 31, 2017					
	Joint ventures				Associates	
	Aliança Geração de Energia	CSP	Petizing(i)	MRS Logística	Hanan Longyu	VLI S.A.
Current assets	137	759	760	309	1,072	738
Non-current assets	1,200	3,712	310	2,063	422	4,172

Total assets	**1,337**	**4,471**	**1,070**	**2,372**	**2,494**	**4,910**
Current liabilities	86	1,060	301	454	226	537
Non-current liabilities	213	2,887	5	844		1,799
Total liabilities	**299**	**3,947**	**306**	**1,298**	**226**	**2,336**
Stockholders'equity	**1,038**	**524**	**764**	**1,074**	**2,268**	**2,574**
Net income (loss)	**49**	**(528)**	**442**	**143**	**79**	**77**

(i)

Aggregate entity information: Companhia Coreano-Brasileira de Pelotização, Companhia Hispano-Brasileira de Pelotização, Companhia Ítalo-Brasileira de Pelotização, Companhia Nipo-Brasileira de Pelotização.

The stand-alone financial statements of those entities may differ from the financial information reported herein, which is prepared considering Vale's accounting policies including eventual goodwill, provisional price adjustment and others.

Accounting policy

Joint arrangements investments Joint arrangements are all entities over which the Company has shared control with one or more parties. Joint arrangement investments are classified as either joint operations or joint ventures depending on the contractual rights and obligations of each investor.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

16. Investments in associates and joint ventures (Continued)

The joint operations are recorded in the financial statements to represent the Company's contractual rights and obligations.

Interests in joint ventures are accounted for using the equity method, after initially being recognized at cost. The Company's investment in joint ventures includes the goodwill identified in the acquisition, net of any impairment loss.

The Company's interest in the profits or losses of its joint ventures is recognized in the income statement and participation in the changes in reserves is recognized in the Company's reserves. When the Company's interest in the losses of an associate or joint venture is equal to or greater than the carrying amount of the investment, including any other receivables, the Company does not recognize additional losses, unless it has incurred obligations or made payments on behalf of the joint venture.

Critical accounting estimates and judgments

Judgment is required in some circumstances to determine whether after considering all relevant factors, the Company has either control, joint control or significant influence over an entity. Significant influence includes situations of collective control.

The Company holds the majority of the voting capital in five joint arrangements (Aliança Geração de Energia S.A., Aliança Norte Energia Participações S.A., Companhia Hispano-Brasileira de Pelotização, Companhia Ítalo-Brasileira de Pelotização and Companhia Nipo-Brasileira de Pelotização), but management has concluded that the Company does not have a sufficiently dominant voting interest to have the power to direct the activities of the entity. As a result, these entities are accounted under equity method due to shareholder's agreements where relevant decisions are shared with other parties.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

17. Noncontrolling interest

a) Summarized financial information

The summarized financial information, prior to the eliminations of the intercompany balances and transactions, about subsidiaries with material noncontrolling interest are as follows:

	December 31, 2018				
	MBR	PTVI	Vale Moçambique NC	SA	Others(i)	Total
Current assets	581	465	202	303		
Non-current assets	2,499	1,567	1,922	1,709		
Related parties Stockholders	721	111	56	22		
Total assets	**3,801**	**2,143**	**2,180**	**2,034**		
Current liabilities	187	165	141	313		
Non-current liabilities	282	153	256	79		
Related parties Stockholders	197		766	8,731		
Total liabilities	**666**	**318**	**1,163**	**9,123**		
Stockholders' equity	3,135	1,825	1,017	(7,089)		
Equity attributable to noncontrolling interests	**1,254**	**745**	**51**	**(1,290)**	**87**	**847**
Net income (loss)	434	58	351	(985)		
Net income (loss) attributable to noncontrolling interests	**174**	**24**	**18**	**(190)**	**10**	**36**
Dividends paid to noncontrolling interests	**168**				**14**	**182**

(i) Dividends paid to noncontrolling interests relates to Vale Oman Pelletizing

	December 31, 2017						
	MBR	RTVM	VNC	Vale Moçambique S.A.	Compañia Minera Miski Mayo S.A.C.	Others(i)	Total
Current assets	408	394	251	381	78		
Non-current assets	3,041	1,582	2,046	1,653	436		
Related parties Stockholders	591	147	115	253	6		
Total assets	**4,040**	**2,123**	**2,412**	**2,287**	**520**		
Current liabilities	170	128	142	128	36		
Non-current liabilities	288	237	222	32	97		
Related parties Stockholders	226	3	1,318	8,232	9		
Total liabilities	**684**	**368**	**1,682**	**8,392**	**142**		
Stockholders' equity	3,356	1,759	730	(6,105)	380		
Equity attributable to noncontrolling interests	**1,342**	**735**	**37**	**(1,101)**	**228**	**73**	**1,314**
Net income (loss)	434	(15)	(572)	(659)	(11)		
Net income (loss) attributable to noncontrolling interests	**174**	**(6)**	**(28)**	**(104)**	**(6)**	**(16)**	**14**
Dividends paid to noncontrolling interests	**113**					**13**	**126**

(i) Discontinued operations

(ii) Dividends paid to noncontrolling interests relates to Vale Oman Pelletizing

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

17. Noncontrolling interest (Continued)

	December 31, 2016					
	MBR	TVN	Vale Moçambique S.A.	Compañia Minera Miski Mayo S.A.C.	Others(i)	Total
Net income (loss)	400	(807)	(541)	3		
Net income (loss) attributable to noncontrolling interests	**165**	**1 (40)**	**(27)**	**2**	**(107)**	**(6)**
Dividends paid to noncontrolling interests	**263**			**11**	**17**	**291**

(i) Discontinued operation

(ii) Dividends paid to noncontrolling interests relates to Vale Oman Pelletizing

The stand-alone financial statements of those entities may differ from the financial information reported herein, which is prepared considering Vale's accounting policies including eventual goodwill, provisional price adjustment and others.

18. Intangibles

Changes in intangibles are as follows:

	Goodwill	Concessions	Right of use	Software	Total
Balance at December 31, 2016	**3,081**	**3,301**	**147**	**342**	**6,871**
Additions		980		26	1,006
Disposals		(9)			(9)
Amortization		(209)	(2)	(142)	(353)
Translation adjustment	65	(61)	7	3	14

Merger of Valepar (note 30)	964				964
Balance at December 31, 2017	**4,110**	**4,002**	**152**	**229**	**8,493**
Cost	4,110	5,075	241	1,554	10,980
Accumulated amortization		(1,073)	(89)	(1,325)	(2,487)
Balance at December 31, 2017	**4,110**	**4,002**	**152**	**229**	**8,493**
Additions		855		7	862
Disposals		(27)		(2)	(29)
Amortization		(135)	(2)	(99)	(236)
Translation adjustment	(457)	(634)	(13)	(24)	(1,128)
Balance at December 31, 2018	**3,653**	**4,061**	**137**	**111**	**7,962**
Cost	3,653	5,043	201	923	9,820
Accumulated amortization		(982)	(64)	(812)	(1,858)
Balance at December 31, 2018	**3,653**	**4,061**	**137**	**111**	**7,962**

a) Goodwill The goodwill arose from the acquisition of iron ore and nickel businesses. In 2017, the goodwill was recognized on the acquisition of Vale controlling interest by Valepar, based on the expected future returns on the ferrous segment. As the fundamentals are still valid on the date of the merger of Valepar by Vale, the goodwill was fully recognized. The Company has not recognized the deferred taxes

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

18. Intangibles (Continued)

over the goodwill, since there are no differences between the tax basis and accounting basis. The Company assesses annually the recoverable amount of the goodwill.

b) Concessions The concessions refer to the agreements with governments for the exploration and the development of ports and railways. The Company holds railway concessions which are valid over a certain period of time. Those assets are classified as intangible assets and amortized over the shorter of their useful lives and the concession term at the end of which they will be returned to the government.

c) Right of use Refers to intangible identified in the business combination of Vale Canada Limited ("Vale Canada") and to the usufruct contract between the Company and noncontrolling stockholders to use the shares of Empreendimentos Brasileiros de Mineração S.A. (owner of Minerações Brasileiras Reunidas S.A. shares). The amortization of the right of use will expire in 2037 and Vale Canada's intangible will end in September of 2046.

Accounting policy

Intangibles are carried at the acquisition cost, net of accumulated amortization and impairment charges.

The estimated useful lives are as follows:

	Useful life
Concessions	3 to 50 years
Right of use	22 to 31 years
Software	5 years

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

19. Property, plant and equipment

Changes in property, plant and equipment are as follows:

	Land	Buildings and improvements	Facilities	Equipment	Mineral properties	Others	Constructions in progress	Total
Balance at December 31, 2016	**724**	**10,674**	**9,471**	**6,794**	**8,380**	**7,515**	**11,861**	**55,419**
Additions(i)							3,392	3,392
Disposals		(11)	(57)	(67)	(138)	(212)	(151)	(636)
Assets retirement obligation					425			425
Depreciation, amortization and depletion		(587)	(736)	(814)	(618)	(754)		(3,509)
Impairment (note 20)	(20)			(34)	(131)		(86)	(271)
Translation adjustment	79	(122)	(105)	(83)	222	29	38	58
Transfers	(65)	2,146	3,213	1,097	929	1,615	(8,935)	
Balance at December 31, 2017	**718**	**12,100**	**11,786**	**6,893**	**9,069**	**8,193**	**6,154**	**54,878**
Cost	718	19,163	18,292	12,840	17,471	12,461	6,154	87,064
Accumulated depreciation		(7,063)	(6,506)	(5,947)	(8,402)	(4,268)		(32,186)
Balance at December 31, 2017	**718**	**12,100**	**11,786**	**6,893**	**9,069**	**8,193**	**6,154**	**54,878**
Additions(i)							2,823	2,823
Disposals	(11)	(53)	(93)	(234)	(8)	(79)	(92)	(570)
Assets retirement obligation					446			446
Depreciation, amortization and depletion		(531)	(655)	(847)	(525)	(653)		(3,211)
Impairment (note 20)		(10)	(18)	(21)		(31)	(104)	(184)
Translation adjustment	(84)	(1,360)	(1,471)	(560)	(864)	(990)	(468)	(5,797)
Transfers	12	806	1,687	1,176	381	829	(4,891)	
Balance at December 31, 2018	**635**	**10,952**	**11,236**	**6,407**	**8,499**	**7,269**	**3,387**	**48,385**
Cost	635	18,267	17,611	12,424	16,717	11,697	3,387	80,738
Accumulated depreciation		(7,315)	(6,375)	(6,017)	(8,218)	(4,428)		(32,353)
Balance at December 31, 2018	**635**	**10,952**	**11,236**	**6,407**	**8,499**	**7,269**	**3,387**	**48,385**

(i) Includes capitalized borrowing costs.

Disposals of assets

The Company recognized a loss of US$322 and US$348 in the income statement as "Impairment and disposal of non-current assets" for the year ended December 31, 2018 and 2017, respectively, due to non-viable projects and operating assets written off through sale or obsolescence.

Additionally, in the year ended December 31, 2017, the Company concluded the sale of four VLOC's and two Floating Transfer Stations in the amount of US$391. The Company recognized a loss of US$133 in the income statement as "Impairment and disposal of non-current assets".

Accounting policy

Property, plant and equipment are recorded at the cost of acquisition or construction, net of accumulated depreciation and impairment charges.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

19. Property, plant and equipment (Continued)

Mineral properties developed internally are determined by (i) direct and indirect costs attributed to build the mining facilities, (ii) financial charges incurred during the construction period, (iii) depreciation of other fixed assets used during construction, (iv) estimated decommissioning and site restoration expenses, and (v) other capitalized expenditures during the development phase (phase when the project demonstrates its economic benefit to the Company, and the Company has ability and intention to complete the project).

The depletion of mineral properties is determined based on the ratio between production and total proven and probable mineral reserves.

Property, plant and equipment, other than mineral properties are depreciated using the straight-line method based on the estimated useful lives, from the date on which the assets become available for their intended use and are capitalized, except for land which is not depreciated.

The estimated useful lives are as follows:

	Useful life
Buildings	15 to 50 years
Facilities	3 to 50 years
Equipment	3 to 40 years
Others:	
Locomotives	12 to 25 years
Wagon	30 to 44 years
Railway equipment	5 to 33 years
Ships	20 years
Others	2 to 50 years

The residual values and useful lives of assets are reviewed at the end of each reporting period and adjusted if necessary.

Expenditures and stripping costs

(i) Exploration and evaluation expenditures Expenditures on mining research are accounted for as operating expenses until the effective proof of economic feasibility and commercial viability of a given field can be demonstrated. From then on, the expenditures incurred are capitalized as mineral properties.

(ii) Expenditures on feasibility studies, new technologies and other researches The Company also conducts feasibility studies for many businesses which it operates including researching new technologies to optimize the mining process. After these costs are proven to generate future benefits to the Company, the expenditures incurred are capitalized.

(iii) Maintenance costs Significant industrial maintenance costs, including spare parts, assembly services, and others, are recorded in property, plant and equipment and depreciated through the next programmed maintenance overhaul.

(iv) Stripping Costs The costs associated with the removal of overburden and other waste materials ("stripping costs") incurred during the development of mines, before production takes place, are capitalized as part of the depreciable cost of the mineral properties. These costs are subsequently amortized over the useful life of the mine.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

19. Property, plant and equipment (Continued)

Post-production stripping costs are included in the cost of inventory, except when a new project is developed to permit access to a significant ore deposits. In such cases, the cost is capitalized as a non-current asset and is amortized during the extraction of the ore deposits, over the useful life of the ore deposits.

Critical accounting estimates and judgments

Mineral reserves The estimates of proven and probable reserves are regularly evaluated and updated. These reserves are determined using generally accepted geological estimates. The calculation of reserves requires the Company to make assumptions about expected future conditions that are uncertain, including future ore prices, exchange rates, inflation rates, mining technology, availability of permits and production costs. Changes in assumptions could have a significant impact on the proven and probable reserves of the Company.

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 asset. 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.

20. Impairment and onerous contracts

The impairment losses (reversals) recognized in the year are presented below:

		Income statement Impairment (reversals)		
Segments by class of assets	**Assets or cash-generating unit**	**2018**	**2017**	**2016**
Property, plant and equipment and intangible				
Iron ore	North system			(160)
Coal	Australia			27
Base metals nickel	Stobie (VCL)		133	
Base metals nickel	Newfoundland (VNL)			631
Base metals nickel	Nouvelle Caledonie (VNC)			284
Several segments	Other assets	184	138	135
Impairment of non-current assets		**184**	**271**	**917**
Onerous contracts		393		257
Impairment of non-current assets and onerous contracts		**577**	**271**	**1,174**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

20. Impairment and onerous contracts (Continued)

a) Impairment of non-financial assets

The Company has carried out an impairment test for the assets for which triggering event was identified. The recoverable amount is assessed by reference to the higher of value in use ("VIU") and fair value less costs of disposal ("FVLCD").

The recoverable amount of each Cash Generating Unit ("CGU") under the impairment testing was assessed using FVLCD model, through discounted cash flow techniques, which is classified as "level 3" in the fair value hierarchy.

