Project Information Document (PID)

Concept Stage | Date Prepared/Updated: 21-May-2019 | Report No: PIDC26925

BASIC INFORMATION

A. Basic Project Data

Country	Project ID	Parent Project ID (if any)	Project Name
Brazil	P170850		Energy and Mineral Sectors Strengthening Project II (P170850)
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
LATIN AMERICA AND CARIBBEAN	Apr 13, 2020	Mar 30, 2020	Energy & Extractives
Financing Instrument	**Borrower(s)**	**Implementing Agency**	
Investment Project Financing	Ministerio de Economia	Ministério de Minas e Energia	

Proposed Development Objective(s)

To strengthen the capacity of public energy and mineral sector institutions to modernize and improve sectoral management and inform energy and mining strategies.

The principal outcome expected from the project is to improve capacity of key institutions in both the energy and the mineral sectors to ensure that they deliver the regulatory adjustments, the improved planning and the modernization of infrastructure - in particular related to information systems and technology development - that are needed in order to support accelerated economic growth that is sustainable from both environmental and social perspectives.

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	50.00
Total Financing	50.00
of which IBRD/IDA	50.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	50.00

Environmental and Social Risk Classification	Concept Review Decision
Substantial	Track II-The review did authorize the preparation to continue

B. Introduction and Context

1. **After a decade of rapid growth and decreases in income inequality, in 2015 Brazil's economy fell into deep recession.** The recession constrained investments across the economy, and policy uncertainty continues to hinder private sector investment. A slow recovery materialized in 2017 and 2018 with 1.1 percent growth in each year. The expected growth rate is 2.1 percent for 2019 and the following years, maintaining the trend of moderately slow economic recovery.[1] Private investment is expected to remain weak and fiscal constraints have restricted the availability of credit**.** Therefore, there are significant needs for long-term financing of infrastructure in Brazil. Brazil remains below countries of similar income in the stock of physical infrastructure and performs poorly in the perception of the quality of infrastructure services. Furthermore, slow generation capacity growth has left Brazil behind most of its competitors.[2]

2. **Both energy and mining are crucially linked to Brazil's economic development.** Brazil has a per capita GDP of approximately US$11,000, and while the country has improved income distribution and access to basic services, the average per capita income masks inequality challenges. Inclusive growth, in an environmentally and socially sustainable manner, is required to address the needs of the poorest regions of the country. The country is endowed with renewable energy resources, oil, and gas, and has followed a low carbon development path. Mining has contributed to economic growth in the country over the past four years, with significant exports of iron ore, manganese, bauxite, gold, and copper.

Sectoral and Institutional Context

Energy Sector overview

3. **The Brazilian energy sector is one of the largest and most sophisticated in the world, with a total installed capacity of 164 GW.** The sector is comprised of a large number of private, national, and international companies with two large, publicly-owned industrial champions. Its territory is endowed with abundant energy resources that remain largely untapped. Owing to the recent discovery of large offshore fields, oil and gas reserves have dramatically increased. Once exploited, these resources are expected to boost Brazilian petroleum production from the 14th to the 7th largest in the world. The hydropower system provides between 60 to 80 percent of the country's electricity and as a result, the carbon intensity of the Brazilian energy matrix is half of the world average and one-sixth of the OECD average.

4. **Electricity**. Since the late 1990's, Brazil has implemented successful reforms to make the energy sector more efficient and to attract private capital. Through the 1990s, a state-owned model dominated the power sector, which resulted in highly subsidized tariffs, a large financial deficit, and weakened plants. In the early 1990's, the Government enacted legislation requiring that all concessions be granted competitively. Other changes included: the establishment of an independent regulator, unbundling, the introduction of wholesale and retail competition, the establishment of a wholesale market, new tariff regimes, and the consolidation of an independent national system operator. Investors participated actively in the privatization with investments of over US$70 billion since 1998. The latest Electricity Generation Expansion Plan edition anticipates renewables will represent 86.1 percent of the electricity generation matrix by 2023, (vs. 79.3% in 2013). Under its Nationally

[1] International Monetary Fund, https://knoema.com/ouazxcc/brazil-gdp-growth-forecast-2019-2024-and-up-to-2060-data-and-charts
[2] Raiser, Martin et al. "How to Close Brazilian Infrastructure Gap in times of austerity". July 2017.

Determined Contributions (NDCs) pledged at COP-21, Brazil committed to reduce national GHG emissions by 43 percent below 2005 levels in 2030 and a 10 percent energy efficiency gain target was set for the energy sector, saving + 105 TWh by 2030.

5. **However, several crises since 2012 have demonstrated the vulnerability of the power sector and the need to overcome various challenges to enable it to better contribute to sustainable growth and improved living standards.** With the generation subsector being driven by a highly intricate multifaceted auctioning system and climate volatility increasingly threatening power generation, there is a need to redesign market rules. The country virtually achieved universal access to electricity but needs to reduce energy poverty levels and close the access gap in remote areas. The system is still plagued by high tariffs, non-technical losses and quality of supply issues. The regulatory framework should be adapted to enable Distributed Energy Resources (DER) and innovative technologies. The electricity pricing structure contains significant distortions due to cross-subsidies and specific sector levies, leading to high and non-transparent end-consumer prices. Thus, there is a need to rationalize prices, subsidies, taxes and levies. Energy conservation measures need to be deployed in the near-term to contain the growth of emissions of the energy sector to levels consistent with the NDC, while still ensuring the supply-demand balance. However, initiatives in this area have been limited to date.

