DDP BRAZIL

DEEP DECARBONISATION IN BRAZIL

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SUMMARY

The deep decarbonisation pathways (DDP) study simulates two GHG emissions scenarios in Brazil until 2050 aligned with the general objective of the Paris Agreement (net-zero GHG emissions in 2050).

The Current Policies Scenario (CPS) follows the trend of ongoing mitigation actions. Its net emissions are of 1.66 Gt CO_2eq in 2030 and 1.89 Gt CO_2eq in 2050, with no increase in mitigation ambitions between 2030 and 2050. The CPS nearly meets the country's previous target for 2030 but is above the new NDC of April 2022 (1.28 Gt CO_2e).

The Deep Decarbonization Scenario (DDS) incorporates more ambitious actions, but no major breakthroughs or use of disruptive technologies, enabling to reach 1.0 Gt CO_2eq in 2030 and achieve net-zero emissions in 2050. DDS's main features are a radical reduction in deforestation rates and an increase of carbon sinks. This is mainly due to an efficient command and control policy on deforestation and carbon pricing policies from 2021. Comparing 2050 emissions in both scenarios with 2020 values, DDS is 99% lower, while CPS is 27% higher. **Table 1** summarizes annual emissions over the period 2005-2050 by sub-sectors. Compared to the current policy scenario (CPS), in 2050 DDS emissions from deforestation are 93% lower.

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

The ACT-DDP research project is an international pilot project, which aims at accelerating the implementation of national and sectoral deep decarbonisation through a better dialogue between private companies and governments and for a mutual enrichment of their low-carbon strategies. Through the synergy between two pioneer initiatives, the Assessing low Carbon Transition (ACT) initiative and the Deep Decarbonization Pathways initiative (DDP), the project partners built and tested methodologies and tools for developing national and sectoral deep decarbonisation pathways compatible with the Paris Agreement and assessing company strategies with them.

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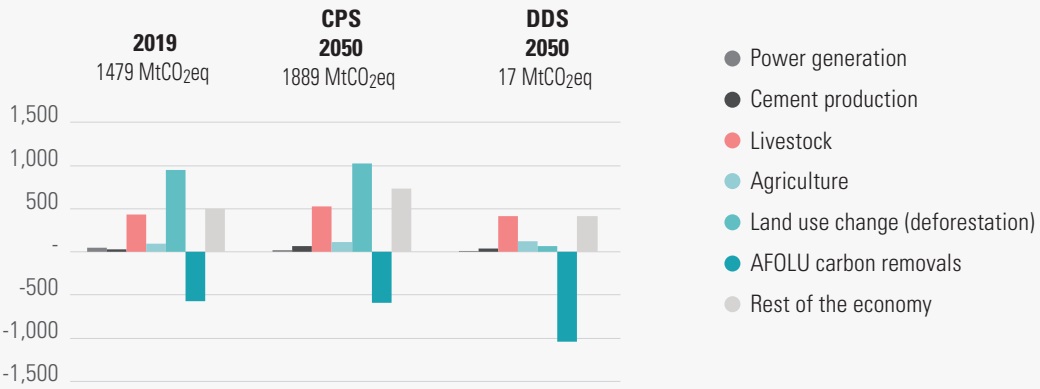
Figure 1. GHG Emissions



Additionally, carbon removals increase 76%, thanks to increased forested and protected areas (indigenous lands and conservation units). Transport is the second most relevant sector, with an emission reduction of 53%, followed by the waste sector with a reduction of 65%, and livestock activities with 22%. Finally, in industry the reduction is of 31%, and in energy supply added to other energy consumption sectors the reduction is of 23%. The only activity with a small increase in emissions is cropping, with 4% more emissions in DDS due to the higher level of limestone use.

In DDS, only two sectors have higher GHG emissions in 2050 than in the base year 2019: cropping activities increase emissions by 28%; and industry by 14%. In these cases, the improvement of technologies currently in use was not sufficient to compensate for the higher production levels. The share of industry in the total gross country's GHG emissions is 9% in 2019, and by 2050 would increase to 12% in CPS. In DDS, it would grow to 21% and remain a "hard-to-abate" sector, although in absolute values, 31% lower than in CPS.

MITIGATION ACTIONS AND COSTS

In DDS, besides the huge effort to curb down deforestation and increase removals, the carbon pricing policy supplies the complementary mitigation actions in other sectors required to reach net-zero emissions in 2050 (See table 2).

Command and control policies combined with constraining the access of farmers and ranchers to public credits (subject to conformity with environmental laws and regulations) achieve 59% of total cumulative GHG emission reductions up to 2050, through the sharp reduction of annual deforestation rate.

The carbon pricing policy can supply 30% of total cumulative avoided emissions up to 2050 in different sectors: AFOLU (18%), Transport (6.5%), Industry (4%), and Energy supply (1%). Carbon prices are introduced through a cap-and trade system in Industry, and a carbon tax on GHG emissions from the combustion of fossil fuels in other sectors. They grow linearly, reaching 25 USD/tCO_2eq in 2030 and 65 USD/tCO_2eq in 2050 and will be neutral from a fiscal perspective, with 100% of the revenues recycled back into the economy through labour charges reduction, and to compensate low-income households for the average price level increase.

