

Infrastructure Outlook Brazil 2023

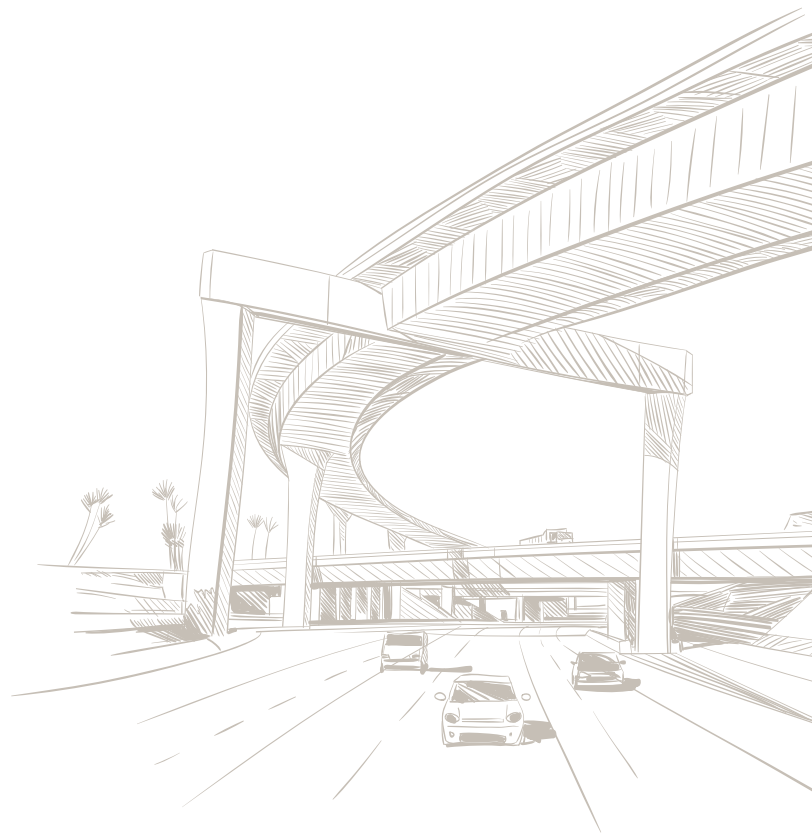




Index

- 1 Regional Overview
- 2 Brazil in Numbers
- 3 Brazil Zoom In
- 4 Key Infrastructure Sectors

- Power & Utilities
- Transportation
- Non-residential Building
- Residential Building
- Water & Waste
- Telecommunications





1 Regional Overview

In the rapidly evolving global business arena, Latin America emerges as a region of immense potential coupled with some complex challenges. While some sectors highlight impressive infrastructure projects representing progress and modernity, others languish due to a stark lack of development. However, for discerning investors and corporate leaders, infrastructure goes beyond mere structures—it forms the foundation of commerce and trade. Latin America's diverse geography, encompassing bustling cities and remote hinterlands, highlights infrastructure's pivotal role in fostering sustainable growth and competitive advantage.

While investment in the region is on the rise, a tangible gap remains between available financing and soaring demand.

Regulatory landscapes marked by fluidity create additional hurdles for multinational corporations and local enterprises alike. Within these challenges, however, lie boundless opportunities. The new millennium has brought a renewed commitment to infrastructure development in Latin America. The advent of Public-Private Partnerships (PPPs) signifies a paradigm shift, combining private sector efficiency with the reach of public initiatives. Additionally, the global push for sustainability is reshaping infrastructure projects to align with long-term environmental goals.

This comprehensive report provides executives and policymakers with insights crucial for informed decision making.

Paving the Way: Infrastructure Investment in Latin America

Latin Americas and Caribbean economies are dedicated to bridging a substantial infrastructure

gap to achieve Sustainable Development Goals by 2030, with governments currently allocating about 3% of the region's GDP to infrastructure. For comparison, East Asia and Pacific countries dedicate around 8%, and the Inter-American Development Bank estimates investments in infrastructure should be between 4-8% of the region's GDP in order to close the existing infrastructure gap of USD 150 billion per year in Latin America.

With regards to private investment, with USD 18.6 billion (+22% YoY) across 56 projects, Latin America was the region with the second-largest commitment in infrastructure, behind East Asia and the Pacific's USD 28.1 billion, according to World Bank's 2021 report. Brazil alone received USD 15.7 billion of private investment commitments across 36 projects, accounting for 84% of the region's PPPs for that year. In contrast, Mexico secured USD 1.1 billion in PPP investment commitments across six projects.

Water and electricity infrastructure are areas of relative strength for the region. More than 94% of the population have access to drinking water, but 20 million households still lack this essential service. Electricity access is also widely extended, with

primarily due to fossil fuels and hydroelectric sources.

Transportation infrastructure, however, remains a significant challenge as the region lacks a dense transportation network, and its paved road density is low. Urban transportation has seen investments in recent decades, with cities like Medellin and Santiago boasting efficient public transportation systems. Yet, the region's airports and ports need more attention to meet the demands of a growing

middle class and increased trade volumes.

Latin America's infrastructure journey highlights sector-specific progress but underscores the need for substantial private investments. Collaborative efforts, transparent partnerships, and strategic resource allocation are crucial as the region pursues its infrastructure goals to fuel economic expansion.



Inter-American Development Bank estimates investments in infrastructure should be between 4-8% of the region's GDP in order to close the existing infrastructure gap of USD 150 billion per year in Latin America.

Water and electricity infrastructure are areas of relative strength in the region, while transportation remains a significant challenge as the region lacks a dense road and highway network

Latin America was the region with the second-largest private investment commitment (USD 18.6 Bn, +22% YoY) in infrastructure in 2021.

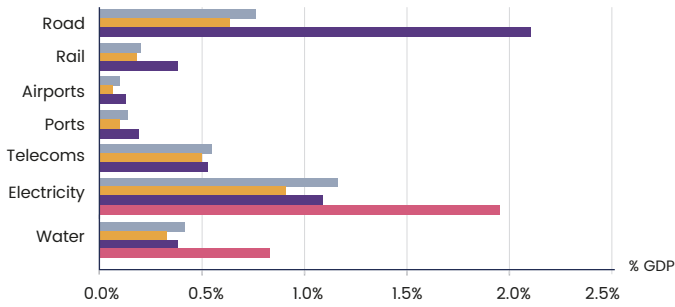


2 Brazil in Numbers

	Country	Brazil
Macro	Population (Million)	215.3 (2022)
	% urban population	87.5% (2022)
	GDP (USD)	\$1.92 Tn USD (2022)
	GDP CAGR (2022-30)	2.39%
	Government debt as a % of GDP	86% (2022)
	Currency	Brazilian Real (BRL)
	USD/Local currency, change LTM	-2.85%
Infra	Infrastructure quality	65/100
	Current investment	1.5 Tn USD
	Investment need	2.7 Tn USD
	Gap	1.2 Tn USD
	Public investment in infrastructure	6.5 Bn USD (2022)
	# of live infrastructure projects	900+ (2023)
ESG	Energy transition index	66/100 (2021)
	Air and GHG emissions per capita	2.05 t CO ₂ /capita (2019)
	Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	1.48%
	Renewable energy consumption (% of total final energy consumption)	50.06%

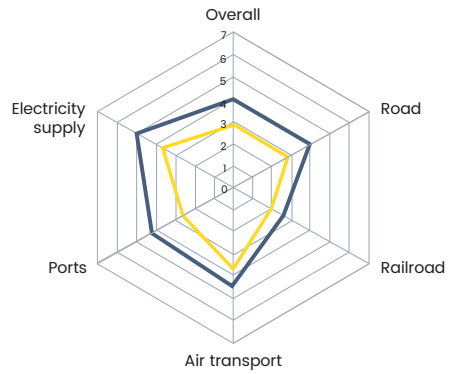
Source: World Bank, OECD, Google Finance, Global Infrastructure Hub, World Economic Forum & ABDIB - Brazilian Association of Infrastructure and Basic Industries.

Infrastructure investment as a percentage of GDP



Legend: 2007-2015 (grey), 2016-2040 (Current trends) (orange), 2016-2040 (Investment need) (purple), 2016-2030 (SDG - requirement over and above IN) (red). Source: Global Infrastructure Hub

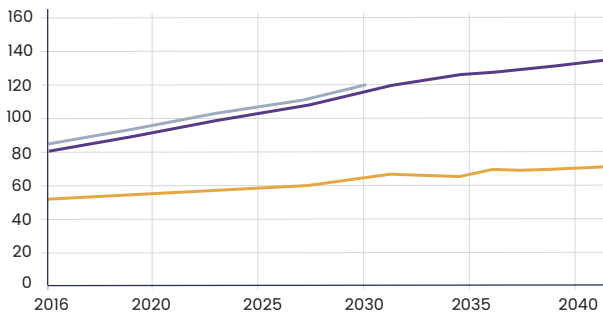
Infrastructure quality



Legend: 1-7 (best), Brazil (yellow), Americas (dark blue). Source: World Economic Forum

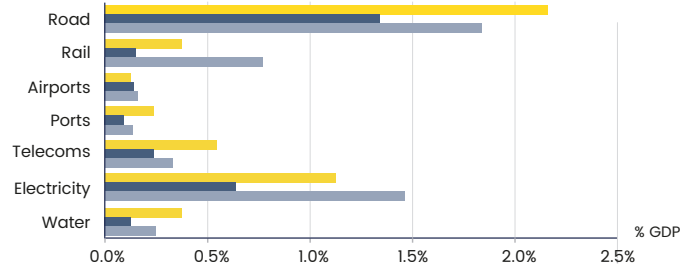
Infrastructure at current trends need

Billion USD



Legend: Current trends (orange), Investment need (purple), Investment need including SDG (grey). Source: Global Infrastructure Hub

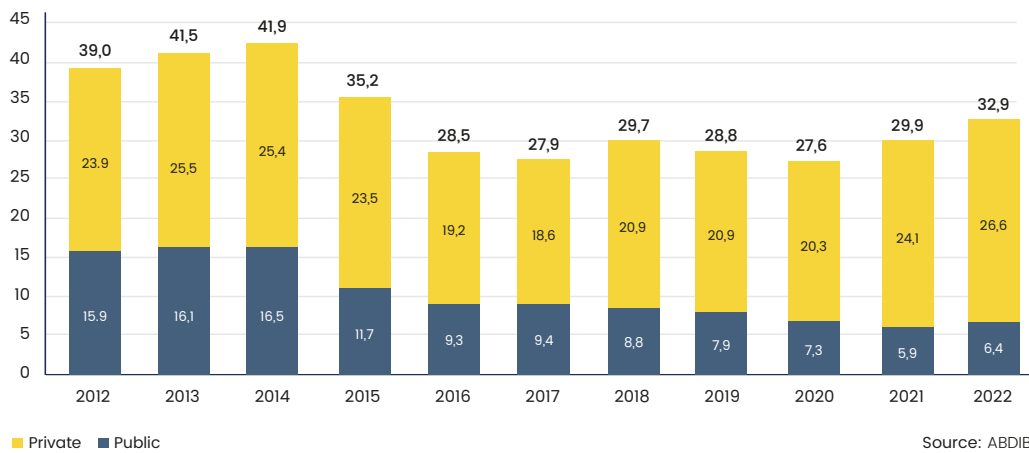
Infrastructure investment need by sector, 2016-2040



Legend: Brazil (yellow), Americas (dark blue), Upper middle income (grey). Source: Global Infrastructure Hub

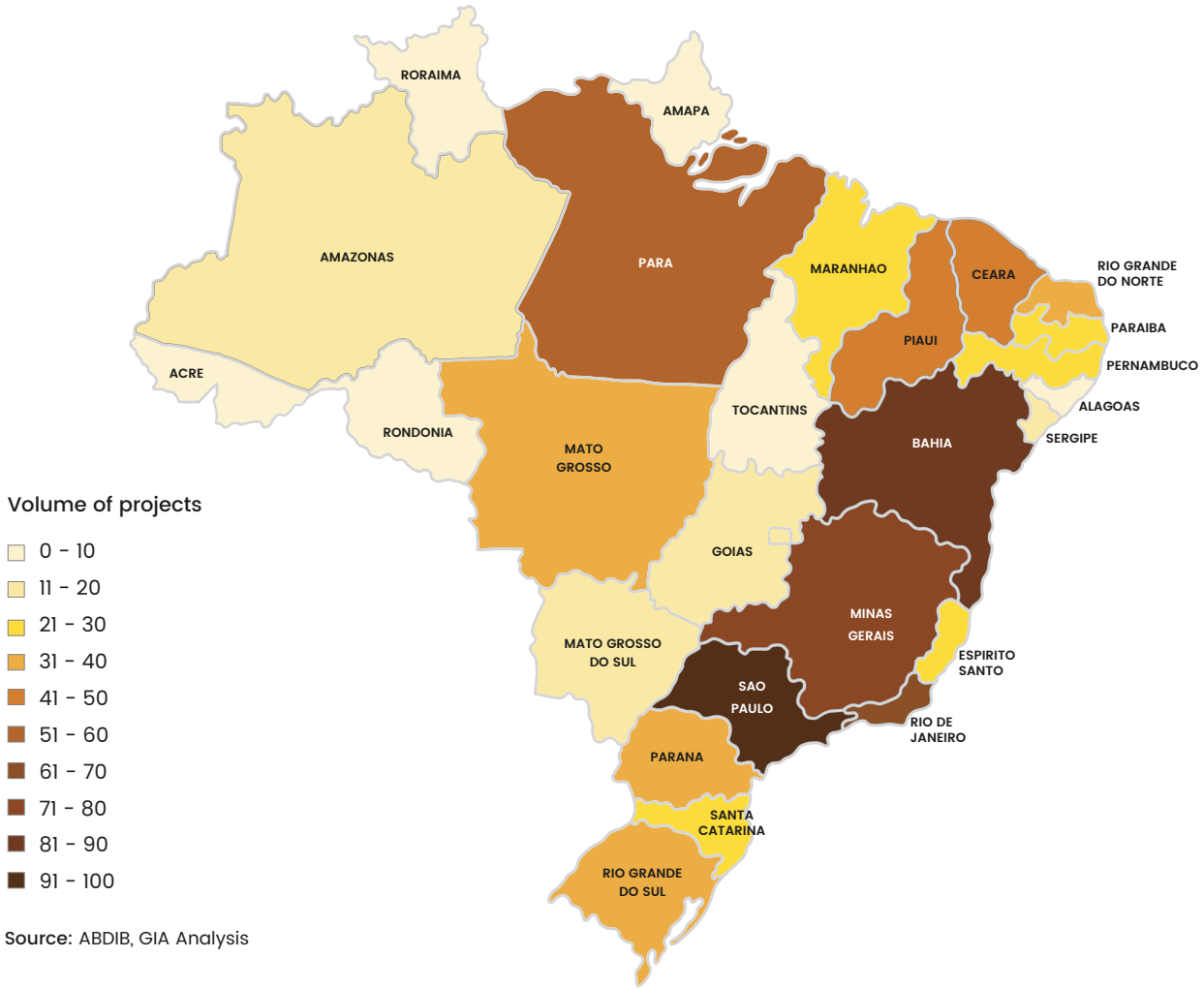
Evolution of public and private investment in infrastructure, 2012-22

