

Vale S.A.
Form 6-K
March 28, 2019
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United States
Securities and Exchange Commission

Washington, D.C. 20549

FORM 6-K

Report of Foreign Private Issuer

Pursuant to Rule 13a-16 or 15d-16

of the

Securities Exchange Act of 1934

For the month of

March 2018

Vale S.A.

Praia de Botafogo, No 186
Botafogo, 22250-145 - Rio de Janeiro RJ - Brasil

(Address of principal executive office)

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(Indicate by check mark whether the registrant files or will file annual reports under cover of Form 20-F or Form 40-F.)

(Check One) Form 20-F Form 40-F

(Indicate by check mark if the registrant is submitting the Form 6-K in paper as permitted by Regulation S-T Rule 101(b)(1))

(Check One) Yes No

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(Check One) Yes No

(Indicate by check mark whether the registrant by furnishing the information contained in this Form is also thereby furnishing information to the Commission pursuant to Rule 12g3-2(b) under the Securities Exchange Act of 1934.)

(Check One) Yes No

(If Yes is marked, indicate below the file number assigned to the registrant in connection with Rule 12g3-2(b). 82- .)

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Financial Statements

December 31, 2018

IFRS in US\$

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The accompanying financial statements presented in U.S. dollars were prepared in accordance with International Financial Reporting Standards - IFRS and are unaudited. When we file our annual report on Form 20-F with the U.S. Securities and Exchange Commission, which is due on April 30, 2019, we expect to include a report of our independent auditor, prepared in accordance with the standards of the Public Company Accounting Oversight Board (PCAOB), on the consolidated financial statements included in such annual report and on the effectiveness of our internal control over financial reporting as of December 31, 2018. As a result of the developments described in note 3 to the accompanying financial statements, our assessment of the effectiveness of our internal control over financial reporting is not complete as of the date of publication of the accompanying financial statements.

On March 27, 2019, we published consolidated financial statements presented in Brazilian reais, in accordance with International Financial Reporting Standards, with an audit report prepared under International Standards of Auditing (ISA) by our independent auditor KPMG, and a free translation was furnished to the SEC on a current report on Form 6-K on the same date.

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Vale S.A. Financial Statements

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Table of Contents**Consolidated Income Statement**

In millions of United States dollars, except earnings per share data

| | Notes | Year ended December 31 | | |
|--|---------------|------------------------|----------------|----------------|
| | | 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: | | | | |

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| | | | | |
|--|---|------|------|------|
| 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.

Table of Contents**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.

Table of Contents**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) |

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| | | | |
|--|--------------|--------------|--------------|
| 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.

Table of Contents**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 |

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| | | | |
|--|------|---------------|---------------|
| 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.

Table of Contents**Consolidated Statement of Changes in Equity**

In millions of United States dollars

| | Share capital | Results on conversion of shares | Capital reserve | Net ownership changes in subsidiaries | Profit reserves | Treasury stocks | Unrealized fair value gain (losses) | Cumulative translation adjustments | Retained earnings | Equity attributable to Vale's stockholders | Equity attributable to noncontrolling interest |
|--|---------------|---------------------------------|-----------------|---------------------------------------|-----------------|-----------------|-------------------------------------|------------------------------------|-------------------|--|--|
| Balance at December 31, 2015 | 61,614 | (152) | | (702) | 985 | (1,477) | (992) | (25,687) | | 33,589 | |
| Net income (loss) | | | | | | | | | 3,982 | 3,982 | |
| Other comprehensive income: | | | | | | | | | | | |
| Retirement benefit obligations | | | | | | | (70) | | | | (70) |
| Cash flow hedge | | | | | | | 7 | | | | 7 |
| Available-for-sale financial instruments | | | | | | | | 1 | | | 1 |
| Translation adjustments | | | | | 195 | | (93) | 2,387 | 102 | 2,591 | |
| Transactions with stockholders: | | | | | | | | | | | |
| Dividends and interest on capital of Vale's stockholders | | | | | | | | | (1,061) | (1,061) | |
| Dividends of noncontrolling interest | | | | | | | | | | | |
| Acquisitions and disposal of noncontrolling interest | | | | 3 | | | | | | | 3 |
| Capitalization of noncontrolling interest advances | | | | | | | | | | | |
| Appropriation to undistributed retained earnings | | | | | 3,023 | | | | (3,023) | | |
| Balance at December 31, 2016 | 61,614 | (152) | | (699) | 4,203 | (1,477) | (1,147) | (23,300) | | 39,042 | |

