BRAZIL

DDP BRAZIL

COUNTRY FACTSHEET

This document presents a synthesis of key results of the decarbonization scenarios developed for Brazil. It describes the key national and sector level techno-economic transformations to 2050, their main socio-economic aspects and resulting emission profiles. It also highlights some main policy implications and challenges, investment insights and necessary developments in international enablers.

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High-level characterization of DDS trajectory

Drivers	2020	**2030**	2040	**2050**	
GDP Growth (in relation to 2020)	-	**29.1%**	57.7%	**91.8%**	
GDP/capita ($USD 2015/capita)	8,750	**10,630**	12,589	**15,248**	

Emissions	2020	**2030**	2040	**2050**	
CO_2	864	**383**	-155	**- 548**	$MtCO_2$
GHG	1,488	**1,005**	454	**17**	$MtCO_2e$
CO_2 Cumulative	-	**7,098**	8,236	**4,718**	$MtCO_2$

Dates

CO_2 Peaking date	Before 2020
CO_2 Peaking date	Before 2020
CO_2 Net Zero date	Before 2040
GHG Net Zero date	≈ 2050

with LULUCF without LULUCF

DDP

The DDP is an initiative of the Institute for Sustainable Development and International Relations (IDDRI). It aims to demonstrate how countries can transform their economies by 2050 to achieve global net zero emissions and national development priorities, consistently with the Paris Agreement. Analyses are carried out at the national scale, by national research teams. National research teams openly share their methods, modelling tools, data and the results of their analyses to share knowledge between partners in a collaborative manner and to facilitate engagement with sectoral experts and decision-makers.

About this project

Thanks to the support of the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), and building on the Deep Decarbonization Pathways (DDP) Initiative and the collaboration with the 2050 Pathways Platform, an IDDRI-led consortium with outstanding partners in four emerging economies has developed granular deep decarbonization pathways to 2050 for Brazil, India, Indonesia and South Africa. These pathways have been brought to public debate and domestic decision-making processes. Methodological insights from this work are shared with researchers and practitioners around the world and with members of the 2050 Pathways Platform to support their process of developing long-term strategies.