Billion USD, constant prizes 2021

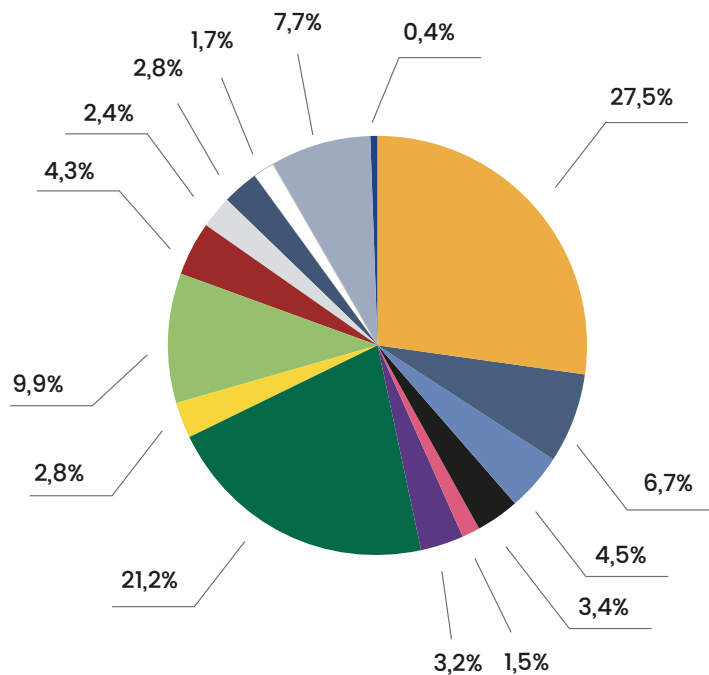
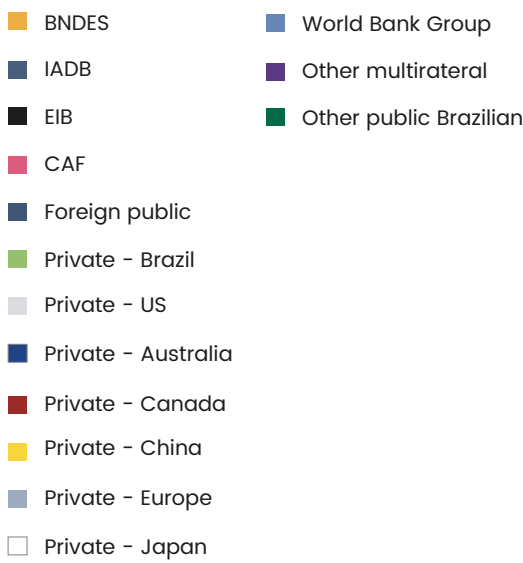


Legend: Private (yellow), Public (dark blue). Source: ABDIB

Selected live projects across federal entities



Main Capital Providers for selected infrastructure projects in Brazil, by number of investments, %





3 Brazil Zoom In

Brazil is the second-largest economy in the Western Hemisphere, surpassed only by the United States. Globally, its economic prowess is recognized by the World Bank, which ranks it as the twelfth largest economy in nominal terms. The nation's attractiveness as an investment destination is evident from its foreign direct investment (FDI) inflows. In 2021, the United Nations Conference on Trade and Development (UNCTAD) positioned Brazil as the seventh-largest recipient of global FDI, with inflows reaching USD 58 billion. This figure, while marking a significant 133% increase from the year prior, still lagged behind the pre-pandemic levels, which stood at USD 65.8 Bn.

Brazil's economic journey in recent years has been a rollercoaster. After grappling with the most profound recession in its modern history, the nation witnessed a resurgence that got halted in 2020 with the global coronavirus pandemic. The silver lining came in 2021 when Brazil's GDP grew by 4.6%, a commendable rebound from the 4.1% contraction in 2020.

According to OECD, economic activity is slowing in Brazil in 2023 due to weaker private consumption and exports affected by lower commodity prices and subdued global demand. Real GDP projections for this year are at 1.7%, and even more modest (1.2%) in 2024. The future remains uncertain, with GDP annual growth projections for 2024-30 being estimated at 2.4% in real terms. Lower employment growth – unemployment stood at 7.9% in the three months leading to July 2023 – and tighter credit conditions will limit household spending capacity in the short to medium term, while

private investment is expected to continue rising but at a slower pace. Inflation has been declining throughout 2022-23 but it remains above target. Monetary policy is therefore projected to stay restrictive, with policy rate standing at 13.25% in August 2023.

Driving Growth: Government Initiatives & Infrastructure Investment

In 2016, under Michel Temer's presidential mandate, the Investment Partnership Program (PPI) was created by Law No. 13,334, of 2016 that created a framework for expanding and strengthening the interaction between the State and the private sector through partnership contracts and other privatization measures. The following Brazilian government, under President Bolsonaro's leadership from 2019 until the end of 2022, prioritized sweeping economic reforms, most notably overhauling the pension system. Despite the pandemic's disruptions, 2021 saw this administration enacting several regulatory frameworks, particularly in the transportation and energy sectors.

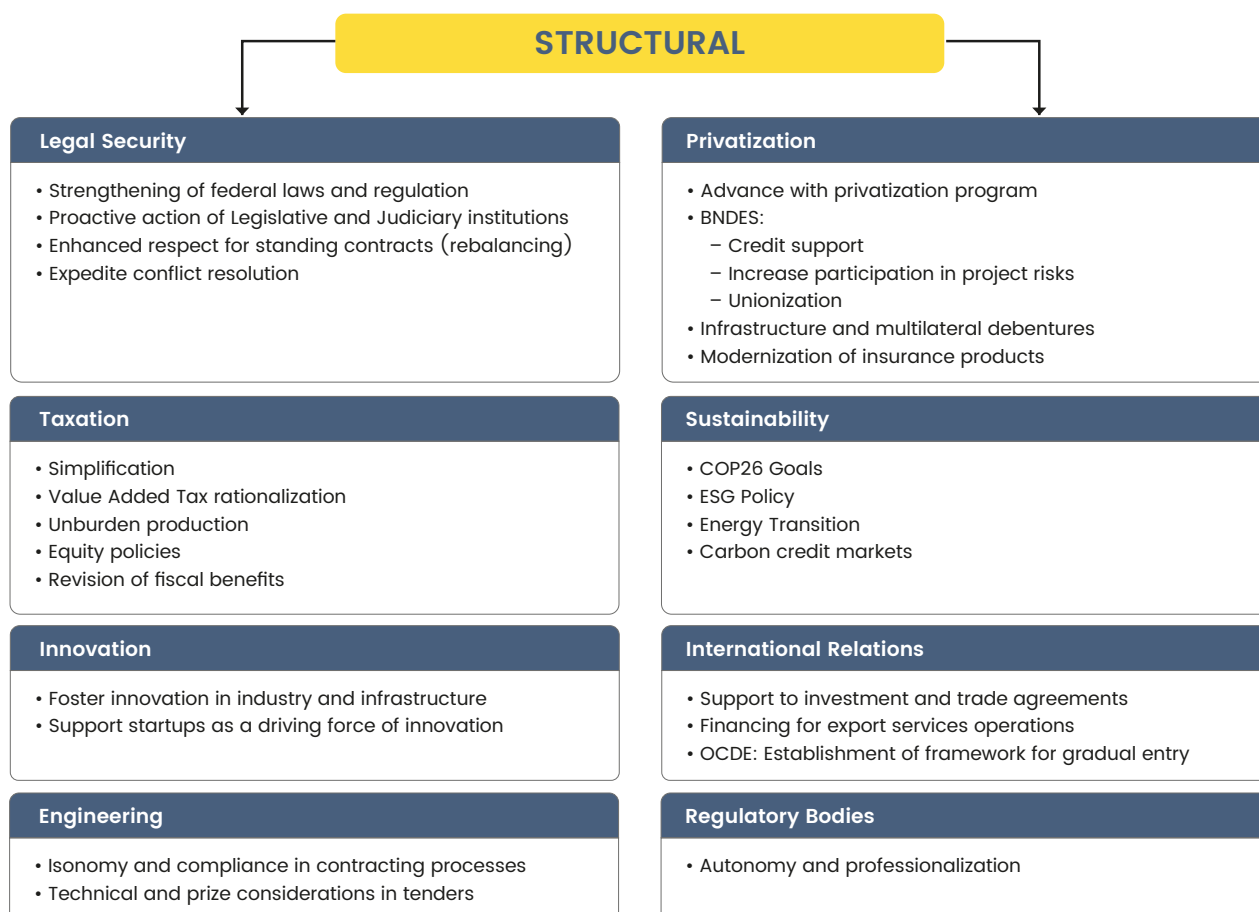
With regards to investment in infrastructure, Brazil experienced a steady 3.4% annual growth in 2017-22, driven by private investment that grew at a 7.4% CAGR in that same period to achieve a 80% share (USD 26 Bn) of total investment. Public investment, by contrast, fell, on average, by -7.2% per year in 2017-22 to USD 6.5 Bn. The nation's recent uptick in Foreign Direct Investment (FDI), a trend it shares with other major recipients in the region like Chile and Colombia, is primarily driven by renewed investments in the mining and fossil fuels sectors. The country has also seen a

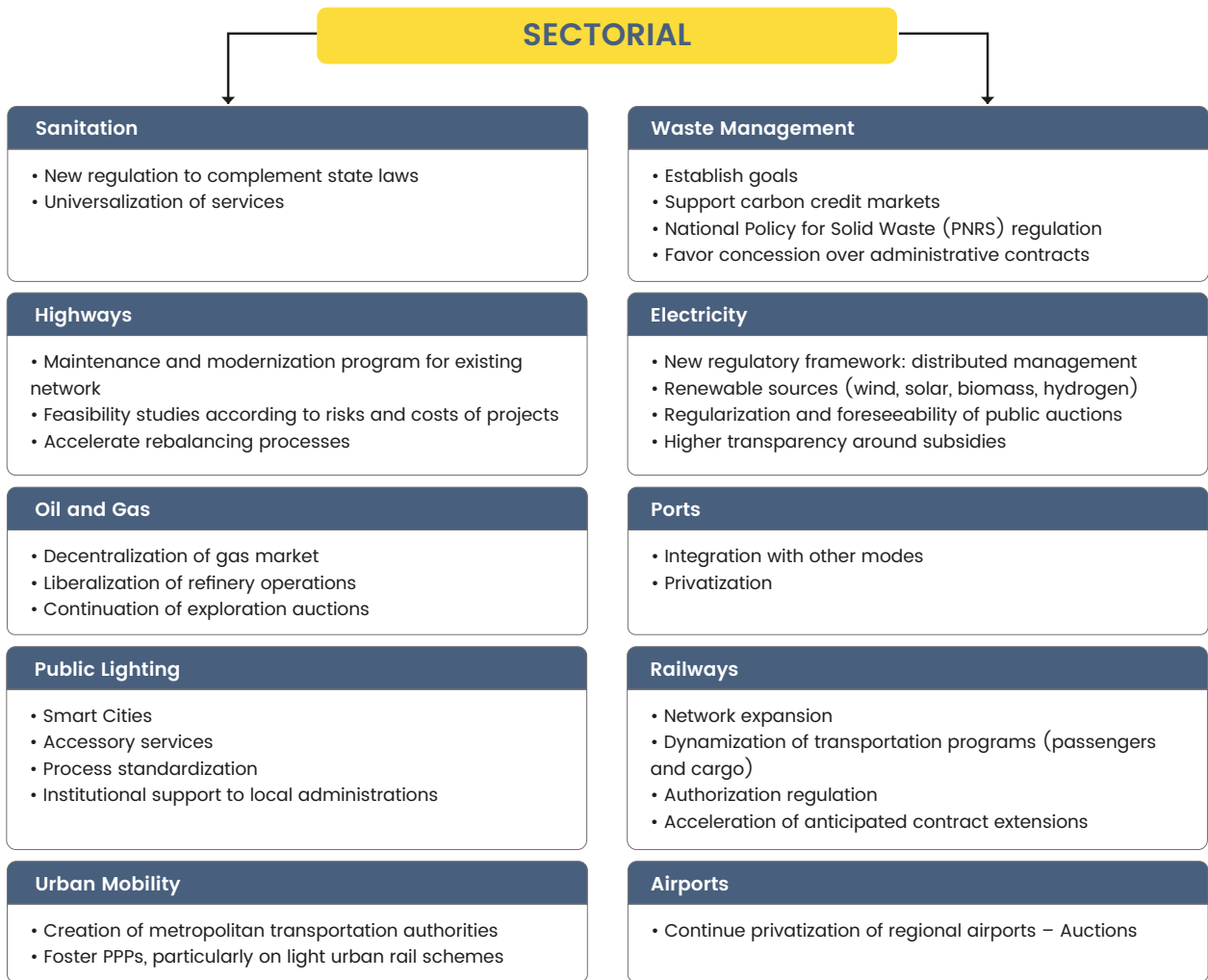
significant increase in the initiation of greenfield projects and international project finance deals, with growth rates of 35% and 32%, respectively. The construction industry has had its ups and downs, from booming in the early 2010s to an abrupt halt after 2014 due to political and economic crises. Signs of recovery were visible in 2019, and despite the setbacks caused by the COVID-19 pandemic and corruption scandals like "Operation Car Wash," the industry ended 2022 on a positive note reporting the creation of nearly 300,000 jobs. The forecasted growth of 1.8% until the end of 2024 suggests a cautiously optimistic future for the sector in the short term.

Returning president Lula da Silva, appointed in early 2023, has recently announced a USD 350 billion infrastructure investment plan, known as the Growth Acceleration Plan (PAC), aimed at stimulating the country's economy and transitioning to greener technologies, with USD 220 billion coming from public funds and the remaining USD 125 Bn from the private sector. The President has been quoted stating that he will not allow fiscal austerity to interrupt his development plans. This plan expects to create four

million jobs and includes both traditional infrastructure projects and sustainable development initiatives. Notably, PAC allocates USD 123 billion to improving sustainability and resilience in cities, USD 110 Bn for energy transition projects and USD 71 Bn to more efficient and cleaner transportation. Types of investments include public works, construction of new facilities and modernization of existing infrastructure. The government has plans to deploy USD 264 billion by the end of Lula's term in 2026. Finally, the PAC program also aims to balance Brazil's budget deficit by 2024.

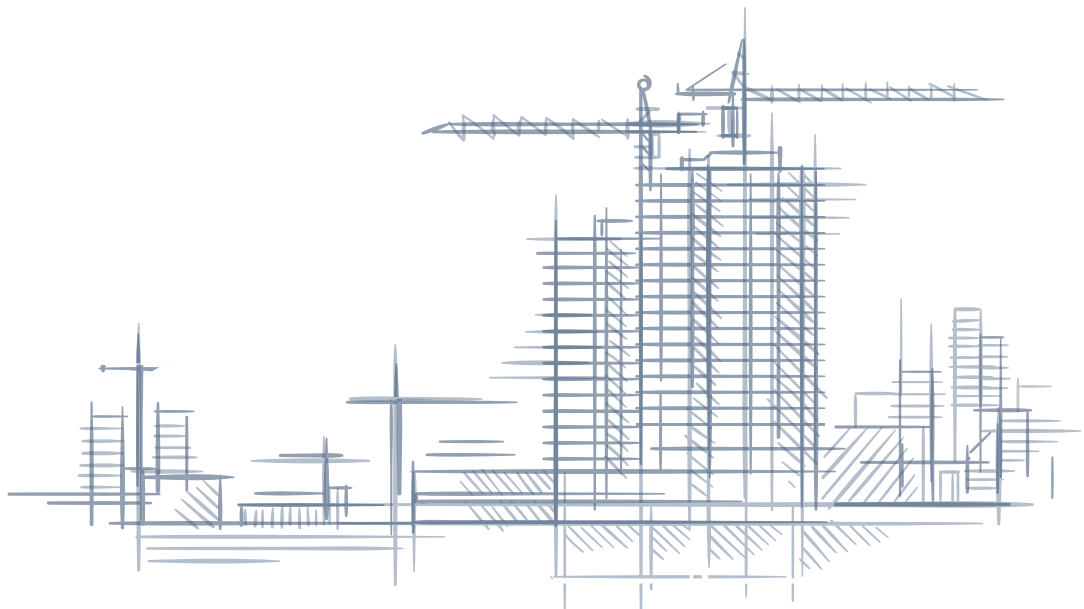
In 2022, Brazilian Association of Infrastructure and Basic Industries (ABDIB), developed a forward-looking agenda of proposals to bolster infrastructure in Brazil. The institution is a private, non-profit entity created to help infrastructure and industrial development in Brazil and its board of directors and advisors includes prominent figures from a large number of incumbent companies. The association distinguishes between structural and sector-specific recommendations, an overview of which is outlined in the figure below these lines.