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| | | | | | | | | | | |
|--|---------------|--------------|--------------|--------------|--------------|----------------|----------------|-----------------|--------------|---------------|
| Net income | | | | | | | | | 5,507 | 5,507 |
| Other comprehensive income: | | | | | | | | | | |
| Retirement benefit obligations | | | | | | | | (46) | | (46) |
| Net investments hedge | | | | | | | | (95) | | (95) |
| Translation adjustments | | | | (158) | | 10 | | 447 | | 299 |
| Transactions with stockholders: | | | | | | | | | | |
| Dividends and interest on capital of Vale's stockholders | | | | (658) | | | | (1,475) | | (2,133) |
| Dividends of noncontrolling interest | | | | | | | | | | |
| Acquisitions and disposal of noncontrolling interest | | | | (255) | | | | | | (255) |
| Capitalization of noncontrolling interest advances | | | | | | | | | | |
| Appropriation to undistributed retained earnings | | | | 4,032 | | | | (4,032) | | |
| Merger of Valepar (note 30) | | | 1,139 | | | | | | | 1,139 |
| Balance at December 31, 2017 | 61,614 | (152) | 1,139 | (954) | 7,419 | (1,477) | (1,183) | (22,948) | | 43,458 |
| Net income | | | | | | | | | 6,860 | 6,860 |
| Other comprehensive income: | | | | | | | | | | |
| Retirement benefit obligations | | | | (16) | | | | 41 | | 25 |
| Fair value adjustment to investment in equity securities | | | | | | | | 60 | | 60 |
| Net investments hedge | | | | | | | | (543) | | (543) |
| Translation adjustments | | | | (1,257) | | 49 | | (1,613) | | (2,821) |
| Transactions with stockholders: | | | | | | | | | | |
| Dividends and interest on capital of Vale's stockholders | | | | | | | | | (2,054) | (2,054) |
| Dividends of noncontrolling interest | | | | | | | | | | |

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| | | | | | | | | | |
|--|---------------|--------------|--------------|--------------|---------------|----------------|----------------|-----------------|---------------|
| Acquisitions and disposal of noncontrolling interest | | | | | | | | | |
| Capitalization of noncontrolling interest advances | | | | | | | | | |
| Appropriation to undistributed retained earnings | | | | | 4,806 | | | (4,806) | |
| Share buyback program | | | | | | (1,000) | | | (1,000) |
| Balance at December 31, 2018 | 61,614 | (152) | 1,139 | (970) | 10,968 | (2,477) | (1,033) | (25,104) | 43,985 |

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

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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 by the Board of Directors on March 27, 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.

The exchange rates used by the Company to translate its foreign operations are as follows:

| | 2018 | Closing rate 2017 | 2016 | 2018 | Average rate for the year ended 2017 | 2016 |
|-------------------------|--------|----------------------|--------|--------|---|--------|
| US Dollar (US\$) | 3.8748 | 3.3080 | 3.2591 | 3.6558 | 3.1925 | 3.4833 |
| Canadian dollar (CAD) | 2.8451 | 2.6344 | 2.4258 | 2.8190 | 2.4618 | 2.6280 |
| Euro (EUR or) | 4.4390 | 3.9693 | 3.4384 | 4.3094 | 3.6088 | 3.8543 |

Table of Contents**Notes to the Financial Statements**

Expressed in millions of United States dollar, unless otherwise stated

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 policies 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 IFRS 9 categories. The reclassification of the financial instruments of the Company on January 1, 2018 were as follows:

| | Measurement category | | | Carrying amount | | Difference |
|-------------------------|----------------------|--------|--------|-----------------|--|------------|
| | IAS 39 | IFRS 9 | IAS 39 | IFRS 9 | | |
| Financial assets | | | | | | |
| Current | | | | | | |

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| | | | | |
|---------------------------------------|-----------------------|----------------|--------|--------|
| Financial investments | Loans and receivables | FVTPL | 18 | 18 |
| Derivative financial instruments | | 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 | 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 | 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 | 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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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.