The cash flows were discounted using a post-tax discount rate ranging from 6% to 10%, which represents an estimate of the rate that a market participant would apply having regard to the time value of money and the risks specific to the asset. The Company used its weighted average cost of capital ("WACC") as a starting point for determining the discount rates, with appropriate adjustments for the risk profile of the countries in which the individual CGU operates.

Iron ore and pellets During 2018, the Company did not identify any changes in the circumstances or indicators that would require reassessment of the carrying amount of the iron ore and pellets CGUs. Of the total goodwill (note 18), US$1,841 is allocated to the group of ferrous mineral CGUs. The impairment analysis based on FVLCD model demonstrates that there was no impairment loss in relation to the individual CGUs or goodwill.

In 2016, based on the market circumstances, the Company decided to resume Nortés system pelletizing plant, based on the studies carried out by management that demonstrated its economic feasibility. Accordingly, the Company reversed the full impairments of US$160 recorded in 2013 and 2015.

Coal Based on the 2018 impairment triggering assessment, the Company has identified trigger of impairment in the Mozambique CGU driven by the lower than planned production volumes during the year. The Company carried out an impairment test based on FVLCD model and concluded that there were no changes in the impairment recognized in 2015.

In 2016, the mining plans for the coal assets in Australia were revised and an impairment loss of US$27 was recognized in the income statement.

Nickel (Onça Puma) In September 2017, the Federal Court granted an injunction suspending the nickel mining operations at Onça Puma (base metals segment). The Company has appealed this decision to seek a suspension of this injunction, but it is not possible to anticipate when Onça Puma activities will resume. On the assumption that the Company will be able to operate this asset in the future, the Company carried out an impairment test based on FVLCD model assuming different returning of operations scenarios and concluded that no impairment loss should be booked.

Nickel (Others) In addition, the Company did not identify any changes in the circumstances or indicators during 2018 that would require reassessment of the carrying amount of the other Nickel CGUs. Of the

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

20. Impairment and onerous contracts (Continued)

total goodwill (note 18), US$1,812 is allocated to the group of nickel CGUs. The impairment analysis based on FVLCD model demonstrates that there was no impairment loss in relation to the individual CGUs or goodwill.

In 2017, an underground mine in Sudbury (Stobie) was affected by seismic activities and the cost to repair the asset is deemed not recoverable in the current market conditions. Therefore, the Company has placed this asset on "care and maintenance" and an impairment of US$133 was recognized in the income statement.

In 2016, the decrease in long term nickel price projections, that significantly reduced the recoverable amounts of the VNL and VNC CGUs, associated with significant capital investments in new processing facilities in recent years, resulted in impairment losses of US$631 and US$284, respectively.

Other assets The Company has undertaken a review on the business plan of its biological assets leading to a reduction in the expected operational capacity of these assets. The Company carried out an impairment test based on FVLCD model and an impairment loss of US$184 was recognized in the income statement.

b) Onerous contract

In 2018, the Company recognized a provision of US$393 (2016: US$257) for the costs in respect of certain long-term contracts in the Midwest system for fluvial transportation and port structure, with minimum guaranteed volume.

Accounting policy

Impairment of non-financial assets 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 ("FVLCD") and value in use ("VIU").

FVLCD is generally determined as the present value of the estimated future cash flows expected to arise from the continued use of the asset from a market participant's perspective, including any expansion prospects. 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. Value in use 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 FVLCD calculation.

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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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

20. Impairment and onerous contracts (Continued)

For the purposes of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash flows (CGU). 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.

Onerous Contracts For certain long-term contracts, a provision is recognized when the present value of the unavoidable cost to meet the Company's obligation exceeds the economic benefits that could be received from those contracts.

Critical accounting estimates and judgments

The Company determines its cash flows based on the budgets approved by management, which require the use of the following assumptions: (i) mineral reserves and mineral resources measured by internal experts; (ii) costs and investments based on the best estimate of projects as supported by past performance; (iii) sale prices consistent with projections available in reports published by industry considering the market price when appropriate; (iv) the useful life of each cash-generating unit (ratio between production and mineral reserves); and (v) discount rates that reflect specific risks relating to the relevant assets in each cash-generating unit. These assumptions are subject to risk and uncertainty. Hence, there is a possibility that changes in circumstances will change these projections, which may affect the recoverable amount of the assets.

21. Loans, borrowings and cash and cash equivalents

a) Cash and cash equivalents

Cash and cash equivalents includes cash, immediately redeemable deposits and short-term investments with an insignificant risk of change in value. They are readily convertible to cash, part in R$, indexed to the Brazilian Interbank Interest rate ("DI Rate"or"CDI") and part denominated in US$, mainly time deposits.

b) Loans and borrowings

As at December 31, 2018 and 2017, loans and borrowings are secured by property, plant and equipment and receivables in the amount of US$221 and US$275, respectively.

The securities issued through Vale's wholly-owned finance subsidiary Vale Overseas Limited are fully and unconditionally guaranteed by Vale.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

21. Loans, borrowings and cash and cash equivalents (Continued)

i) Total debt

	Current liabilities		Non-current liabilities	
	December 31, 2018	December 31, 2017	December 31, 2018	December 31, 2017
Principal in:				
US$	256	649	10,300	16,060
EUR			1,088	1,140
R$	492	515	2,940	3,368
Other currencies	25	17	127	206
Accrued charges	**230**	**522**	**8**	**12**
Total	**1,003**	**1,703**	**14,463**	**20,786**

The future flows of debt payments principal and interest are as follows:

	Principal	Estimated future interest payments(i)
2019	773	831
2020	1,053	799
2021	1,233	732
2022	1,872	662
Between 2023 and 2027	5,109	2,132
2028 onwards	5,188	3,794
Total	**15,228**	**8,950**

(i)

Based on interest rate curves and foreign exchange rates applicable as at December 31, 2018 and considering that the payments of principal will be made on their contracted payments dates. The amount includes the estimated interest not yet accrued and the interest already recognized in the financial statements.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

21. Loans, borrowings and cash and cash equivalents (Continued)

ii) Reconciliation of debt to cash flows arising from financing activities

	Loans and borrowings
December 31, 2017	**22,489**
Additions	1,225
Repayments(i)	(7,841)
Interest paid	(1,121)
Cash flow from financing activities	**(7,737)**
Effect of exchange rate	(407)
Interest accretion	1,121
Non-cash changes	**714**
December 31, 2018	**15,466**

(i) In 2018, the Company conducted a cash tender offer for Vale Overseas' 5.875% guaranteed notes due 2021, 6.875% guaranteed notes due 2036, 4.375% guaranteed notes due 2022 and a cash tender offer for Vale S.A.' 5.625% guaranteed notes due 2042 and repurchased a total of US$3,730. The Company also redeemed all of Vale Overseas' 4.625% guaranteed notes due 2020 totaling US$499.

Accounting policy

Loans and borrowings are initially measured at fair value, net of transaction costs incurred and are subsequently carried at amortized cost and updated using the effective interest rate method. Any difference between the proceeds (net of transaction costs) and the redemption value is recognized in the Income statement over the period of the loan, using the effective interest rate method. The fees paid in obtaining the loan are recognized as transaction costs.

Loans and borrowing costs are capitalized as part of property, plants and equipment if those costs are directly related to a qualified asset. The capitalization occurs until the qualified asset is ready for its intended use. The average capitalization rate is 17%. Borrowing costs that are not capitalized are recognized in the income statement in the period in which they are incurred.

Liquidity risk The revolving credit facilities available today were provided by a syndicate of several global commercial banks. To mitigate liquidity risk, Vale has two revolving credit facilities, which will mature in 2020 and 2022, in the available amount of US$5,000 to assist the short term liquidity management and to enable more efficiency in cash management, being consistent with the strategic focus on cost of capital reduction. As of December 31, 2018 these lines are undrawn.

Some of the Company's debt agreements with lenders contain financial covenants. The primary financial covenants in those agreements require maintaining certain ratios, such as debt to EBITDA and interest coverage. The Company has not identified any instances of noncompliance as at December 31, 2018 and 2017.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

22. Liabilities related to associates and joint ventures

In March 2016 Samarco and its shareholders, Vale S.A. and BHP Billiton Brasil Ltda. ("BHPB"), entered into an Agreement ("Framework Agreement") with the Brazilian federal government, the two Brazilian states (Espírito Santo and Minas Gerais) and other governmental authorities, in connection with the lawsuit related to the Samarco dam failure (note 28d), in order to implement the programs for remediation and compensation of the areas and communities affected.

The Framework Agreement has a 15-year term, renewable for successive one-year periods until all the obligations under the Framework Agreement have been satisfied.

Under the Framework Agreement, Samarco, Vale S.A. and BHPB have established a foundation ("Fundação Renova" or "Foundation") to develop and implement social and economic remediation and compensation, to be funded by Samarco. To the extent that Samarco does not meet its funding obligations to the foundation, each of Vale S.A. and BHPB will provide, under the terms of the Framework Agreement, funds to the Foundation in proportion to its 50% equity interest in Samarco.

As a consequence of the dam failure, governmental authorities ordered the suspension of Samarco's operations.

Due to the uncertainties regarding Samarco's future cash flow, Vale S.A. maintains a provision for the obligation to comply with the reparation and compensation programs under the Framework Agreement (pro rata to its proportional equity interest in Samarco).

The changes in the provisions are as follows:

	2018	2017
Balance at January 01,	**996**	**1,077**
Payments	(290)	(294)
Present value valuation	165	182
Provision increase	403	38
Translation adjustment	(153)	(7)
Balance at December 31,	**1,121**	**996**
Current liabilities	289	326
Non-current liabilities	832	670
Liabilities	**1,121**	**996**

In 2018, the Fundação Renova reviewed the estimates for the expenditures required to mitigate and compensate for the impacts of the disruption from Samarco's tailing dam. As a result of this revision, Vale S.A. recognized in 2018 an additional provision of US$403 (R$1,523 million), which amounts to the present value of Vale's new estimated secondary responsibility to support the Renova Foundation works and is equivalent to 50% of Samarco's additional obligations over the next 12 years.

In addition to the provision above, Vale S.A. made available in the year ended December 31, 2018 and 2017 the amount of US$84 and US$142, respectively, which was fully used to fund Samarco's working

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

22. Liabilities related to associates and joint ventures (Continued)

capital and was recognized in Vale's income statement as an expense in "Equity results and other results in associates and joint ventures". Vale S.A. intends to make available until June 30, 2019 short-term facilities up to US$88 to support Samarco's cash necessity, without any binding obligation to Samarco in this regard. Such support will be released simultaneously with BHPB, and pursuant to the same amounts, terms and conditions, subject to the fulfillment of certain milestones.

The summarized financial information of Samarco are as follows:

	December 31, 2018	December 31, 2017
Current assets	54	66
Non-current assets	3,443	6,016
Total assets	**3,497**	**6,082**
Current liabilities	6,069	5,481
Non-current liabilities	3,934	3,636
Total liabilities	**10,003**	**9,117**
Negative reserves	**(6,506)**	**(3,035)**
Loss	**(1,257)**	**(930)**

Under Brazilian legislation and the terms of the joint venture agreement, Vale does not have an obligation to provide funding to Samarco. Therefore, Vale's investment in Samarco was impaired in full and no provision was recognized in relation to the Samarco's negative reserves.

Critical accounting estimates and judgments

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 a result of further technical analysis and the ongoing negotiations with the Federal Prosecution Office, (ii) resolution of uncertainty in respect of the 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. At each reporting period, Vale S.A. will reassess the key assumptions used by Samarco in the preparation of the projected cash flows and will adjust the provision, if required.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

23. Financial instruments classification

The Company classifies its financial instruments in accordance with the purpose for which they were acquired, and determines the classification and initial recognition according to the following categories:

	December 31, 2018				December 31, 2017		
Financial assets	**Amortized cost**	**At fair value through OCI**	**At fair value through profit or loss**	**Total**	**Loans and receivables or amortized cost**	**At fair value through profit or loss**	**Total**
Current							
Cash and cash equivalents	5,784			5,784	4,328		4,328
Financial investments			32	32	18		18
Derivative financial instruments			39	39		106	106
Accounts receivable	2,756		(108)	2,648	2,430	170	2,600
Related parties	364			364	1,898		1,898
	8,904		**(37)**	**8,867**	**8,674**	**276**	**8,950**
Non-current							
Derivative financial instruments			392	392		453	453
Investments in equity securities		987		987			
Loans	153			153	151		151
Related parties	1,612			1,612	2,628		2,628
	1,765	**987**	**392**	**3,144**	**2,779**	**453**	**3,232**
Total of financial assets	**10,669**	**987**	**355**	**12,011**	**11,453**	**729**	**12,182**
Financial liabilities							
Current							
Suppliers and contractors	3,512			3,512	4,041		4,041
Derivative financial instruments			470	470		104	104
Loans and borrowings	1,003			1,003	1,703		1,703
Related parties	1,134			1,134	882		882
	5,649		**470**	**6,119**	**6,626**	**104**	**6,730**

Non-current						
Derivative financial instruments		344	344		686	686
Loans and borrowings	14,463		14,463	20,786		20,786
Related parties	960		960	975		975
Participative stockholders' debentures		1,407	1,407		1,233	1,233
	15,423	**1,751**	**17,174**	**21,761**	**1,919**	**23,680**
Total of financial liabilities	**21,072**	**2,221**	**23,293**	**28,387**	**2,023**	**30,410**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

23. Financial instruments classification (Continued)

The classification of financial assets and liabilities by currencies are as follows:

	December 31, 2018					
Financial assets	**R$**	**US$**	**CAD**	**EUR**	**Others currencies**	**Total**
Current						
Cash and cash equivalents	2,765	2,883	23	12	101	5,784
Financial investments	1	31				32
Derivative financial instruments	30	9				39
Accounts receivable	447	2,197	4			2,648
Related parties		364				364
	3,243	**5,484**	**27**	**12**	**101**	**8,867**
Non-current						
Derivative financial instruments	380	12				392
Investments in equity securities		987				987
Loans	5	148				153
Related parties		1,612				1,612
	385	**2,759**				**3,144**
Total of financial assets	**3,628**	**8,243**	**27**	**12**	**101**	**12,011**
Financial liabilities						
Current						
Suppliers and contractors	1,791	1,182	292	141	106	3,512
Derivative financial instruments	389	81				470
Loans and borrowings	532	410	25	36		1,003
Related parties	769	365				1,134
	3,481	**2,038**	**317**	**177**	**106**	**6,119**
Non-current						
Derivative financial instruments	321	23				344
Loans and borrowings	2,948	10,300	127	1,088		14,463
Related parties	65	895				960
Participative stockholders' debentures	1,407					1,407

	4,741	**11,218**	**127**	**1,088**	**17,174**
Total of financial liabilities	**8,222**	**13,256**	**444**	**1,265**	**106** **23,293**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

23. Financial instruments classification (Continued)

	December 31, 2017					
Financial assets	**R$**	**US$**	**CAD**	**EUR**	**Others currencies**	**Total**
Current						
Cash and cash equivalents	1,790	2,395	48	11	84	4,328
Financial investments	1	17				18
Derivative financial instruments	60	46				106
Accounts receivable	246	2,334	6		14	2,600
Related parties		1,898				1,898
	2,097	**6,690**	**54**	**11**	**98**	**8,950**
Non-current						
Derivative financial instruments	384	69				453
Loans	5	146				151
Related parties		2,628				2,628
	389	**2,843**				**3,232**
Total of financial assets	**2,486**	**9,533**	**54**	**11**	**98**	**12,182**
Financial liabilities						
Current						
Suppliers and contractors	2,464	1,108	386	49	34	4,041
Derivative financial instruments	95	9				104
Loans and borrowings	768	880	18	37		1,703
Related parties		882				882
	3,327	**2,879**	**404**	**86**	**34**	**6,730**
Non-current						
Derivative financial instruments	638	48				686
Loans and borrowings	3,379	16,060	207	1,140		20,786
Related parties	78	897				975
Participative stockholders' debentures	1,233					1,233
	5,328	**17,005**	**207**	**1,140**		**23,680**

Total of financial liabilities	**8,655**	**19,884**	**611**	**1,226**	**34**	**30,410**

Accounting policy

The Company classifies financial instruments based on its business model for managing the assets and the contractual cash flow characteristics of those assets. The business model test determines the classification based on the business purpose for holding the asset and whether the contractual cash flows represent only payments of principal and interest.