6. **A new reform plan for the power sector was launched by the government in 2017, motivated by the new opportunities presented by technologies and players not relevant fifteen years ago, and in 2018, the MME presented a draft bill to restructure and modernize the model of the Brazilian power sector**. As a result, more sophisticated regulation, planning, risk assessments, technologies, and institutional capacities will be needed. This activity aims at supporting the government to evaluate regulatory options and strengthen the institutional capacity to implement these reforms.

7. **Oil**. Brazil has taken steps to enable the entry of new players and the development of its basins. At +2.7 million barrels per day, Brazil is self-sufficient for the first time in its history, and is a hotspot for deep-water, unconventional oil and gas production. In 1997, Brazil revoked Petrobras‘ monopoly on key segments of the supply chain. An independent agency, the National Petroleum Authority (ANP), defines and implements a modern process for granting concessions and monitoring industry performance. If exploration and production of the pre-salt oil basins are successful, production is expected to surpass 5 million barrels per day in 2019, creating a large surplus to be exported. At the same time, Petrobras will have to double its annual investments in the next 12 years, which will present significant challenges.

8. **Natural gas**. Domestic gas production in Brazil doubled between 2006 and 2016 and accounted for 62 percent of natural gas consumed. The Brazil-Bolivia pipeline allows Brazil to import 30 million cubic meters per day, (33.5 percent of consumption) and LNG accounted for 4.5 percent of consumption in 2016. The pre-salt fields are expected to make Brazil a major global oil and gas player. At present, however, natural gas represents only about 15 percent (up from less than 2 percent in 1998) of Brazil’s primary energy supply, fueling industry and power generation most notably when hydropower is insufficient. The Natural gas market grew in the late 1990s, following the introduction of long-term supply contracts for power generators at subsidized prices. Demand is forecasted to increase from 57 million cubic meters a day in 2016 to 95 million cubic meters in 2026.

9. **Brazil’s domestic hydrocarbon reserves offer significant potential to increase the role of domestic natural gas in the country’s energy matrix.** However, despite its hydrocarbon reserves endowment, Brazil’s large industrial and residential consumers pay more than US$16/MMBtu and US$30-50/MMBtu respectively. Many state gas distribution companies favor a tripartite ownership model in which the state government, Petrobras and private investors are shareholders. The state participation poses governance challenges, making distribution tariffs subject to political interference. States also raise a significant share of revenues from taxes on energy consumption and have often favored fiscal objectives to the detriment of the profitability of distribution companies. Privatization of distribution companies with majority government stakes

could greatly improve governance but faces challenges as it would require changes to the concession model based on a tripartite ownership model. On the consumption side, the gas market remains largely captive of Petrobras and local distribution companies. Although possible in some states, there is no incentive for companies to become a "free consumer" due to considerable supply risks, as alternative suppliers are limited.

10. **Petrobras has begun to divest some of its natural gas network assets.** However, as long as Petrobras controls a large share of the transportation network, private investment in critical upstream infrastructure will remain below potential. Divestment of Petrobras assets can have a positive impact in the mid term, but poses challenges for the security of supply in the short run. Over time, new sources of supply offshore as well as from LNG will reduce gas supply risks, but during the transition, the shift from long-term contracts in a captive market to greater reliance on competition will need careful support from the regulator. Despite a regulatory framework that allows for entry of alternative suppliers and competitive provision, the Brazilian market has remained highly captive, resulting in higher prices for end consumers.

Mineral Sector overview

11. **Brazil's growth over the last four years has been driven to a significant extent by the expansion of the mineral sector and related industries**. Production, value added and exports in mining have risen rapidly since 2003, with primary mining exports quadrupling in value. In 2018, the mining and mineral processing sector was responsible for 1.4 percent of GDP and 13 percent of total exports. Currently, Brazil is one of the top three producers in the world of iron ore, gold, manganese, and bauxite. It is also an important producer of nickel, copper, zinc, and gold. Brazil is viewed as a country with an important mining potential based on the country's size and significant, fertile Precambrian and Paleozoic geology, comparable to Canada and Australia. In addition to iron ore, gold, alumina, niobium, nickel, titanium, coating quality kaolin and vanadium, Brazil has a wide choice of targets for strategic minerals such as lithium, rare earth, thorium and uranium.

12. **While the country is expected to remain a world leader in mineral commodities production, the sector is facing several challenges that are hindering the development of its full potential**. These challenges relate to weak institutional capacity, aggravated by declining budget to fulfill their roles, weak regulatory capacity that has resulted in serious environmental impacts, but also, not less important, a lack of true vision and strategy for the sector that is clearly reflected in a context of absence of adequate and strategic public policies. Brazil is falling behind on attractiveness for investments in the mining sector despite its known geological potential.