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.

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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.

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 |

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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;

(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.

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.

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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.

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.

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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.

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.

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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).

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.

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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.

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.

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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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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.

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 | | | | | | Adjusted EBITDA |
|--|------------------------------|--|--|-------------------------|--|--|-----------------|
| | Net operating revenue | Cost of goods sold and services rendered | Selling, administrative and other operating expenses | Research and evaluation | Pre operating and operational stoppage | Dividends received and interest from associates and joint ventures | |
| 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 |
| Ferrous alloys 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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| | Year ended December 31, 2017 | | | | | | Adjusted EBITDA |
|---------------------------------------|------------------------------|--|--|-------------------------|--|--|-----------------|
| | Net operating revenue | Cost of goods sold and services rendered | Selling, administrative and other operating expenses | Research and evaluation | Pre operating and operational stoppage | Dividends received and interest from associates and joint ventures | |
| 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 |
| Ferrous alloys 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 |

| | Year ended December 31, 2016 | | | | | | Adjusted EBITDA |
|-------------------------|------------------------------|--|--|-------------------------|--|--|-----------------|
| | Net operating revenue | Cost of goods sold and services rendered | Selling, administrative and other operating expenses | Research and evaluation | Pre operating and operational stoppage | Dividends received and interest from associates and joint ventures | |
| 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 |

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| | | | | | | | |
|---------------------------------------|---------------|-----------------|--------------|--------------|--------------|------------|---------------|
| 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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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

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| | 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 |

| | 2018 | | Year ended December 31 | | | 2016 | | Depreciation, depletion and amortization |
|------------------|--|-------------------|--|-------------------|--|--|-------------------|--|
| | Capital expenditures (ii) Sustaining capital | Project execution | Capital expenditures (ii) Sustaining capital | Project execution | Depreciation, depletion and amortization | Capital expenditures (ii) Sustaining capital | Project execution | |
| Ferrous minerals | 1,569 | 823 | 1,194 | 1,485 | 1,709 | 891 | 2,355 | 1,533 |
| Coal | 132 | 24 | 73 | 45 | 296 | 149 | 463 | 185 |
| Base metals | 1,189 | 34 | 960 | 50 | 1,590 | 1,045 | 12 | 1,636 |
| Others | 6 | 7 | 4 | 20 | 113 | 3 | 33 | 133 |
| Total | 2,896 | 888 | 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.

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Expressed in millions of United States dollar, unless otherwise stated

d) Investment in associates and joint ventures, intangible and property, plant and equipment by geographic area

| | December 31, 2018 | | | December 31, 2017 | | | Total | Total |
|------------------------------------|--|--------------|-------------------------------|--|--------------|-------------------------------|---------------|---------------|
| | Investments in associates and joint ventures | Intangible | Property, plant and equipment | Investments in associates and joint ventures | Intangible | Property, plant and equipment | | |
| Brazil | 2,604 | 5,875 | 29,226 | 2,993 | 6,231 | 34,209 | 37,705 | 43,433 |
| Canada | | 1,956 | 9,905 | | 2,118 | 10,967 | 11,861 | 13,085 |
| Americas, except Brazil and Canada | 247 | | | 200 | | | 247 | 200 |
| Europe | | | 366 | | | 394 | 366 | 394 |
| Indonesia | | 1 | 2,776 | | | 2,787 | 2,777 | 2,787 |
| Asia, except Indonesia | 374 | | 1,025 | 375 | | 1,100 | 1,399 | 1,475 |
| Australia | | | | | | 45 | | 45 |
| New Caledonia | | | 2,796 | | | 2,965 | 2,796 | 2,965 |
| Mozambique | | 130 | 1,459 | | 143 | 1,532 | 1,589 | 1,675 |
| Oman | | | 829 | | 1 | 868 | 829 | 869 |
| Other regions | | | 3 | | | 11 | 3 | 11 |
| Total | 3,225 | 7,962 | 48,385 | 3,568 | 8,493 | 54,878 | 59,572 | 66,939 |

e) Net operating revenue by geographic area

| | Year ended December 31, 2018 | | | | Total |
|---|------------------------------|--------------|--------------|------------|---------------|
| | Ferrous minerals | Coal | Base metals | Others | |
| 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 |

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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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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.