These developments underscore Brazil's emerging role as a key player in both traditional and renewable energy sectors. Potential investors should tread with caution, as despite the myriad opportunities the country offers, it also presents some challenges. High transportation and labor costs, coupled with low

domestic productivity and political uncertainties, can pose hurdles. The nation's intricate tax, local content, and regulatory requirements further compound these challenges, making it imperative for investors to navigate the Brazilian market with diligence and foresight.



SWOT Analysis

Strengths

- **Market size:** Brazil's infrastructure industry is by far the largest and most active in Latin America, with the volume of opportunities for those with a solid position in this market being unrivalled.
- **Government Initiatives:** The Government of Brazil has been actively pursuing privatization through concession auctions and regulatory reforms to attract financing.
- **Significant Investments:** Brazil's PAC (Programa de Aceleração do Crescimento) with its USD 350 Bn infrastructure plan is a major strength in terms of investment opportunities. The program, funded through various means including public-private partnerships, makes Brazil an attractive destination for investors, particularly those interested in sustainable development and infrastructure.

Weaknesses

- **Logistics Bottlenecks:** Brazil's logistics costs account for around 12.7% of its GDP, which is 4% more than in the U.S. This inefficiency stems from poor transportation infrastructure, leading to higher operational expenses.
- **Unpredictable Economic Recovery:** Economic growth has largely stagnated or trended downward annually since 2012, affecting domestic demand and weakening Brazil's currency.
- **Complicated Tax System:** Brazil imposes high taxes and tariffs on imported goods and services. The tax system is complex, ranking 184 out of 190 countries in terms of ease of paying taxes.
- **Legal System:** The overburdened legal system in Brazil can lead to delays and uncertainties in the implementation and operation of infrastructure projects. The legal complexities can also increase the cost and risk associated with infrastructure investment.

Infrastructure SWOT

Threats

- **Environmental Concerns:** Brazil has faced several years of drought and low reservoir levels, emphasizing the need for better water conservation and management.
- **Restrictions to access long-term financing:** These restrictions are associated with the reduced participation of BNDES, which contributed about 80% of the funds to finance infrastructure projects in the last decade, and the impact of international banking regulations (Basel II), which require a high capital component for long-term financing and thus limit commercial banks' appetite for assets of this kind.
- **Solid Waste Issues:** Brazil is the fourth-largest plastic waste producer globally, with only a small fraction being recycled.
- **Non-transparent Public Procurement Processes:** Government tenders often favor domestic players due to local content requirements and high levels of corruption.

Opportunities

- **Private Investments in Railways:** The government is focusing on increasing private investments in railways, especially for cargo.
- **Water and Sanitation:** With the new sanitation regulatory framework, there's a push to ensure that by 2033, 99% of the population has access to clean water and 90% to sewage treatment.
- **Solid Waste Management:** The federal government aims to modernize solid waste management, including closing all dumpsites in the next two years and increasing recycling rates.
- **Government Procurement:** Brazil passed a new government procurement law in April 2021, aiming to make their procurement market more open to international bidders.



4

Key Infrastructure Sectors



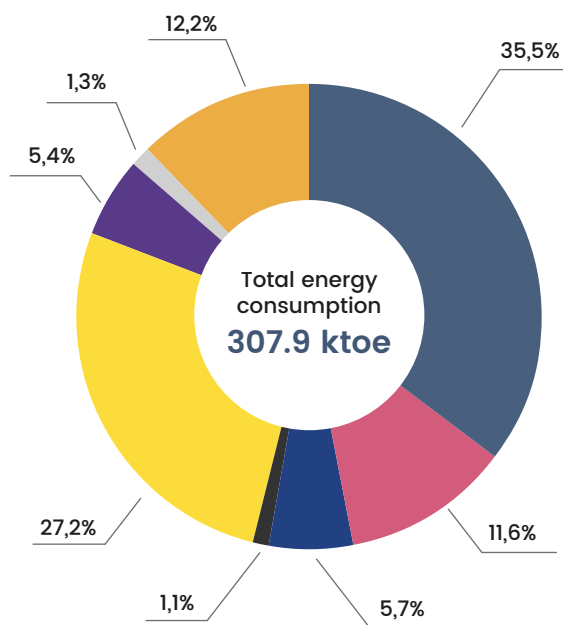
Power and Utilities

Brazil has an extensive landmass rich in natural resources, coupled with a climate and soil fertility that far exceed the country's projected energy needs for the next three decades. The nation is on track to shift from being a net importer of energy to a net exporter, managing a diverse and abundant array of energy resources.

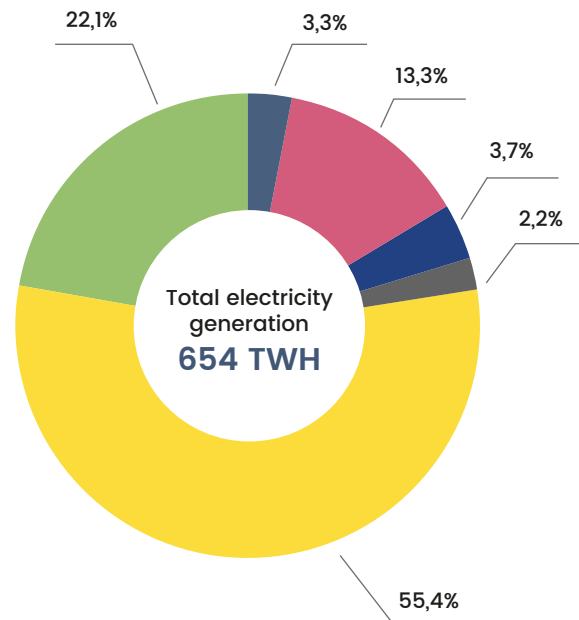
Brazil's primary energy consumption bounced back in 2021 to pre-pandemic level in 2019 (12.57 EJ in 2021 and 12.56 EJ in 2019). The combined share of energy consumption from oil, gas and coal stood at 53%, with natural gas being the fastest growing fuel, increasing 29% above its 2020 level. In terms of installed capacity for centralized power generation, non-hydro

renewable sources account for roughly 22% while hydroelectric dams, primarily along the Amazon River Basin, remain the main source with over 55%. By the year 2030, non-hydro renewable sources are expected to gain share in the mix and account for at least 1/3 of the energy generated, a gain that comes mainly from hydropower reducing its weight.

Energy consumption by source (2021), %



Power generation (TWh) by source (2021), %



Oil Natural gas Coal Nuclear Hydro Wind Solar Other renewables All renewables

Source: bp's Statistical Review of World Energy

The Brazilian power sector is presently undergoing significant structural changes in its legal and regulatory framework. Various public consultations

and legislative efforts are underway to modernize and improve the applicable regulations. One noteworthy change is the adjustment of eligibility



Power and Utilities

requirements for large consumers to participate in power trading within the free market. These requirements have been gradually reduced over the years, making it easier for more participants to enter the free market. This reduction in eligibility criteria led to an increase in renewable energy projects within the free market segment between 2020 and 2021.

Additionally, there has been a growing emphasis on Environmental, Social, and Governance (ESG) measures within the sector, although at a slower pace. This has resulted in a small increase in long-term power purchase agreements involving renewable sources and self-production structures, established between energy market players and large consumers, to meet power demand and ESG goals.

The expansion of power generation is anticipated to put pressure on transmission infrastructure, necessitating the development of new transmission facilities and the expansion of existing ones. These projects are auctioned by the federal government through the National Electric Energy Agency (ANEEL), with a set schedule for upcoming auctions.

This increase in participants within the free market has prompted discussions about revising the regulations regarding the involvement of energy traders, specifically focusing on market reliability. ANEEL and the Energy Trading Chamber (CCEE) are considering factors such as financial stability and technical expertise in market rules and risks, and evaluating agents' criminal records or administrative penalties to enhance transaction reliability.

Furthermore, as of December 2022, exporters and power producers are able to execute power purchase agreements in foreign currency, thanks to Law No. 14,286/2021. Additionally, Law No. 14,182/2021,

published in July 2021, aims to privatize Eletrobras, enhancing the company's investment capacity in both energy generation and transmission segments.

On January 7th, 2022, Law No. 14,300 established the legal framework for distributed generation projects in Brazil, primarily targeting renewable on-site generation plants, limited to 5 MW. Subsequently, on January 25, 2022, the Brazilian Federal Government issued Decree No. 10,946/2022, outlining guidelines for offshore wind projects in Brazil. This decree focuses on the allocation of physical space and the utilization of natural resources for offshore electricity generation. Finally, new mines and energy minister, Alexandre Silveira, announced in January 2023 the creation of a National Energy Transition Secretariat, which would be dedicated exclusively to structuring public policies aimed to position Brazil as a world leader in clean energy – a top challenge for the new administration.

Certainly, the Brazilian energy sector is currently undergoing a revision process in its legal and regulatory framework to address the energy transition, ESG goals, and foster a competitive market. Various regulatory measures are being implemented to empower energy consumers to manage their energy demand and supply more freely.

By the year 2030, non-hydro renewable sources are expected to gain share in the mix and account for at least 1/3 of the energy generated, a gain that comes mainly from hydropower reducing its weight.



Power and Utilities

Transmission lines

Latest transmission lines auctions held by Energy and Mines Ministry.

Auction	Capex (USD million)	States	Sponsor	Km of Lines	Capacity (MVA)	Construction start	Construction start
2nd Energy Transmission Auction 2023	\$4,520m	GO/MA/MG/SP/TO	Ministério de Minas e Energia	3000	9840	N/A	N/A
1st Energy Transmission Auction 2023	\$3,152.61m	BA/ES/MG/PE/TJ/SE/SP	Ministério de Minas e Energia	6122	400	N/A	N/A
2nd Energy Transmission Auction 2022	\$704.53m	ES/MA/MG/PA/RJ/RO	Ministério de Minas e Energia	710	3,650	16/12/2022	N/A
1st Energy Transmission Auction 2022	\$3,072.90m	AC/AM/AP/BA/ES/MG/MS/MT/PA/RO/SC/SE/SP	Ministério de Minas e Energia	5425	6,180	30/06/2022	N/A
2nd Energy Transmission Auction 2021	\$581.42m	BA/MG/PR/SP	Ministério de Minas e Energia	902	1,000	17/12/2021	N/A
1st Energy Transmission Auction 2021	\$259.17m	AC/MT/RJ/RO/SP/TO	Ministério de Minas e Energia	515	2,600	30/06/2021	N/A
Transmission Installations Concession Auction nº 01/2020	\$1,479.37m	AM/BA/ES/GO/MS/RS/SP	Ministério de Minas e Energia	1958	6,420	17/12/2020	31/03/2021
Transmission Auction 2019	\$847.41m	BA/AC/GO/CE/MG/MS/SP/MT/PA/AL/RJ/RS	Ministério de Minas e Energia	2470	7,800	19/12/2019	N/A

Renewables

In July 2022 Brazil reached 22 GW of installed wind power from 777 completed wind energy plants, with a further 4.9 GW of capacity currently under construction, positioning the country as the 7th in the world in terms of installed wind power and the 4th largest producer of wind energy in the world (72 TWh), behind only China, USA and Germany. Wind is more intense from June to December, coinciding with the months of lower rainfall intensity, putting the wind as a potential complementary source of energy to hydroelectricity. The north-east region of Brazil is home to 90% of the country's installed wind energy capacity due to the favorable climate conditions and strong winds.

With regards to solar power, Brazil's installed capacity reached 22 GW In October 2022, making it the 14th country in the world in terms of installed solar power, and the 11th largest producer of solar

energy in the world (16.8 TWh). This stems from Brazil having one of the highest solar incidence in the world. As a part of the new energy plan PDE 2024, the Ministry of Mines and Energy revised the country's solar energy targets compared to the target planned for 2023. The initial target includes producing 3,500MW of solar power by 2023, while the new target includes generating 7,000MW of solar energy by 2024.





Power and Utilities

Selected live solar and wind power projects

Name	Capex (USD million)	State	Capacity (MW)	Type	Date construction start	Date construction end
Camocim Offshore Wind Farm	2,183	Ceara	1,200	Offshore Wind	2024	2028
Ventos do Mar Potiguar wind complex	3,429	Rio Grande do Norte	2,484	Offshore Wind	2025	2029
Votu Winds offshore wind farm	1,500	Espirito Santo	1,440	Offshore Wind	2025	2029
Wind Park wind complex	636	Rio Grande do Sul	675	Onshore Wind	2023	TBD
Feijão Hybrid Wind - Photovoltaic Farm	700	Piauí / Pernambuco	456	Onshore Wind	2022	TBD
Serra do Tigre Wind Farm	1,099	Rio Grande do Norte	756	Onshore Wind	2024	TBD
Novo Horizonte wind complex (Stage 1)	597	Bahia	423	Onshore Wind	TBD	TBD
San Francisco Canindé photovoltaic park	1,187	Sergipe	1,200	Photovoltaic	TBD	TBD
Photovoltaic project in Port Açu	1,000	Rio de Janeiro	1,100	Photovoltaic	2025	2026
Sol do Cerrado Photovoltaic Complex	624	Minas Gerais	766	Photovoltaic	2023	TBD
Jaíba SE1 Solar Plant	52,653	Minas Gerais	40	Photovoltaic	2023	TBD
Kuara photovoltaic complex (Phase 1 / Stages 1, 2 & 3)	1,290	Ceara	1,500	Photovoltaic	TBD	TBD

Hydro

Globally, Brazil is the second largest producer of hydropower, behind China, and the Itaipu Dam is the world's second largest hydroelectric power station by installed capacity. Built on the Paraná River dividing

Brazil and Paraguay, the dam provides over 75% of Paraguay's electric power needs and meets more than 20% of Brazil's total electricity demand.

Selected live hydroelectric projects

Project name	Technology	Capex (USD million)	Area	Capacity MW	Owner
Nossa Senhora de Fátima Thermoelectric Plant	CHP	903	Rio de Janeiro	1,355	Eneva
Piratininga Thermoelectric Power Plant - Block I & II	Natural gas generation	1,239	Sao Paulo	2,554	Metropolitan Company of Water and Energy of Sao Paulo
Rio Grande thermoelectric power plant	Natural gas generation	1,075	Rio Grande do Sul	1,280	Metropolitan Company of Water and Energy of Sao Paulo
Porto do Açu III Thermoelectric Plant (GNA II)	CHP	1,126	Rio de Janeiro	160	GNA (JV: Prumo Logística, BP, Siemens & SPIC)
Lins thermoelectric plant	Natural gas generation	1,097	Sao Paulo	2,050	Omega Engenharia



Power and Utilities

Oil and gas

The Buzios oil and gas field, located in the pre-salt Santos Basin offshore Rio de Janeiro, is the world's largest deepwater discovery. Managed by Petrobras, the state-owned oil company, this field began its journey in April 2018. By March 2020, it reached a production zenith of 640,000 bopd, with four operational floating production storage and offloading (FPSO) units. Since its commencement, Buzios has generously contributed over 100 million barrels of oil and gas equivalent. Currently, it outputs 560,000 barrels per day, which constitutes a significant 17% of Brazil's national output. The efficiency of the field is underscored by the remarkably low extraction cost of just \$4 per barrel. As part of its ambitious strategic plan spanning 2020–2024, Petrobras has introduced additional FPSOs since 2022, including Almirante Barroso platform capable of producing up to 150,000 barrels of oil and 211.89 million cubic feet of gas per day. This field's expansion includes six additional units currently under construction with a combined capacity of 1,200,000 barrels per day and a total investment north of USD 13 billion, with Petrobras holding a majority stake and complemented by Chinese capital.