Financial instruments are measured at fair value through profit or loss unless certain conditions are met that permit measurement at fair value through other comprehensive income ("FVOCI") or amortized cost. Gains and losses recorded in other comprehensive income for debt instruments are recognized in profit or loss only on disposal.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

23. Financial instruments classification (Continued)

Investments in equity instruments are measured at fair value through profit or loss unless they are eligible to be measured at FVOCI. The Company recognizes equity instruments and gains and losses are never being recycled to profit or loss.

Information about the Company's exposure to credit risk is set out in note 33.

All financial liabilities are initially measured at fair value, net of transaction costs incurred and are subsequently carried at amortized cost and updated using the effective interest rate method. Participative stockholders' debentures and Derivative financial instruments are measured at fair value through profit or loss.

24. Fair value estimate

Due to the short-term cycle, it is assumed that the fair value of cash and cash equivalents balances, financial investments, accounts receivable and accounts payable approximate their book values. For the measurement and determination of fair value, the Company uses various methods including market, income or cost approaches, in order to estimate the value that market participants would use when pricing the asset or liability. The financial assets and liabilities recorded at fair value are classified and disclosed in accordance with the following levels:

Level 1 Unadjusted quoted prices on an active, liquid and visible market for identical assets or liabilities that are accessible at the measurement date;

Level 2 Quoted prices (adjusted or unadjusted) for identical or similar assets or liabilities on active markets; and

Level 3 Assets and liabilities, for which quoted prices, do not exist, or where prices or valuation techniques are supported by little or no market activity, unobservable or illiquid.

a) Assets and liabilities measured and recognized at fair value:

	December 31, 2018				December 31, 2017		
	Level 1	Level 2	Level 3	Total	Level 2	Level 3	Total
Financial assets							
Financial investments	32			32			
Derivative financial instruments		136	295	431	289	270	559
Accounts receivable		(108)		(108)	170		170
Investments in equity securities	987			987			
Total	**1,019**	**28**	**295**	**1,342**	**459**	**270**	**729**
Financial liabilities							
Derivative financial instruments		636	178	814	581	209	790
Participative stockholders' debentures		1,407		1,407	1,233		1,233

Total	**2,043**	**178**	**2,221**	**1,814**	**209**	**2,023**

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Notes to the Financial Statements (Continued)

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24. Fair value estimate (Continued)

The Company changed its accounting estimate on the calculation of the participative stockholders' debentures from January 1, 2018. The Company has replaced in the calculation the assumption of spot price at the reporting date to the weighted average price traded on the market within the last month of the quarter.

There were no transfers between Level 1 and Level 2, or between Level 2 and Level 3 in the year ended December 31, 2018.

The following table presents the changes in Level 3 assets and liabilities for the year ended December 31, 2018:

	Financial assets	Derivative financial instruments Financial liabilities
Balance at December 31, 2017	270	209
Gain and losses recognized in income statement	25	(31)
Balance at December 31, 2018	295	178

Methods and valuation techniques

i) Derivative financial instruments

Derivative financial instruments are evaluated through the use of market curves and prices impacting each instrument at the closing dates, detailed in the item "market curves" (note 34).

For the pricing of options, the Company often uses the Black & Scholes model. In this model, the fair value of the derivative is determined basically as a function of the volatility and the price of the underlying asset, the strike price of the option, the risk free interest rate and the option maturity. In the case of options where payoff is a function of the average price of the underlying asset over a certain period during the life of the option, the Company uses Turnbull & Wakeman model. In this model, in addition to the factors that influence the option price in the Black-Scholes model, the formation period of the average price is also considered.

In the case of swaps, both the present value of the long and short positions are estimated by discounting their cash flows by the interest rate in the related currency. The fair value is determined by the difference between the present value of the long and short positions of the swap in the reference currency.

For the swaps indexed to TJLP, the calculation of the fair value assumes that TJLP is constant, that is, the projections of future cash flows in Brazilian Reais are made considering the last TJLP disclosed.

Forward and future contracts are priced using the future curves of their corresponding underlying assets. Typically, these curves are obtained on the stock exchanges where these assets are traded, such as the London Metals Exchange ("LME"), the Commodity Exchange ("COMEX") or other providers of market prices. When there is no price for the desired maturity, Vale uses an interpolation between the available maturities.

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Notes to the Financial Statements (Continued)

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24. Fair value estimate (Continued)

The fair value of derivatives within level 3 is estimated using discounted cash flows and option model valuation techniques with unobservable inputs of discount rates, stock prices and commodities prices.

ii) Participative stockholders' debentures Consist of the debentures issued during the privatization process (note 13), for which fair values are measured based on the market approach. Reference prices are available on the secondary market.

Critical accounting estimates and judgments

The fair values of financial instruments that are not traded in active markets are determined using valuation techniques. Vale uses its own judgment to choose between the various methods. Assumptions are based on the market conditions, at the end of the year.

An analysis of the impact if actual results are different from management's estimates is present on note 34 (sensitivity analysis).

b) Fair value of financial instruments not measured at fair value

The fair value estimate for level 1 is based on market approach considering the secondary market contracts. For loans allocated to level 2, the income approach is adopted and the fair value for both fixed-indexed rate debt and floating rate debt is determined on a discounted cash flow basis using LIBOR future values and Vale's bonds curve.

The fair values and carrying amounts of loans and borrowings are as follows:

Financial liabilities	Balance	Fair value	Level 1	Level 2
December 31, 2018				
Debt principal	15,228	16,262	10,686	5,576
December 31, 2017				
Debt principal	21,955	23,088	14,935	8,153

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Notes to the Financial Statements (Continued)

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25. Derivative financial instruments

a) Derivatives effects on statement of financial position

	Assets			
	December 31, 2018		December 31, 2017	
	Current	Non-current	Current	Non-current
Derivatives not designated as hedge accounting				
Foreign exchange and interest rate risk				
CDI & TJLP vs. US$ fixed and floating rate swap	9		38	
IPCA swap	7	84	9	82
Eurobonds swap		4		27
Pré-dolar swap	19	1	22	32
	35	**89**	**69**	**141**
Commodities price risk				
Nickel	2		22	3
Bunker oil	1		15	
	3		**37**	**3**
Others (note 34)	1	303		309
	1	**303**		**309**
Total	**39**	**392**	**106**	**453**

	Liabilities			
	December 31, 2018		December 31, 2017	
	Current	Non-current	Current	Non-current
Derivatives not designated as hedge accounting				
Foreign exchange and interest rate risk				
CDI & TJLP vs. US$ fixed and floating rate swap	383	98	95	410
IPCA swap	35	47		41
Eurobonds swap	5		4	
Pré-dolar swap	10	18	5	24

	433	**163**	**104**	**475**
Commodities price risk				
Nickel	8	2		
Bunker oil	29			
	37	**2**		
Others (note 34)		179		211
		179		**211**
Total	**470**	**344**	**104**	**686**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

25. Derivative financial instruments (Continued)

b) Effects of derivatives on the income statement, cash flow and other comprehensive income

	Gain (loss) recognized in the income statement Year ended December 31		
	2018	**2017**	**2016**
Derivatives not designated as hedge accounting			
Foreign exchange and interest rate risk			
CDI & TJLP vs. US$ fixed and floating rate swap	(206)	152	869
IPCA swap	(23)	43	78
Eurobonds swap	(27)	36	(19)
Euro forward		46	(46)
Pré-dolar swap	(23)	36	77
	(279)	**313**	**959**
Commodities price risk			
Nickel	(25)	30	(42)
Bunker oil	6	(80)	268
	(19)	**(50)**	**226**
Others	**32**	**191**	**74**
Derivatives designated as cash flow hedge accounting			
Foreign exchange			(3)
			(3)
Total	**(266)**	**454**	**1,256**

	Financial settlement inflows (outflows)

	Year ended December 31		
	2018	2017	2016
Derivatives not designated as hedge accounting			
Foreign exchange and interest rate risk			
CDI & TJLP vs. US$ fixed and floating rate swap	(135)	(181)	(513)
IPCA swap	7	(20)	(25)
Eurobonds swap	(3)	(39)	(142)
Pré-dolar swap	10	(1)	(90)
	(121)	**(241)**	**(770)**
Commodities price risk			
Nickel	8	4	(30)
Bunker oil	49	(3)	(799)
	57	**1**	**(829)**
Others	**(3)**		
Derivatives designated as cash flow hedge accounting			
Foreign exchange			(3)
			(3)
Total	**(67)**	**(240)**	**(1,602)**

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Notes to the Financial Statements (Continued)

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25. Derivative financial instruments (Continued)

	Gain (loss) recognized in other comprehensive income Year ended December 31		
	2018	2017	2016
Derivatives designated as cash flow hedge accounting			
Foreign exchange			2
Total			**2**

The maturity dates of the derivative financial instruments are as follows:

	Last maturity dates
Currencies and interest rates	December 2027
Bunker oil	June 2019
Nickel	December 2020
Others	December 2027

c) Hedge in foreign operations

As at December 31, 2018 the carrying value of the debts designated as instrument hedge of the Company's investment in foreign operations (Vale International S.A. and Vale International Holding GmbH; hedging objects) are US$2,467 and EUR750, respectively. The foreign exchange losses of US$823 (US$543, net of taxes) and US$144 (US$95, net of taxes), were recognized for the year ended December 31, 2018 and 2017, respectively in the "Cumulative translation adjustments" in stockholders' equity. This hedge was highly effective throughout the year ended December 31, 2018.

Accounting policy

The Company uses financial instruments to hedge its exposure to certain market risks arising from operational, financing and investing activities. Derivatives are included within financial assets or liabilities at fair value through profit or loss unless they are designated as effective hedging instruments.

At the beginning of the hedge operations, the Company documents the type of hedge, the relation between the hedging instrument and hedged items, its risk management objective and strategy for undertaking hedge operations. The Company also documents, both at hedge inception and on an ongoing basis that the hedge is expected to continue to be highly effective. The Company adopts the hedge accounting procedure and designates certain derivatives as shows below:

Cash flow hedge The effective portion of changes in the fair value of derivatives that are designated and qualify as cash flow hedges is recognized in equity within "Unrealized fair value gain (losses)". The gain or loss relating to the ineffective portion is recognized immediately in the income statement. When a hedging instrument expires or is sold, or when a hedge no longer meets the criteria for hedge accounting, any cumulative gain or loss existing in equity at that time remains in equity and is recognized in profit or loss when the transaction is recognized in the income statement.

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Notes to the Financial Statements (Continued)

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25. Derivative financial instruments (Continued)

Net investment hedge Hedges of net investments in foreign operations are accounted for similarly to cash flow hedges. Any gain or loss on the hedging instrument relating to the effective portion of the hedge is recognized in equity within "Cumulative translation adjustments". The gain or loss relating to the ineffective portion is recognized immediately in the income statement. Gains and losses accumulated in equity are included in the statement of income when the foreign operation is partially or fully disposed of or sold.

Derivatives at fair value through profit or loss Certain derivative instruments do not qualify for hedge accounting. Changes in the fair value of any of these derivative instruments are recognized immediately in the income statement.

26. Provisions

	Current liabilities		Non-current liabilities	
	December 31, 2018	December 31, 2017	December 31, 2018	December 31, 2017
Payroll, related charges and other remunerations	1,046	1,101		
Onerous contracts	60	102	642	364
Environmental obligations(i)	100	30	202	79
Asset retirement obligations (note 27)	85	87	3,030	3,081
Provisions for litigation (note 28)			1,357	1,473
Employee postretirement obligations (note 29)	72	74	1,864	2,030
Provisions	**1,363**	**1,394**	**7,095**	**7,027**

(i) In 2018, the Company recognized an obligation in the amount of US$229 related to certain environmental obligation that became effective from the current year due to changes in the regulation in place.

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27. Asset retirement obligations

Provision is made for expected costs for the closure of the mines and deactivation of the related mining assets. Changes in the provision for asset retirement obligations and long-term interest rates (per annum, used to discount these obligations to present value and to update the provisions) are as follows:

	December 31, 2018	December 31, 2017
Balance at beginning of the year	**3,168**	**2,519**
Present value valuation	15	70
Settlements	(259)	(60)
Revisions on cash flows estimates	461	620
Translation adjustment	(270)	96
Effect of discontinued operations		
Transfer to net assets held for sale		(77)
Balance at end of the year	**3,115**	**3,168**
Current	85	87
Non-current	3,030	3,081
	3,115	**3,168**

Long-term interest rates (per annum)		
Brazil	4.94%	5.34%
Canada	0.77%	0.57%
Other regions	1.33% 8.59%	0.72% 6.13%

Accounting policy

When the provision is recognized, the corresponding cost is capitalized as part of property, plant and equipment and it is depreciated over the useful life of the related mining asset, resulting in an expense recognized in the income statement.

The long-term liability is discounted at presented value using a long-term risk free discount rate applicable to the liability and the unwinds are recorded in the income statement and is reduced by payments for mine closure and decommissioning of mining assets.

The accrued amounts of these obligations are not deducted from the potential costs covered by insurance or indemnities.

Critical accounting estimates and judgments

Judgment is required to determine key assumptions used on the asset retirement obligation measurement such as, interest rate, cost of closure, useful life of the mining asset considering the current conditions of closure and the projected date of depletion of each mine. Any changes in these assumptions may significantly impact the recorded provision. Therefore, the estimated costs for closure of the mining assets are deemed to be a critical accounting estimate. These estimates are annually reviewed.

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Expressed in millions of United States dollar, unless otherwise stated

28. Litigation

a) Provision for litigation

Vale is party to labor, civil, tax and other ongoing lawsuits, at administrative and court levels. Provisions for losses resulting from lawsuits are estimated and updated by the Company, based on analysis from the Company's legal consultants.