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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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

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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 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.

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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.

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.

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Expressed in millions of United States dollar, unless otherwise stated

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 |

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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Expressed in millions of United States dollar, unless otherwise stated

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 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.

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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.

9. Basic and diluted earnings per share

The basic and diluted earnings per share are presented below:

| | 2018 | Year ended December 31 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 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.

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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 .

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 |

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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.

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 |

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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.

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 |

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| | | | |
|--|--------------|--------------|----------------|
| 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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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.

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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.

15. Subsidiaries

The significant consolidated entities in each business segment are as follows:

| | Location | Main activity/Business | % Ownership | % Voting capital | % Noncontrolling 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 Calédonie 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 | % Noncontrolling interest |
|---|----------|------------------------|-------------|------------------|---------------------------|
| Direct and indirect subsidiaries | | | | | |
| Compañía 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% |

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Notes to the Financial Statements

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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.

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.

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Expressed in millions of United States dollar, unless otherwise stated

16. Investments in associates and joint ventures

The significant non-consolidated entities of the Company are as follows:

| | Main | | | % Noncontrolling interest | |
|---|-------------|-------------------|-------------|---------------------------|-------|
| | Location | activity/Business | % Ownership | % Voting capital | |
| 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% |

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) |

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| | | | | | | |
|---|--------------|--------------|--------------|--------------|--------------|--------------|
| 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.

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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.

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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Investments in associates and joint ventures (continued)

| Associates and joint ventures | % ownership | % voting capital | Investments in associates and joint ventures | | | Equity results in the income statement | | | Dividends received | | |
|---|-------------|------------------|--|-------------------|--------------|--|------------|------------|--------------------|------------|--|
| | | | December 31, 2018 | December 31, 2017 | 2018 | 2017 | 2016 | 2018 | 2017 | 2016 | |
| Ferrous minerals | | | | | | | | | | | |
| Baovale Mineração S.A. Companhia | 50.00 | 50.00 | 23 | 26 | 5 | 7 | 9 | 1 | 1 | | |
| Coreano-Brasileira de Pelotização Companhia | 50.00 | 50.00 | 104 | 89 | 69 | 50 | 17 | 32 | 19 | 26 | |
| Hispano-Brasileira de Pelotização (i) Companhia | 50.89 | 51.00 | 83 | 82 | 55 | 41 | 15 | 23 | 16 | 27 | |
| Ítalo-Brasileira de Pelotização (i) Companhia | 50.90 | 51.00 | 81 | 80 | 60 | 40 | 16 | 32 | 17 | 9 | |
| Nipo-Brasileira de Pelotização (i) Companhia | 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 | 98 | 309 | 245 | 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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c) Summarized financial information

The summarized financial information about relevant associates and joint-ventures for the Company are as follows:

| | | | | | | |
|--------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Current assets | 186 | 693 | 964 | 263 | 1,104 | 679 |
| Total assets | 1,124 | 3,755 | 1,260 | 2,089 | 1,496 | 4,617 |
| Current liabilities | 83 | 970 | 437 | 359 | 203 | 544 |
| Total liabilities | 241 | 3,755 | 439 | 1,058 | 229 | 2,339 |

| | | | | | | |
|--------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Current assets | 137 | 759 | 760 | 309 | 1,072 | 738 |
| Total assets | 1,337 | 4,471 | 1,070 | 2,372 | 1,494 | 4,910 |
| Current liabilities | 86 | 1,060 | 301 | 454 | 226 | 537 |
| Total liabilities | 299 | 3,947 | 306 | 1,298 | 226 | 2,336 |

(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.

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.

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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.

