An innovative approach for Paris compatible sectoral decarbonization strategies and actions

ACT ASSESSING LOW CARBON TRANSITION ®

DDP DEEP DECARBONIZATION PATHWAYS

Greenhouse Gas Emission Scenarios for Brazil up to 2050

Centro Clima / COPPE / UFRJ

COP-26 - 9 November 2021

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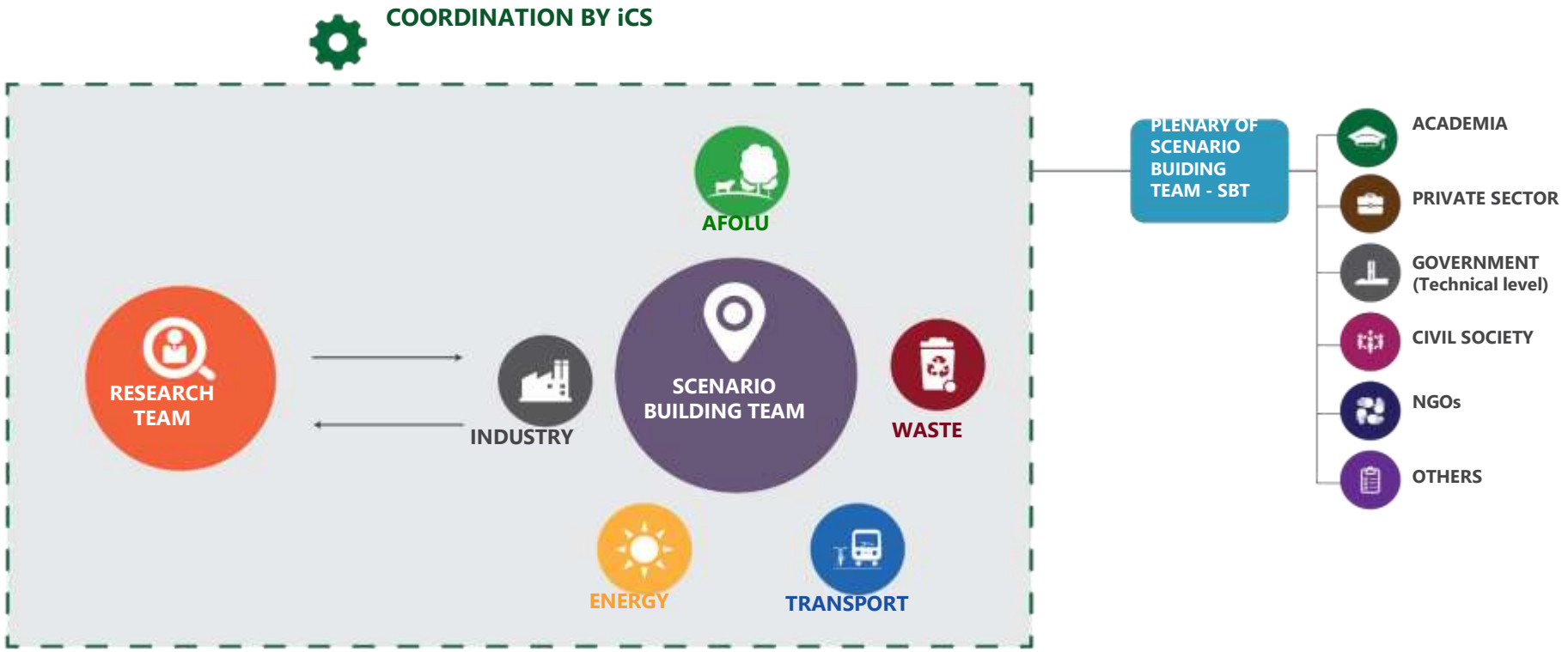
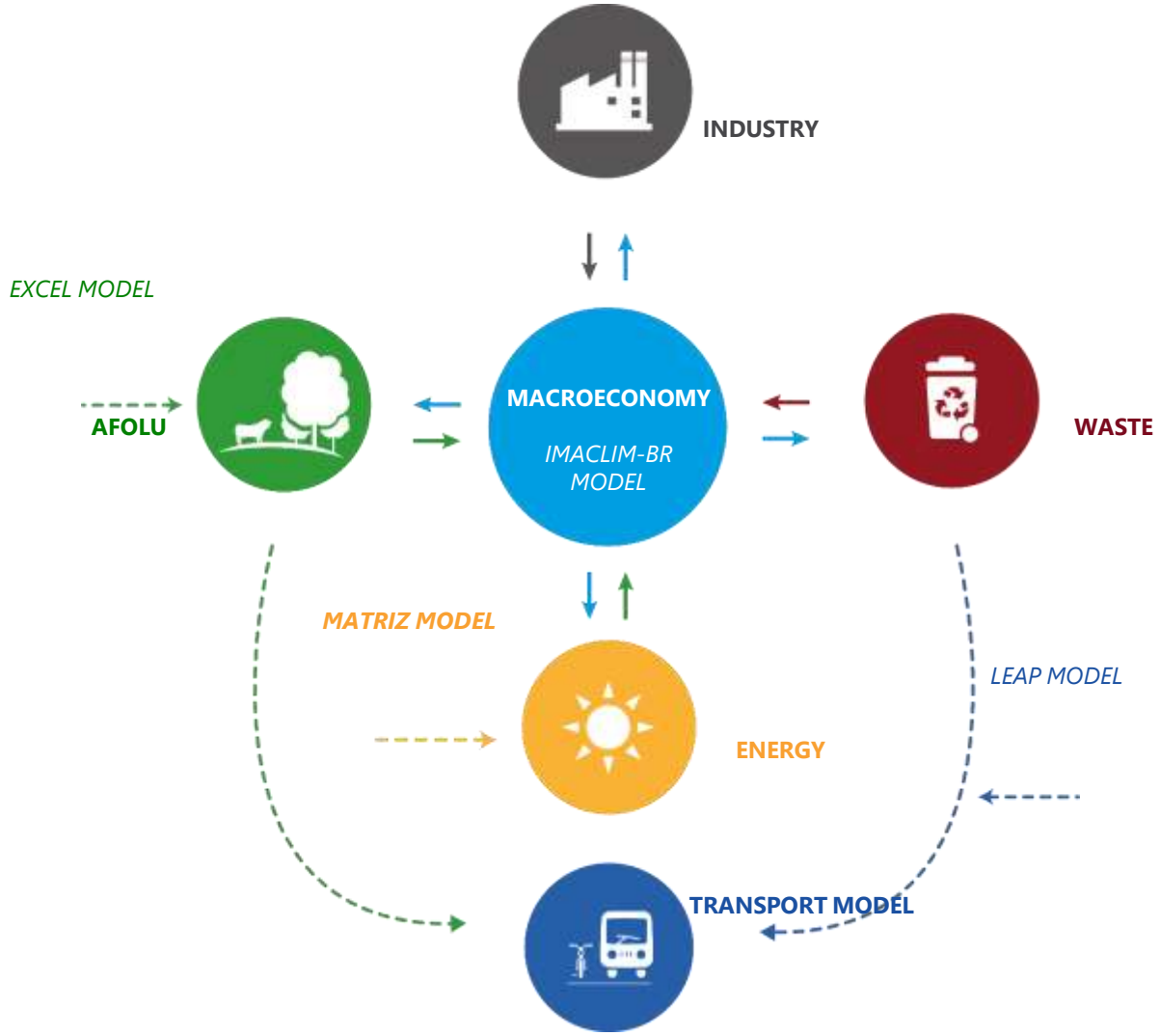
IES-Brasil Process: Dialogue with stakeholders