13. **Congress approved in 2017 a series of measures updating the mining legislation to tackle attractiveness issues.** The National Minerals Agency (ANM) was created by upgrading the Mines Department (DNPM) in hopes of modernizing its regulatory capacity and independence. In addition, the Brazilian Government, with support from the World Bank's Energy Sector Technical Assistance Project (ESTAL), approved a new strategic plan for the mining sector – the National Mining Plan 2030 (PNM). The PNM has three priority areas: (a) improved governance; (b) value-added processes; and (c) sustainability. The implementation of PNM so far has been limited due to lack of funds and political commitment. The proposed Project will finance studies to assist in the implementation of the PNM and will contribute to support the MME's social and environmental agenda through targeted actions that will improve the quality of life in mining areas, notably those affected by artisanal and small-scale mining. Brazil's most important mines (except iron ore and bauxite) are located outside the Amazon Basin, and the majority of the country's surface area is still regarded as poorly exploited for minerals.

14. ***Institutional overview.*** **ANM –** The objective of ANM is to improve the licensing processing bureaucracy, reducing processing costs and overall modernization of the sector. New Mining Code - Specific improvements include: (i) international standard for reporting of Reserves and Resources; (ii) online staking by certified exploration/mining companies; (iii) easier surface/property access by the title holder; and (iv) the

bidding of more than 30,000 titles. Brazil's 9 key drivers for Expansion of the Extractive industry to be regulated and enforced by the ANM are: (i) Improve geological knowledge and dissemination to international investors; (ii) Establish a National Strategy for minerals that should be selected for verticalization in the country and especially ones ready for direct export.; (iii) Enforce best practice in the environmental, social and safety sectors; (iv) Impose on current Exploration reports, adherence to international rules of Resource and Reserves Reporting; (v) Modernize the on-line staking process of first arrived first served basis; (vi) Make the exploration database from companies that have lost or relinquished titles, available as open file data within a logical time frame; (vii) Expedite Environmental Licensing for Exploration Permits while maintaining high standards; (viii) Organize Government run Core Libraries to be administered by and within Local ANM Districts; and (ix) Limit of border areas of mineral exploration for foreign controlled mining groups from 150km to 20km.

15. **CPRM/National Geological Survey Company.** The main responsibilities of CPRM are to support the formulation of mineral and geological policy, to participate in planning, coordination and execution of the geology and hydrology services of responsibility of the Union throughout the national territory. Its mission is to promote the discovery and use of the country's mineral and water resources, as well as to develop information systems, charts and maps that translate national geological and hydrological knowledge, making it accessible to interested parties, expand the geophysical knowledge of the whole national territory through aerial acquisitions, and carry out terrestrial surveysto meet the guidelines of the projects developed institutionally. The CPRM, through its technical staff, has been used mainly for geological cartography in association with universities and, rarely, with private companies. Geophysical and geochemical surveys are also carried out, looking for data coverage of the entire Brazilian territory. In the past years, with support from the META 1 project, CPRM has been able to build its technical capacity to provide mapping for disaster risk management.

16. **Tailings Dam Safety.** As a consequence of the Samarco Dam failure, iron ore producers Vale and BHP were held responsible, and the fragility of present controls by the government agencies and companies responsible for wet tailing dams was highlighted. The more recent Brumadinho tailings dam disaster highlighted the fragility and inadequacy of the government's regulatory capacity and Vale's operational standards. The reason for the accident is still under investigation, but so far 64 people have been pronounced dead, and the numbers are expected to grow (264+). The situation requires immediate action to ensure that such accidents do not occur again. Several measures need to be put in place and will require coordination between MME, ANM and CPRM. Strengthening ANM's regulatory capacity and installing a dam monitoring system are paramount for the safety of mine operations and should be implemented. Budgetary allocations for its effective implementation should be a priority.

Relationship to CPF

17. **The proposed project is fully aligned with the World Bank Group's FY18-FY23 Country Partnership Framework (CPF) for Brazil** (Report #113529-BR), discussed by the Executive Directors on July 13, 2017. The project supports Focus Area 2, Private Sector Investment and Productivity Growth, by addressing regulatory barriers in the energy and mining sectors, to enable private sector investment, as well as addressing other distortions (tariffs, subsidies and taxes), which can affect incentives and growth in general. The project also supports Focus Area 3, inclusive and sustainable development, by addressing regulatory, and technical, issues which can affect sustainable urban services, as well as the development of rural areas, particularly given the ongoing disruptive technological changes (e.g. e-mobility, distributed energy resouces, and microgrids). In addition, the proposed project will strengthen domestic capacity for planning, design and implementation of concessions with a dedicated capacity-building component.

C. Proposed Development Objective(s)

To strengthen the capacity of key public sector institutions to improve the contribution of energy and mineral resources to accelerated national economic growth and increased social and environmental sustainability.

The principal outcome expected from the project is to improve capacity of key institutions in both the energy and the mineral sectors to ensure that they deliver the regulatory adjustments, the improved planning and the modernization of infrastructure - in particular related to information systems and technology development - that are needed in order to support accelerated economic growth that is sustainable from both environmental and social perspectives.

Key Results (From PCN)

18. The main direct beneficiaries are the public sector institutions, through which the Brazilian population will indirectly benefit from more reliable power at lower prices and from the economic benefits of a growing and more efficient energy and mining sector. The population will also benefit from improved planning, policies, and execution of more environmentally and socially sustainable projects in the energy and mineral sectors.