Changes in provision for litigation are as follows:

	Tax litigation	Civil litigation	Labor litigation	Environmental litigation	Total of litigation provision
Balance at December 31, 2016	**214**	**84**	**534**	**7**	**839**
Additions and reversals, net	22	17	126	4	169
Payments	(117)	(3)	(105)		(225)
Indexation and interest	10	35	37	(1)	81
Translation adjustment	(10)	(2)	(10)		(22)
Merger of Valepar (note 30)(i)	631				631
Balance at December 31, 2017	**750**	**131**	**582**	**10**	**1,473**
Additions and reversals, net	17	65	106	(3)	185
Payments	(5)	(23)	(116)	(2)	(146)
Additions discontinued operations	21	1	16		38
Indexation and interest	23	17	(7)	(1)	32
Translation adjustment	(114)	(25)	(85)	(1)	(225)
Balance at December 31, 2018	**692**	**166**	**496**	**3**	**1,357**

(i) refers to litigations of PIS/COFINS of interest on capital.

i. Provisions for labor litigation Consist of lawsuits filed by employees and service suppliers, related to employment relationships mainly in Brazil. The relevant claims are related to payment for overtime work, commuting time, and health and safety conditions. Also the Brazilian national social security institute ("INSS") contingencies are related to legal and administrative disputes between INSS and Vale due to applicability of compulsory social security charges.

b) Contingent liabilities

Contingent liabilities are administrative and judicial claims, with expectation of loss classified as possible, and for which the recognition of a provision is not considered necessary by the Company, based on legal advice. The contingent liabilities are as follows:

	December 31, 2018	December 31, 2017
Tax litigation	8,641	8,840
Civil litigation	1,957	1,623
Labor litigation	1,475	1,952
Environmental litigation	1,051	2,190
Total	**13,124**	**14,605**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

28. Litigation (Continued)

i Tax litigation Our most significant tax-related contingent liabilities result from disputes related to (i) the deductibility of our payments of social security contributions on the net income ("CSLL") from our taxable income, (ii) challenges of certain tax credits we deducted from our PIS and COFINS payments, (iii) assessments of CFEM ("royalties"), and (iv) charges of value-added tax on services and circulation of goods ("ICMS"), especially relating to certain tax credits we claimed from the sale and transmission of energy, ICMS charges to anticipate the payment in the entrance of goods to Pará State and ICMS/penalty charges on our own transportation. The changes reported in the period resulted, mainly, from the exclusion of the tax cases related to IPI, PIS and COFINS (isolated fine), IRPJ and ICMS (PRCT) and due to the new proceedings related to IRPJ, CSLL, ICMS, ISS and IPTU and the application interest and inflation adjustments to the disputed amounts.

ii Civil litigation Most of those claims have been filed by suppliers for indemnification under construction contracts, primarily relating to certain alleged damages, payments and contractual penalties. A number of other claims are related to contractual disputes regarding inflation index. The changes reported in the period resulted, mainly from reviewing the process related to commercial divergences of supply contracts.

iii Labor litigation Represents individual claims by employees and service providers, primarily involving demands for additional compensation for overtime work, commuting time or health and safety conditions; and the Brazilian national social security institute ("INSS") regarding contributions on compensation programs based on profits.

iv Environmental litigation The most significant claims concern alleged procedural deficiencies in licensing processes, non-compliance with existing environmental licenses or damage to the environment.

c) Judicial deposits

In addition to the provisions and contingent liabilities, the Company is required by law to make judicial deposits to secure a potential adverse outcome of certain lawsuits. These court-ordered deposits are monetarily adjusted and reported as non-current assets until a judicial decision to draw the deposit occurs.

	December 31, 2018	December 31, 2017
Tax litigation	1,069	1,201
Civil litigation	60	60
Labor litigation	555	712
Environmental litigation	32	13
Total	**1,716**	**1,986**

Beside the deposits already made, the Company has bank guarantees for judicial deposits in the amount of US$1.5 billion. The annual cost of these guarantees is 1.5% and it is recognized as "financial expenses".

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

28. Litigation (Continued)

d) Contingencies related to Samarco accident

Given the status of the contingencies related to Samarco accident, it is not possible to provide a range of possible outcomes or a reliable estimate of potential losses for Vale S.A. Consequently, no contingent liability has been quantified and no provision was recognized.

(i) Public civil claim filed by the Federal Government and others and Public civil claim filed by Federal Prosecution Office ("MPF")

In 2016, the federal government, the Brazilian states of Espírito Santo and Minas Gerais and other governmental authorities have initiated a public civil lawsuit against Samarco and its shareholders, with an estimated value indicated by the plaintiffs of US$5.2 billion (R$20.2 billion). In the same year, MPF filed a public civil action against Samarco and its shareholders and presented several claims, including: (i) the adoption of measures for mitigating the social, economic and environmental impacts resulting from the dam failure and other emergency measures; (ii) the payment of compensation to the community; and (iii) payments for the collective moral damage. The action value indicated by MPF is US$40 billion (R$155 billion).

In 2018, the parties entered into an agreement ("Term of Adjustment of Conduct"), which was determined, in summary, (i) the complete extinction of the public civil claim of US$5.2 billion (R$20.2 billion) filed by the Federal Government and others; and (ii) the partial extinction of the public civil claim of US$40 billion (R$155 billion) filed by MPF. In relation to the public civil claim of US$40 billion (R$155 billion), the parties continue to negotiate for the termination of some of their requests, as well as other lawsuits whose objects have already been included in the Term of Adjustment of Conduct.

(ii) United States class action lawsuits

Samarco and its shareholders were named as defendants in securities class action lawsuits in the Federal Court in New York, related to disclosures of risks of the operations of Samarco and others. The plaintiffs have not specified an amount of alleged damages in these actions.

(iii) Criminal lawsuit

In 2016, the MPF brought a criminal lawsuit against Samarco and its shareholders, VogBr Recursos Hídricos e Geotecnia Ltda. and 22 individuals for the consequences related to Fundão dam failure. All prosecution witnesses residing in Brazil have been heard. Currently, the criminal lawsuit awaits for a position from Judiciary and all hearings related to this action are suspended.

e) Contingent assets

In 2015, the Company filed an enforceable action in the amount of US$135 (R$524 million) referring to the final court decision in favor of the Company of the accrued interest of compulsory deposits from 1987 to 1993. Currently it is not possible to estimate the economic benefit inflow as there is a pending judicial decision. Consequently, the asset was not recognized in the financial statements.

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Notes to the Financial Statements (Continued)

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28. Litigation (Continued)

In March 2017, the Federal Supreme Court (STF) decided that the ICMS shall not be included in PIS and COFINS tax basis. The related decision is not final because is still pending the judgment of an appeal from the Federal Government. Vale has been discussing this issue in two judicial proceedings, which are covered by taxable events occurred since December 2001. In one of them, Vale reached a favorable final judicial decision on March 18, 2019. In the other case, the Company is awaiting the application of the STF decision by Federal Regional Court of the 2nd Region. The asset was not recognized in the financial statements and the effects of the favorable final judicial decision on March 18, 2019 will be evaluated by the Company.

Accounting policy

A provision is recognized when it is considered probable that an outflow of resources will be required to settle the obligation and can be reliably estimated. The liability is accounted against an expense in the income statement. This obligation is updated based on the developments of the judicial process or interest accretion and can be reversed if the expectation of loss is not considered probable due to changes in circumstances or when the obligation is settled.

Critical accounting estimates and judgments

By nature, litigations will be resolved when one or more future event occurs or fails to occur. Typically, the occurrence or not of such events is outside of the Company's control. Legal uncertainties involve the application of significant estimates and judgments by management regarding the potential outcomes of future events.

29. Employee benefits

a) Employee postretirements obligations

In Brazil, the management of the pension plans is the responsibility of Fundação Vale do Rio Doce de Seguridade Social ("Valia") a nonprofit entity with administrative and financial autonomy. The Brazilian plans are as follows:

Benefit plan Vale Mais *("Vale Mais")* and benefit plan Valiaprev *("Valiaprev")* Certain Company's employees are participants of Vale Mais and Valiaprev plans with components of defined benefits (specific coverage for death, pensions and disability allowances) and components of defined contributions (for programmable benefits). The defined benefit plan is subject to actuarial evaluations. The defined contribution plan represents a fixed amount held on behalf of the participants. Both Vale Mais and Valiaprev were overfunded as at December 31, 2018 and 2017.

Defined benefit plan *("Plano BD")* The Plano BD has been closed to new entrants since the year 2000, when the Vale Mais plan was implemented. It is a plan that has defined benefit characteristics, covering almost exclusively retirees and their beneficiaries. It was overfunded as of December 31, 2018 and 2017 and the contributions made by the Company are not relevant.

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Notes to the Financial Statements (Continued)

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29. Employee benefits (Continued)

Complementary Allowance *("Abono complementação")* benefit plan The Company sponsors a specific group of former employees entitled to receive additional benefits from Valia regular payments plus post-retirement benefits that covers medical, dental and pharmaceutical assistance. The contributions made by the Company finished in 2014. The complementary allowance benefit was overfunded as at December 31, 2018 and 2017.

Other benefits The Company sponsors medical plans for employees that meet specific criteria and for employees who use the complementary allowance benefit. Although those benefits are not specific retirement plans, actuarial calculations are used to calculate future commitments. As those benefits are related to health care plans they have the nature of underfunded benefits, and are presented as underfunded plans as at December 31, 2018 and 2017.

The Foreign plans are managed in accordance with their region. They are divided between plans in Canada, United States of America, United Kingdom, Indonesia, New Caledonia, Japan and Taiwan. Pension plans in Canada are composed of a defined benefit and defined contribution component. Currently the defined benefit plans do not allow new entrants. The foreign defined benefit plans are underfunded as at December 31, 2018 and 2017.

Employers' disclosure about pensions and other post-retirement benefits on the status of the defined benefit elements of all plans is provided as follows.

i. Change in benefit obligation

	Overfunded pension plans	Underfunded pension plans	Other benefits
Benefit obligation as at December 31, 2016	**3,343**	**4,045**	**1,296**
Service costs	7	86	30
Interest costs	360	183	67
Benefits paid	(326)	(275)	(65)
Participant contributions		(12)	
Effect of changes in the actuarial assumptions	64	167	11
Translation adjustment	(51)	276	71
Benefit obligation as at December 31, 2017	**3,397**	**4,470**	**1,410**
Service costs	5	101	36
Interest costs	282	158	59
Benefits paid	(296)	(272)	(60)
Participant contributions		(11)	
Effect of changes in the actuarial assumptions	679	(164)	(32)
Translation adjustment	(490)	(353)	(133)

Benefit obligation as at December 31, 2018	**3,577**	**3,929**	**1,280**

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Notes to the Financial Statements (Continued)

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29. Employee benefits (Continued)

ii. Evolution of assets fair value

	Overfunded pension plans	Underfunded pension plans	Other benefits
Fair value of plan assets as at December 31, 2016	**4,694**	**3,419**	
Interest income	513	151	
Employer contributions	45	65	65
Participant contributions		(12)	
Benefits paid	(326)	(275)	(65)
Return on plan assets (excluding interest income)	(21)	174	
Translation adjustment	(77)	254	
Fair value of plan assets as at December 31, 2017	**4,828**	**3,776**	
Interest income	406	127	
Employer contributions	35	49	60
Participant contributions	2		
Benefits paid	(296)	(247)	(60)
Return on plan assets (excluding interest income)	479	(145)	
Translation adjustment	(717)	(287)	
Fair value of plan assets as at December 31, 2018	**4,737**	**3,273**	

iii. Reconciliation of assets and liabilities recognized in the statement of financial position

	Plans in Brazil					
	December 31, 2018			December 31, 2017		
	Overfunded pension plans	Underfunded pension plans	Other benefits	Overfunded pension plans	Underfunded pension plans	Other benefits
Balance at beginning of the year	**1,431**			**1,351**		
Interest income	124			152		
Changes on asset ceiling	(172)			(45)		

Translation adjustment	(223)			(27)		
Balance at end of the year	**1,160**			**1,431**		
Amount recognized in the statement of financial position						
Present value of actuarial liabilities	(3,577)	(334)	(249)	(3,397)	(401)	(258)
Fair value of assets	4,737	162		4,828	239	
Effect of the asset ceiling	(1,160)			(1,431)		
Liabilities		**(172)**	**(249)**		**(162)**	**(258)**
Current liabilities		(4)	(19)			(22)
Non-current liabilities		(168)	(230)		(162)	(236)
Liabilities		**(172)**	**(249)**		**(162)**	**(258)**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

29. Employee benefits (Continued)

	Foreign plan			
	December 31, 2018		December 31, 2017	
	Overfunded pension plans	Underfunded pension plans	Other benefits	Underfunded pension plans	Other benefits
Amount recognized in the statement of financial position					
Present value of actuarial liabilities		(3,595)	(1,031)	(4,069)	(1,152)
Fair value of assets		3,111		3,537	
Liabilities		**(484)**	**(1,031)**	**(532)**	**(1,152)**
Current liabilities		(16)	(33)	(16)	(36)
Non-current liabilities		(468)	(998)	(516)	(1,116)
Liabilities		**(484)**	**(1,031)**	**(532)**	**(1,152)**

	Total			
	December 31, 2018		December 31, 2017	
	Overfunded pension plans	Underfunded pension plans	Other benefits	Underfunded pension plans	Other benefits
Balance at beginning of the year	**1,431**		**1,351**		
Interest income	124		152		
Changes on asset ceiling	(172)		(45)		
Translation adjustment	(223)		(27)		
Balance at end of the year	**1,160**		**1,431**		

Amount recognized in the statement of financial position						
Present value of actuarial liabilities	(3,577)	(3,929)	(1,280)	(3,397)	(4,470)	(1,410)
Fair value of assets	4,737	3,273		4,828	3,776	
Effect of the asset ceiling	(1,160)			(1,431)		
Liabilities		**(656)**	**(1,280)**		**(694)**	**(1,410)**
Current liabilities		(20)	(52)		(16)	(58)
Non-current liabilities		(636)	(1,228)		(678)	(1,352)
Liabilities		**(656)**	**(1,280)**		**(694)**	**(1,410)**

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

29. Employee benefits (Continued)

iv. Costs recognized in the income statement

	Year ended December 31								
	2018				2017			2016	
	Overfunded pension plans	Underfunded pension plans	Other benefits	Underfunded plans	Overfunded pension plans	Underfunded pension plans	Other benefits	Underfunded pension plans	Other benefits
Service cost	5	101	36	7	86	30	10	76	(16)
Interest on expense on liabilities	282	158	59	360	183	67	362	175	66
Interest income on plan assets	(406)	(127)	(513)		(151)	(512)		(151)	
Interest expense on effect of (asset ceiling)/ onerous liability	124		152			156			
Total of cost, net	**5**	**132**	**95**	**6**	**118**	**97**	**16**	**100**	**50**

v. Costs recognized in the statement of comprehensive income

	Year ended December 31								
	2018				2017			2016	
	Overfunded pension plans	Underfunded pension plans	Other benefits	Underfunded plans	Overfunded pension plans	Underfunded pension plans	Other benefits	Underfunded pension plans	Other benefits
Balance at beginning of the year	**(163)**	**(496)**	**(189)**	**(153)**	**(496)**	**(160)**	**(113)**	**(495)**	**(95)**
Effect of changes actuarial assumptions	(679)	172	32	(65)	(167)	(27)	(71)	(117)	(75)
Return on plan assets (excluding interest income)	479	(144)			167		281	71	
Change of asset ceiling	172			47		(36)			
Others	(1)		(1)	(3)		(14)		35	
	(29)	**28**	**31**	**(21)**		**(41)**	**(26)**	**(11)**	**(75)**
Deferred income tax	10	(7)	(8)	7	(3)	12	9	16	17
Others comprehensive income	**(19)**	**21**	**23**	**(14)**	**(3)**	**(29)**	**(17)**	**5**	**(58)**
Translation adjustments	23	11	10	4	4	1	(23)	(6)	(7)
Transfers/ disposal	(7)	(4)	28		(1)	(1)			
Accumulated other comprehensive income	**(166)**	**(468)**	**(128)**	**(163)**	**(496)**	**(189)**	**(153)**	**(496)**	**(160)**

vi. Risks related to plans

The Administrators of the plans have committed to strategic planning to strengthen internal controls and risk management. This commitment is achieved by conducting audits and assessments of internal controls, which aim to mitigate operational market and credit risks. Risks are presented as follow:

Legal lawsuits: issuing periodic reports to internal audit and directors contemplating the analysis of lawyers about the possibility of loss (remote, probable or possible), aiming to support the administrative

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29. Employee benefits (Continued)

decision regarding provisions. Analysis and ongoing monitoring of developments in the legal scenario and its dissemination within the institution in order to subsidize the administrative plans, considering the impact of regulatory changes.