- Scenario Building Team (SBT) for stakeholders engagement: experts from the government, business sector, scientific community and NGOs
- Modelling team coordinated by Centro Clima
- The SBT (>200 experts contacted through bilateral meetings and workshops, split in 6 sectors) is responsible for:
  - agreeing upon the scenarios´general and sectorial assumptions
  - identifying mitigation measures to be adopted in the scenario runs; estimating their viability, costs and pace of deployment
  - Identifying barriers to the deep decarbonization scenarios and policy tools (regulatory and economic) to overcome them

DIALOGUE WITH STAKEHOLDERS



MODELLING TOOLS

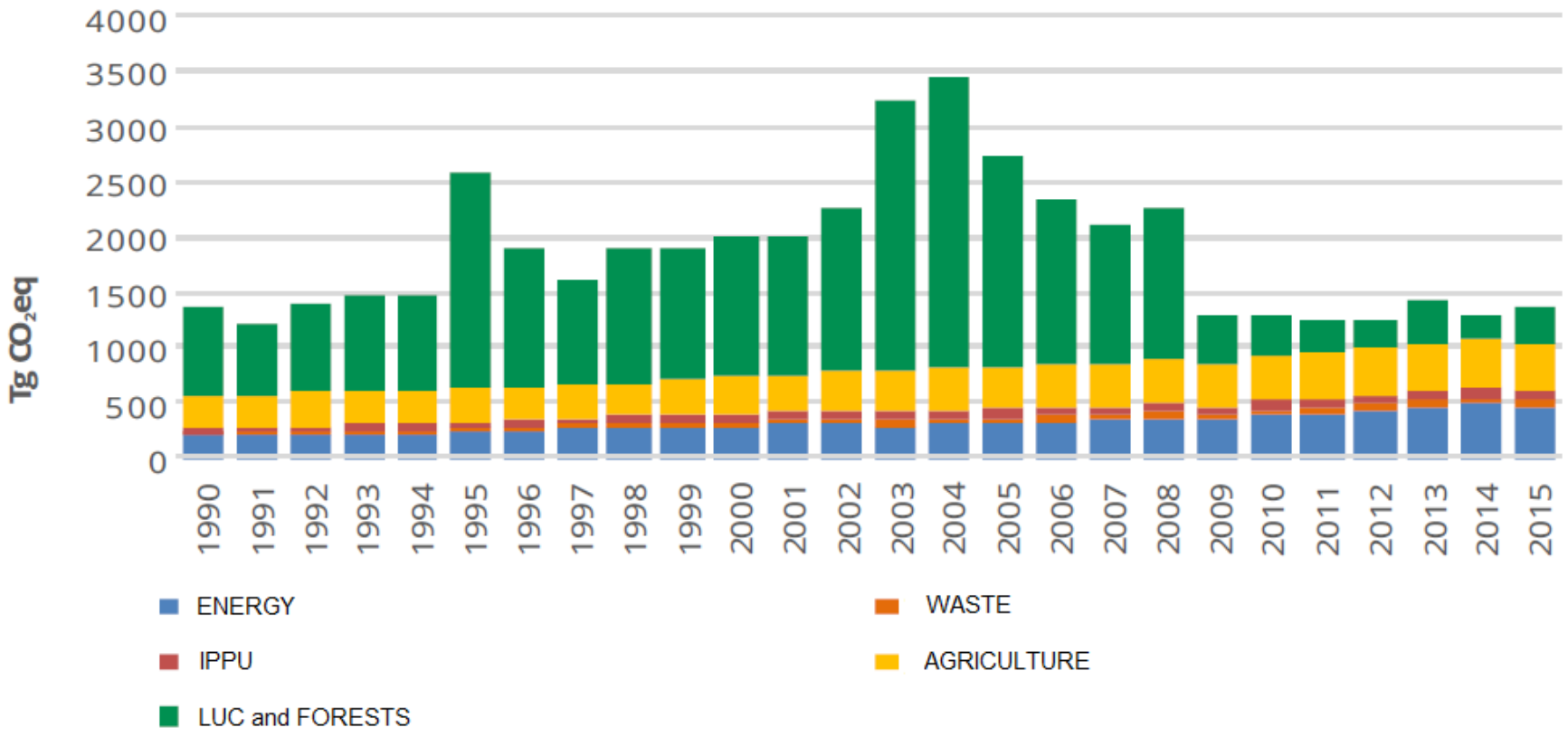


Methodology – Scenario Design

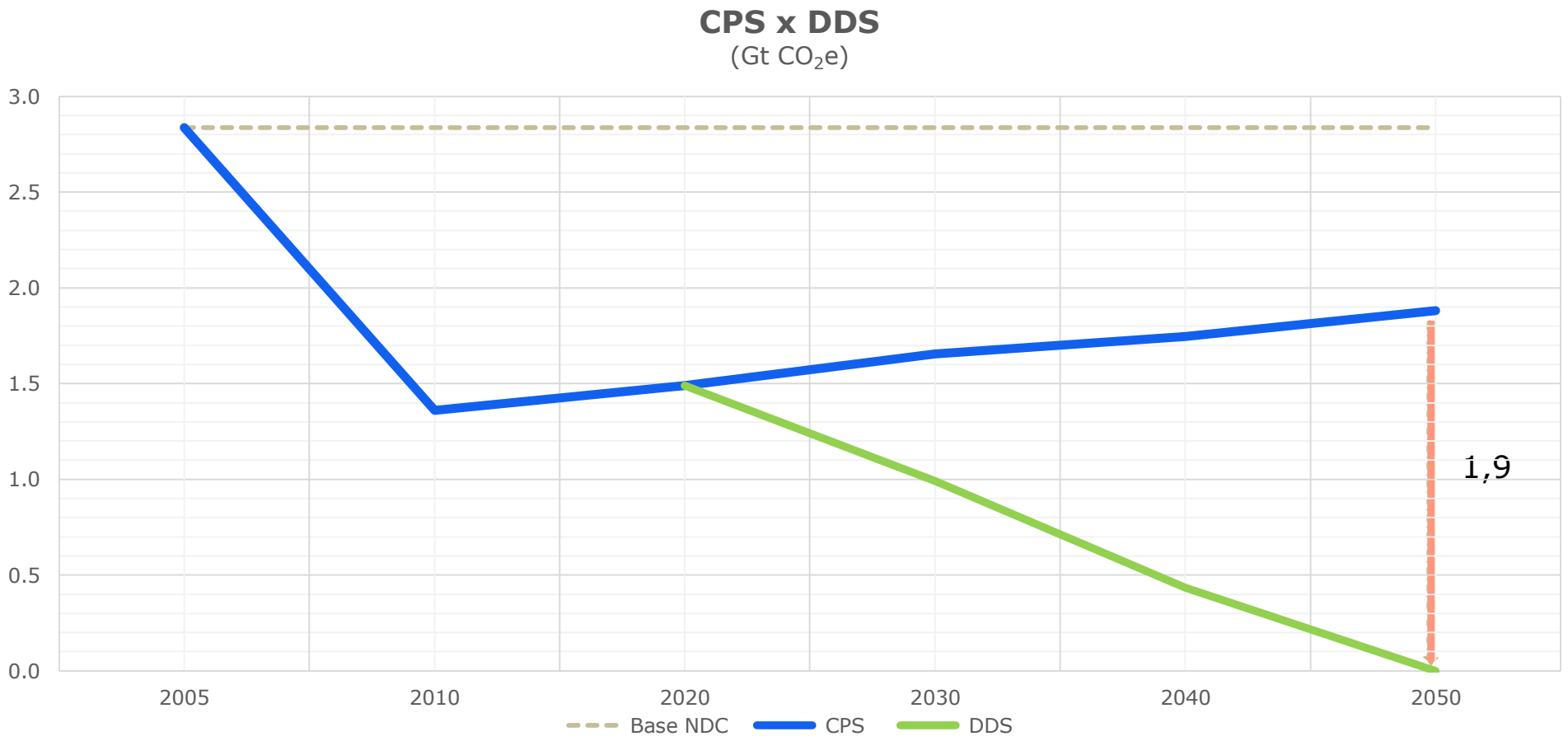
- **Two Scenarios:**
  - **CPS** (Current Policies Scenario)
    - Current mitigation actions only: no increase in ambition and no carbon pricing
  - **DDS** (Deep Decarbonization Scenario) backcasting to net zero GHG emissions in 2050
    - Radical reduction of annual deforestation rate and increase of forest sinks
    - Carbon pricing from 2025 to 2050:
      - on IPPU and energy-related emissions (AFOLU and Waste emissions not included)
      - Applied through a cap-and-trade scheme in industry, and carbon taxes in other sectors
      - 25 US$/tCO2e in 2030; 45 USD/tCO2e in 2040 and 65 USD/tCO2e in 2050
      - Fiscal neutrality; 100% of revenues from carbon pricing used to reduce labor taxes (to increase employment generation) and to compensate poor households of the increase in general price levels
    - Sectoral models include mitigation actions up to the carbon price in each period.