19. Immediate beneficiaries from this Project will include the various public institutions, sectoral agencies and departments, such as (i) MME, together with its Secretariat for Planning and Energy Development (SPE), the Secretariat for Electricity (SEE), the Secretariat for Oil, Gas and Biofuels (SPG), the Secretariat for Geology, Mining and Mineral Processing (SGM), the Assessoria Especial de Meio Ambiente (AESA); (ii) Energy Planning Company (EPE); (iii) the National Electricity Regulatory Agency (ANEEL); (iv) the National Center for Research in Electricity (CEPEL): (v) CPRM; (vi) ANM; (vii) Secretariat for Planning, Budget and Administration (SPOA); and, (viii) the National Operator of the Transmission System (ONS). Through strengthening the capacity of these entities, the country will be in a stronger position to adapt to the changing economic conditions. Improved institutions will enable enhanced energy security, environmental sustainability, and improved services for the population as a whole.

D. Concept Description

20. The proposed Project would support sector-wide efficiency through two components.

1. **Component 1 (US$ 25 million): Support for the energy transition towards modern energy and mining sectors**

1.1. Sub-component 1.1: Mining. Provision of support for, inter-allia: (i) the proposal of a preliminary Mining Sector Strategy/Artisanal and Small-Scale Mining Strategy /Critical minerals strategy; (ii) the review of key mining regulations; (iii) the review of methodology for the tendering of mining areas; and (iv) performing a Supply Chain analysis for critical minerals.

1.2. Sub-component 1.2: Climate resilience. Provision of support for inter-allia: (i) Planning studies, model upgrades (hydrological risk, integrated planning with water and agriculture/irrigation sector, including an analysis of the impact of water use restrictions in the power sector); (ii) analysis of electricity matrix diversification and variable renewable energy (VRE) integration (including dispatching, role of gas and storage, power flow analysis, etc.); and (iii) analysis of governance under climate stress.

1.3. Sub-component 1.3: Gas sectoral reform. Including inter-allia: (i) proposing a framework for fostering private investments in downstream gas sector; (ii) proposing improved regulation for gas transport; and (iii) proposing alternatives for market development and fostering investments for LNG and GLP.

1.4. Sub-component 1.4: Energy transition: Decentralization, decarbonization and digitalization of the energy and mining sector. Including inter allia: (i) analyzing Electricity Costs and Tariffs [including inter-allia (a) a methodology update, (b) a review of sectoral charges and (c) taxes, and (d) Nodal pricing]; (ii) performing a revision of Energy markets (including energy, ancillary services and capacity payments); (iii) analyzing

feasibility, business models and financial mechanisms (Including PPPs) for new technologies [including inter-allia smart-grids, Distributed Energy Resources (DER), storage, e-mobility, off-shore wind, etc.]; (iv) performing analysis on end-user issues (inter allia: demand side management, Energy efficiency, and linkages to tariff review); and (v) proposals for decarbonizing the mining sector (inter allia: innovation, Renewable Energy (RE), Energy Efficiency (EE) for the processing of minerals/metals).

2. **Component 2 (US$ 24 million, of which US$ 25 million IBRD): Institutional strengthening and capacity building of relevant stakeholders**

2.1. Sub-component 2.1: Strengthening of Mining institutions including: MME (Ministério de Minas e Energia), ANM (Agência Nacional de Mineração), CPRM (Companhia de Pesquisa e Recursos Minerais), SGM (Secretaria de Geologia, Mineração e Transformação Mineral), to support: (i) the operationalization of the ANM (management and functional review; tailings dam safety capacity; modernization of the mining cadaster); (ii) Training; (iii) provision of specialized hardware and software, and digitalization of processes; and (iv) proposals for harmonization of processes and policies.

2.2. Sub-component 2.2: Strengthening of Electricity Sector institutions: MME, ONS (Operador Nacional do Sistema Elétrico), EPE (Empresa de Pesquisa de Energética), ANEEL (Agência Nacional de Energia Elétrica), Eletrobras.
To support: (i) Training; and (ii) provision of specialized hardware and software

2.3. Sub-component 2.3: Strengthening of Gas Sector institutions: MME, ANP (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis), Petrobras. To support: (i) Training; (ii) provision of specialized hardware and software, and digitalization of processes; and (iii) proposals for harmonization of processes and policies.

2.4. Sub-component 2.4: Knowledge Sharing and Dissemination, to support, inter-allia: (i) Stakeholder Engagement; and (ii) Workshops, translations, publications.

Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

Summary of Screening of Environmental and Social Risks and Impacts

The screening of Environmental and Social Risks and Impacts for this TA project was based on the proposed activities and extensive work experience in other projects developed with Brazilian government, especially the Energy and Mineral Sectors Strengthening Project (P126537), first phase of this operation, which was closed December 31, 2018. It took into consideration contextual risks and potential downstream implications.
Considering the Technical Assistance nature of the project and the scale of its products, risks and impacts are consequently moderate, which simplifies the screening efforts. It is also important to note that work related to the project - TA activities - will not have any impact under the ESSs. Potential adverse impacts are expected when and whether the inputs of the conceptual studies and analytical works are used as inputs for review policies and regulations in the mining and energy sectors. This use will happen beyond the lifetime of the project. One of the important outcomes will be to increase the institutional capacity of the client and some regulatory agencies to manage potential environmental and social risks in the energy and mining sectors after the TA has been completed. The TA itself does not reduce or increase environmental and/or social impacts, but the enhanced institutional capacity of implementing and regulatory agencies (which is expected from the TA activities) after the TA closure may lead to reduce adverse social and

environmental risks and impacts in these sectors.