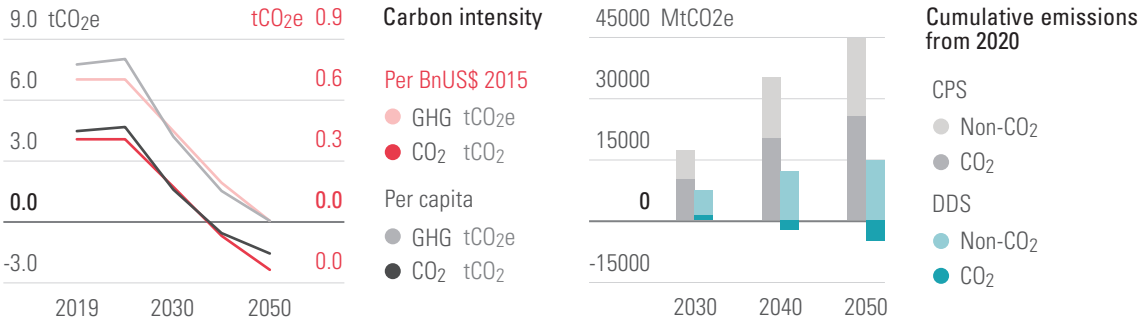
IDDRI

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

ECONOMY WIDE TRANSFORMATIONS

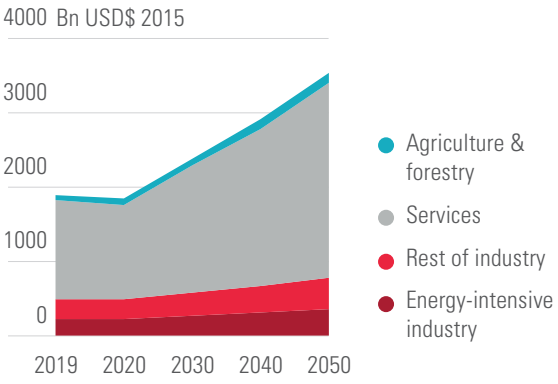
- Brazil achieves GHG neutrality in 2050, with most emission reductions coming from a radical reduction in deforestation rates and an increase of carbon sinks, mainly through increased forested and protected areas (indigenous lands and conservation units). Net CO_2 emissions of the AFOLU sector reach negative values already in 2030 (-60 Mt CO_2). In 2040, net GHG emissions from AFOLU are also negative (-65 Mt CO_2e) as its negative CO_2 emissions more than offset N_2O and CH_4 emissions (mainly from cattle enteric fermentation). In 2050, economy-wide net GHG emissions are nearly zero thanks to AFOLU.
- Electricity consumption resumes in 2021, growing faster than overall energy consumption despite end-use efficiency gains. The expansion of the power sector continues to be based on renewable sources, with associated GHG emissions decreasing further, from 24 Mt CO_2eq in 2019 to 1.7 Mt CO_2eq in 2050.
- In Deep Decarbonization Scenario (DDS), only two sectors have higher GHG emissions in 2050 than in the base year 2019: cropping activities increase emissions by 29% due to increased production of biofuels; and industry by 14% due to increased activity and despite the implementation of well-known mitigation measures which reduce by 35% its GHG emissions in 2050.
- Carbon pricing policy is assumed from 2021 for a significant share of the emissions (Energy and IPPU), as a necessary complement to the efforts in the land use sector.

Figure 1. Carbon intensity and cumulative emissions



KEY NATIONAL-SCALE SOCIO-ECONOMIC ASPECTS

Figure 2. Evolution of GDP



In 2050, 89% of the 233 million Brazilian citizens live in cities (+25%), household revenue has grown by 20%, and people mobility has increased by 30% over the period.

- Following the sharp downturn in the economy from 2015 to 2020, recovery starts in 2021 along with a modest decline of Gini index, with annual average GDP growth rates ranging from 3.5% to 2% over the period up to 2050. Agriculture continues to be an essential driver of Brazilian economic growth. Substantial growth in E&P activities is due to a significant increase in offshore oil and gas production from the pre-salt layer. Increasing shares of oil production are

Figure 3. Evolution of the purchasing power of household classes in Brazilian DDS scenario

	2015	2020	2030	2050
Purchasing power HH1 (2015=1) (Poorest 20% of households, below the extreme poverty line in 2015)	1.00	1.05	1.46	2.46
Purchasing power HH2 (2015=1) (40% of households, below the poverty line in 2015)	1.00	1.04	1.38	2.17
Purchasing power HH3 (2015=1) (30% of households)	1.00	1.01	1.29	1.93
Purchasing power HH4 (2015=1) (Richest 10% of households)	1.00	0.98	1.23	1.80

progressively directed towards exports as production costs are kept low and remain competitive in the world market.

- Living standards in Brazil slowly improve. In 2050, GDP per capita is 75% higher than in 2020, reaching 15k $ USD, as GDP nearly doubles and population growth is of merely 10% in the period (becoming nearly stable after 2040). Household disposable income and purchasing power increase across all classes. In 2030 Brazilian average GDP per capita reaches the level observed in 2020 for Russia and in 2050 the level observed in 2020 for Poland. Household size is projected to slowly decrease. Trade becomes more important to Brazil and import taxes and protectionism are reduced over the scenario timeframe.
- A pathway towards net-zero GHG emissions in 2050 can be reached with a carbon price of 25, 45 and 65 USD/t CO_2eq, respectively, in each decade. AFOLU remains the key sector to this end, since it presents the largest mitigation potential with a low cost per avoided GHG emission. Energy efficiency measures in industry, and electromobility in passenger transport also provide relevant contributions.
- Carbon pricing is neutral from a fiscal perspective, with 100% of its revenues recycled back into the economy through labour charges reduction aiming to foster employment, and to compensate low-income households for the average price level increase. Thus, DDS allows neutralizing GHG emissions in 2050 while not just mitigates the adverse effects of carbon taxation on poor households but also improves income distribution.