Additionally, Petrobras and its partners in the Libra consortium have greenlit the Mero-4 FPSO for deployment at the Mero field in the Santos Basin. The new FPSO Alexandre de Gusmão will be the fourth production platform at the Mero field, with the other three existing units producing 180,000 barrels of oil per day. The new FPSO has also a production capacity of 180,000 bopd and can process 12 million standard cubic meters of gas daily. Additionally, it has a water injection capacity of 250,000 barrels per day and storage for 1.4 million barrels of crude oil. The vessel will be anchored almost 160 km off the coast of Rio de Janeiro state in waters about 1,900m deep, and is set

for completion in 2024. Petrobras signed a letter of intent (LoI) with SBM Offshore for a 22.5-year lease and operate contract of the Mero-4 FPSO.

The BM-C-33 Gas and Condensate Field is being developed in water depths up to 2,900m in the Campos Basin pre-salt, approximately 200 km off the coast of Rio de Janeiro, an area encompassing three unique pre-salt discoveries: Pão de Açúcar, Gávea, and Seat. The combined recoverable reserves for these sites surpass one billion barrels of oil equivalent. The project's innovative development strategy involves deploying an FPSO capable of processing both gas and oil condensate, thereby eliminating the need for additional onshore processing. This FPSO is set to produce 16 million cubic meters of gas daily, with an anticipated average export of 14 million cubic meters per day. Scheduled to commence operations in 2028, the BM-C-33 project represents an investment of approximately USD 9 Bn. Its significance is further highlighted by its potential to cater to 15% of Brazil's total gas demand upon activation. Notably, it will pioneer the treatment of gas offshore in Brazil, connecting directly to the national grid without the need for onshore processing. The gas will be transported via a 200-kilometer offshore pipeline to Macaé, Rio de Janeiro, while liquids will be offloaded using shuttle tankers. Final investment decision was made on May 2023 by Equinor, a Norwegian oil and gas company with a 35% stake in the asset, and partners Repsol Sinopec Brasil (35%) and Petrobras (30%). The field's reserves, combined with its projected daily production capacity of about 125,000 barrels of crude oil and 565 million standard cubic feet of associated gas, position it as a cornerstone development in Brazil's natural gas market.



Power and Utilities

Pipeline

Selected live hydroelectric projects

Name	Capex (USD million)	States	Length (km)	Wall thickness (in)	Capacity (million m ³ /day)
Route 3 gas pipeline (Santos Basin to the Gaslub Itaboraí pole)	1,424	Rio de Janeiro	355	22-24	18
Central Brazil gas pipeline (São Carlos - Brasília)	1,340	Sao Paulo , Goiás, Federal District	905	14	3.8
Vaca Muerta - Porto Alegre gas pipeline	3,700	Neuquen (Argentina), Rio Grande do Sul	1,400	n/a	15
Santo Antônio dos Lopes - São Luís Gas Pipeline	1,113	Maranhao	282	20	8
Santo Antônio dos Lopes - Caucaia Gas Pipeline	1,159	Maranhao , Ceara , Piaui	684	20	8
Uruguaiana (RS) - Triunfo (RS) gas pipeline (Section II)	1,000	Rio Grande do Sul	600	24	15
Pre-salt of the Santos basin - Port of Itaguaí gas pipeline (Rota 4b)	1,204	Rio de Janeiro	299	24	20
Bilac - Santa Maria gas pipeline (Chimarrão B)	2,319	Rio Grande do Sul , Santa Catarina , Parana , Sao Paulo	1,237	20	8
Penápolis-Canoas gas pipeline (Chimarrão A)	2,207	Sao Paulo , Parana , Rio Grande do Sul , Santa Catarina	1,168	20	8

Thermoelectric plants

Selected live thermoelectric plant projects

Project name	Technology	Capex (USD million)	Area	Capacity MW	Owner
Nossa Senhora de Fátima Thermoelectric Plant	CHP	903	Rio de Janeiro	1,355	Eneva
Piratininga Thermoelectric Power Plant - Block I & II	Natural gas generation	1,239	Sao Paulo	2,554	Metropolitan Company of Water and Energy of Sao Paulo
Rio Grande thermoelectric power plant	Natural gas generation	1,075	Rio Grande do Sul	1,280	Metropolitan Company of Water and Energy of Sao Paulo
Porto do Açú III Thermoelectric Plant (GNA II)	CHP	1,126	Rio de Janeiro	160	GNA (JV: Prumo Logística, BP, Siemens & SPIC)
Lins thermoelectric plant	Natural gas generation	1,097	Sao Paulo	2,050	Omega Engenharia

Green Hydrogen

Hydrogen has been identified as a key component of low carbon energy systems and is expected to have an important role in Brazil's journey towards decarbonization. There is a lot of potential for a green hydrogen economy in Brazil due to the abundance of renewable resources and strong regional support. The country has taken key steps in the sector and in 2022, it established a green hydrogen secretariat to accelerate growth. A mapping conducted by H2 Brazil, a project

resulting from a partnership between the German Agency for International Cooperation (GIZ) and the Brazilian Ministry of Mines and Energy, has identified at least 42 green hydrogen production projects in the country of different sizes and stages of development. H2 Brazil, which started in 2021 and will run until the end of 2023, mapped more than 800 companies and institutions in 12 sectors of the green hydrogen value chain in five Brazilian regions.



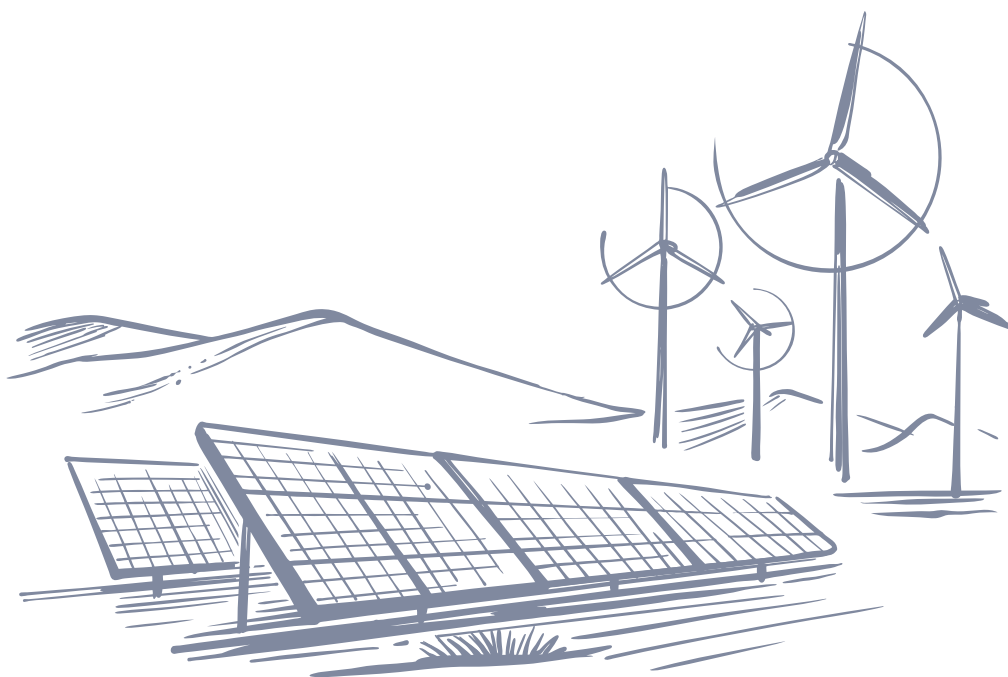
Power and Utilities

Meanwhile, the state government of Ceará, in northeastern Brazil, is taking important steps towards for the development of a new green hydrogen hub at the Port of Pecém, located 60 kilometers from the capital city of Fortaleza and in a strategic location to trade with European ports. The 19,000-hectare Pecém Industrial and Port Complex (CIPP) is a joint venture between the state government (70%) and the Port of Rotterdam (30%), which is the main recipient of the hydrogen exported via Ceará.

To this date, 18 Memoranda of Understanding (MoUs) have been signed with national and foreign companies to design, supply, execute and operate projects in the hub, including Engie, the largest private-sector power producer in Brazil, and Australian mining company Fortescue. The most advanced developments, however, are led by Singaporean/Australian Enegix and local players Cactus Energia Verde and EDP Brazil, with the latter having already commenced production in December 2022. Enegix Energy is moving forward with plans to build a huge clean hydrogen plant on the

northeast coast of Brazil. The US\$5.4-billion Base One project is intended to transform solar and wind power into more than 600 million kg of green H₂ annually. This development, currently at the feasibility study and capital raising stage, would be 20 times larger than the biggest green hydrogen plant in operation today. On the other hand, Cactus Energia Verde's hydrogen plant is a substantial investment of USD 5.4 billion capable of producing 120,000 tons per year of green hydrogen, 958,000 tons per year of green oxygen, and 640,000 tons per year of green ammonia.

For the green hydrogen produced in Brazil to become competitive, the price level for the renewable energy required for hydrogen production should decrease to between \$10/MWh and \$30/MWh (BRL 149/MWh), still off the prices of the last rounds of wind and solar auctions. Although the level of competitiveness is still low, the cost of transportation and storage will also be a differential for the production and commercialization of green hydrogen.





Transportation

Brazil is at a pivotal moment in its infrastructure development, with significant investments and initiatives underway across various sectors. From expanding and modernizing its rail and road networks to upgrading airports and seaports, the country is making strides to enhance its logistical capabilities and connectivity. Additionally, a focus on urban mobility aims to transform public transportation, making it more efficient and accessible for its citizens. These concerted efforts in infrastructure development are not only crucial for Brazil's economic growth but also pivotal in elevating the nation's global standing in trade, tourism, and sustainable living.

The Government of Brazil has been actively promoting privatization through concession auctions and regulatory reforms. As of August 2022, the government had collected over USD 24 Bn in concession fees and committed more than USD 96 Bn in investments.

Trucks remain the primary mode of cargo transport in the country, making logistics expensive with total costs accounting for about 12.7% of Brazil's GDP. The government aims to increase private investments, especially in railways and ports. One major ongoing project is the privatization of the Santos Port Authority, the largest Latin America. Rail legislation passed in December 2021 allows private players to Design-Build-Operate (DBO), and as of October 2022, there were 89 new requests to build and operate short lines, representing more than 22,000 km of new railways with an estimated private investment of USD 49.6 Bn.

Railways

Brazil is making significant strides to modernize its rail infrastructure through its Growth Acceleration Program. President Lula da Silva announced on August 11th 2023 an investment of USD 18.1 Bn for various rail projects across the country. This disbursement is planned in two phases, with the first allocating USD 10.6 Bn during the period 2023-26, while the second phase starts in 2026 and consists of the remaining USD 7.52 Bn. The

majority of this investment, amounting to over on, is expected to come from the private sector. This funding will be directed towards 15 new or existing rail projects. On the other hand, the federal government will directly contribute USD 1.1 Bn, specifically for the construction of three major new rail lines: North-South Railway (FNS) Extension with an estimated investment of USD 793m over 30 years, the USD 12.7 Bn Ferrogrão project and the West-East Integration Railway (FIOL) with an estimated cost of USD 3 Bn. Additional funds are also allocated for the enhancement of existing rail lines and for the planning of greenfield projects, including the São Paulo-Campinas inter-city rail scheme. Other noteworthy ongoing projects like the Transnordestina project between Salgueiro and Suape and the 485 km West-East Integration Railway (Ferrovia de Integração Oeste-Leste) are also part of this program.

Tax Incentives for Rail Projects

In a parallel development, Brazil's National Council for Finance Policy approved a tax exemption on rail investments in August 2023. This exemption specifically targets the ICMS tax, which is usually applied to the circulation of goods and transport services. The move is expected to reduce the overall project costs by up to 15%.

Federal Minister of Transport Renan Filho has hailed this tax exemption as a "gigantic and unprecedented



Transportation

incentive" for the rail sector. The primary aim of this tax relief is to attract more private funding by making rail projects more financially viable.

Railroad concession renewals

The railroad concession renewals in Brazil are undergoing a significant rediscussion. The federal government of Brazil and major railroad operators, including Vale, Rumo, and MRS, have been in intense negotiations regarding the planned concession renewals that were agreed upon during the previous administration. A crucial clause in the contract addendum stipulates that the renewals will only materialize if 80% of all contracted investments are executed by specific deadlines: 2027 for Rumo and Vale, and 2026 for MRS. This acceleration of investments is pivotal as it supports the early renewal of concessions, negating the need for new bidding processes.

Vale faces a particularly complex situation. The company had finalized an agreement in December 2020 to renew contracts for the Carajás Railway and Vitória-Minas Railway for an additional 30 years, starting from 2027. The counterparty commitment was approximately USD 5.15 billion. The primary work of the deal is the construction of the Fico (Central-West Integration Railway) between Mara Rosa (state of Goiás) and Água Boa (state of Mato Grosso), a project that is set to be completed in April 2028 but for which recent progress has been slow.

The ANTT (National Land and Transport Agency) has expressed confidence in the commitment of the concessionaires and does not foresee the possibility of non-fulfillment of the renewals. The agency emphasizes that the addenda have modern inspection mechanisms to ensure compliance.

Passenger train services

The Brazilian government, under President Luiz Inácio Lula de Silva, is set to rejuvenate its regional passenger train services. The National Railway Plan, scheduled for release in October 2023, will likely incorporate plans to introduce regional passenger services across seven short to medium-distance routes. To support these initiatives, a Passenger Rail Transport Policy, which will set forth guidelines, principles, and objectives for the new passenger trains, is also expected to be unveiled around the same timeframe. These routes will undergo feasibility studies, encompassing technical and economic evaluations. Public-private partnerships are envisioned to establish these passenger services. Although the majority of these routes might utilize existing rail alignments currently serving freight trains, significant track and infrastructure refurbishment will probably be required. The proposed routes include connections such as Brasília to Luziânia, Maringá to Londrina, Pelotas to Rio Grande, Salvador to Feira de Santana, Fortaleza to Sobral, São Luís to Itapecuru Mirim, and Duque de Caxias to Itaboraí and Niterói. Currently, Brazil has suburban trains in several cities and some tourist operations, with the main line passenger services being operated by the mining group Vale.

Selected Projects

The Central Bi-Oceanic Railway Project is an ambitious infrastructure initiative aimed at enhancing connectivity and trade across South America. Spanning approximately 2,400 km from Campo Grande in Brazil to Antofagasta in Chile, this railway corridor will traverse through Brazil, Paraguay, Argentina, and Chile. A significant component of this project is the Bioceanic Route bridge, connecting Brazil and Paraguay, which has



Transportation

secured an investment of approximately USD 93.75 million. Furthermore, Bolivia is keen on bolstering its global trade capabilities through the Bioceanic Integration Railway Corridor, connecting it to Brazil and Peru. The technical feasibility of the Central Bi-Oceanic railway was entrusted to the Spanish narrow-gauge rail company, FEVE, a division of the state-owned Spanish railway company Renfe Operadora with a rich legacy in Spain's railway infrastructure, especially in the narrow-gauge sector, making it a pivotal player in the realization of this transcontinental railway vision. Capital providers for the project include multilaterals UNASUR, IADB and CAF.