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 | VNC | Vale Moçambique S.A. | 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 | | |

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| | | | | | | |
|---|--------------|------------|-----------|----------------|-----------|------------|
| 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 | PTVI | VNC | Vale Moçambique S.A. | Compañia Mineradora Miski Mayo S.A.C. (i) | Others (ii) | Total |
| Current assets | 408 | 394 | 251 | 381 | 78 | | |
| Non-current assets | 3,041 | 1,586 | 2,046 | 1,653 | 436 | | |
| Related parties - Stockholders | 591 | 147 | 115 | 253 | 6 | | |
| Total assets | 4,040 | 2,127 | 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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| | December 31, 2016 | | | | | | Total |
|---|-------------------|----------|-------------|-------------------------|---|--------------|------------|
| | MBR | PTVI | VNC | Vale Moçambique S.A. | Compañia Mineradora Miski Mayo S.A.C. (i) | Others (ii) | |
| Net income (loss) | 400 | 2 | (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 |

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| | | | | | |
|-------------------------------------|--------------|--------------|------------|------------|--------------|
| 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 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.

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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 |

19. Property, plant and equipment

Changes in property, plant and equipment are as follows:

| | Land | Building | 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 | 6,119 | 54,878 |
| Cost | 718 | 19,163 | 18,292 | 12,840 | 17,471 | 12,461 | 6,119 | 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 | 6,119 | 54,878 |

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| | | | | | | | | |
|--|------------|---------------|---------------|--------------|--------------|--------------|--------------|---------------|
| 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.

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).

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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.

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.

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20. Impairment and onerous contracts

The impairment losses (reversals) recognized in the year are presented below:

| Segments by class of assets | Assets or cash-generating unit | 2018 | Income statement | |
|---|--------------------------------|------------|------------------------|--------------|
| | | | Impairment (reversals) | |
| | | | 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 Calédonie (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 |

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.

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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 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.

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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.

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.**

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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.

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.

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.

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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.

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.

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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 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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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:

| | Amortized cost | December 31, 2018 At fair value through OCI | December 31, 2018 At fair value through profit or loss | Total | Loans and receivables or amortized cost | December 31, 2017 At fair value through profit or loss | Total |
|-------------------------------------|-------------------|---|--|---------------|--|--|---------------|
| Financial assets | | | | | | | |
| 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 |

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| | | | | | | |
|---------------------------------------|---------------|--------------|---------------|---------------|--------------|---------------|
| 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 |

The classification of financial assets and liabilities by currencies are as follows:

| | December 31, 2018 | | | | | Total |
|---------------------------------------|-------------------|---------------|------------|--------------|-------------------|---------------|
| | R\$ | US\$ | CAD | EUR | Others currencies | |
| Financial assets | | | | | | |
| 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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| | December 31, 2017 | | | | | |
|---------------------------------------|-------------------|---------------|------------|--------------|-------------------|---------------|
| | R\$ | US\$ | CAD | EUR | Others currencies | Total |
| Financial assets | | | | | | |
| 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.

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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.

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.

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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

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| | | | | | | |
|---------------------------------------|--------------|------------|--------------|--------------|------------|--------------|
| 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 |

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:

| | Derivative financial instruments | |
|--|----------------------------------|-----------------------|
| | Financial assets | 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 |

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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.

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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25. Derivative financial instruments

a) Derivatives effects on statement of financial position

| | December 31, 2018 | | December 31, 2017 | |
|---|-------------------|-------------|-------------------|-------------|
| | Current | Non-current | Current | Non-current |
| Assets | | | | |
| 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 |

| | December 31, 2018 | | December 31, 2017 | |
|---|-------------------|-------------|-------------------|-------------|
| | Current | Non-current | Current | Non-current |
| Liabilities | | | | |
| 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 |

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 |

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| | 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) |
| | | | |
| | 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.

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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.

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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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 |

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.

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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 .

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.

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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.

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.

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.

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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 |

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 | | | | | |
|---|--------------------------|---|----------------|--------------------------|---|----------------|
| | Overfunded pension plans | December 31, 2018 Underfunded pension plans | Other benefits | Overfunded pension plans | December 31, 2017 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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| | Foreign plan | | | | | |
|---|--------------------------|--|----------------|--------------------------|--|----------------|
| | Overfunded pension plans | December 31, 2018 Underfunded pension plans | Other benefits | Overfunded pension plans | December 31, 2017 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 | | | | | |
|---|--------------------------|--|----------------|--------------------------|--|----------------|
| | Overfunded pension plans | December 31, 2018 Underfunded pension plans | Other benefits | Overfunded pension plans | December 31, 2017 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) |

iv. Costs recognized in the income statement

| | Year ended December 31 | | | | | | | | |
|---|--------------------------|---------------------------|----------------|--------------------------|---------------------------|----------------|--------------------------|---------------------------|----------------|
| | 2018 | | | 2017 | | | 2016 | | |
| | Overfunded pension plans | Underfunded pension plans | Other benefits | Overfunded pension plans | Underfunded pension plans | Other benefits | Overfunded pension plans | 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 | Overfunded pension plans | Underfunded pension plans | Other benefits | Overfunded pension plans | 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) | (271) | (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) |