INTERNATIONAL KEY ENABLERS

- International finance supply for investment and innovation grows throughout the period to promote good quality education, health, and infrastructure, allowing labor productivity in developing countries to grow faster and close part of the productivity gap to developed countries.
- International pressures on the control of farming chains associated with degradation and deforestation contribute to making DDS viable. Countries that do not commit to reducing GHG emissions and controlling deforestation will face market barriers that will hamper exports. The soybean, beef, and forestry chains are examples of this context that apply to Brazil.
- The DDS demands a continuous reduction in the relationship between price and energy density of batteries.
- Global carbon pricing and fast technological development in renewable energy technologies (mainly batteries, solar and wind), are the key international enablers of DDS. A domestic car-bon tax can reduce the competitiveness of power generation from natural gas, while technology improvements and growing international experience of developers can enable the competitive-ness of renewables.

SECTORAL SYSTEM TRANSFORMATIONS

- In the DDS, agriculture production increases significantly, but its GHG emissions are kept in 2050 slightly (1%) under 2019 level. There is an expressive growth in crop production, while the agricultural area increases moderately due to high productivity gains. DDS assumes a con-tinuation of global historical trends in food preferences; demand for meat increases as it be-comes more accessible in developing countries. To this, beef production in Brazil grows 75%, reaching 18.3 million CWE in 2050, with a total herd of 200 million heads. Cattle ranching in-tensification is the action with the most significant mitigation potential.
- The reduction of deforestation is key for Brazil to reach climate neutrality. Efforts to curb deforestation will resume in 2023 reaching a reduction of 83% in 2023-2025, given the possibility of change in governmental policies and increasing international pressure over agricultural chains associated with deforestation. Zero illegal deforestation in the Amazon biome will be achieved in 2050. Fostering reforestation and restoration of 30 Mha with native species in public and private areas is also relevant for the sectoral transformation, and fast-growing planted forests (eucalyptus and pine) become critical carbon removals.
- In DDS, society experiences new mobility configurations linked to population aging, teleactivities, new technologies, and structural changes. Consumers choose more efficient and eco-friendly technologies, stimulating the penetration of electromobility and biofuels. The biofuels market is expanded and diversified, and a number of measures are put in place for accelerating the electrification of the vehicle fleet and expanding the transport infrastructure in key areas.
- No new passenger cars with internal combustion engines (ICE) will be registered from 2045. In 2050, almost half of the vehicle stock is composed of hybrids (HEV), plug-in hybrids (PHEV), and fully electric vehicles (BEV).
- By 2050, 70% of energy consumption of flex-fuel vehicle (ICE and hybrid) is supplied by hydrous ethanol and 30% from a blend of gasoline with 27% anhydrous ethanol content (E27). Biodiesel blend reaches 40% in the blend with diesel oil (B40). For inland navigation, blending biodiesel with ship fuel will only start in 2031, at a 10% rate (B10). Blending above 20% will be supplemented with HVO. Blending of bio-oil in cabotage navigation, replacing fuel oil, will start at 5% in 2031, reaching 20% in 2050.
- Freight diesel railways are gradually modernized and electrified via contractual additives in their respective concessions. In 2050, road transport accounts for 42% of the transport activity (tkm), and rail and water account for 35% and 22%. BEV, HEV, and PHEV constitute 33% of the stock of freight vehicles, concentrated on urban transport.
- Industrial growth is assumed to restart in 2021, after successive crises over the last 30 years. From 2020 until 2050, the value-added annual average growth rate of the cement, iron and steel, and chemical industries reaches 2.6%, 1.9%, and 1.7%, respectively. Industrial facilities improve technologies currently in use, without introducing new processes nor mitigation breakthrough or disruptive technologies.
- In the waste sector, GHG emissions are cut by 36% in 2050, while in CPS they grow by 82%. The substantial extension of sanitation services to bridge the current infrastructure deficit can lead to a huge increase of emissions unless biogas capture and burning technologies are massively introduced.