The Rio–São Paulo high-speed rail project, often referred to as the "bullet train", is an ambitious initiative aimed at connecting the two most well known Brazilian cities, Rio de Janeiro and São Paulo. The railway is designed to cover a distance of approximately 378 kilometers, with intermediate stations at São José dos Campos and Volta Redonda. The São Paulo terminus is planned to be located in the Pirituba area, while the Rio terminus is expected to be at Santa Cruz. The high-speed trains are designed to run at speeds of up to 350 km/h, reducing the travel time between the two cities to around 90 minutes. The project's budget has seen fluctuations, with initial estimates at USD 4,583m that later escalated to USD 7,208m. International companies like Alsaldo Brena from Italy and China Railways showed interest in the construction contract but later withdrew due to viability concerns. In February 2023, National Land Transport Agency (ANTT) granted TAV Brazil authorization for the planning, construction and operation of the new high-speed line, with a redesigned project, removing the São Paulo–Campinas branch and airport stations from the project and moving the São Paulo and Rio stations away from the city centers.

The Transnordestina project represents a significant advancement in Brazil's infrastructure development, aiming to enhance regional trade and connectivity in the northeast of the country. This railroad, a public initiative, is designed to transport cargo, primarily grains and minerals, from the remote region of Piauí to regional ports for export or distribution within the country. This railway will span from Eliseu Martins in Piauí to Pecém port in Ceará, covering a total of 1,282 kilometers. The project is divided into two main stretches: the first connects Eliseu Martins to Suape port in Pernambuco, while the second links Salgueiro in Pernambuco to Pecém port in Ceará. The capital expenditure for this project is approximately USD 3,300m.

The East–West Railway (FIOL) is a railway project in the state of Bahia, seen as a strategic move to facilitate the transportation of minerals from the south and grains from the west parts of the state. Once fully operational, it is expected to significantly reduce greenhouse gas emissions of cargo transport by up to 86%. The project consists of three segments and a total of 1,527 km, and will connect the future port at Ilheus (Bahia) with Figueirópolis (Tocantins), where it will link with the North–South railway. FIOL 1, the first segment connecting the cities of Caetité and Ilhéus is a 537 km stretch that traverses 19 municipalities and its completion is set for 2027 with presidential efforts to expedite construction to the year prior by including the project as a strategic axis in the new infrastructure Growth Acceleration Plan (PAC). Concession spans 35 years and mandates an investment of USD 687.5m. Of this, approximately USD 333.3m is allocated for the ongoing construction, which is currently 80% complete. The second and third sections are being tendered by the (National Land Transport Agency (ANTT)).



Transportation

The Ferrogrão EF-170 Railroad project, initiated by the federal government of Brazil, is a USD 5 Bn logistical endeavor aiming to consolidate Brazil's new export rail corridor through the North Ark (Arco Norte). This railway project, which has been under discussion for over four years, is a part of the old Investment Partnership Program (PPI). The estimated investment for the project is USD 5 billion and the federal administration is seeking private investment with a concession period lasting 69 years. The government's projection is for the EF-170 to be operational within a decade. The 933 kilometers of Ferrogrão will follow the path of the BR-163, one of the country's largest highways running north to south. The railroad tracks will connect the municipality of Sinop (MT) to the district of Miritituba (PA) on the banks of the Tapajós River, and it aims to solve the issue of 70% of Mato Grosso's soybean and corn crop currently flowing through ports in the south and southeast, despite being located more than two thousand kilometers from the origin.

With over 7,200 km the Central-Atlantic Railroad is the largest concession in Brazil's federal network. It operates in various corridors connecting states like Goiás, Minas Gerais, São Paulo, Espírito Santo, Rio de Janeiro, and Bahia. The project focuses on improvements to the railway section between Corumbá (Mato Grosso do Sul) and Santos (Sao Paulo) and its main objectives are to enhance Brazil's transportation matrix by increasing the role of rail transport for cargo, integrating the Brazilian-Bolivian systems and upgrading the railway to operate trains with up to 32 tons/axle. The project also aims to restore the infrastructure to ensure the safety and operability of the railway. The projected rehabilitation includes the enhancement of special art works, recovery of cuts, embankments, superficial and deep drainage, replacement of TR-50 rails with TR-68,

ballast purging, replacement of deteriorated sleepers, rail track leveling, and the establishment and expansion of crossing yards.

Rumo Logística, under the Cosan group, has embarked on the Northern Grid (Malha Norte) railway expansion project in Mato Grosso, aiming to connect Rondonópolis to Lucas do Rio Verde with over 700 kilometers of new tracks. The project, which has faced delays due to consultations with indigenous communities, represents an investment of between USD 2.9 Bn and USD 3.13 Bn. The first phase spans 210 kilometers from Rondonópolis to Campo Verde and is set to be operational by the first quarter of 2026, while the entire railway is anticipated to be completed between 2028 and 2029.

The São Paulo intercity railway (Trem Intercidades – TIC), a public-private partnership structured by the São Paulo state government, aims to connect São Paulo and its neighboring suburbs, namely Campinas, 90 kilometers northwest of downtown São Paulo. At least three consortia of Brazilian and multinational companies are gearing up to bid for the TIC auction scheduled for November 2023, marking a significant resurgence in passenger rail transport investments. The São Paulo government is close to securing an international loan of USD 700m for its contributions to the project, negotiated with institutions like the World Bank, the Inter-American Development Bank, and the French Development Agency. Governor Tarcísio de Freitas is in discussions to include the TIC in the new administration's Growth Acceleration Plan. The project's total investment is estimated at approximately USD 2.67 Bn, with the state government covering 47% of this amount. The metropolitan train service is expected to be operational by 2028, while the express service between Barra Funda and Campinas, covering the



Transportation

distance in 64 minutes at speeds of up to 140 km/h, is slated for 2030. The São Paulo–Campinas train is just the beginning of a series of medium-speed rail transport projects that the state aims to implement.

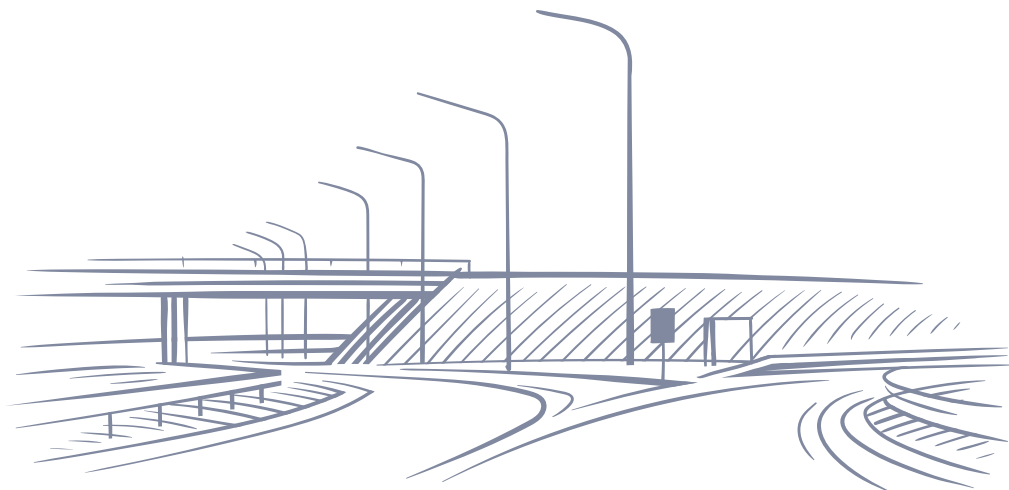
Airports

Brazil's air and seaports are receiving substantial investments to increase their capacity and efficiency. New terminals are being built, and existing facilities are being upgraded to accommodate larger volumes of passengers and cargo. Advanced technology is being integrated into operations to streamline customs procedures and enhance security measures. These upgrades are crucial for Brazil to become a key player in international trade and tourism.

The goal of airport concessions is to lure investment for the expansion and modernization of Brazil's airport facilities, thereby enhancing the quality of air travel services. These concession agreements, overseen and regulated by Brazil's National Civil

Aviation Agency (ANAC), adhere to global quality standards.

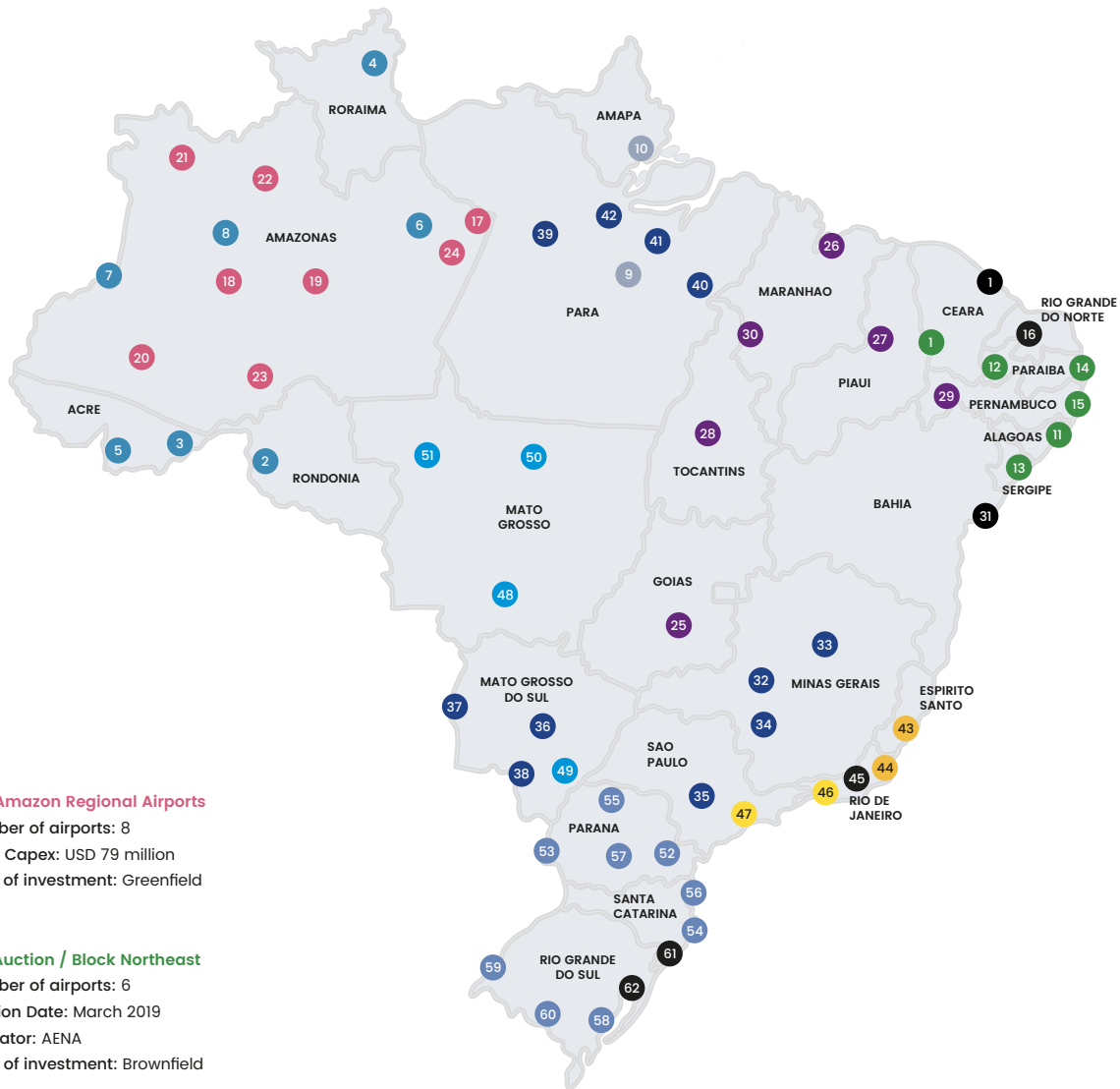
A 2022 auction spearheaded by Congonhas São Paulo Airport, generated an initial contribution of USD 566m. The auction, organized by the National Civil Aviation Agency (ANAC), saw 15 airports awarded to the private sector for a 30-year period. These airports collectively handle about 15.8% of the country's total passenger traffic. The approach shifted to regional clusters starting from the fifth round of auctions. The seventh round followed this cluster model and offered 15 airports divided into three groups to private investors. This round secured commitments for around USD 1.5 Bn over a 30-year period. The winning bidders included Aena Desarrollo Internacional, XP Infra IV Fund, and the Novo Norte Aeroportos consortium (Infraero, Dix Empreendimentos, Agemar). Looking ahead to 2023–2024, Rio de Janeiro's Galeão and Santos Dumont airports are expected to be bundled together and offered to a single operator through an auction.





Transportation

Latest airports concessions



● **PPP Amazon Regional Airports**
 Number of airports: 8
 Total Capex: USD 79 million
 Type of investment: Greenfield

● **5th Auction / Block Northeast**
 Number of airports: 6
 Auction Date: March 2019
 Operator: AENA
 Type of investment: Brownfield

● **5th Auction / Block Center-East**
 Number of airports: 4
 Auction Date: March 2019
 Operator: Consórcio Aereoeste
 Type of investment: Brownfield

● **5th Auction / Block Southeast**
 Number of airports: 2
 Auction Date: March 2019
 Operator: Zurich Airport
 Type of investment: Brownfield

● **6th Auction / Block North I**
 Number of airports: 7
 Auction Date: April 2021
 Operator: Vinci Airports
 Type of investment: Brownfield

● **6th Auction / Block Central**
 Number of airports: 6
 Auction Date: April 2021
 Operator: Companhia de Participações em Concessões
 Type of investment: Brownfield

● **6th Auction / Block South**
 Number of airports: 9
 Auction Date: April 2021
 Operator: Companhia de Participações em Concessões
 Type of investment: Brownfield

● **7th Auction / Block SP-MG-MS-PA**
 Number of airports: 11
 Auction Date: August 2022
 Operator: AENA
 Type of investment: Brownfield

● **7th Auction / Block General Aviation RJ-SP**
 Number of airports: 2
 Auction Date: August 2022
 Operator: XP Infra 4
 Type of investment: Brownfield

● **7th Auction / Block North II**
 Number of airports: 2
 Auction Date: August 2022
 Operator: Socicam and Dux
 Type of investment: Brownfield