Note To view the Environmental and Social Risks and Impacts, please refer to the Concept Stage ESRS Document**.**

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APPROVAL

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Additional Sectoral Information for Proposed META 2 Project

Energy Sector overview

1. The Brazilian energy sector is one of the largest and most sophisticated in the world, with a total installed capacity of 164 GW. The sector is comprised of a large number of private, national, and international companies with two large, publicly-owned industrial champions: PETROBRAS, in the oil and gas sector, and ELETROBRAS, in the power sector. Its territory is endowed with abundant energy resources that provide energy security and remain largely untapped. Due to the recent discovery of large offshore oil fields in the ―pre-salt‖ geological layer, oil and gas reserves have dramatically increased. Once exploited, these resources are expected to boost Brazilian petroleum production from the 14th to the 7th largest in the world. Brazil is also one of the world's leaders in biofuels, having accumulated significant experience in bioethanol. Finally, the hydropower system is one of the largest in the world, with an installed capacity of 98,700 Megawatts (MW) that provides between 60-80 percent of the country's electricity, while using only one third of its estimated potential. As a result, the carbon intensity of the Brazilian energy matrix is half of the world average and one-sixth of the OECD average. Brazil continues to aim to be a leader in low carbon development: it adopted in 2010 the Política Nacional sobre Mudança do Clima, under which the Government voluntarily committed to reduce national emissions by 36.1 to 38.9 percent by 2020.

2. Since the late 1990's, Brazil has implemented successful reforms to make the energy sector more efficient and to attract private capital. Through the 1990s, a state-owned model dominated the power sector which resulted in highly subsidized tariffs, a large financial deficit, and weakened plants. In the early 1990's, the Government enacted legislation requiring that all concessions be granted competitively: this legislation paved the way for competition and private sector participation. The main changes introduced included: the establishment of an independent regulator, unbundling the earlier vertical integration of the industry, the introduction of wholesale and retail competition, the establishment of new commercial agreements and a wholesale market, new tariff regimes, and the consolidation of an independent national system operator. In 2004, the public energy planning entity, Empresa de Pesquisas Energéticas (EPE), was created and assigned the responsibility to develop energy planning nationwide. Investors participated actively in the privatization and in greenfield investments, with investments of over US$70 billion since 1998. However, the power sector still needs to overcome various challenges in order to enable it to better contribute to environmentally sustainable growth and improved living standards.

3. **Electricity**. Brazil is one of the largest and most developed power markets in Latin America, but several crises since 2012 have demonstrated its vulnerability. A severe drought began in 2012, leading to a considerable increase of the use of costly thermal plants and a spike in the cost of electricity. While operational costs of the energy system skyrocketed, tariffs were initially maintained at the same level, generating a huge cash shortfall and considerable financial stress on the sector. In contrast to the approach taken to the 2001 energy crisis, no demand-side actions were implemented during the

2014 power crisis, and the crisis was addressed by continuous and costly dispatch of thermal generation. Since 2015, revenue shortfalls have progressively been transferred to the customers, resulting in a significant tariff hike. To improve the resilience of the energy sector, Brazil has implemented a number of innovative electricity sector policies over the last years, including successful renewable energy auctions. The latest Electricity Generation Expansion Plan edition (PDEE 2023) anticipates renewables (including large hydro) will represent 86.1% of the electricity generation matrix by 2023, up from 79.3% in 2013. Under its Nationally Determined Contributions (NDCs) pledged at COP-21, Brazil has committed to a reduction in national GHG emissions by 37 percent below 2005 levels in 2025, and 43 percent by 2030 and, in terms of energy efficiency, a 10% efficiency gain target was set for the energy sector, meaning approximately 105 TWh should be saved by 2030.

4. Even though the country virtually achieved universal access to electricity, there is still a need to reduce energy poverty levels and close the access gap in remote areas. The system is still plagued by high tariffs, non-technical losses and quality of supply (particularly in the Amazon Region). Additionally, remote areas in the Amazon region are mostly served by fossil fuels (diesel). Sustainable solutions may be pursued through innovation and Distributed Energy Resources (DER). The regulatory framework should be adapted to enable grid edge technologies (mini/microgrids) investments.

5. Brazil‘s large, integrated multi-source power system has become complex. With the generation subsector being driven by a highly intricate multifaceted auctioning system (which involves coordinating the activities of 176 generation companies, 31 trading companies and 49 distribution companies) and climate volatility increasingly threatening power generation. As a result there is a need to (re)design market rules based on market price principles.

6. Regarding the tariffs, the Brazilian power market has regulated prices for retail customers, embodying cross-subsidies across consumer groups (the regulated contract environment, ACR); and free spot prices set in power market auctions for bulk consumers (the free contracts environment, (ACL)). The regulated electricity tariffs are established by ANEEL through Periodic Tariff Reviews and vary for each energy distribution company. The pricing structure is characterized by significant distortions due to cross-subsidies and specific sector levies, leading to high and non-transparent end-consumer prices. Thus, there is a need to remove cross subsidies and rationalize prices, subsidies, taxes and levies.