Actuarial the annual actuarial valuation of the benefit plans comprises the assessment of costs, revenues and adequacy of plan funding. It also considers the monitoring of biometric, economic and financial assumptions (asset volatility, changes in interest rates, inflation, life expectancy, salaries and other).

Market profitability projections are performed for the various plans and profiles of investments for 10 years in the management study of assets and liabilities. These projections include the risks of investments in various market segments. Furthermore, the risks for short-term market of the plans are monitored monthly through metrics of VaR (Value at Risk) and stress testing. For exclusive investment funds of Valia, the market risk is measured daily by the custodian asset bank.

Credit assessment of the credit quality of issuers by hiring expert consultants to evaluate financial institutions and internal assessment of payment ability of non-financial companies. For assets of non-financial companies, the assessment is conducted by monitoring of the company until the maturity of the security.

vii. Actuarial and economic assumptions and sensitivity analysis

All calculations involve future actuarial projections about some parameters, such as: salaries, interest, inflation, the trend of social security in Brazil ("INSS") benefits, mortality and disability.

The economic and actuarial assumptions adopted have been taken considering the maturity dates and therefore, in the short term they would not realize.

The following assumptions were adopted in the assessment:

	Brazil					
	December 31, 2018			December 31, 2017		
	Overfunded pension plans	Underfunded pension plans	Other benefits	Overfunded pension plans	Underfunded pension plans	Other benefits
Discount rate to determine benefit obligation	8.86% - 9.10%	9.10%	9.05% - 9.29%	9.74% - 9.85%	9.84%	9.74% - 9.91%
Nominal average rate to determine expense/ income	8.86% - 9.10%	9.10%	N/A	9.74% - 9.85%	9.84%	N/A
Nominal average rate of salary increase	4.00% - 6.08%	6.08%	N/A	4.25% - 6.34%	4.25% - 6.34%	N/A
Nominal average rate of benefit increase	4.00%	6.08%	N/A	4.85%	4.85%	N/A
Immediate health care cost trend rate	N/A	N/A	7.12%	N/A	N/A	7.38%
Ultimate health care cost trend rate	N/A	N/A	7.12%	N/A	N/A	7.38%
Nominal average rate of price inflation	4.00%	4.00%	4.00%	4.25%	4.25%	4.25%

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Notes to the Financial Statements (Continued)

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29. Employee benefits (Continued)

	Foreign			
	December 31, 2018		December 31, 2017	
	Underfunded pension plans	Other benefits	Underfunded pension plans	Other benefits
Discount rate to determine benefit obligation	3.56%	3.66%	3.26%	3.44%
Nominal average rate to determine expense/ income	3.26%	N/A	3.84%	N/A
Nominal average rate of salary increase	3.20%	N/A	3.27%	N/A
Nominal average rate of benefit increase	N/A	3.00%	N/A	3.00%
Immediate health care cost trend rate	N/A	5.90%	N/A	5.99%
Ultimate health care cost trend rate	N/A	4.56%	N/A	4.56%
Nominal average rate of price inflation	2.10%	2.10%	2.10%	2.10%

For the sensitivity analysis, the Company considers the effect of 1% in nominal discount rate to determine the actuarial liability. The effects of this variation on the actuarial liability, the assumption adopted the average duration of the plan are as follows:

	December 31, 2018		
	Overfunded pension plans	Underfunded pension plans	Other benefits
Nominal discount rate 1% increase			
Actuarial liability balance	3,310	3,459	1,114
Assumptions made	9.98%	5.03%	5.42%
Nominal discount rate 1% reduction			
Actuarial liability balance	3,891	4,471	1,488
Assumptions made	7.98%	3.03%	3.42%

viii. Assets of pension plans

Brazilian plan assets as at December 31, 2018 and 2017 include respectively (i) investments in a portfolio of Vale's stock and other instruments in the amount of US$13 and US$37 and (ii) Brazilian Federal Government securities in the amount of US$4,199 and US$4,617.

Foreign plan assets as at December 31, 2018 and 2017 include Canadian Government securities in the amount of US$674 and US$864, respectively.

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Notes to the Financial Statements (Continued)

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29. Employee benefits (Continued)

ix. Overfunded pension plans

Assets by category are as follows:

	December 31, 2018				December 31, 2017			
	Level 1	Level 2	Level 3	Total	Level 1	Level 2	Level 3	Total
Debt securities Corporate		47		47		72		72
Debt securities Government	2,447			2,447	2,757			2,757
Investments funds Fixed Income	2,441			2,441	2,515			2,515
Investments funds Equity	450			450	531			531
International investments	25			25	24			24
Structured investments Private Equity funds			159	159			196	196
Structured investments Real estate funds			15	15			15	15
Real estate			339	339			365	365
Loans to participants			160	160			224	224
Total	**5,363**	**47**	**673**	**6,083**	**5,327**	**72**	**800**	**6,199**
Funds not related to risk plans(i)				(1,346)				(1,871)
Fair value of plan assets at end of year				**4,737**				**4,828**

(i) Financial investments not related to coverage of overfunded pension plans

Measurement of overfunded plan assets at fair value with no observable market variables (level 3) are as follows:

	Private equity funds	Real estate funds	Real estate	Loans to participants	Total
Balance as at December 31, 2016	**140**	**10**	**370**	**260**	**780**

Return on plan assets	37	(2)	4	29	68
Assets purchases	31	8	13	75	127
Assets sold during the year	(8)		(17)	(137)	(162)
Translation adjustment	(4)	(1)	(5)	(3)	(13)
Balance as at December 31, 2017	**196**	**15**	**365**	**224**	**800**
Return on plan assets	15		39	25	79
Assets purchases	2	2	7	233	
Assets sold during the year	(26)		(16)	(292)	(334)
Translation adjustment	(28)	(2)	(56)	(30)	(116)
Balance as at December 31, 2018	**159**	**15**	**339**	**160**	**673**

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Notes to the Financial Statements (Continued)

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29. Employee benefits (Continued)

x. Underfunded pension plans

Assets by category are as follows:

	December 31, 2018				December 31, 2017			
	Level 1	Level 2	Level 3	Total	Level 1	Level 2	Level 3	Total
Cash and cash equivalents	3	18		21	4	28		32
Equity securities	1,186	2		1,188	1,364	3		1,367
Debt securities – Corporate		374		374		338		338
Debt securities – Government	116	680		796	141	801		942
Investments funds – Fixed Income	42	296		338	159			159
Investments funds – Equity		124		124	8	392		400
Structured investments – Private Equity funds			213	213	97		197	294
Real estate			51	51			44	44
Loans to participants			3	3			5	5
Others			165	165			195	195
Total	**1,347**	**1,494**	**432**	**3,273**	**1,773**	**1,562**	**441**	**3,776**

Measurement of underfunded plan assets at fair value with no observable market variables (level 3) are as follows:

	Private equity funds	Real estate	Loans to participants	Others	Total
Balance as at December 31, 2016	**187**	**24**	**6**	**173**	**390**
Return on plan assets	8	1		10	19
Assets purchases	13	17			30
Assets sold during the year	(18)	(1)			(19)
Translation adjustment	7	3	(1)	12	21
Balance as at December 31, 2017	**197**	**44**	**5**	**195**	**441**
Return on plan assets	32	3		(15)	20
Assets purchases	22	18			40

Assets sold during the year	(22)	(10)	(1)		(33)
Translation adjustment	(16)	(4)	(1)	(15)	(36)
Balance as at December 31, 2018	**213**	**51**	**3**	**165**	**432**

xi. Disbursement of future cash flow

Vale expects to disburse US$125 in 2019 in relation to pension plans and other benefits.

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Notes to the Financial Statements (Continued)

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29. Employee benefits (Continued)

xii. Expected benefit payments

The expected benefit payments, which reflect future services, are as follows:

	December 31, 2018		
	Overfunded pension plans	Underfunded pension plans	Other benefits
2019	259	222	61
2020	268	223	63
2021	276	223	65
2022	284	223	67
2023	291	224	69
2024 and thereafter	1,543	1,116	369

b) Profit sharing program ("PLR")

The Company recorded as cost of goods sold and services rendered and other operating expenses related to the profit sharing program US$503, US$780 and US$331 for the years ended December 31, 2018, 2017 and 2016, respectively.

c) Long-term compensation plan

For the long-term awarding of eligible executives, the Company compensation plans include Matching Program and Performance Share Unit Program PSU, with three to four years-vesting cycles, respectively, with the aim of encouraging employee's retention and stimulating their performance.

For the Matching program, the participants can acquire Vale's common shares in the market without any benefits being provided by Vale. If the shares acquired are held for a period of three years and the participants keep employment relationship with Vale, the participant is entitled to receive from Vale an award in shares, equivalent to the number of shares originally acquired by the executive. It should be noted that, although a specific custodian of the shares is defined by Vale, the shares initially purchased by the executives have no restriction and can be sold at any time. However, if it's done before the end of the three-year-vesting period, they lose the entitlement of receiving the related award paid by Vale.

For PSU program, the eligible executives have the opportunity to receive during a four year-vesting cycle, an award equivalent to the market value of a determined number of common shares and conditioned to Vale's performance factor measured as an indicator of total return to the shareholders (TSR). This award is paid in cash and can occur in cumulative installments of 20% (at the end of 2nd year), 30% (at the end of 3rd year) and 50% (at the end of 4th year), conditioned to the performance factor of each year.

Liabilities of the plans are measured at fair value at every reporting period, based on market rates. Compensation costs incurred are recognized by the defined vesting period of three or four years. For the years ended December 31, 2018, 2017 and 2016 the Company recognized in the income statement the amounts of US$95, US$65 and US$37, respectively, related to long-term compensation plan.

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Notes to the Financial Statements (Continued)

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29. Employee benefits (Continued)

Accounting policy

Employee benefits

i. Current benefits wages, vacations and related taxes

Payments of benefits such as wages or accrued vacation, as well as the related social security taxes over those benefits are recognized monthly in income, on an accruals basis.

ii. Current benefits profit sharing program

The Company has the Annual Incentive Program (AIP) based on Team and business unit's contribution and Company-wide performance through operational cash generation. The Company makes an accrual based on evaluation periodic of goals achieved and Company result, using the accrual basis and recognition of present obligation arising from past events in the estimated outflow of resources in the future. The accrual is recorded as cost of goods sold and services rendered or operating expenses in accordance with the activity of each employee.

iii. Non-current benefits long-term incentive programs

The Company has established a procedure for awarding certain eligible executives (Matching and Virtual Shares Programs) with the goal of encouraging employee retention and optimum performance. Plan liabilities are measured at each reporting date, at their fair values, based on market prices. Obligations are measured at each reporting date, at fair values based on market prices. The compensation costs incurred are recognized in income during the vesting period as defined.

iv. Non-current benefits pension costs and other post-retirement benefits

The Company has several retirement plans for its employees.

For defined contribution plans, the Company's obligations are limited to a monthly contribution linked to a pre-defined percentage of the remuneration of employees enrolled in these plans.

For defined benefit plans, actuarial calculations are periodically obtained for liabilities determined in accordance with the Projected Unit Credit Method in order to estimate the Company's obligation. The liability recognized in the statement of financial position represents the present value of the defined benefit obligation as at that date, less the fair value of plan assets. The Company recognized in the income statement the costs of services, the interest expense of the obligations and the interest income of the plan assets. The remeasurement of gains and losses, return on plan assets (excluding the amount of interest on return of assets, which is recognized in income for the year) and changes in the effect of the ceiling of the active and onerous liabilities are recognized in comprehensive income for the year.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

29. Employee benefits (Continued)

For overfunded plans, the Company does not recognize any assets or benefits in the statement of financial position or income statement until such time as the use of the surplus is clearly defined. For underfunded plans, the Company recognizes actuarial liabilities and results arising from the actuarial valuation.

Critical accounting estimates and judgments

Post-retirement benefits for employees The amounts recognized and disclosed depend on a number of factors that are determined based on actuarial calculations using various assumptions in order to determine costs and liabilities. One of these assumptions is selection and use of the discount rate. Any changes to these assumptions will affect the amount recognized.

At the end of each year the Company and external actuaries review the assumptions that will be used for the following year. These assumptions are used in determining the fair values of assets and liabilities, costs and expenses and the future values of estimated cash outflows, which are recorded in the plan obligations.

30. Stockholders' equity

a) Share capital

As at December 31, 2018, the share capital was US$61,614 corresponding to 5,284,474,782 shares issued and fully paid without par value.

	December 31, 2018		
Stockholders	**ON**	**PNE**	**Total**
Litel Participações S.A. and Litela Participações S.A.	1,075,773,534		1,075,773,534
BNDES Participações S.A.	342,484,176		342,484,176
Bradespar S.A.	296,009,366		296,009,366
Mitsui & Co., Ltd	286,347,055		286,347,055
Foreign investors ADRs	1,211,272,764		1,211,272,764
Foreign institutional investors in local market	1,235,808,225		1,235,808,225
FMP FGTS	54,638,358		54,638,358
PIBB Fund	2,300,038		2,300,038
Institutional investors	332,021,902		332,021,902
Retail investors in Brazil	289,602,980		289,602,980
Brazilian Government (Golden Share)		12	12
Outstanding shares	**5,126,258,398**	**12**	**5,126,258,410**
Shares in treasury	158,216,372		158,216,372
Total issued shares	**5,284,474,770**	**12**	**5,284,474,782**

Share capital per class of shares (in millions)	**61,614**	**61,614**
Total authorized shares	**7,000,000,000**	**7,000,000,000**

The Board of Directors may, regardless of changes to by-laws, issue new common shares (up to the total authorized shares), including the capitalization of profits and reserves to the extent authorized.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

30. Stockholders' equity (Continued)

The Company repurchases its shares to hold in treasury for future sale or cancellation. These shares are recorded in a specific account as a reduction of stockholders´ equity at their acquisition value and carried at cost. These programs are approved by the Board of Directors with determined terms and number of shares.