#	City	State	Capex (USD million)	Status
● 1	Fortaleza	Ceará	285	Concession under contract
● 2	Porto Velho	Rondônia	58	Concession under contract
● 3	Rio Branco	Acre	33	Concession under contract
● 4	Boa Vista	Roraima	41	Concession under contract
● 5	Cruzeiro do Sul	Acre	17	Concession under contract
● 6	Manaus	Amazonas	127	Concession under contract
● 7	Tabatinga	Amazonas	14	Concession under contract
● 8	Tefé	Amazonas	19	Concession under contract
● 9	Belém	Pará	156	Concession under contract
● 10	Macapá	Amapá	15	Concession under contract
● 1	Juazeiro do Norte	Ceará	40	Concession under contract
● 11	Maceió	Alagoas	86	Concession under contract
● 12	João Pessoa	Paraíba	56	Concession under contract
● 13	Aracaju	Sergipe	53	Concession under contract
● 14	Campina Grande	Paraíba	32	Concession under contract
● 15	Recife	Pernambuco	180	Concession under contract
● 16	São Gonçalo do Amarante	Rio Grande do Norte	64	Concession under contract
● 17	Parintins	Amazonas		
● 18	Carauari	Amazonas		
● 19	Coari	Amazonas		
● 20	Eirunepé	Amazonas	79	Technical studies
● 21	São Gabriel da Cachoeira	Amazonas		
● 22	Barcelos	Amazonas		
● 23	Lábrea	Amazonas		
● 24	Maués	Amazonas		
● 25	Goiânia	Goiás	114	Concession under contract
● 26	São Luís	Maranhão	71	Concession under contract
● 27	Teresina	Piauí	66	Concession under contract
● 28	Palmas	Tocantins	37	Concession under contract
● 29	Petrolina	Pernambuco	45	Concession under contract
● 30	Imperatriz	Maranhão	41	Concession under contract
● 31	Salvador	Bahia	479	Concession under contract
● 32	Uberlândia	Minas Gerais	95	Concession under contract
● 33	Montes Claros	Minas Gerais	37	Concession under contract
● 34	Uberaba	Minas Gerais	53	Concession under contract
● 35	Congonhas	São Paulo	730	Concession under contract
● 36	Campo Grande	Mato Grosso do Sul	78	Concession under contract
● 37	Corumbá	Mato Grosso do Sul	41	Concession under contract
● 38	Ponta Porã	Mato Grosso do Sul	42	Concession under contract
● 39	Santarém	Pará	58	Concession under contract
● 40	Marabá	Pará	30	Concession under contract
● 41	Carajás	Pará	31	Concession under contract
● 42	Altamira	Pará	30	Concession under contract
● 43	Vitória	Espírito Santo	67	Concession under contract
● 44	Macaé	Rio de Janeiro	56	Concession under contract
● 45	Santos Dumont	Rio de Janeiro	266	Technical studies
● 46	Jacarepaguá	Rio de Janeiro	46	Concession under contract
● 47	Campo de Marte	São Paulo	64	Concession under contract
● 48	Várzea Grande	Mato Grosso	112	Concession under contract
● 49	Rondonópolis	Mato Grosso	15	Concession under contract
● 50	Sinop	Mato Grosso	18	Concession under contract
● 51	Alta Floresta	Mato Grosso	15	Concession under contract
● 52	Curitiba	Paraná	109	Concession under contract
● 53	Foz do Iguaçu	Paraná	153	Concession under contract
● 54	Navegantes	Santa Catarina	143	Concession under contract
● 55	Londrina	Paraná	81	Concession under contract
● 56	Joinvile	Santa Catarina	51	Concession under contract
● 57	Bacacheri	Paraná	11	Concession under contract
● 58	Pelotas	Rio Grande do Sul	15	Concession under contract
● 59	Uruguaiana	Rio Grande do Sul	15	Concession under contract
● 60	Bagé	Rio Grande do Sul	15	Concession under contract
● 61	Florianópolis	Santa Catarina	200	Concession under contract
● 62	Porto Alegre	Rio Grande do Sul	396	Concession under contract



Transportation

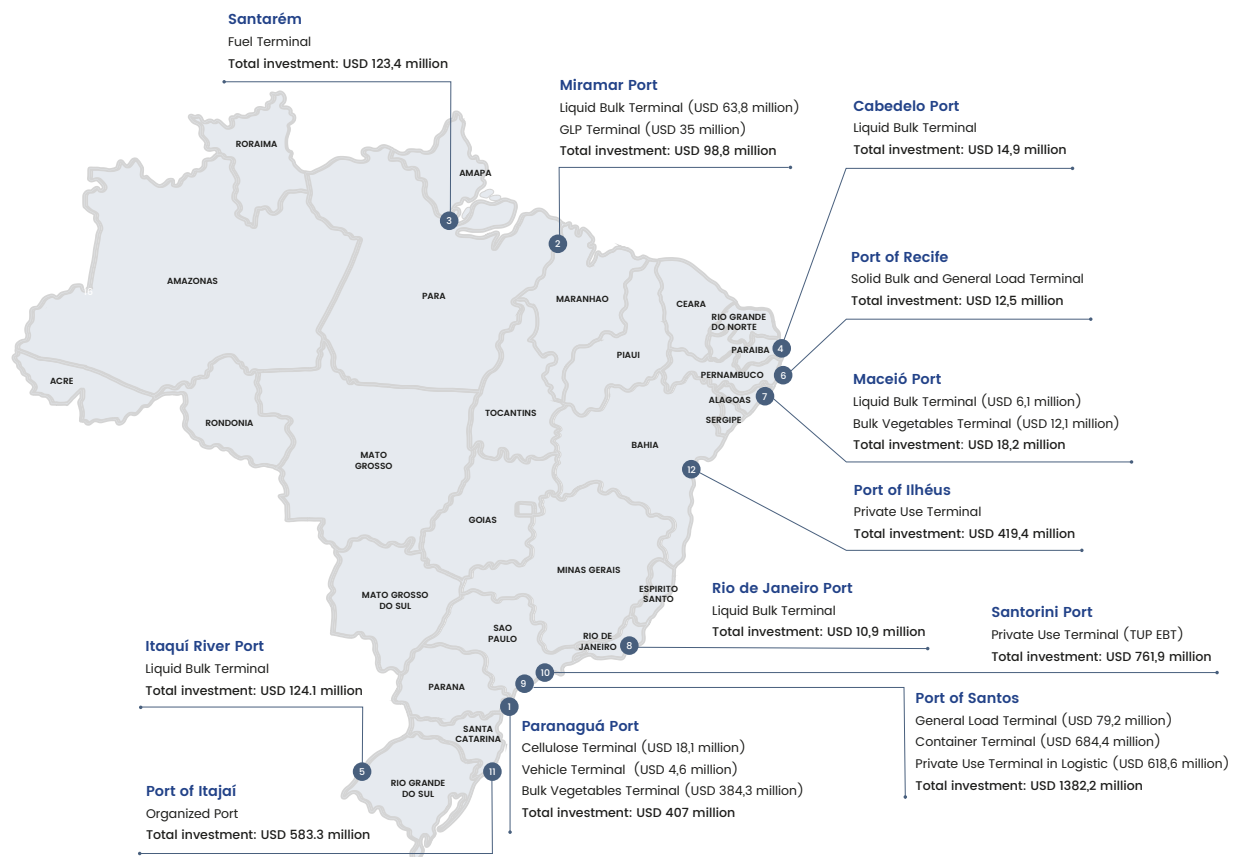
Ports

According to the National Water Transportation Agency (ANTAQ), dependent of the Ministry of Ports and Airports, Brazilian port terminals processed a total of 1,209 million tons of cargo throughout 2022, a similar level to the previous year (-0.4% y-o-y). State-owned ports accounted for one third of total load. Regarding types of cargo, gas and liquid bulk represented 67% of processed volume, followed by solid bulk (17%), containers (12,4%) and general cargo (3.6%) in Q4 2022.

The former Bolsonaro administration pursued full privatization port of Santos in the state of Sao Paulo,

the largest in Latin America processing over 3.5 million TEUs in 2022. In July 2020, the now extinct Ministry of Infrastructure released a plan to lease out Santos on an operator-concession model that hoped to attract USD 2 billion of investment over the 35-year period of the concession. Nevertheless, recently appointed minister of ports and airports, Marcio Franca, stated in December 2022 that the long-awaited privatization of the port of Santos will not go forward, but rather they will focus on concessions on private terminals with the port authority remaining state owned.

Latest ports auctions





Transportation

Highways

Brazil's government is actively seeking to attract a significant amount of private investment to its highway sector. A senior official announced that they aim to secure around USD 62 Bn by the end of 2026. This initiative is part of a new concession model that the government is still finalizing in collaboration with the private sector.

This new strategy marks a sharp increase in highway investment during President Lula da Silva's term, compared to his predecessor Jair Bolsonaro. Under the previous administration, the government awarded seven highway concessions between 2019 and 2022, representing a total of just 49 billion reais of investment.

George Santoro, the executive secretary at the Ministry of Transportation, emphasized the new government's intention to attract new foreign investors. The first auctions under this new model are scheduled for August and September 2023 and are expected to bring in around USD 20 billion for four different schemes located in Parana, Minas

Gerais, and Rio de Janeiro. Santoro mentioned that there has been international interest from firms from countries like Spain, Canada, Portugal, Italy, Switzerland, China, India, Australia, Argentina, Uruguay, and Colombia. The new model will award the license to operate a highway to the company offering the lowest toll rates and will include technological upgrades like "free flow" tolls.

The Inter-American Development Bank (IDB) has approved a USD 480m loan in 2023 for the State of São Paulo to enhance its highway infrastructure with a program that aims to upgrade approximately 470 kilometers of at least seven state highways. The State of São Paulo will see significant benefits from this program, as it will directly impact 2.15 million inhabitants in 44 municipalities, reducing transportation costs and travel times for various production chains. The program also aims for greater social inclusion by improving road quality in vulnerable areas. The loan will be disbursed over five years and comes with a six-year grace period.

Name	Investment (USD million)	States	Kms	Project Status	Sponsor
5th Round of Road Concessions in the State of São Paulo (Northwest Lot A and Northwest Lot B)	\$1,458.33m	SP	5,515	Concession under contract	NA
BR-040 (Cristalina-Belo Horizonte) (re-bid - 679.7 km)	\$1,291.25m	DF/GO/MG	680	Planning Auction	Ministry of Transportation
BR-101/290/386/448/RS - Southern Integration Highway (RIS)	\$1,625.00m	RS	473	Technical / feasibility studies	Ministry of Transportation
BR-116/493/RJ/MG (Rio-Valadares)	\$2,352.08m	MG/RJ	727	Concession under contract	Ministry of Transportation
BR-153/080/414/GO/TO (Goias - Tocantins)	\$1,628.54m	GO/TO	NA	Concession under contract	Ministry of Transportation
BR-153/262/GO/MG (re-bid) (Hidrolandia-Paranaíba-Rio Grande- Pouso Alto)	\$1,122.92m	GO/MG	531	Technical / feasibility studies	Ministry of Transportation
BR-381/MG (Belo Horizonte- Joao Monvelde)	\$1,145.83m	MG	304	Planning Auction	Ministry of Transportation
Highway - BR 040/495/MG/RJ - Rio de Janeiro to Belo Horizonte	\$1,916.67m	MG/RJ	451	Planning Auction	Ministry of Transportation



Transportation

Name	Investment (USD million)	States	Kms	Project Status	Sponsor
Highways in Santa Catarina	\$6,250.00m	SC	3,000	Technical / feasibility studies	Ministry of Transportation
Minas Gerais Highways - Subsystem 1	\$1,145.83m	MG	1,081	N/A	State of Minas Gerais
Nova Dutra	\$3,013.79m	RJ/SP	625	Concession under contract	Ministry of Transportation
Paraná Integrated Highways - lot 1	\$1,310.21m	PR	473	Planning Auction	Ministry of Transportation
Paraná Integrated Highways - lot 2	\$2299.66m	PR	604	Planning Auction	Ministry of Transportation
Paraná Integrated Highways - lot 3	\$1,688.33m	PR	569	Planning Auction	Ministry of Transportation
Paraná Integrated Highways - lot 4	\$1,740.21m	PR	628	Planning Auction	Ministry of Transportation
Paraná Integrated Highways - lot 6	\$1,771.88m	PR	646	Planning Auction	Ministry of Transportation
PIPA - Piracicaba-Panorama	\$2,916.67m	SP	1,273	Concession under contract	NA
Rodoanel - Belo Horizonte metropolitan region	\$1,166.67m	MG	NA	Contract signed	NA
Studies for the concession of 6,700 km of federal highways - North Central lots (2,153.6 km)	\$1,208.33m	GO/MT/RO	6,700	Technical / feasibility studies	Ministry of Transportation
Studies for the concession of 6,700 km of federal highways - Northeast lots (2,471 km)	\$4,466.67m	BA/CE/PB/PE/RN/SE	6,700	Technical / feasibility studies	Ministry of Transportation

The Santos-Guarujá tunnel, which has been envisioned for nearly a century, will serve as a land connection between the municipalities of Santos and Guarujá, facilitating the movement of vehicles, bicycles, and pedestrians. The construction of this tunnel is planned to last from 2024 to 2028, and will be carried out through a collaboration between the federal government and the state government of São Paulo. It is qualified under the State of São Paulo's Investment Partnership Program (PPI-SP) and is expected to be realized through a public-private partnership, with an estimated investment of USD 1.25 Bn. The company that becomes part of the PPP will be responsible for the tunnel's operation for a period that can range between 30 and 35 years. Moreover, the primary objective of the tunnel is to serve as a land connection between the two municipalities, as the current crossing options between Santos and Guarujá are by ferry or a 43-kilometer road stretch.

The tunnel, with a length of 860 meters, will allow a crossing time of just over a minute and a half, and it is estimated that around 150,000 people will use it daily.

Reports of late July 2023 confirm that the project of the bridge to connect Salvador and Itaparica was about to start soon after many discussions among ministers in Brazil and China, the country of origin of the China Communications Construction Company (CCCC) in charge of the construction. Early this April, the governor of the state of Bahia met with the the president of China Communications Construction Company to discuss the work on the bridge and deliberate on its technical and financial facets.

The Minister of the Civil House, in a social media post, indicated ongoing efforts to initiate the bridge's construction promptly. The Salvador-Itaparica Bridge, valued at approximately USD 1.2 Bn, is set to



Transportation

span 12.4 km, potentially making it the longest bridge in Latin America.

Urban transportation

Brazil is also focusing on improving urban mobility by investing in public transportation systems, including buses, subways, and light rail. These projects aim to reduce congestion, lower carbon emissions, and provide more accessible and convenient travel options for the public. Innovations in smart transportation technologies such as real-time tracking, predictive maintenance, traffic management systems and open Wi-Fi on transit, among others, are also being adopted to make these systems more user-friendly and efficient. Brazil's urban mobility landscape is characterized by significant challenges, including insufficient infrastructure for public transportation, cycling, and pedestrian pathways. Historically, the nation's urban centers have been designed to cater primarily to private vehicles over sustainable transportation methods.

Future projections indicate anticipated investments in infrastructure and technology to elevate the quality of public transportation. Intelligent traffic control systems, including smart traffic lights and sensors, are seen as potential solutions to mitigate congestion and improve traffic flow. At its core, urban mobility is intrinsically linked to the overall quality of life, impacting accessibility, safety, and comfort in transportation. Investments in this sector can significantly influence health, the environment, and the economy, underscoring the importance of prioritizing equitable and inclusive mobility solutions.

Metro

São Paulo, Brazil's bustling metropolis, is making

significant strides in enhancing its urban railway infrastructure. The city is actively developing new metro lines, including the prominent Line 6, for which Intesa Sanpaolo, the Italian banking group, is financing approximately USD 3.57 Bn. This initiative stands as one of Latin America's most substantial public-private infrastructure projects. Additionally, the proposed Line 16-Violet, spanning 32 km with 23 stations, is set to improve connectivity from Cidade Tiradentes to the central Oscar Freire district. Concurrently, the São Paulo Metro Line 2-Green is undergoing an expansion, funded by a USD 315m investment from Intesa Sanpaolo, adding 8.7 km of tracks and 8 new stations.

As São Paulo's metro system continues to expand, the city is laying the groundwork for future developments. Moreover, upcoming projects like the Line 6-Orange extension and Line 17-Gold Monorail are on the horizon. The São Paulo Metro Line 17-Gold, a crucial part of the São Paulo monorail system, has secured a financing agreement of USD 296 million. This funding was established between the development bank of Latin America (CAF) and the government of the state of São Paulo. The loan encompasses four primary components: works, operating systems, rolling stock, and management. Once completed, the monorail will span 7.7 kilometers, providing a vital connection between the Congonhas airport and the Morumbi station. The monorail's stations include Congonhas, Brooklin Paulista, Garden Airport, Vereador José Diniz, Campo Belo, Vila Cordeiro, Chucuri Zaidan, and Água Esprada. This infrastructure project is anticipated to significantly enhance the quality of life for São Paulo's residents by offering a rapid transit system in a region previously lacking such connectivity. The project not only promotes improved mobility but also emphasizes environmental considerations and minimizes the need for expropriations.



Transportation

Furthermore, São Paulo state government is taking significant measures to develop the metro Line 19 – Sky blue. This line, spanning 17.6 km and featuring 15 stations, will run entirely underground, connecting Guarulhos, São Paulo's second most populous city, to the central region of São Paulo. The metro line will traverse areas like Vila Medeiros and Vila Maria in the city's north, which currently lack metro services. Once operational, it's anticipated to accommodate over 500,000 passengers daily. Construction is expected to start in 2023, contingent on the government's ability to fund its share of the USD 3.125 Bn project cost, co-financed with a private entity, and opening is planned for 2030. The state government has allocated USD 10.4m for the initial studies and the basic project.