7. To address some of the sector challenges a new reform plan for the power sector was launched by the government in 2017, motivated by the new opportunities presented by technologies and players not relevant fifteen years ago. It was discussed in the context of Public Consultation 33, launched in July 2017. As a result of these consultations, in February 2018, the MME presented a draft bill (PL) that aims to restructure and modernize the model of the Brazilian power sector with the following objectives: (i) encourage efficiency in business decisions, guaranteeing low tariffs, security of supply and socio-environmental sustainability; (ii) appropriately allocate the risks among agents that operate in the market, in order to allow their individual management; (iii) remove barriers to market entry, including the barriers for purchase by foreigners of property, including land, in rural areas (law no. 5709/71); (iv) respect existing contracts, providing an appropriate transition between the current and the new proposed model, to increase the security and attractiveness of the market to new entrants including from abroad. As a result, more sophisticated regulation, planning, risk assessments, technologies, and institutional capacities will be needed.

8. **Oil and Natural Gas**. In the oil sector, Brazil has taken many steps to enable the entry of new players and the development of its twenty-three oil basins. Brazil is currently the world’s 10th largest oil producer with approximately 2.7 million barrels per day and is a hotspot for deep-water, unconventional oil and gas production. In 1997, Brazil revoked Petrobras‘ monopoly on key segments of the supply chain, such as exploration and production. An independent agency, the National Petroleum Authority (ANP), was created to define and implement a modern process for granting concessions and to monitor industry performance. As part of this transformation, Petrobras became a stronger, more competitive company, further enhancing its technological development capabilities, in particular in the area of deep-sea, offshore exploration and production. Oil production increased to more than 2 million barrels per day, making Brazil self-sufficient

for the first time in its history. Attesting to the success of public-private partnerships, the discovery of the pre-salt basin in 2007 was a joint effort between Petrobras, BG Group and Galp Energia. If exploration and production efforts in the pre-salt basin are successful, it is expected that oil production will surpass 5 million barrels per day in 2019, creating a large surplus to be exported. At the same time, Petrobras will have to double its annual investments in the next 12 years, which will present significant challenges.

9. **The development of Brazil's natural gas industry** over the past decade has also been notable. Domestic gas production in Brazil doubled between 2006 and 2016 and accounted for 62 percent of natural gas consumed. The implementation of the Brazil-Bolivia pipeline was transformational, allowing Brazil to import 30 million cubic meters per day, and accounted for 33.5 percent and LNG (through its three regasification terminals) accounted for 4.5 percent of consumption in 2016. The discovery of large offshore pre-salt fields is expected to make Brazil one of the major global oil and gas player by 2040. At present, however, natural gas represents only about 15 percent (up from less than 2 percent in 1998) of Brazil's primary energy supply, fueling industry and power generation most notably when hydropower is insufficient. Natural gas began to play a significant role in Brazil's energy mix in the late 1990s, following the introduction of long-term supply contracts for power generators at subsidized prices. Demand is met with a combination of domestic production, liquified natural gas (LNG) imports, and piped gas from Bolivia. Gas demand is forecasted to increase in the coming decades, where according to Brazil's Energy Research Co. (EPE), a state-owned think tank, the natural gas market supply in Brazil will grow from 57 million cubic meters a day in 2016 to 95 million cubic meters in 2026.

10. Brazil's domestic hydrocarbon reserves offer significant potential to increase the role of domestic natural gas in the country's energy matrix. Domestic gas is produced onshore (27 percent) and offshore (73 percent), with the majority (67 percent) coming from associated fields. Looking ahead, planned upstream activities could significantly reduce Brazil's need to import natural gas. Gas produced from the pre-salt fields discovered in the Santos Basin, in particular, is expected to contribute to an estimated average annual increase in domestic production of 7.1 percent between 2018 and 2022. However, despite its hydrocarbon reserves endowment, Brazil's end-user gas price is high in comparison with other South-American and European markets. Large industrial and residential consumers pay more than $16/MMBtu and $30-$50/MMBtu respectively.

11. During the period 1997–99 the states of Sao Paulo and Rio de Janeiro privatized their gas distribution companies, while other states decided in favor of a tripartite ownership model in which the state government, Petrobras and private investors were shareholders. The state participation poses governance challenges, making distribution tariffs subject to political interference. States also raise a significant share of revenues from excise taxes on energy consumption and have often emphasized tax revenue objectives to the detriment of the profitability of distribution companies. The privatization of distribution companies with majority government stakes could greatly improve governance but faces challenges as it would require changes to the concession model based on a tripartite ownership model.

12. On the consumption side, the gas market remains largely captive of Petrobras and local distribution companies. The states of Sao Paulo, Espirito Santo and Rio de Janeiro allow large consumers to become so-called "free consumers" after the 11th anniversary of the concession contract. However, since Petrobras remains the only supplier of gas and since a uniform distribution fee must be paid to network operators by free and captive consumers, there is no incentive to become a free consumer. Moreover, on the free market there is considerable supply risks, as alternative suppliers are so far limited.