Brazilian GHG Emissions

GHG emissions in Brazil (3rd National Communication)



Results: Economy-wide GHG Emissions (Gt CO_2eq)



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Greenhouse Gas Emission Scenarios for the Power Sector in Brazil until 2050

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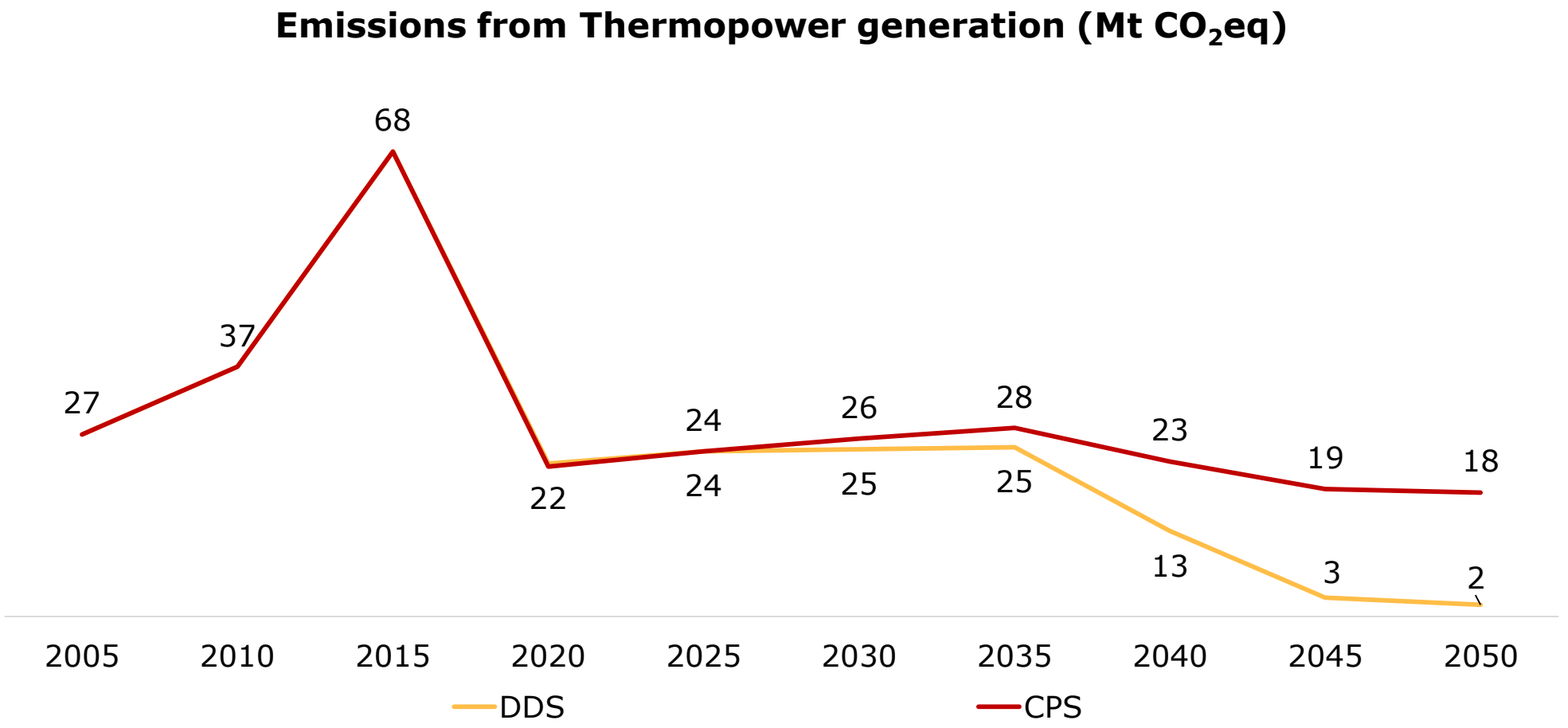
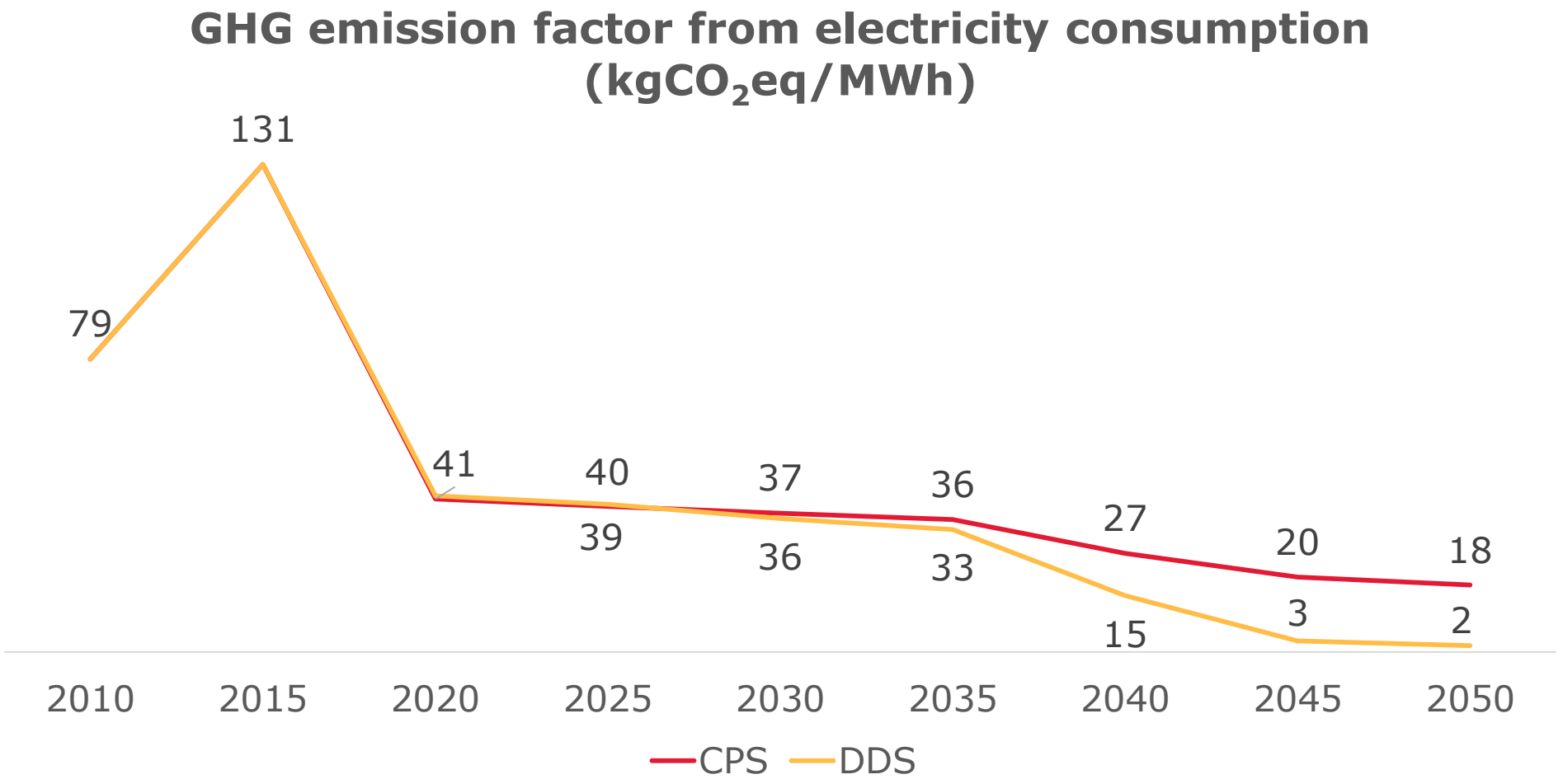
Results - GHG Emissions