Additionally, the Belo Horizonte metro system, currently managed by the public CBTU (Companhia Brasileira de Trens Urbanos), is undergoing significant expansion, after over two decades of awaiting this project. The development primarily focuses on the construction of Line 2, which will connect the city's existing line to the densely populated Barreiro. This new line is set to span ten kilometers and will feature seven new stations. The entire project is expected to be completed by 2029. The privatization of the metro system, which was approved by the Union Court of Auditors (Tribunal de Contas da União) in August, has set the stage for these developments. The BNDES (Banco Nacional de Desenvolvimento Econômico e Social) and the state government have outlined an investment plan for the metro's expansion. Of the total projected investment of USD 770m over a 30-year concession period, USD 666.7m will be publicly funded, with the federal government contributing USD 583.33m and the state government of Minas Gerais adding the rest. The remaining amount will be covered by the winning company of the privatization bid.

As part of the expansion project, Line 1, which began operations in 1986 and transports approximately 210,000 passengers daily, will undergo renovations before the construction of Line 2 commences, as stipulated in the privatization contract. The winning company in the privatization bid will also bear some operational costs over the 30-year contract duration, details of which will be disclosed upon the publication of the official bid document.

Finally, the construction of East Line (Linha Leste) metro project in Fortaleza is focused on the Colégio Militar, Rua Nunes Valente, Chico da Silva, and Papicu stations. Originally slated for completion in December 2022, the project has seen an investment of USD 375m comprising of USD 250 million from the Government of the State of Ceará and USD 137.5m from federal funds. Once operational, the East Line will span 7.3 kilometers and feature one surface station (Tirol-Moura Brasil) and four underground stations. It aims to integrate with other metro lines and the light rail network Parangaba-Mucuripe, offering a 15-minute travel time between the city center and Papicu. The metro line is expected to transport up to 150,000 passengers daily, enhancing urban mobility and reducing travel times for residents.

Light rail

In the vibrant landscape of Brazil's urban transportation, three standout light rail projects have taken center stage: Firstly, CCR Metrô Bahia proposes constructing a 20.4km light rail route connecting Salvador's Piatã district to São Luiz in Simões Filho, with 20 stops and 27 LRVs, potentially conflicting with a proposed BRT route. Secondly, the VLT project linking Cuiabá to Várzea Grande for the 2014 World Cup faced extensive dismantling due to scandal and cost issues, with plans to transform it into a BRT system instead. Lastly, the government of Rio de



Transportation

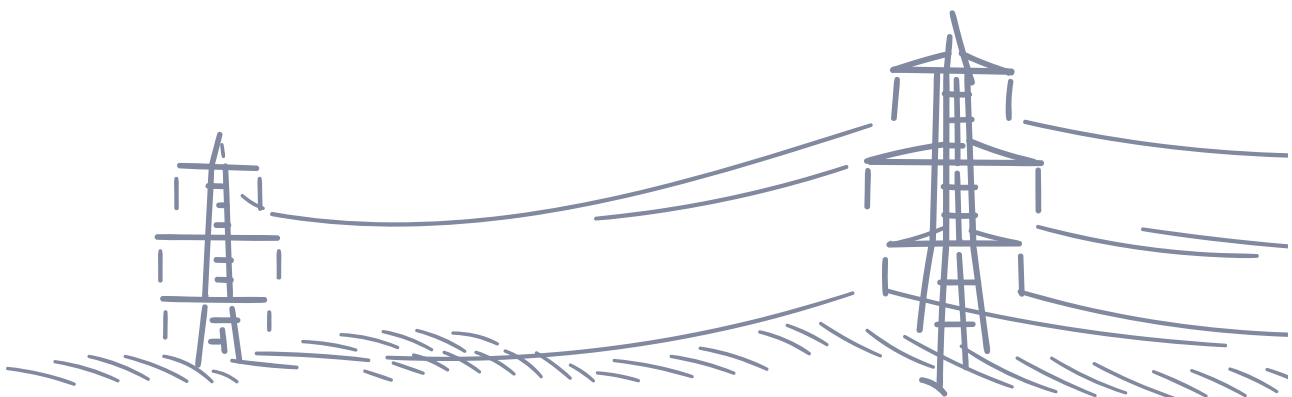
Janeiro supports a \$370 million USD plan for a 17km 'light subway' route to Rio Galeão Tom Jobim International Airport, starting from Estácio metro station and potentially accommodating up to 130,000 passengers daily, with funding from the airport concessionaire.

Bus rapid transit (BRT)

Brazil is making significant strides in enhancing urban mobility through various Bus Rapid Transit (BRT) projects. The BRT-ABC project, funded entirely by the private sector with an investment of USD 174.7 million, is set to connect municipalities in São Paulo, including São Caetano, São Bernardo do Campo, and Santo André, to the capital city. This ambitious endeavor is expected to transport up to 115,000 passengers daily and will significantly reduce travel times with its 18-kilometer route, 20 stops, and a fleet of 82 electric buses. Secondly, the Sorocaba BRT, which was the first PPP for the segment in Brazil, has consistently maintained passenger satisfaction above 80% for three consecutive years since starting operations, emphasizing the success of the BRT model in the country. The third and final phase of the Sorocaba BRT project, located in the Western region, is

currently in the implementation phase and is expected to be completed within 12 months. Furthermore, the Alto Tietê region is eagerly awaiting the BRT system, which promises to serve Arujá, Poá, Itaquaquecetuba, and Ferraz de Vasconcelos, potentially saving commuters up to 20 minutes on their daily journeys.

Brazil's dedication to efficient and sustainable public transportation extends beyond São Paulo. In the city of Curitiba, renowned for its highly successful BRT system, there is an ongoing BRT Rideability Improvement Project aimed at further enhancing the system. Curitiba serves as a global example of how to plan, build, and operate a municipal bus rapid transit system effectively. Additionally, Porto Alegre is making strides with its BRT Project, which features a diametral route traversing the city center, connecting trunk and feeding interchange terminals. This development is expected to significantly improve connectivity and accessibility for residents. These projects collectively demonstrate Brazil's commitment to providing efficient, environmentally friendly, and accessible public transportation options for its citizens, ultimately improving their quality of life and reducing traffic congestion.





Non-Residential Building

Industrial

The crude oil refining capacity in Brazil currently amounts to over 2.5 million barrels per day with Replan refinery, located in the state of São Paulo, leading the pack with a capacity of 434 thousand barrels of oil per day. Unsurprisingly, state-run Petrobras is the main player in the industry, accounting for over 82% of the national refining capacity. Brazil's new mines and energy minister Alexandre Silveira has stressed the urgency to expand and modernize national refineries, taking them to the country's regions as the nationwide deficit in refining capacity makes the population "hostages to the importation of oil products and natural gas".

Consequently, there are a number of refineries at different stages of development at present. The Abreu e Lima refinery, located in Pernambuco, has embarked on a significant expansion project from 2022 to 2026, with a hefty investment of USD 68 billion. This ambitious initiative by Petrobras aims to boost the refinery's production capacity from 150,000 to 260,000 barrels per day (bpd), reinforcing its role as a key player in Brazil's oil industry. Secondly, the Ceará Refinery is a project undertaken by Noxis Energy to be completed in 2025. Situated in the northeastern state of Ceará, this refinery has a daily production capacity of 50,000 barrels per day (bpd). On top of that, Noxis Energy's Ilhéus Refinery, set to begin operating in 2024 in Ilhéus, Bahia, represents a substantial investment of USD 55m. This refinery is designed to produce 5 million tons of fuel annually, helping towards meeting Brazil's fuel demands and reducing the nation's reliance on fuel imports. Finally, the SAF facility, commencing in 2025 in Manaus, is a promising venture by Brasil BioFuels with a capacity to output 165 million gallons of sustainable aviation fuel (SAF) per year.

This facility contributes to the country's efforts to adopt more eco-friendly and sustainable aviation practices, addressing environmental concerns in such industry.

Mexico and Brazil are the most attractive locations for potential gigafactory investments based on certain indicators that would facilitate the introduction of a plant, according to recent studies. Among the largest developments in this segment is Argentinian electric vehicle company Bravo Motor's ambitious project in Brazil, initially announced in 2022 is set to transform the landscape of electric vehicles and battery production in Latin America. Collaborating with ABB, a Swedish-Swiss industrial equipment specialist, the "Cluster Colossus" gigafactory located in Nova Lima, Minas Gerais, will receive substantial investments totaling USD 4.8 billion over a decade. This collaboration aims to pioneer advanced robotics and electrification technologies for production and charging infrastructure, underpinning the plant's output of electric vehicles, batteries, and other components for domestic and export markets, with pilot production scheduled to commence in 2024. The factory in Minas Gerais anticipates producing 22,790 electric vehicles annually by 2024, further expanding through 2029, creating 14,000 direct and indirect jobs and producing 43,750 electric vehicle battery kits yearly. Bravo Motor Company, led by entrepreneur Miguel Angel Bravo, has shifted its operations to Brazil and the United States, leaving behind regulatory hurdles in Argentina.



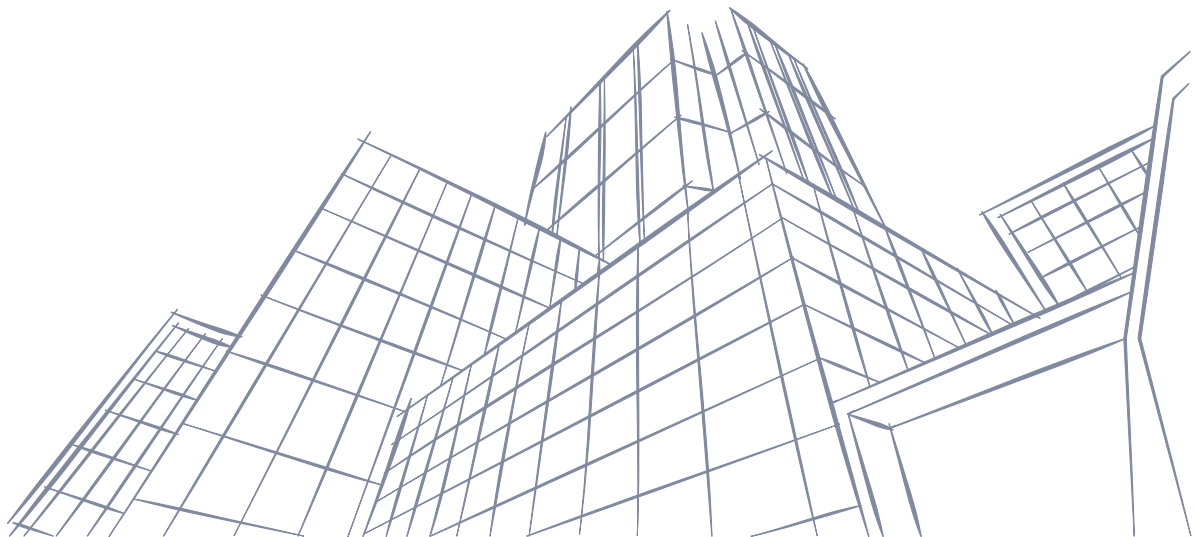
Non-Residential Building

Health infrastructure

The health infrastructure in Brazil accounts for 6,704 hospitals and a total of 404k beds in 2023, according to Statista. The sector is expected to grow in real terms, supported by the government's ongoing efforts to boost foreign and private investment to develop the country's healthcare system.

Exciting healthcare developments are underway in Florianópolis, where a substantial investment project is set to transform the healthcare landscape. Through a USD 190 million PPP, multiple hospital units will be consolidated into the specialized Santa Catarina complex, that also contemplates two greenfield investments and upgrade of two existing hospitals. This centralized management will allow the state of Santa Catarina to optimize management and services. Meanwhile, in Rio de Janeiro, the 115-year-old, fully subsidized Municipal Hospital Souza Aguiar located in the city center is planning

an auction for the concession of care services via a PPP seeking to raise over USD 170 million in investment. There is a second lot up for auction in Rio de Janeiro for USD 90m, as there are feasibility studies currently in progress for the modernization of hospitals in the Sagrado Filho municipal network as well as privatization of management of non-care services. These are the first PPPs to be proposed in the state, but the model has successfully been implemented already in other states: Minas Gerais, Sao Paulo and Bahia. Finally, in São Bernardo do Campo, in Sao Paulo, the region is poised to welcome its first São Luiz hospital, with a noteworthy investment of approximately \$61.5 million USD. This initiative promises advanced healthcare facilities, diagnostics, and oncology services, all within a more comfortable and patient-centric environment. These expansions mark significant milestones in healthcare infrastructure, patient care, and investment across the most populated regions in the country.

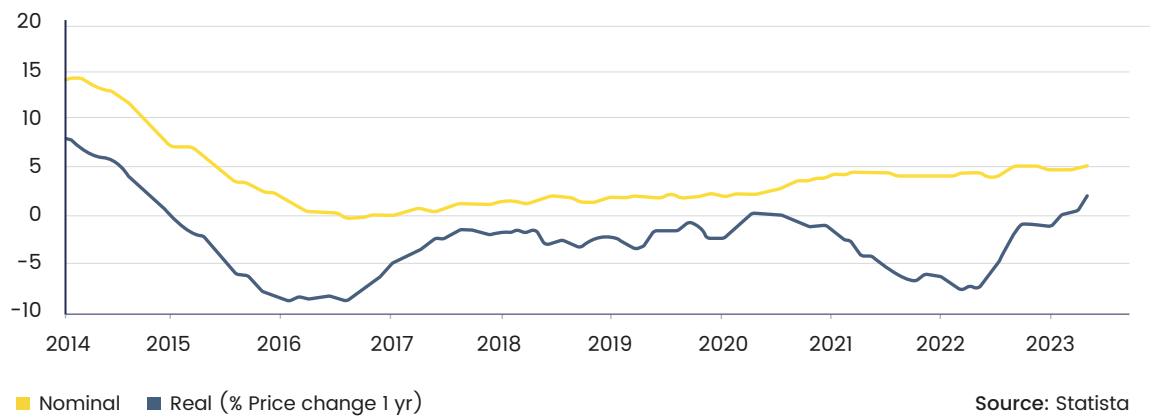




Residential Building

The Brazil Construction Market is currently in a phase of significant expansion. After a buoyant year in 2021, sales in the Brazilian real estate market continued to soar in 2022 with a 14% uptick across the country between January and September, with the high-end home sector experiencing a surge of 91.5%. In tandem, prices for new property are in the rise, with August 2023 prices being 4.7% higher than a year prior. However, when adjusted for inflation these price hikes are more modest, as shown in the figure below.

Brazil's house price annual change



With an expected Compound Annual Growth Rate (CAGR) of around 8% in 2023–28 for the housing market. This growth is fueled by a low-interest-rate environment in Brazil, benefiting both homebuyers, who can secure affordable mortgages, and builders obtaining cheaper financing for construction projects. Government housing programs like "Casa Verde e Amarela" are also contributing to this positive trend.

Challenges and Roadblocks

Main challenges in the market are political instability and economic conditions that have led to a high budget deficit, 4.6% of Brazil's GDP, which could potentially slow down the initiation and completion of new projects. The COVID-19 pandemic has further complicated matters, causing delays and affecting financial planning across the sector. Operational

challenges like a shortage of building materials, rising costs, and bureaucratic inefficiencies are also hindrances, not to mention the corruption scandals that have plagued the sector.