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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 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 | | | | | |
|---|---------------------------------|--|-----------------------|---------------------------------|--|-----------------------|
| | Overfunded pension plans | December 31, 2018 Underfunded pension plans | Other benefits | Overfunded pension plans | December 31, 2017 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% |

| | 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% |

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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:

| | Overfunded pension plans | December 31, 2018 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 | 8.98% | 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.

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 |

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| | | | | | | |
|---|--------------|-----------|------------|--------------|--------------|--------------|
| 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 | 5,827 | 72 |
| 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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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.

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.

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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 is 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.

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.

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.

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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 | | |
|--|--------------------------|------------|---------------|
| | ON | PNE | Total |
| Stockholders | | | |
| 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 |

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| | | | |
|--|----------------------|-----------|----------------------|
| 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.

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.

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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.

The remuneration paid to stockholders based on the 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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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.

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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.

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).

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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 | 3,185,653,000 | 1,838,235,414 | 173,543,667 | 5,197,432,081 |
| PNA/PNE | 1,967,721,926 | (1,967,721,914) | | 12 |
| | 5,153,374,926 | (129,486,500) | 173,543,667 | 5,197,432,093 |
| Shares in treasury | | | | |
| ON | 31,535,402 | 55,507,287 | | 87,042,689 |
| PNA | 59,405,792 | (59,405,792) | | |
| Total issued shares | 5,244,316,120 | (133,385,005) | 173,543,667 | 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 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.

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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.

Information about related party transactions and effects on the financial statements is set out below:

a) Transactions with related parties

| | Year ended December 31 | | | Total |
|-----------------------------|------------------------|------------|--------------------|----------------|
| | 2018 | | | |
| | Joint Ventures | Associates | Major stockholders | |
| Net operating revenue | 352 | 309 | 207 | 868 |
| Cost and operating expenses | (2,269) | (39) | | (2,308) |
| Financial result | 115 | | (115) | |

| | Year ended December 31 | | | Total |
|-----------------------------|------------------------|------------|--------------------|----------------|
| | 2017 | | | |
| | Joint Ventures | Associates | Major stockholders | |
| 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.

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 |

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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.

c) The key management personnel remuneration

| | 2018 | Year ended December 31 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.

Purchase obligations - Mainly relate to agreements for the acquisition of fuel, energy and the acquisition of raw materials and services.

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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.

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.

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(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.

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 products 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 arise 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 debt's 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.

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.

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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.

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.

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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 a currency offset in the company's cash flows, by matching its receivables - mainly linked to US\$ - with its payables.

| Flow | Notional | Index | Fair value | Financial Settlement Inflows (Outflows) | Value at Risk | Fair value by year | | |
|------|----------|-------|------------|---|---------------|--------------------|------|-------|
| | | | | | | 2019 | 2020 | 2021+ |