A significant share of avoided emissions can be obtained at negative or very low costs. Costs for a given mitigation option may vary throughout the three decades due to increasing economies of scale and variations in cost assumptions (e.g., decreasing costs for electric vehicles and renewable electricity).

Table 1 – Total GHG Emissions per Sector, 2005-2050, under CPS and DDS (Mt CO_2eq)

$MtCO_2eq$		2010	2019	2030	2050	CPS-DDS (2050)
Power generation	CPS	37	51	26	16	-89%
	DDS			24	2	
Industry - Cement production	CPS	36	32	46	66	-36%
	DDS			38	42	
Livestock	CPS	329	433	466	529	-22%
	DDS			453	413	
Land Use Change (LUC) – gross emissions	CPS	668	948	1,024	1,024	-93%
	DDS			614	71	
Removals (LUC, Forest, Protected Areas and Other)	CPS	-313	-574	-556	-593	76%
	DDS			-695	-1042	
Rest of the economy	CPS	603	588	660	847	-37%
	DDS			571	531	
Total	CPS	1,361	1,479	1,665	1,889	-99%
	DDS			1,005	17	

Table 2. Cumulative avoided emissions (CPS-DDS) per mitigation actions, per decade (Mt CO_2eq)

Cumulative avoided emissions per decade (Mt CO_2eq)	2021 – 2030	2031 – 2040	2041 – 2050
Total Mitigation Actions	3,629	10,069	16,103
Carbon Pricing Policy	1,013	2,618	5,254
AFOLU	619	1,483	3,281
Native forest restoration in public areas (through government concession)	38	302	1,291
Native forest restoration in private areas (offsets)	121	322	572
Planted forests (homogeneous and integrated crop-livestock- forest systems)	196	244	275
Agriculture	39	76	38
Livestock (restoration of degraded pastures, intensification, other)	225	538	1,105
Transport (freight and passenger)	233	639	1,064
Modal shift	132	169	271
Electromobility	-	346	520
Biofuels	98	124	273
Industry	126	387	694
Energy intensive industries	86	257	451
Light industry (rest of industry)	40	129	243
Energy Supply	35	110	216
Power generation	8	42	107
Self-consumption and fugitive emissions	28	68	109
Other Mitigation Policies	2,616	7,451	10,849
AFOLU	2,461	6,957	9,887
Reducing annual deforestation rate	2,252	6,367	8,940
Increasing conservation units, indigenous lands and other protected areas	209	590	947
Waste	155	494	963

Table 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

MACROECONOMIC AND SOCIAL IMPLICATIONS

Regarding the socioeconomic context, the population size increases from 210 million inhabitants in 2019 to about 233 million inhabitants in 2050. In this period, the urban population share grows from 86% to 89%. Following the sharp downturn in the economy from 2015 to 2020, Brazilian economic recovery is assumed to start on 2021: annual average GDP growth rates would be of 3.5% in 2021; 2.5% from 2021 to 2030; 2.25% from 2031 to 2040; and 2% from 2041 to 2050 (with linear growth assumed within each decade). Household disposable income as a share of GDP is projected to increase. Trade will become more important to Brazil during the scenario timeframe.

DDS allows to reach carbon neutrality while keeping slightly better economic and social development results than in CPS, thanks to the following policy: i) part of the carbon revenues are transferred back from the government to households to neutralize the effect of the carbon price on purchasing power; ii) the rest of the carbon revenues is used to reduce labor charges.

The higher employment and wage levels in DDS improve income distribution. The positive impact on households' income levels is particularly relevant for the lowest income groups (bottom 60%), which depend more on labor income. The 20% poorest households, most of which were under the extreme poverty line in the base year, benefit even more from the DDS scenario due to the direct transfers of collected carbon revenues from the government.

KEY FINDINGS

- DDS is just one among many pathways for Brazil to reach climate neutrality by 2050.
- Underlying assumption: use of only competitive technologies at the time of adoption; huge mitigation potential at low costs in Brazil even before the deployment of technological "breakthroughs".
- Sharp reduction of annual deforestation rate and native vegetation restoration in public and private areas have a significant abatement potential and lower costs than mitigation actions in other sectors.
- DDS allows to reach carbon neutrality while keeping slightly better economic and social development results than in CPS (smart recycling of carbon pricing revenues).

PRIORITY SHORT-TERM POLICIES AND ACTIONS

1. Resuming policies successfully adopted in the recent past (2004-2012) to sharply reduce annual deforestation rates: both command-and-control and economic instruments.
2. Developing smart financial mechanisms to foster the funding of investments in mitigation actions, and mainly in forest cover restoration and low-carbon infrastructure.
3. Carbon Pricing: provide a long-term, stable signal to induce economic agents to choose low-carbon technologies through a well-structured cap-and-trade scheme for industry and a carbon tax on other sectors.
4. Relying on the AFOLU sector to reduce and capture the largest share of emissions in the first half of the century to get close to the net-zero target by 2050 helps to reduce overall costs for Brazil and provides sufficient time for disruptive technologies to be economically viable.

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