13. Against this background, Petrobras has begun to divest some of its natural gas network assets. The sale of Gaspetro (gas distribution activities) in 2015, Nova Transportadora do Sudeste (NTS) (gas transmission network) in 2016, and the expected sale of LNG terminals and power plants in the near future shows the change in the role played by Petrobras. Importantly, Petrobras also plans to sell a majority stake in Transportadora Associada de Gás S.A (TAG), which would decrease its control of gas pipelines by about half. Still, the company is constructing a new offshore pipeline to carry gas from pre-salt production onshore and is also constructing a new gas processing plant in Itaboraí, Rio de Janeiro

State) and expanding another (Caraguatatuba). As long as Petrobras controls a large share of the transportation network, private investment upstream and in critical infrastructure may continue to remain below potential.

14. While the divestment of Petrobras assets is thus welcome, it poses some challenges for the security of supply in the short run. Historically Petrobras has played the crucial role of the supplier of last resort. As such, for instance it aggregated domestic demand to negotiate the gas import contract with Bolivia. The approaching end of the Bolivian supply contract in 2019 is a source of supply uncertainty, should Petrobras no longer purchase gas on behalf of domestic consumers. Over time, new sources of supply offshore as well as from LNG will reduce gas supply risks, but during the transition, the shift from long-term contracts in a captive market to greater reliance on competition will need careful support from the regulator. Despite a regulatory framework that allows for entry of alternative suppliers and competitive provision, in reality the Brazilian market has remained highly captive and poorly regulated, resulting in higher prices for end consumers.

15. **Biofuels**. Brazil has made significant advances in its biofuels sector, mainly as the result of two national programs which have reached industrial scale. First, the Pro-Alcool program, launched in 1975, helped develop a large national industry able to compete with gasoline to fuel the Brazil's flex-fuel vehicles. As a result of the program, Brazil is the lowest cost and second largest producer of ethanol in the world. Brazil produces 6,800 liters of ethanol per hectare, more than double US production. The cost of production is about one third of European costs. Cogeneration from sugar/ethanol producing facilities has contributed to the sustainability of the Pro-Alcool program, by allowing sale of excess power to the grid. Sugar cane energy-related products represent 18 percent of the energy matrix in Brazil. Second, the National Program for Biodiesel Production and Use (NPBPU), launched in June 2004, is expected to increase percentages of diesel mix from 3 percent to 20 percent. Research and development in agriculture and biogenetics are contributing to increase productivity.

16. **Outlook**. Brazil has achieved remarkable results in revamping its oil, gas, ethanol and power sectors and will continue to face transformational opportunities, while also facing many challenges. There is large potential to expand energy supply to cover domestic and international markets in a sustainable and cost-competitive way given Brazil's comparative advantage of having cheap, reliable and sustainable energy. However, challenges related to financing, planning, technology, and regulations, will be large. There is also a risk that emissions from the industry significantly increase. A new vision and corresponding improvements in the business model, regulatory mechanisms and capabilities are necessary to meet these demands while also growing in a sustainable way. The success of tackling these changes depends, inter alia, on strong capacity building within Government agencies.

17. **Under the Paris Agreement, Brazil has made a Nationally Determined Contribution to reduce GHG emission by 37 percent by 2025 and 43 percent by 2030** relative to 2005 levels. Moreover, Brazil's NDC states a goal of achieving 10% efficiency gains in energy sector by 2030 (approx. 105 TWh saved by 2030). Against this backdrop, energy conservation measures need to be deployed in the near-term to contain the growth emissions of the energy sector to levels consistent with the NDC, while still ensuring the supply-demand balance. Supply-side reforms are not sufficient to reduce volatility in Brazil's complex energy matrix, nor would they be cost-effective on their own. Demand-side management interventions must play a larger role. However, initiatives in this area have been limited to date.

Mineral Sector overview

18. Brazil's growth over the last four years has been driven to a significant extent by the expansion of the mineral sector and related industries. Production, value added and exports in mining have risen rapidly since 2003, with primary mining exports quadrupling in value. In 2018, the mining and mineral processing sector was responsible for 1.4 percent of GDP and 13 percent of total exports. Currently Brazil is one of the top three producers in the world of iron ore, gold, manganese, and bauxite. It is also an important producer of nickel, copper, zinc, and gold. According to the country's

chamber of mines, Instituto Brasileiro de Mineracao (IBRAM), of the expected investments in mining, two thirds of which will be for the production of iron ore.

19. Brazil is viewed as a country with an important mining potential based on the country's vast territorial area, ranking fifth in the world with 8,511,965sqkm and with significant, fertile Precambrian and Paleozoic geology comparable to Canada and Australia. Excluding the Amazon rainforest, which is about 35% of its land surface, Brazil has more outcropping geological exposure when compared to its peers. In addition to iron ore, gold, alumina, niobium, nickel, titanium, coating quality kaolin and vanadium, Brazil has a wide choice of targets for strategic minerals such as lithium, rare earth, thorium and uranium.