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| | December 31, 2018 | December 31, 2017 | Average rate | December 31, 2018 | December 31, 2017 | December 31, 2018 | December 31, 2018 | | | |
|--|----------------------|----------------------|-----------------|----------------------|----------------------|----------------------|----------------------|----|-------|------|
| CDI vs. US\$ fixed rate swap | | | | | | | | | | |
| Receivable | R\$ 1,581 | R\$ 3,540 | CDI | 98.70% | (46) | (33) | (28) | 6 | (13) | (21) |
| Payable | US\$ 456 | US\$ 1,104 | Fix | 3.12% | | | | | | (12) |
| TJLP vs. US\$ fixed rate swap | | | | | | | | | | |
| Receivable | R\$ 2,303 | R\$ 2,982 | TJLP + | 1.20% | (370) | (381) | (102) | 20 | (306) | (21) |
| Payable | US\$ 994 | US\$ 1,323 | Fix | 1.54% | | | | | | (43) |
| TJLP vs. US\$ floating rate swap | | | | | | | | | | |
| Receivable | R\$ 181 | R\$ 216 | TJLP + | 0.84% | (56) | (53) | (5) | 2 | (56) | |
| Payable | US\$ 107 | US\$ 123 | Libor + | -1.24% | | | | | | |
| R\$ fixed rate vs. US\$ fixed rate swap | | | | | | | | | | |
| Receivable | R\$ 1,078 | R\$ 1,158 | Fix | 7.05% | (8) | 24 | 10 | 19 | 9 | 46 |
| Payable | US\$ 351 | US\$ 385 | Fix | -0.62% | | | | | | (63) |
| IPCA vs. US\$ fixed rate swap | | | | | | | | | | |
| Receivable | R\$ 1,315 | R\$ 1,000 | IPCA + | 6.55% | (80) | (34) | 6 | 7 | (33) | (10) |
| Payable | US\$ 434 | US\$ 434 | Fix | 3.98% | | | | | | (37) |
| IPCA vs. CDI swap | | | | | | | | | | |
| Receivable | R\$ 1,350 | R\$ 1,350 | IPCA + | 6.62% | 89 | 85 | 1 | | 5 | 48 |
| Payable | R\$ 1,350 | R\$ 1,350 | CDI | 98.59% | | | | | | 36 |

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(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 | | Index | Average rate | Fair value | | Financial Settlement | Value at Risk | Fair value by year | | |
|--|-------------------|-------------------|-------|--------------|------------------------------|-------------------|----------------------|---------------|--------------------|-------|---|
| | December 31, 2018 | December 31, 2017 | | | (Outflows) December 31, 2018 | December 31, 2018 | 2019 | | 2020 | 2021+ | |
| EUR fixed rate vs. US\$ fixed rate swap | | | | | (1) | 23 | (3) | 8 | (7) | (5) | 9 |
| Receivable | 500 | 500 | Fix | 3.75% | | | | | | | |
| Payable | US\$ 613 | US\$ 613 | Fix | 4.29% | | | | | | | |

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) | | Bought / Sold | Average strike (US\$/ton) | Fair value | | Financial settlement Inflows (Outflows) December 31, 2018 | Value at Risk December 31, 2018 | Fair value by year 2019 |
|--------------|----------------------|----------------------|---------------|------------------------------|----------------------|----------------------|--|---------------------------------------|-------------------------------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | | |
| 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.

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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 settlement inflows/outflows are offset by the protected items' losses/gains due to nickel and copper prices changes.

| Flow | Notional (ton) | | Bought / Sold | Average strike (US\$/ton) | Fair value | | Financial settlement Inflows (Outflows) December 31, 2018 | Value at Risk December 31, 2018 | Fair value by year | |
|---|----------------------|----------------------|------------------|---------------------------------|----------------------|----------------------|--|---------------------------------------|--------------------|------------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | | 2019 | 2020+ |
| Fixed price sales protection | | | | | | | | | | |
| Nickel forwards | 7,244 | 9,621 | B | 12,166 | (10) | 24 | 7 | 2 | (8) | (2) |
| Raw material purchase protection | | | | | | | | | | |
| Nickel forwards | 120 | 292 | S | 12,242 | | | 1 | | | |
| Copper forwards | 81 | 79 | S | 6,142 | | | | | | |
| Total | | | | | (10) | 24 | 8 | 2 | (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) | | Bought / Sold | Average strike (US\$/day) | Fair value | | Financial Settlement Inflows (Outflows) December 31, 2018 | Value at Risk December 31, 2018 | Fair value by year | |
|------|----------------------|----------------------|------------------|------------------------------|----------------------|----------------------|---|---------------------------------------|-----------------------|-------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | | 2019 | 2020+ |

| | | | | | | |
|------------------|-----|---|--------|---|-----|---|
| Freight forwards | 480 | B | 14,509 | 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) | | Bought / Sold | Average strike (US\$/share) | Fair value | | Financial settlement Inflows (Outflows) December 31, 2018 | Value at Risk December 31, 2018 | Fair value by year 2023 |
|--------------|---------------------|-------------------|---------------|-----------------------------|-------------------|-------------------|---|---------------------------------|-------------------------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | | |
| Call options | 10,000,000 | 10,000,000 | B | 44 | 8 | 39 | 1 | 8 | |