Incremental costs directly attributable to the issue of new shares or options are recognized in stockholders' equity as a deduction from the amount raised, net of taxes.

b) Share buyback program

The Company concluded in November 2018, share buyback program for Vale's common shares and their respective ADSs approved by the Board of Directors on July 25, 2018, and repurchased a total of 71,173,683 common shares, at an average price of US$14.05 per share, for a total aggregate purchase price of US$1,000. The shares were acquired in the stock market based on regular trading conditions. The shares acquired are held in treasury for future sale or cancellation.

c) Remuneration to the Company's stockholders

The Company's by-laws determine the minimum remuneration to stockholders of 25% of net income, after appropriations to legal reserve and tax incentive reserve, as follows:

	2018
Net income of the year	**6,860**
Appropriation to legal reserve	(343)
Appropriation to tax incentive reserve	(401)
Net income after appropriations to legal reserve and tax incentive reserve	**6,116**
Minimum mandatory remuneration(i)	1,529
Stockholders' remuneration paid in September, 2018	(2,054)
Appropriation to investments reserve	(4,062)

(i) Due to the Brazilian legislation, the Company must retain and collect the amount of withholding tax (15%) and cannot be considered when charging the interest on capital to the mandatory dividend, the minimum mandatory remuneration before tax is US$1,799 based on the interest on capital.

The Company approved in March, 2018, the new policy of stockholders' remuneration of the Company, approved in March 2018, which provides for a semi-annual payment of 30% of Adjusted EBITDA less sustaining capital. In September, 2018, the Company paid stockholders' remuneration in the amount of US$1,876 (US$0.360951164 per share), US$1,659 based on the interest on capital and US$217 based on dividends, for the first half of 2018 approved by Board of Directors on July 25, 2018. This payment comprises the minimum mandatory remuneration for the year ended December 31, 2018.

Following the Brumadinho dam failure (as described on note 3), Vale has determined the suspension of the Shareholder Remuneration Policy and any other deliberation on shares buyback.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

30. Stockholders' equity (Continued)

The remuneration paid to stockholders based on the on interest on capital and dividends during 2018 and 2017 amounted US$3,313 (US$0.636637439 per share) and US$1,456 (US$0.282400343 per share), respectively.

d) Profit reserves

The amount of profit reserves is distributed as follows:

	Legal reserve	Tax incentive reserve	Investments reserve	Additional remuneration reserve	Total of profit reserves
Balance as at December 31, 2016	**1,384**	**377**	**1,808**	**634**	**4,203**
Allocation of Income	275	216	3,541		4,032
Dividends and interest on capital of Vale's stockholders				(658)	(658)
Translation adjustment	(29)	(13)	(140)	24	(158)
Balance as at December 31, 2017	**1,630**	**580**	**5,209**		**7,419**
Allocation of Income	343	401	4,062		4,806
Translation adjustment	(251)	(99)	(907)		(1,257)
Balance as at December 31, 2018	**1,722**	**882**	**8,364**		**10,968**

Legal reserve Is a legal requirement for Brazilian public companies to retain 5% of the annual net income up to 20% of the capital. The reserve can only be used to compensate losses or to increase capital.

Tax incentive reserve Results from the option to designate a portion of the income tax for investments in projects approved by the Brazilian Government as well as tax incentives.

Investment reserve Aims to ensure the maintenance and development of the main activities that comprise the Company's operations and to retain budgeted capital for investments. Based on the Company's by-laws, this reserve is capped to 50% of the annual distributable net income, up to the amount of the share capital. The remaining balance over 50% of the annual distributable net income is retained based on the capital investments budget submitted for approval in the Stockholders' Meeting, pursuant to article 196 of the Law 6,404.

Additional remuneration reserve Arises from the remuneration proposed by Management that exceeds the mandatory minimum remuneration of 25% of the adjusted net income.

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Notes to the Financial Statements (Continued)

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30. Stockholders' equity (Continued)

e) Unrealized fair value gain (losses)

	Retirement benefit obligations	Fair value adjustment to investment in equity securities	Conversion shares	Total gain (losses)
Balance as at December 31, 2016	**(809)**		**(338)**	**(1,147)**
Other comprehensive income	(46)			(46)
Translation adjustment	10			10
Balance as at December 31, 2017	**(845)**		**(338)**	**(1,183)**
Other comprehensive income	41	60		101
Translation adjustment	49			49
Balance as at December 31, 2018	**(755)**	**60**	**(338)**	**(1,033)**

f) Vale's corporate governance restructuring in 2017

At the General Extraordinary Stockholders' Meeting, held on June 27, 2017, stockholders approved the corporate restructuring of the Company proposed by Valepar S.A. (former controlling stockholder). The corporate restructuring was based on (i) conversion of Vale class "A" preferred shares into common shares; (ii) amendment of Vale's by-laws, so as to adjust to Novo Mercado rules; and (iii) the merger of Valepar S.A. into Vale.

(i) Conversion of preferred shares and merger of Valepar S.A.

At the General Extraordinary Stockholders' Meeting, held on June 27, 2017, stockholders approved the voluntary conversion of Vale class "A" preferred shares into common shares ("ON"), based on the conversion rate of 0.9342 common shares for each Vale class "A" preferred share.

On August 11, 2017, the voluntary conversion period expired and an aggregate of 1,660,581,830 preferred shares (excluding treasury shares), corresponding to 84.4% of the total outstanding preferred shares, were converted into common shares.

At the Extraordinary Stockholders' Meeting of Valepar S.A, held on August 14, 2017, stockholders approved the merger of Valepar with and into Vale. Thereafter, Valepar ceases to exist and, as consequence, its stockholders hold direct interests in Vale, through the 1.2065 Vale common shares received for each Valepar share held by them. As a result, Vale issued 173,543,667 new common shares to Valepar's stockholders, all registered and without par value.

On August 14, 2017, the merger was accounted in Vale's stockholders' equity as capital reserve, based on the accounting appraisal report of Valepar's net assets, amounting to US$1,158.

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Notes to the Financial Statements (Continued)

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30. Stockholders' equity (Continued)

The impacts arising from the merger in the Company's assets and liabilities are as follows:

	August 14, 2017
Current assets	24
Judicial deposits	951
Intangible	964
Current liabilities	20
Provisions for litigation	631
Taxes payable	130
Net assets	**1,158**

At the Extraordinary Stockholders' Meeting and at the Special Stockholders' Meeting, held on October 18, 2017, preferred stockholders approved the conversion of all Class "A" preferred shares into common shares of the Company, in the proportion of 0.9342 common share for each class "A" preferred share. During the period from October 20, 2017 until November 21, 2017, inclusive, the stockholders holding Vale's Class "A" preferred shares dissenting with regard to the resolution of the Special Meeting, had the right to withdraw from the Company, receiving R$24.26 per share which is the equivalent of Vale stockholders' equity per share at December 31, 2016. At the end of this period, 10,397 common shares were converted into treasury shares (corresponding to 11,130 preferred shares).

At the Extraordinary Stockholders' Meeting held on December 21, 2017 stockholders' approved the migration of the Company to the special listing segment of B3 S.A. ("Novo Mercado"), following the conversion of the class "A" preferred shares into common shares.

The stockholders' equity corresponds to 5,284,474,770 common shares and 12 preferred shares special class ("PNE" or "Golden shares"), and there were no changes in the amount of share capital.

	Share position before conversion	Conversion of the preferred shares	Issue of new shares	Share position after conversion
Shares outstanding				
ON	3,185,653,180	1,808,235,474	173,543,667	5,197,432,081
PNA/PNE	1,967,721,926	(1,967,721,914)		12
	5,153,374,916	**(159,486,440)**	**173,543,667**	**5,197,432,093**
Shares in treasury				
ON	31,535,403	55,507,287		87,042,689
PNA	59,405,792	(59,405,792)		

Total issued shares	**5,244,316,107**	**(103,385,073)**	**5,284,474,782**

g) Shareholders Agreement

On the date of the merger of Valepar into Vale, August 14, 2017, the former Controlling Shareholders of Valepar executed a new shareholders' agreement ("Vale Agreement") that binds only 20% of the totality

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

30. Stockholders' equity (Continued)

of Vale's common shares issued by Vale, and will be in force until November 9, 2020, with no provision for renewal.

For 6 months from the date of entry into force of the Vale Agreement, the Shareholders will be obligated not to transfer, by any means, either directly or indirectly, Vale shares they receive as a result of the implementation of the Proposal ("Lock-Up"), except for (i) the transfer of Vale's shares by the Shareholders to their affiliates and their current shareholders, provided that such transferred shares shall remain subject to the Lock-Up, and (ii) the transfer of shares held by the Shareholders prior to the merger of Valepar.

Accounting policy

Stockholder's remuneration The stockholder's remuneration is paid on dividends and interest on capital. This remuneration is recognized as a liability in the financial statements of the Company based on bylaws. Any amount above the minimum mandatory remuneration approved by the by-laws shall only be recognized in current liabilities on the date that is approved by stockholders.

The Company is permitted to distribute interest attributable to stockholders' equity. The calculation is based on the stockholders' equity amounts as stated in the statutory accounting records and the interest rate applied may not exceed the Brazilian Government Long-term Interest Rate ("TJLP") determined by the Central Bank of Brazil. Also, such interest may not exceed 50% of the net income for the year or 50% of retained earnings plus profit reserves as determined by Brazilian corporate law.

The benefit to the Company, as opposed to making a dividend payment, is a reduction in the income tax burden because this interest charge is tax deductible in Brazil. Income tax of 15% is withheld on behalf of the stockholders relative to the interest distribution. Under Brazilian law, interest attributed to stockholders' equity is considered as part of the annual minimum mandatory dividend. This notional interest distribution is treated for accounting purposes as a deduction from stockholders' equity in a manner similar to a dividend and the tax deductibility recorded in the income statement.

31. Related parties

The Company's related parties are subsidiaries, joint ventures, associates, stockholders and its related entities and key management personnel of the Company. Transactions between the parent company and its subsidiaries are eliminated on consolidation and are not disclosed in this note.

Related party transactions were made by the Company on terms equivalent to those that prevail in arm´s-length transactions, with respect to price and market conditions that are no less favorable to the Company than those arranged with third parties.

Purchases, accounts receivable and other assets, and accounts payable and other liabilities relate largely to amounts charged by joint ventures and associates related to the pelletizing plants operational lease and railway transportation services.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

31. Related parties (Continued)

Information about related party transactions and effects on the financial statements is set out below:

a) Transactions with related parties

	Year ended December 31 2018			
	Joint Ventures	**Associates**	**Major stockholders**	**Total**
Net operating revenue	352	309	207	**868**
Cost and operating expenses	(2,269)	(39)		**(2,308)**
Financial result	115		(115)	

	Year ended December 31 2017			
	Joint Ventures	**Associates**	**Major stockholders**	**Total**
Net operating revenue	399	337	146	**882**
Cost and operating expenses	(1,943)	(29)	(29)	**(2,001)**
Financial result	118	(14)	(819)	**(715)**

	Year ended December 31 2016			
	Joint Ventures	**Associates**	**Major stockholders**	**Total**
Net operating revenue	166	345	141	**652**
Cost and operating expenses	(916)	(51)	(37)	**(1,004)**
Financial result	(29)	1	(882)	**(910)**

Net operating revenue relates to sale of iron ore to the steelmakers and right to use capacity on railroads. Cost and operating expenses mostly relate to the operational leases of the pelletizing plants.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

31. Related parties (Continued)

b) Outstanding balances with related parties

	December 31, 2018				December 31, 2017			
	Joint Ventures	Associates	Major stockholders	Total	Joint Ventures	Associates	Major stockholders	Total
Assets								
Cash and cash equivalents			1,256	**1,256**			817	**817**
Accounts receivable	110	42	3	**155**	73	55	3	**131**
Dividends receivable	132			**132**	112	14		**126**
Loans	1,976			**1,976**	4,526			**4,526**
Derivatives financial instruments			297	**297**			284	**284**
Other assets	25			**25**	17			**17**
Liabilities								
Supplier and contractors	221	21	24	**266**	192	35	201	**428**
Loans		1,325	2,650	**3,975**	1,245	4,508		**5,753**
Derivatives financial instruments			112	**112**			109	**109**
Other liabilities	769			**769**	612		16	**628**

Major stockholders

Refers to regular financial instruments with large financial institutions of which the stockholders are part of the controlling "shareholders' agreement".

Coal segment transactions

In March 2018, Nacala BV, a joint venture between Vale and Mitsui on the Nacala's logistic corridor, closed the project financing and repaid a portion of the shareholders' loans from Vale, in the amount of US$2,572. The outstanding receivable of US$1,976 carries interest at 7.44% p.a.

The loan from associates mainly relates to the loan from Pangea Emirates Ltd, part of the group of shareholders which owns 15% interest on Vale Moçambique which carries interest at 6.54% p.a.

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Notes to the Financial Statements (Continued)

Expressed in millions of United States dollar, unless otherwise stated

31. Related parties (Continued)

c) The key management personnel remuneration

	Year ended December 31		
	2018	**2017**	**2016**
Short-term benefits			
Wages	8	10	8
Direct and indirect benefits	11	10	4
Profit sharing program ("PLR")	10	8	
	29	**28**	**12**
Long-term benefits			
Shares based	**3**	**5**	**1**
Severance	**20**	**19**	**5**
	52	**52**	**18**

The amounts described above include the Board of Directors and the Executive Officers.

32. Commitments

a) Contractual obligations

The table below presents the annual minimum future payments, which are required and non-cancelable, related to contractual obligations of the Company as of December 31.

	2019	**2020**	**2021**	**2022**	**2023 and thereafter**	**Total**
Operating lease	250	201	189	166	1,692	2,498
Purchase obligations	2,677	1,445	548	463	2,194	7,327
Total minimum payments required	**2,927**	**1,646**	**737**	**629**	**3,886**	**9,825**

Operating lease The Company has operating lease agreements in place with third parties related to port structures and port operations, transportation services, energy plants and property leases for its operational facilities.

Vale also has long-term agreements for the exploration and processing of iron ore with its joint ventures, such as the agreements to lease pelletizing plants in Brazil. The leases have varying terms and on renewal, the terms of the leases are renegotiated. The minimum future payments have been calculated considering the non-cancellable period of the lease agreements.

The total amount of operational leasing expenses for the year ended on December 31, 2018, 2017 and 2016 were US$1,044, US$805 and US$532, respectively.

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Notes to the Financial Statements (Continued)

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32. Commitments (Continued)

Purchase obligations Mainly relate to agreements for the acquisition of fuel, energy and the acquisition of raw materials and services.

b) Guarantees provided

As of December 31, 2018, corporate guarantees provided by Vale (within the limit of its direct or indirect interest) for the companies Norte Energia S.A. and Companhia Siderúrgica do Pecém S.A. were US$331 and US$1,404, respectively.

The net book value of property, plant and equipment pledged to secure judicial claims on December 31, 2018 and 2017 were US$6 and US$15, respectively.

c) Nickel Operations Indonesia

The Company´s subsidiary PT Vale Indonesia Tbk ("PTVI"), a public company in Indonesia, has an agreement in place with the Government of Indonesia to operate its mining licenses which includes a commitment to divest an additional 20% of PTVI's shares to Indonesian participants by October 2019 (approximately 20% of PTVI's shares are already registered on the Indonesian Stock Exchange). The existing major shareholders, Vale Canada and Sumitomo Metal Mining, Co., Ltd., will comply with the divestment obligation on a pro rata basis.