Water & Waste

In Brazil, water management has traditionally been a high-priority issue, receiving substantial attention from both the government and private sectors. A recent report by the National Association and Union of Private Water and Sewage Service Concessionaires (Abcon Sindcon), the entity that represents private sanitation operators in Brazil, titled "Panorama 2023" outlines a roadmap to achieve universal water and wastewater services by 2033. The report warns that without a significant uptick in investment, it could take until 2060 to ensure wastewater services for 90% of the population and until 2091 to provide piped water to 99%. On a positive note, the number of municipalities served by the private sector has nearly tripled to 850 since 2013, indicating growing private sector involvement. Over the next four years, an estimated USD 62.8 Bn will be required for water management projects. To expedite this, the Panorama report suggests increased funding from major Brazilian development banks and the establishment of a federal foreign exchange guarantee fund for dollar-denominated concession debt. Federal initiatives like the Growth Acceleration Program have been key drivers, and various financial mechanisms are in place to support both large cities and smaller municipalities.

The Tietê River in São Paulo has been a focal point for environmental initiatives due to its high pollution levels. The São Paulo State Basic Sanitation Company (SABESP) leads one of Latin America's most extensive sanitation projects, aiming to improve the river's water quality. Since its inception in 1992, the project has seen investments of around USD 1.6 Bn. However, a report by the SOS Mata Atlântica Foundation revealed a 40% increase in the river's pollution slick within a year, with the polluted stretch expanding from 85 km in 2021 to 122 km in 2022. The state government has achieved some improvements, expanding the sewage collection network from 70% to over 90% in urban areas and increasing sewage treatment from 24% to 85%. Additionally, a financing contract with the Inter-American Development Bank is anticipated, aiming to invest USD 104 million in the Rebirth Tietê (Renasce Tietê) program to further restore the river.

The Baixio de Irecê Irrigation Project in the state of Bahia was successfully auctioned for USD 17.3 million to BRL T 2010 Fundo de Investimentos Multiestratégia Investimento no Exterior. This initiative, Brazil's first irrigation auction, covers 314 km² of irrigable land in

the Médio São Francisco region, specifically in the municipality of Xique-Xique. With an anticipated investment of USD 229m over 35 years, the project is set to benefit over 250,000 people and generate around 180,000 jobs. Located approximately 500 km from Salvador, the Baixio de Irecê project aims to introduce agricultural production land, targeting crops like pineapple, banana, and sugarcane.

The Brazilian Ministry of Integration and Regional Development (MIDR), the governmental body responsible for formulating and implementing policies related to regional development, integration, and infrastructure has allocated a budget of approximately USD 29.1m to continue the development of the Seridó Project. This initiative aims to provide water security to about 300,000 individuals across 24 municipalities in the state of Rio Grande do Norte. The total federal government investment for this project is estimated to be around USD 150.6m. The construction is being managed by the Development Company of the Valleys of São Francisco and Parnaíba (Codevasf), a public company associated with MIDR, with the expected completion date in 2025. The project is designed to ensure water security in the region,



Water & Waste

especially considering the frequent drying up of local reservoirs during prolonged droughts. The infrastructure will consist of six water supply systems, divided into two axes (North and South), with the initial construction focusing on parts of the Northern axis. This will include 113 kilometers of water supply lines, pumping stations, and water treatment facilities. The project will serve various cities in Rio Grande do Norte, ensuring a regular water supply for consumption, industrial use, and other needs.

The state of Ceará is advancing sanitation efforts in its rural areas through partnerships with the United Nations and the European Union Latin America Investment Facility (EULAIF). This joint initiative aims to provide universal sanitation services to over 750,000 people by 2024. EULAIF's program, with a budget of USD 69.9m, will rehabilitate water and sanitation systems, benefiting 32,500 people with clean drinking water and 5,000 more with improved sanitation. Additionally, an auction for two public-private sanitation partnerships in Ceará has attracted four bidders. The projects, divided into two lots, require investments of USD 514m and USD 673m respectively, targeting improvements in sewage services across multiple cities, with contracts spanning 30 years.

Moreover, the state of Ceará is set to construct a seawater desalination plant and water supply

system with a capacity of 1 cubic meter per second, aiming to provide water to approximately 720,000 individuals by 2025. The plant, located at Playa del Futuro in Fortaleza, will result in a 12% increase in the region's water supply. The financial investment for this project is estimated at about USD 100 million. In return, the anticipated benefits from this infrastructure are projected to be around USD 600 million for the local population.

The Rio de Janeiro State Company for Water and Drainage (Cedae) is responsible of the collection, treatment, and distribution of water in the state and is currently working in a new wastewater treatment plant in Novo Guandu Rio de Janeiro. This plant is a pivotal initiative to enhance the region's water quality and availability. The project, valued at approximately USD 887m aims to address the water treatment needs of the local population and is set to commence its first construction phase. Once operational in 2025, this station will produce over 12 million liters of water per second and feature in Cedae's largest reservoir with a capacity of 53 million liters. The groundwork spans an area exceeding 390,000 m², and the project, divided into four phases, will include a treated water pipeline of over 3.3 km. This facility will significantly boost the water supply to regions like Baixada Fluminense and Rio de Janeiro.





Telecommunications

Brazil's telecommunications sector accounted for 0.45% of the GDP in 2021, a return to pre-pandemic levels. The COVID-19 pandemic accelerated the shift to online platforms for work, education, and consumption, which led to an expansion in both mobile and fixed broadband services. Currently, over 98% of Brazil's population has access to 4G coverage, and every city offers fixed broadband, although only 83% of homes are connected. Rural connectivity has also seen improvements, with 70% of the rural population now having some form of internet access, up from 53% in 2019. This is due to targeted policies and regulations aimed at encouraging small operators to extend their services to these areas. Mobile internet is the most popular form of connectivity, used by 81% of the population, followed by fixed connectivity accessed by computers at 78%. About 60% of the population has access to both forms of connectivity.

The advent of 5G technology is seen as a game-changer, with the potential to revolutionize various sectors including healthcare, logistics, and urban planning. A significant auction for radio frequency took place in November 2021, concluding with USD 8.75 Bn committed by the winning carriers including America Movil, Telefonica, and Telecom Italia for investment in 5G coverage and 20-year contracts with the possibility for extension. The National Telecommunications Agency (ANATEL) serves as the main regulatory authority of the Brazilian telecom sector, and its objective is for all municipalities in Brazil to have 5G coverage by 2030. A study suggests that the introduction of 5G technology in Brazil could potentially contribute USD 1.2 trillion to the economy and boost productivity by USD 3 trillion by the year 2035. Additionally, the International Data Corporation predicts that the advent of 5G will catalyze other technologies like AI, big data or cloud computing, generating over USD 25.5 Bn in Brazil by 2025.

Winners of the 5G spectrum are obligated to fulfill several infrastructure requirements. These included extending coverage to the 26 state capitals and the federal district by July 2022, ensuring coverage for all cities with a population greater than 30,000 by 2029 and providing 4G coverage to all towns with more than

600 residents by 2028. Additionally, they are required to lay optical fiber networks in municipalities with more than 20,000 residents by 2025 and those with fewer than 20,000 residents by 2026. They must also cover federal highways with optical fiber and establish a private, secure 5G network for exclusive government use.

Brazil's National Telecommunications Agency (Agencia Nacional de Telecomunicacoes, Anatel) announced the approval for the use of the 3.5GHz band for 5G services in 78 additional towns as of 25 January 2023. These towns are located in the states of Sao Paulo, Minas Gerais, Santa Catarina, Para, Espirito Santo, Rio Grande do Sul, Parana, Pernambuco, Bahia, and Rio de Janeiro, in the vicinity of large population centers. This means that 140 towns and cities across the country, covering 38.5% of the population, have already received approval for 3.5GHz launches. On top of this, ANATEL anticipated that by June 2023 a further 1,610 municipalities will be approved for 3.5GHz connectivity. However, it's worth noting that the coverage obligations for several of these approved locations won't be mandatory until 2025. The actual 5G rollout in these areas will largely depend on the deployment strategies of telecom operators Vivo, Claro, and TIM Brasil.

With regards to optic fiber projects, Petrobras, the state-controlled oil company, is making significant



Telecommunications

strides in enhancing its technological infrastructure to support its offshore operations. The company is in the process of installing a fiber optic network spanning over 1,600 km in the Campos and Santos basins (Rio de Janeiro). This initiative is set to bolster the 5G system across 29 production platforms in these basins and 17 onshore units by 2024, and it includes refineries, gas treatment units, and ports. The integration of this 5G system is expected to amplify data transmission speeds manifold, facilitating remote operations and real-time monitoring in confined settings. The fiber optic connection is projected to be operational by December 2023, providing a robust backhaul for Petrobras's private 4G mobile network on its offshore platforms and laying the foundation for a future transition to 5G. The company has a similar fiber optic structure already in place in the Campos Basin that also utilizes satellite backhaul in certain scenarios. This new network is anticipated to inject a capacity of 15 terabytes per second (Tbps) for their platforms. Given the vast volumes of seismic data generated on these platforms, with a single platform producing 6 TB of data daily from seismic applications alone, this enhanced connectivity is crucial. All this data is transmitted to Petrobras's data center for processing, driving operational efficiency.

On the other hand, Oi, a leading telecommunications company, has been aggressively expanding its fiber-optic infrastructure across the nation. Since 2018, the company has invested significantly, resulting in the completion of 18.2 million HPs (Homes Passed) and 4 million HCs (Homes Connected) across 250 cities. This expansion has propelled Oi to capture a 34% market share in Brazil's fiber broadband sector, with its broadband revenue witnessing a 94% surge over three years. In collaboration with Huawei, Oi introduced Latin America's first FTTR (Fiber to the Room) for domestic solutions in 2022, offering broadband speeds between 400 Mbps and 1 Gbps. This innovation aims to address Wi-Fi bottlenecks in larger apartments, with plans to extend the Oi FIBRA X fiber network service to nine major

cities, including Sao Paulo. Additionally, the project's vision is to expand the trunk network, offering neutral wholesale connectivity to third parties with Oi as their anchor client. The objective is to serve 32 million homes with last-mile fiber. Oi's legacy trunk network spans 400,000km and reaches over 2,300 Brazilian municipalities. With a capital expenditure of USD 5,610 million, Oi is positioning itself as a digital solutions leader, emphasizing its all-optical strategy and the premium HBB (Hybrid Broadcast Broadband) brand FIBRA X.

Brazil has also joined the Humboldt fiber optic cable project, a Chilean-led initiative connecting South America with Oceania and Asia. The cable will span 14,810 kilometers, linking Valparaíso in Chile to Sydney in Australia across the Pacific Ocean, with a data transmission capacity of up to 400 Gbps. This venture, involving other countries like Argentina, Australia, and New Zealand, aims to bolster Brazil's global internet connectivity. The project's estimated investment is USD 400m, with a public-private partnership conformed by Desarrollo País, a state-owned infrastructure development company, and H2 Cable, a subsidiary of the Singapore-based firm of BW Digital, set to operate the asset for 25 years.

Investment in data centers saw a 17% increase in 2021-22, reaching \$850 million, indicating a robust demand for core internet and electronic services infrastructure, and there are numerous projects underway that confirm the growing tendency in this space.

Firstly, the Ascenty Campus in Sumaré is strategically located in the metropolitan region of Campinas, a major technology hub in the state of Sao Paulo. The campus is situated alongside the Anhanguera highway, providing easy access to major roads and proximity to São Paulo's capital. Ascenty is recognized as the largest data center and connectivity service provider in Latin America with 34 data centers either in operation or



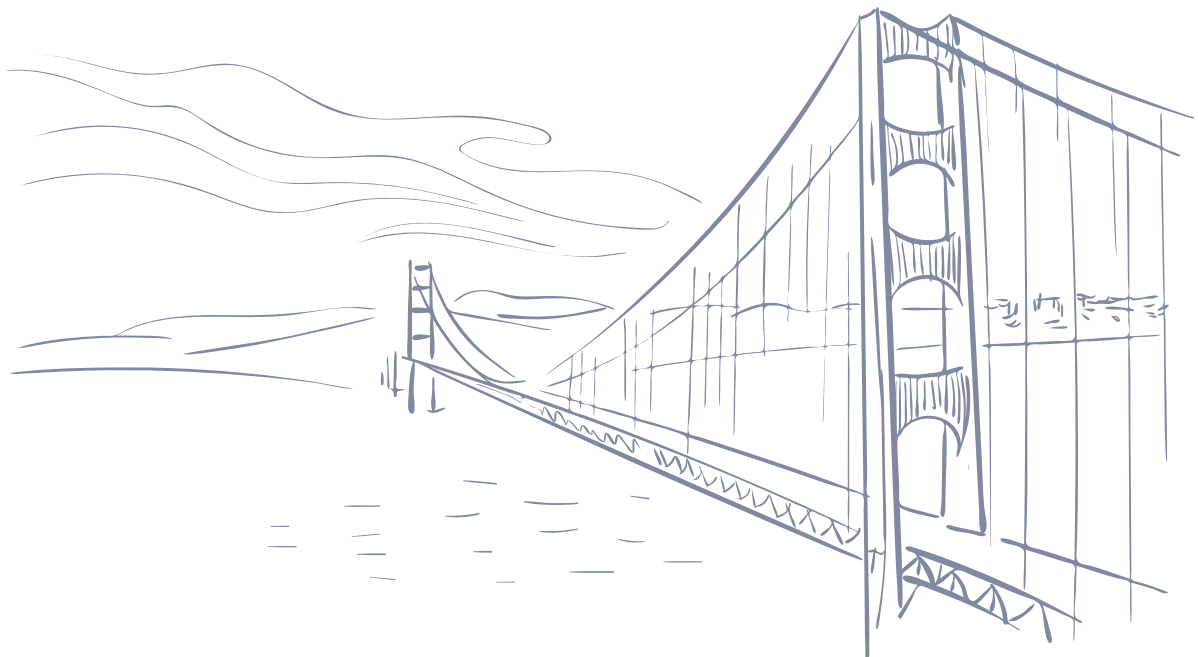
Telecommunications

under construction across Brazil, Chile, Mexico, and Colombia, interconnected by a vast 5,000 km proprietary fiber-optic network. The total investment for the development of these data centers is USD 1.05 Bn. Ascenty's commitment to world-class infrastructure is evident in their facilities, offering solutions like colocation, cloud connectivity, and internet services. Their expansion is backed by significant stakeholders: Brookfield Infrastructure Partners and Digital Realty, the world's largest data center company with over 300 units across six continents.

Moreover, Ascenty owns and additional campus in Hortolândia, also located in the metropolitan region of Campina. Currently, the campus boasts four Data Centers, providing a total of 23 MW of available energy and covering a total area of 11,000 m², and two additional units for a combined 60 MW and 46,000 m² are under construction. These centers are designed with a focus on redundancy across all systems, from power to cooling and networking. The strategic location in Hortolândia, one of the top 100 Brazilian cities for

investment, has attracted numerous businesses and industries. Total investment for the Hortolândia campus is estimated at USD 1.17Bn.

Finally, CloudHQ has initiated in 2023 the construction of a new hyperscale campus in Paulínia, Sao Paulo. This marks CloudHQ's inaugural venture in both Brazil and Latin America. The expansive 228 MW campus is projected to house up to six buildings, with an investment surpassing USD 3 Bn. The initial phase will feature three buildings, each boasting a 48 MW capacity. Paulínia's strategic positioning within a technology hub and its proximity to São Paulo makes it an optimal location for this hyperscale data center campus. The facility will be powered by a 225 MW power substation, which has the potential to be upgraded to 400 MW. The transmission lines connecting the campus to the grid are slated for completion in the first half of 2024. CloudHQ, established in 2016, has a portfolio of data center developments across various global locations.





CONTACT US

[Click here](#)

1221 Brickell Ave, Ste 900. Miami FL 33131, USA

FOLLOW US