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) | | Bought / Sold | Average strike (R\$/share) | Fair value | | Financial settlement Inflows (Outflows) December 31, 2018 | Value at Risk December 31, 2018 | Fair value by year 2027 |
|--------------------|---------------------|-------------------|---------------|----------------------------|-------------------|-------------------|---|---------------------------------|-------------------------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | | |
| Conversion options | 140,239 | 140,239 | S | 8,006 | (59) | (57) | 4 | (59) | |

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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. In this case, the Company could settle through cash or shares.

| Flow | Notional (quantity, in millions) | | Bought / Sold | Average strike (R\$/share) | Fair value | | Financial settlement Inflows (Outflows) December 31, 2018 | Value at Risk December 31, 2018 | Fair value by year 2019+ |
|---------|----------------------------------|----------------------|---------------|-------------------------------|----------------------|----------------------|---|---------------------------------------|--------------------------------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | | |
| 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) | | Bought / Sold | Average strike (US\$/ton) | Fair value | | Value at Risk December 31, 2018 | Fair value by year 2019 |
|-----------------|----------------------|----------------------|------------------|------------------------------|----------------------|----------------------|---------------------------------------|-------------------------------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | |
| Nickel forwards | 3,763 | 2,627 | S | 11,289 | 2 | 1 | 1 | 2 |
| Copper forwards | 2,035 | 2,718 | S | 6,172 | | | | |
| Total | | | | | 2 | 1 | 1 | 2 |

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.

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| Flow | Notional (volume/month) | | Bought / Sold | Average strike (US\$/ton) | Fair value | | Financial settlement Inflows (Outflows) December 31, 2018 | Value at Risk December 31, 2018 | Fair value by year | |
|--------------|-------------------------|----------------------|------------------|------------------------------|----------------------|----------------------|--|---------------------------------------|--------------------|------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | | 2018 | 2018 |
| 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) | | Bought / Sold | Average strike (R\$/share) | Fair value | | Financial settlement Inflows (Outflows) December 31, 2018 | Value at Risk December 31, 2018 | Fair value by year | |
|------------|---------------------|-------------------|------------------|-------------------------------|----------------------|----------------------|--|---------------------------------------|--------------------------|-------|
| | December 31, 2018 | December 31, 2017 | | | December 31, 2018 | December 31, 2017 | | | 2018 | 2018 |
| Put option | 1,105,070,863 | 1,105,070,863 | S | 3.88 | (103) | (133) | | 10 | | (103) |

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Expressed in millions of United States dollar, unless otherwise stated

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. | | |
| 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. | | |

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| | | | | |
|--|---|---------------------|-------|-------|
| 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) |
| 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 |

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Expressed in millions of United States dollar, unless otherwise stated

| Instrument | Instrument's main risk events | Probable | Scenario I | Scenario II |
|---|--------------------------------------|-----------------|-------------------|--------------------|
| 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 |
| Instrument | Main risks | Probable | Scenario I | Scenario II |
| Embedded derivatives - Raw material purchase (nickel) | Nickel price increase | 2 | (8) | (19) |
| Embedded derivatives - Raw material purchase (copper) | Copper price increase | | (3) | (6) |
| Embedded derivatives - Gas purchase | Pellet price increase | (1) | (2) | (5) |
| Embedded derivatives - Guaranteed minimum return (VLI) | VLI stock value decrease | (103) | (229) | (442) |

i) Financial counterparties ratings

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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.

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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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 |

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| | | | | | |
|-------|-----|-------|-----|-------|-----|
| 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 | Price (US\$/day) | Maturity | Price (US\$/day) | Maturity | 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 | | |

(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 |

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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 |

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 |

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| | | | | | |
|----------|------|----------|------|----------|------|
| 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 |
|----------|--------|----------|--------|----------|--------|

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Signatures

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

Vale S.A.
(Registrant)

By:

/s/ André Figueiredo
Director of Investor Relations

Date: March 27, 2019