33. Risk management

Vale considers that an effective risk management is key to achieve the Company's objectives and to ensure people and environmental safety, financial stability and flexibility of the Company as well as the going concern of its business.

Therefore, Vale has developed its risk management strategy in order to provide an integrated approach of the risks that the company is exposed to, considering not only the risks generated by variables traded in financial markets (market risk) and those arising from liquidity risk, but also risk from counterparties obligations (credit risk); those that are related to governance, business model and external environment (strategic risks); risks relating to inadequate or failed internal processes, people, health, safety, environmental and social (operational risk); information security (cybernetic risk) and internal and external compliance (compliance risk).

a) Corporate risk management policy

The Board of Directors established a corporate risk management policy defining principles and guidelines applicable to this process in the company and the corresponding governance structure based on the lines of defense model.

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Notes to the Financial Statements (Continued)

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33. Risk management (Continued)

This policy determines that the first line of defense, that is, the owners of the control activities related to the identified risks and testing assignees of the business units, projects, administrative and support are direct responsible for identifying, assessing, remediating, monitoring and managing risk events under an integrated approach.

The Executive Risk Management Committee is the main body of the risk management structure, and is responsible to provide recommendations regarding Vale's Risk Management System and to support the Executive Board on the risk monitoring activities and with the related deliberations needed on its corporate management.

The Executive Board is in-charge for the approval of the policy deployment into rules and responsibilities directed to management and control of risks through issuing of internal normative documents.

Internal normative documents related risk management complement the corporate risk management policy and define practices, processes, controls, roles and assignments.

b) Liquidity risk management

The liquidity risk arises from the possibility that Vale might not perform its obligations on due dates, as well as face difficulties to meet its cash requirements due to market liquidity constraints.

See note 21 "Loans, borrowings and cash and cash equivalents" for details on the Company's liquidity risk.

c) Credit risk management

Vale's exposure to credit risk arises 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.

(i) Commercial credit risk management

See note 10 "Accounts receivable" for details on commercial credit risk.

(ii) Treasury credit risk management

To manage the credit exposure arising from cash investments and derivative instruments, credit limits are approved to each counterparty with whom the Company has credit exposure.

Furthermore, the Company controls the portfolio diversification and monitors different indicators of solvency and liquidity of the different counterparties that were approved for trading.

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Notes to the Financial Statements (Continued)

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33. Risk management (Continued)

d) Market risk management

Vale is exposed to several market risk factors that can impact its cash flow. The assessment of this potential impact arising from the volatility of risk factors and their correlations is performed periodically to support the decision making process regarding the risk management strategy, that may incorporate financial instruments, including derivatives.

The portfolio of these financial instruments is monitored on a monthly basis, enabling financial results surveillance and its impact on cash flow.

Considering the nature of Vale's business and operations, the main market risk factors which the Company is exposed to are:

- Foreign exchange and interest rates;
- Product prices and input costs.

Foreign exchange and interest rate risk

The company's cash flow is subjected to volatility of several currencies, as its product are predominantly priced in US dollar, while most of the costs, disbursements and investments are denominated in other currencies, mainly Brazilian real and Canadian dollar.

In order to reduce the potential impact that arises from this currency mismatch, derivatives instruments may be used as a risk mitigation strategy.

Vale implements hedge transactions to protect its cash flow against the market risks that arises from its debt obligations mainly currency volatility. The hedges cover most of the debt denominated in Brazilian reais and Euros. The Company uses swap and forward transactions to convert debt linked to Brazilian real and Euros into US dollar, with volumes, flows and settlement dates similar to those of the debt instruments or sometimes lower, subject to market liquidity conditions.

Hedging instruments with shorter settlement dates are renegotiated through time so that their final maturity matches or becomes closer to the debts` final maturity. At each settlement date, the results of the swap and forward transactions partially offset the impact of the foreign exchange rate in Vale's obligations, contributing to stabilize the cash disbursements in US dollar.

Vale has also exposure to interest rate risks over loans and financings. The US Dollar floating rate debt in the portfolio consists mainly of loans including export pre-payments, commercial banks and multilateral organizations loans. In general, such debt instruments are indexed to the LIBOR (London Interbank Offer Rate) in US dollar.

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Notes to the Financial Statements (Continued)

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33. Risk management (Continued)

Risk of product and input prices

Vale is also exposed to market risks related to volatility in commodity and input prices. In accordance with risk management policy, risk mitigation strategies involving commodities may be used to reduce Vale's cash flow volatility. The risk mitigation strategy may incorporate derivative instruments, predominantly forwards, futures and options.

e) Strategic risk management

Vale addresses the risks related to the execution of established business strategies considering the internal and external environment, as well as risks related to internal procedures and conduct consistent with the Company's values, mission and strategic objectives.

f) Operational risk management

Vale acts managing operational risks primarily guaranteeing the satisfactory management of health, safety and the environment, but also acts preventing material losses, maintenance of its productive capacity and good relationship with communities.

g) Cybernetic risk management

Vale invests in information security technology to mitigate risks of theft, breach or violation of information privacy, availability of its technology assets and data integrity on the Company's systems.

h) Compliance risk management

Vale manage risks associated with the ongoing compliance with legal requirements, standards and other regulations related to the Company's business, including the standards required on reporting and disclosing information to the market.

i) Capital management

The Company's policy aims at establishing a capital structure that will ensure the continuity of the business in the long term. Within this perspective, the Company has been able to maintain a debt profile suitable for its activities, with an amortization well distributed over the years, thus avoiding a concentration in one specific period.

j) Insurance

Vale contracts several types of insurance policies, such as operational risk policy, engineering risks insurance (projects), civil responsibility, life insurance policy for their employees, among others. The coverage of these policies is similar to the ones used in general by the mining industry and is issued in line with the objectives defined by the Company, with the corporate risk management policy and the limitation imposed by the insurance and reinsurance global market.

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Notes to the Financial Statements (Continued)

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33. Risk management (Continued)

Insurance management is performed with the support of focal points in the various operational areas of the Company. Among the management instruments, Vale uses captive reinsurance to balance the price on reinsurance contracts with the market, as well as, enable direct access to key international markets of insurance and reinsurance.

34. Additional information about derivatives financial instruments

The risk of the derivatives portfolio is measured using the delta-Normal parametric approach, and considers that the future distribution of the risk factors and its correlations tends to present the same statistic properties verified in the historical data. The value at risk estimate considers a 95% confidence level for a one-business day time horizon.

The following tables detail the derivatives positions for Vale and its controlled companies as of December 31, 2018, with the following information: notional amount, fair value including credit risk, gains or losses in the period, value at risk and the fair value breakdown by year of maturity.

a) Foreign exchange and interest rates derivative positions

(i) Protection programs for the R$ denominated debt instruments

In order to reduce cash flow volatility, swap transactions were implemented to convert into US$ the cash flows from certain debt instruments denominated in R$ with interest rates linked mainly to CDI, TJLP and IPCA. In those swaps, Vale pays fixed or floating rates in US$ and receives payments in R$ linked to the interest rates of the protected debt instruments.

The swap transactions were negotiated over-the-counter and the protected items are the cash flows from debt instruments linked to R$. These programs transform into US$ the obligations linked to R$ to achieve

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Notes to the Financial Statements (Continued)

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34. Additional information about derivatives financial instruments (Continued)

a currency offset in the company's cash flows, by matching its receivables mainly linked to US$ with its payables.

	Notional					Fair value	Financial Settlement Inflows (Outflows)	Value at Risk	Fair value by year		
Flow	**December 31, 2018**	**December 31, 2017**	**Average interest rate**			**December 31, 2018**	**December 31, 2017**	**December 31, 2018**	**2019**	**2020**	**2021+**
CDI vs. US$ fixed rate swap						(46)	(33)	(28)	(6)	(21)	(12)
Receivable	R$ 1,581	R$ 3,540	CDI	+	8.70%						
Payable	US$ 456	US$ 1.104	Fix		3.12%						
TJLP vs. US$ fixed rate swap						(370)	(381)	(102)	(206)	(21)	(43)
Receivable	R$ 2,303	R$ 2,982	TJLP	+	1.20%						
Payable	US$ 994	US$ 1.323	Fix		1.54%						
TJLP vs. US$ floating rate swap						(56)	(53)	(5)	(36)		
Receivable	R$ 181	R$ 216	TJLP	+	0.84%						
Payable	US$ 107	US$ 123	Libor	+	1.24%						
R$ fixed rate vs. US$ fixed rate swap						(8)	24	10	(19)	46	(63)
Receivable	R$ 1,078	R$ 1,158	Fix		7.05%						
Payable	US$ 351	US$ 385	Fix		0.62%						
IPCA vs. US$ fixed rate swap						(80)	(34)	6	(33)	(10)	(37)
Receivable	R$ 1,315	R$ 1,000	IPCA	+	6.55%						
Payable	US$ 434	US$ 434	Fix		3.98%						
IPCA vs. CDI swap						89	85	1	48	36	
Receivable	R$ 1,350	R$ 1,350	IPCA	+	6.62%						
Payable	R$ 1,350	R$ 1,350	CDI	+	8.59%						

(ii) Protection program for EUR denominated debt instruments

In order to reduce the cash flow volatility, swap transactions were implemented to convert into US$ the cash flows from certain debt instruments issued in Euros by Vale. In those swaps, Vale receives fixed rates in EUR and pays fixed rates in US$.

The swap transactions were negotiated over-the-counter and the protected items are the cash flows from debt instruments linked to EUR. The financial settlement inflows/outflows are offset by the protected items' losses/gains due to EUR/US$ exchange rate.

Flow	Notional December 31, 2018		Notional December 31, 2017		Average contracted rate	Fair value December 31, 2018	Financial Settlement (Outflows) Inflows December 31, 2017	Value at Risk December 31, 2018	Fair value by year 2019	2020	2021+
EUR fixed rate vs. US$ fixed rate swap						**(1)**	**23**	**(3)**	**87**	**(5)**	**9**
Receivable	€	500	€	500	Fix 3.75%						
Payable	US$	613	US$	613	Fix 4.29%						

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Notes to the Financial Statements (Continued)

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34. Additional information about derivatives financial instruments (Continued)

b) Commodities derivative positions

(i) Bunker Oil purchase cash flows protection program

In order to reduce the impact of bunker oil price fluctuation on maritime freight hiring/supply and, consequently, reducing the company's cash flow volatility, bunker oil hedging transactions were implemented, through options contracts.

The derivative transactions were negotiated over-the-counter and the protected item is part of Vale's costs linked to bunker oil prices. The financial settlement inflows/outflows are offset by the protected items' losses/gains due to bunker oil price changes.

Flow	Notional (ton) December 31, 2018	Bought / Sold	Average strike December 31, 2018	Fair value December 31, 2018	Financial settlement Inflows (Outflows) December 31, 2018	Value at Risk December 31, 2018	Fair value by year 2019
Call options	2,100,000	B	520	1	40	1	1
Put options	2,100,000	S	297	(29)	9	9	(29)
Total				**28**	**49**	**10**	**28**

(ii) Protection programs for base metals raw materials and products

In the operational protection program for nickel sales at fixed prices, derivative transactions were implemented to convert into floating prices the contracts with clients that required a fixed price, in order to keep nickel revenues exposed to nickel price fluctuations. Those operations are usually implemented through the purchase of nickel forwards.

In the operational protection program for the purchase of raw materials and products, derivative transactions were implemented, usually through the sale of nickel and copper forward or futures, in order to reduce the mismatch between the pricing period of purchases (concentrate, cathode, sinter, scrap and others) and the pricing period of the final product sales to the clients.

The derivative transactions are negotiated at London Metal Exchange or over-the-counter and the protected item is part of Vale's revenues and costs linked to nickel and copper prices. The financial

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Notes to the Financial Statements (Continued)

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34. Additional information about derivatives financial instruments (Continued)

settlement inflows/outflows are offset by the protected items' losses/gains due to nickel and copper prices changes.

Flow	Notional (ton) December 31, 2018	Notional (ton) December 31, 2017	Average strike Bought/ Sold	Fair value December 31, 2018	Financial settlement Inflows (Outflows) December 31, 2017	Value at Risk December 31, 2018	Fair value by year 2019	2020+
Fixed price sales protection								
Nickel forwards	7,244	9,621	$12,166	(10)	24	7	(8)	(2)
Raw material purchase protection								
Nickel forwards	120	292	$12,242			1		
Copper forwards	81	79	$6,142					
Total				**(10)**	**24**	**8**	**(8)**	**(2)**

c) Freight derivative positions

In order to reduce the impact of maritime freight price volatility on the company's cash flow, freight hedging transactions were implemented, through Forward Freight Agreements (FFAs). The protected item is part of Vale's costs linked to maritime freight spot prices. The financial settlement inflows/outflows of the FFAs are offset by the protected items' losses/gains due to freight price changes.

The FFAs are contracts traded over the counter and can be cleared through a Clearing House, in this case subject to margin requirements.

Flow	Notional (days) December 31, 2018	Notional (days) December 31, 2017	Average strike Bought/ Sold	Fair value December 31, 2018	Financial settlement Inflows (Outflows) December 31, 2017	Value at Risk December 31, 2018	Fair value by year 2019
Freight forwards	480		$4,509	1	(3)		1

d) Wheaton Precious Metals Corp. warrants

The company owns warrants of Wheaton Precious Metals Corp. ("Wheaton"), a Canadian company with stocks negotiated in Toronto Stock Exchange and New York Stock Exchange. Such warrants configure American call options and were received as part of the payment regarding the sale of part of gold payable flows produced as a sub product from Salobo copper mine and some nickel mines in Sudbury.

Flow	Notional (quantity) December 31, 2018	Notional (quantity) December 31, 2017	Bought / Sold	Average strike (US$/barrel) December 31, 2018	Average strike (US$/barrel) December 31, 2017	Fair value December 31, 2018	Financial settlement Inflows (Outflows) December 31, 2017	Value at Risk December 31, 2018	Fair value by year 2023
Call options	10,000,000	10,000,000	B	44	8	39		1	8

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Notes to the Financial Statements (Continued)

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34. Additional information about derivatives financial instruments (Continued)

e) Debentures convertible into shares of Valor da Logística Integrada ("VLI")

The company has debentures in which lenders have the option to convert the outstanding debt into a specified quantity of shares of VLI owned by the company.

Flow	Notional (quantity) December 31, 2018	December 31, 2017	Average Bought / Sold	Fair value December 31, 2018	December 31, 2017	Financial settlement Inflows (Outflows) December 31, 2018	Value at Risk December 31, 2018	Fair value by year 2027
Conversion options	140,239	140,239	S	$8,006	(59)	(57)	4	(59)

f) Options related to Minerações Brasileiras Reunidas S.A. ("MBR") shares

The Company entered into a stock sale and purchase agreement that has options related to MBR shares. Mainly, the Company has the right to buy back this non-controlling interest in the subsidiary. Moreover, under certain restrict and contingent conditions, which are beyond the buyer's control, such as illegality due to changes in the law, the contract has a clause that gives the buyer the right to sell back its stake to the Company. It this case, the Company could settle through cash or shares.