20. **While the country is expected to remain a world leader in mineral commodities production, the sector is facing several challenges that are hindering the development of its full potential**. These challenges **relate to weak institutional capacity, aggravated by declining budget to fulfill their roles, weak regulatory capacity** that has resulted in serious environmental impacts, but also, not less important, **a lack of true vision and strategy for the sector that is clearly reflected in a context of absence of adequate and strategic public policies.** The Fraser Institute ranks Brazil 56th as per Investment Attractiveness Index after Mexico, Suriname and Namibia. Brazil is falling behind on attractiveness for investments in the mining sector despite its known geological potential.

21. To tackle some of these issues, the Congress approved in 2017 a series of measures updating the mining legislation. This included, among other reforms, the creation of the National Minerals Agency by upgrading the inefficient Mines Department (DNPM) in hopes of modernizing its regulatory capacity and providing further budgetary support and independence. In addition, the Brazilian Government, with support from the World Bank's Energy Sector Technical Assistance Project (ESTAL), approved a new strategic plan for the mining sector – the National Mining Plan 2030 (PNM). The PNM has three priority areas: (a) improved governance; (b) value-added processes; and (c) sustainability. The implementation of PNM so far has been limited due to lack of funds and political commitment. The proposed Project will finance studies to assist in the implementation of the PNM and will contribute to support the MME's social and environmental agenda through targeted actions that will improve the quality of life in mining areas, notably those affected by artisanal and small-scale mining.

22. Contrary to common belief, Brazil's most important mines (except iron ore and bauxite) are located outside the Amazon Basin, and the large majority of the country's surface area is still regarded as poorly explored for minerals when compared to leading countries such as Canada, Australia, USA and South Africa.

Institutional Overview

23. **DNPM/ANM –** The July 2017 approval of Agencia Nacional de Mineração (ANM) is seen as a positive step over the aging Mines Department - DNPM. The objective was to improve the licensing processing bureaucracy, reducing processing costs and overall modernization of the sector. New Mining Code - Specific improvements include the following: (i) international standard for reporting of Reserves and Resources; (ii) online staking by certified exploration/mining companies; (iii) easier surface/property access by the title holder; and (iv) the bidding of more than 30,000 titles.

24. Brazil's 9 key drivers for Expansion of the Extractive industry to be regulated and enforced by the DNPM/ANM are: (i) Improve geological knowledge and dissemination to international investors; (ii) Establish a National Strategy for minerals that should be selected for verticalization in the country and especially ones ready for direct export. e.g. gold vs iron ore; (iii) Enforce best practice in the environmental, social and safety sectors; (iv) Impose on current Exploration reports, adherence to international rules of Resource and Reserves Reporting; (v) Modernize the on-line staking process of first arrived first served basis; (vi) Make the exploration database from companies that have lost or relinquished titles, available as open file data within a logical time frame; (vii) Expedite Environmental Licensing for Exploration Permits while maintaining high standards; (viii) Organize Government run Core Libraries to be administered by and within Local ANM Districts; and (ix) Limit of border areas of mineral exploration for foreign controlled mining groups from 150km to 20km.

25. **CPRM/National Geological Survey Company -** Founded in 1969 CPRM is Brazil's Geological Survey Company. The company has over 1.700 professionals, of whom some 500 are geologists, hydro geologists, hydrology engineers and mine engineers. A third holds a masters or doctoral degree. The main responsibilities of CPRM are to support the formulation of mineral and geological policy, to participate in planning, coordination and execution of the geology and hydrology services of responsibility of the Union throughout the national territory. The mission is to promote the discovery and use of the country's mineral and water resources. Also, to develop information systems, charts and maps that translate national geological and hydrological knowledge, making it accessible to interested parties, expand the geophysical knowledge of the whole national territory through aerial acquisitions (executed since 1953), in partnership with other public institutions, and carry out terrestrial surveys (as geochemical surveys), whose objectives are to meet the guidelines of the projects developed institutionally.

26. The CPRM, through its technical staff, has been used, as far as the mineral and energy sector is concerned, mainly for geological cartography, developing maps and carrying out mapping projects in association with universities and, rarely, with private companies. Geophysical and geochemical surveys are also carried out, looking for data coverage of the entire Brazilian territory. In the past years, with support from the META 1 project, CPRM has been able to build it's technical capacity to provide mapping for disaster risk management. The company is working in several cities and municipalities in Brazil to support urban planning and risk mitigation actions in geologically unstable areas.

Tailings Dam Safety

27. The Samarco Dam failure, on 5 November 2015, caused the discharge of 62 million m3 of iron mines tailings over 230 counties in Minas Gerais and Espirito Santo. As a consequence, iron ore producers Vale and BHP were held responsible for the disaster. The fragility of present controls by the government agencies and companies responsible for wet tailing dams was highlighted. The tailings inundated the valley of Rio Doce and its tributaries, all the way to the Atlantic Ocean some 300 km away.

28. The Brumadinho tailings dam disaster, on January 25, 2019, has highlighted the fragility and inadequacy of the government's regulatory capacity and Vale's operational standards. The reason for the accident is still under investigation, but so far 64 people have been pronounced dead and the numbers are expected to grow (264+).

29. The urgency of the situation requires immediate action to ensure that such accidents do not occur again. Several measures need to be put in place and will require coordination between MME, ANM and CPRM. Strengthening ANM's regulatory capacity and installing a dam monitoring system are paramount for the safety of mine operations and should be implemented. Budgetary allocations for its effective implementation should be a priority.