Flow	Notional (quantity, in millions) December 31, 2018	December 31, 2017	Average Bought / Sold	Fair value December 31, 2018	December 31, 2017	Financial settlement Inflows (Outflows) December 31, 2018	Value at Risk December 31, 2018	Fair value by year 2019+
Options	2,139	2,139	B/S	1.7 279	251		15	279

g) Embedded derivatives in contracts

The Company has some nickel concentrate and raw material purchase agreements in which there are provisions based on nickel and copper future prices behaviour. These provisions are considered as embedded derivatives.

Flow	Notional (ton) December 31, 2018	December 31, 2017	Average Bought / Sold	Fair value December 31, 2018	December 31, 2017	Value at Risk December 31, 2018	Fair value by year 2019
Nickel forwards	3,763	2,627	$1,289	2	1	1	2
Copper forwards	2,035	2,718	$6,172				
Total				2	1	1	2

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Notes to the Financial Statements (Continued)

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34. Additional information about derivatives financial instruments (Continued)

The Company has also a natural gas purchase agreement in which there´s a clause that defines that a premium can be charged if the Company's pellet sales prices trade above a pre-defined level. This clause is considered an embedded derivative.

Flow	Notional (volume/month) December 31, 2018	December 31, 2017	Average Bought / strike December 31, 2018	Fair value December 31, 2018	December 31, 2017	Financial settlement Inflows (Outflows) December 31, 2018	Value at Risk December 31, 2018	Fair value by year 2019	2020+
Call options	746,667	746,667	S 233	(1)	(2)		1	(1)	

In August 2014 the Company sold part of its stake in Valor da Logística Integrada ("VLI") to an investment fund managed by Brookfield Asset Management ("Brookfield"). The sales contract includes a clause that establishes, under certain conditions, a minimum return guarantee on Brookfield's investment. This clause is considered an embedded derivative, with payoff equivalent to that of a put option.

Flow	Notional (quantity) December 31, 2018	December 31, 2017	Average Bought / strike December 31, 2018	Fair value December 31, 2018	December 31, 2017	Financial settlement Inflows (Outflows) December 31, 2018	Value at Risk December 31, 2018	Fair value by year 2019	2020+
Put option	1,105,070,863	1,865,070,863	S 3.88	(103)	(133)		10	(103)	

h) Sensitivity analysis of derivative financial instruments

The following tables present the potential value of the instruments given hypothetical stress scenarios for the main market risk factors that impact the derivative positions. The scenarios were defined as follows:

Probable: the probable scenario was based on the risks listed below and instruments were developed based on data from B3, Central Bank of Brazil, London Metals Exchange and Bloomberg

Scenario I: fair value estimated considering a 25% deterioration in the associated risk variables

Scenario II: fair value estimated considering a 50% deterioration in the associated risk variables

Instrument	Instrument's main risk events	Probable	Scenario I	Scenario II
CDI vs. US$ fixed rate swap	R$ depreciation	(46)	(154)	(262)
	US$ interest rate inside Brazil decrease	(46)	(50)	(53)

	Brazilian interest rate increase	(46)	(46)	(46)
Protected item: R$ denominated debt	R$ depreciation	n.a.		

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34. Additional information about derivatives financial instruments (Continued)

Instrument	Instrument's main risk events	Probable	Scenario I	Scenario II
TJLP vs. US$ fixed rate swap	R$ depreciation	(370)	(614)	(858)
	US$ interest rate inside Brazil decrease	(370)	(378)	(386)
	Brazilian interest rate increase	(370)	(379)	(388)
	TJLP interest rate decrease	(370)	(379)	(388)
Protected item: R$ denominated debt	R$ depreciation	n.a.		
TJLP vs. US$ floating rate swap	R$ depreciation	(56)	(82)	(108)
	US$ interest rate inside Brazil decrease	(56)	(56)	(57)
	Brazilian interest rate increase	(56)	(56)	(57)
	TJLP interest rate decrease	(56)	(56)	(57)
Protected item: R$ denominated debt	R$ depreciation	n.a.		
R$ fixed rate vs. US$ fixed rate swap	R$ depreciation	(8)	(85)	(161)
	US$ interest rate inside Brazil decrease	(8)	(18)	(28)
	Brazilian interest rate increase	(8)	(25)	(40)
Protected item: R$ denominated debt	R$ depreciation	n.a.		
IPCA vs. US$ fixed rate swap	R$ depreciation	(80)	(194)	(308)
	US$ interest rate inside Brazil decrease	(80)	(83)	(87)
	Brazilian interest rate increase	(80)	(87)	(93)
	IPCA index decrease	(80)	(84)	(87)
Protected item: R$ denominated debt	R$ depreciation	n.a.		
IPCA vs. CDI swap	Brazilian interest rate increase	89	71	55
	IPCA index decrease	89	79	70
Protected item: R$ denominated debt linked to IPCA	IPCA index decrease	n.a.	(79)	(70)
EUR fixed rate vs. US$ fixed rate swap	EUR depreciation	(1)	(170)	(340)
	Euribor increase	(1)	(6)	(11)
	US$ Libor decrease	(1)	(16)	(33)
Protected item: EUR denominated debt	EUR depreciation	n.a.	170	340
Bunker Oil protection				
Options	Bunker Oil price decrease	(28)	(126)	(283)
Protected item: Part of costs linked to bunker oil prices	Bunker Oil price decrease	n.a.	126	283
Maritime Freight protection				
Forwards	Freight price decrease	1	(1)	(3)
Protected item: Part of costs linked to maritime freight prices	Freight price decrease	n.a.	1	3
Nickel sales fixed price protection				

Forwards	Nickel price decrease	(10)	(29)	(48)
Protected item: Part of nickel revenues with fixed prices	Nickel price fluctuation	n.a.	29	48
Purchase protection program				
Nickel forwards	Nickel price increase			
Protected item: Part of costs linked to nickel prices	Nickel price increase	n.a.		
Copper forwards	Copper price increase			
Protected item: Part of costs linked to copper prices	Copper price increase	n.a.		
Wheaton Precious Metals Corp. warrants	WPM stock price decrease	8	2	
Conversion options VLI	VLI stock value increase	(59)	(94)	(138)
Options MBR	Iron ore price decrease	279	186	105

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Notes to the Financial Statements (Continued)

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34. Additional information about derivatives financial instruments (Continued)

Instrument		Main risks	Probable	Scenario I	Scenario II
Embedded derivatives (nickel)	Raw material purchase	Nickel price increase	2	(8)	(19)
Embedded derivatives (copper)	Raw material purchase	Copper price increase		(3)	(6)
Embedded derivatives	Gas purchase	Pellet price increase	(1)	(2)	(5)
Embedded derivatives return (VLI)	Guaranteed minimum	VLI stock value decrease	(103)	(229)	(442)

i) Financial counterparties' ratings

The transactions of derivative instruments, cash and cash equivalents as well as investments are held with financial institutions whose exposure limits are periodically reviewed and approved by the delegated authority. The financial institutions' credit risk is performed through a methodology that considers, among other information, ratings provided by international rating agencies.

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34. Additional information about derivatives financial instruments (Continued)

The table below presents the ratings published by agencies Moody's and S&P regarding the main financial institutions that we had outstanding positions as of December 31, 2018.

Long term ratings by counterparty	Moody's	S&P
ANZ Australia and New Zealand Banking	Aa3	AA
Banco ABC	Ba3	BB
Banco Bradesco	Ba3	BB
Banco do Brasil	Ba3	BB
Banco de Credito del Peru	Baa1	BBB+
Banco do Nordeste	Ba3	BB
Banco Safra	Ba3	BB
Banco Santander	A2	A
Banco Votorantim	Ba3	BB
Bank of America	A3	A
Bank of China	A1	A
Bank of Mandiri	Baa2	BB+
Bank of Nova Scotia	Aa2	A+
Bank Rakyat	Baa2	BB+
Bank of Tokyo Mitsubishi UFJ	A1	A
Banpará		BB
Barclays	Baa3	BBB
BBVA	A3	A
BNP Paribas	Aa3	A
BTG Pactual	Ba3	BB
Caixa Economica Federal	Ba3	BB
Canadian Imperial Bank	Aa2	A+
China Construction Bank	A1	A
CIMB Bank	A3	A
Citigroup	Baa1	BBB+
Credit Agricole	A1	A+
Credit Suisse	Baa2	BBB+
Deutsche Bank	A3	BBB+
Goldman Sachs	A3	BBB+
HSBC	A2	A
Intesa Sanpaolo Spa	Baa1	BBB
Itaú Unibanco	Ba3	BB
JP Morgan Chase & Co	A2	A
Macquarie Group Ltd	A3	BBB

Mega Int. Commercial Bank	A1	A
Mizuho Financial	A1	A
Morgan Stanley	A3	BBB+
National Australia Bank NAB	Aa3	AA
National Bank of Canada	Aa3	A
National Bank of Oman	Baa3	
Natixis	A1	A+
Rabobank	Aa3	A+
Royal Bank of Canada	Aa2	AA
Societe Generale	A1	A
Standard Bank Group	Ba1	
Standard Chartered	A2	BBB+
Sumitomo Mitsui Financial	A1	A
UBS	Aa3	A
Unicredit	Baa1	BBB

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34. Additional information about derivatives financial instruments (Continued)

j) Market curves

(i) Products

Nickel

Maturity	Price (US$/ton)	Maturity	Price (US$/ton)	Maturity	Price (US$/ton)
SPOT	10,595	JUN19	10,777	DEC19	10,943
JAN19	10,637	JUL19	10,809	DEC20	11,231
FEB19	10,663	AUG19	10,838	DEC21	11,516
MAR19	10,692	SEP19	10,865	DEC22	11,799
APR19	10,720	OCT19	10,891		
MAY19	10,749	NOV19	10,916		

Copper

Maturity	Price (US$/lb)	Maturity	Price (US$/lb)	Maturity	Price (US$/lb)
SPOT	2.63	JUN19	2.71	DEC19	2.70
JAN19	2.71	JUL19	2.70	DEC20	2.70
FEB19	2.71	AUG19	2.70	DEC21	2.69
MAR19	2.71	SEP19	2.70	DEC22	2.70
APR19	2.71	OCT19	2.70		
MAY19	2.71	NOV19	2.70		

Bunker Oil

Maturity	Price (US$/ton)	Maturity	Price (US$/ton)	Maturity	Price (US$/ton)
SPOT	334	JUN19	307	DEC19	270
JAN19	327	JUL19	302	DEC20	267
FEB19	322	AUG19	297	DEC21	238
MAR19	319	SEP19	291	DEC22	213
APR19	315	OCT19	283		
MAY19	311	NOV19	276		

Maritime Freight (Capesize 5TC)

Maturity	Maturity	Maturity

	Price (US$/day)		Price (US$/day)		Price (US$/day)
SPOT	14,797	JUN19	15,096	DEC19	20,350
JAN19	16,175	JUL19	16,817	Cal 2020	15,613
FEB19	12,225	AUG19	16,817	Cal 2021	13,350
MAR19	13,233	SEP19	16,817	Cal 2022	13,433
APR19	13,521	OCT19	20,350		
MAY19	13,896	NOV19	20,350		

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34. Additional information about derivatives financial instruments (Continued)

(ii) Foreign exchange and interest rates

US$ Brazil Interest Rate

Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)
02/01/19	4.24	12/02/19	3.61	04/01/22	3.68
03/01/19	3.83	01/02/20	3.60	07/01/22	3.73
04/01/19	3.55	04/01/20	3.63	10/03/22	3.69
05/02/19	3.50	07/01/20	3.64	01/02/23	3.73
06/03/19	3.47	10/01/20	3.64	04/03/23	3.74
07/01/19	3.48	01/04/21	3.67	07/03/23	3.72
08/01/19	3.52	04/01/21	3.66	10/02/23	3.74
09/02/19	3.47	07/01/21	3.65	01/02/24	3.82
10/01/19	3.53	10/01/21	3.67	07/01/24	3.73
11/01/19	3.60	01/03/22	3.67	01/02/25	3.85

US$ Interest Rate

Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)
1M	2.52	6M	2.78	11M	2.78
2M	2.62	7M	2.78	12M	2.78
3M	2.79	8M	2.78	2Y	2.71
4M	2.79	9M	2.78	3Y	2.67
5M	2.79	10M	2.78	4Y	2.69

TJLP

Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)
02/01/19	6.98	12/02/19	6.98	04/01/22	6.98
03/01/19	6.98	01/02/20	6.98	07/01/22	6.98
04/01/19	6.98	04/01/20	6.98	10/03/22	6.98
05/02/19	6.98	07/01/20	6.98	01/02/23	6.98
06/03/19	6.98	10/01/20	6.98	04/03/23	6.98

07/01/19	6.98	01/04/21	6.98	07/03/23	6.98
08/01/19	6.98	04/01/21	6.98	10/02/23	6.98
09/02/19	6.98	07/01/21	6.98	01/02/24	6.98
10/01/19	6.98	10/01/21	6.98	07/01/24	6.98
11/01/19	6.98	01/03/22	6.98	01/02/25	6.98

BRL Interest Rate

Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)
02/01/19	6.41	12/02/19	6.53	04/01/22	8.17
03/01/19	6.42	01/02/20	6.55	07/01/22	8.35
04/01/19	6.43	04/01/20	6.70	10/03/22	8.43
05/02/19	6.44	07/01/20	6.91	01/02/23	8.53
06/03/19	6.44	10/01/20	7.16	04/03/23	8.64
07/01/19	6.45	01/04/21	7.36	07/03/23	8.70
08/01/19	6.46	04/01/21	7.59	10/02/23	8.79
09/02/19	6.46	07/01/21	7.77	01/02/24	8.86
10/01/19	6.49	10/01/21	7.95	07/01/24	8.98
11/01/19	6.52	01/03/22	8.08	01/02/25	9.1

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34. Additional information about derivatives financial instruments (Continued)

Implicit Inflation (IPCA)

Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)
02/01/19	3.74	12/02/19	3.87	04/01/22	4.03
03/01/19	3.75	01/02/20	3.88	07/01/22	4.12
04/01/19	3.77	04/01/20	3.81	10/03/22	4.11
05/02/19	3.78	07/01/20	3.88	01/02/23	4.14
06/03/19	3.78	10/01/20	3.90	04/03/23	4.18
07/01/19	3.79	01/04/21	3.93	07/03/23	4.19
08/01/19	3.79	04/01/21	3.98	10/02/23	4.22
09/02/19	3.79	07/01/21	4.01	01/02/24	4.25
10/01/19	3.83	10/01/21	4.04	07/01/24	4.30
11/01/19	3.85	01/03/22	4.05	01/02/25	4.35

EUR Interest Rate

Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)
1M	(0.41)	6M	(0.28)	11M	(0.24)
2M	(0.38)	7M	(0.26)	12M	(0.23)
3M	(0.36)	8M	(0.25)	2Y	(0.17)
4M	(0.32)	9M	(0.25)	3Y	(0.08)
5M	(0.29)	10M	(0.24)	4Y	0.05

CAD Interest Rate

Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)	Maturity	Rate (% p.a.)
1M	2.30	6M	2.34	11M	1.24
2M	2.29	7M	2.00	12M	1.13
3M	2.31	8M	1.74	2Y	2.29
4M	2.32	9M	1.54	3Y	2.31
5M	2.33	10M	1.37	4Y	2.35

Currencies	Ending rates				
CAD/US$	0.7341	US$/BRL	3.8748	EUR/US$	1.1452