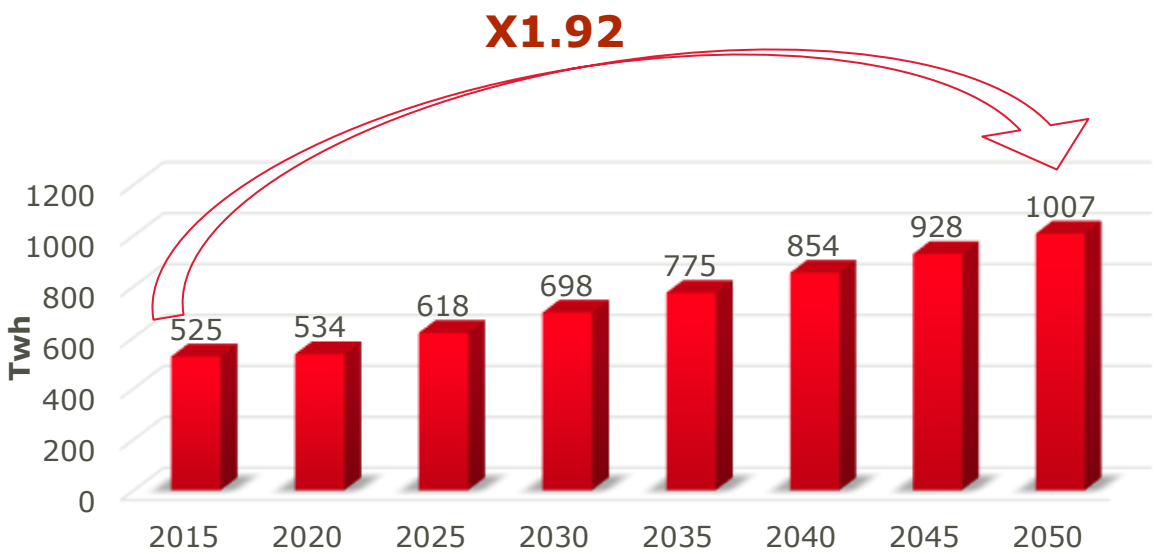


Indicators

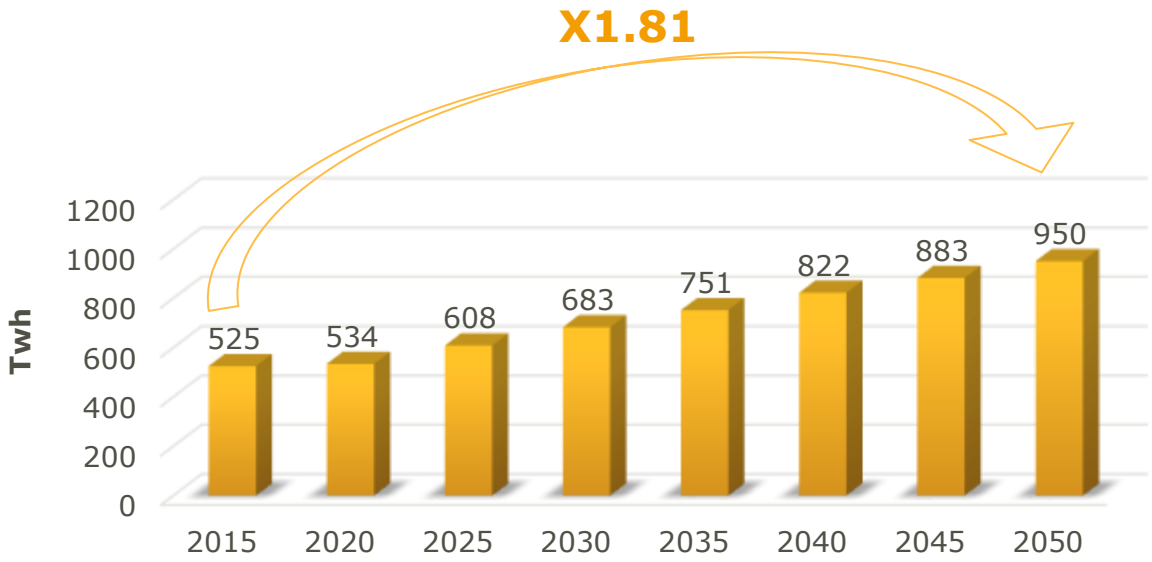

GHG emission factor from electricity consumption
(kgCO2eq/MWh)
131
79
41
40
39
37
36
36
33
27
15
20
3
18
2
2010
2015
2020
2025
2030
2035
2040
2045
2050
CPS
DDS

Results - Electricity Consumption

CPS



DDS



2050: Electricity demand is 6% lower in DDS than in CPS (greater energy efficiency in Industry, mainly)

Indicators

Mentioned in 1st NDC	Data	CPS				DDS				NDC Goal
Indicator	2015	2020	**2030**	2040	2050	2020	**2030**	2040	2050	**2030**
Share of renewables in the energy matrix(%)	43%	50%	**50%**	52%	53%	50%	**53%**	59%	62%	**45%**
Share of renewables, except hydro, in the energy matrix(%)	32%	37%	**36%**	39%	41%	37%	**39%**	44%	48%	**28%**
Share of renewables in electricity generation(%)	60%	83%	**81%**	86%	89%	83%	**82%**	90%	95%	-
Share of renewables, except hydro, in electricity generation(%)	16%	23%	**24%**	31%	44%	23%	**24%**	33%	46%	**23%**
Electricity Consumption/Energy Consumption (%)	17%	18%	19%	19%	**20%**	18%	20%	22%	**25%**	

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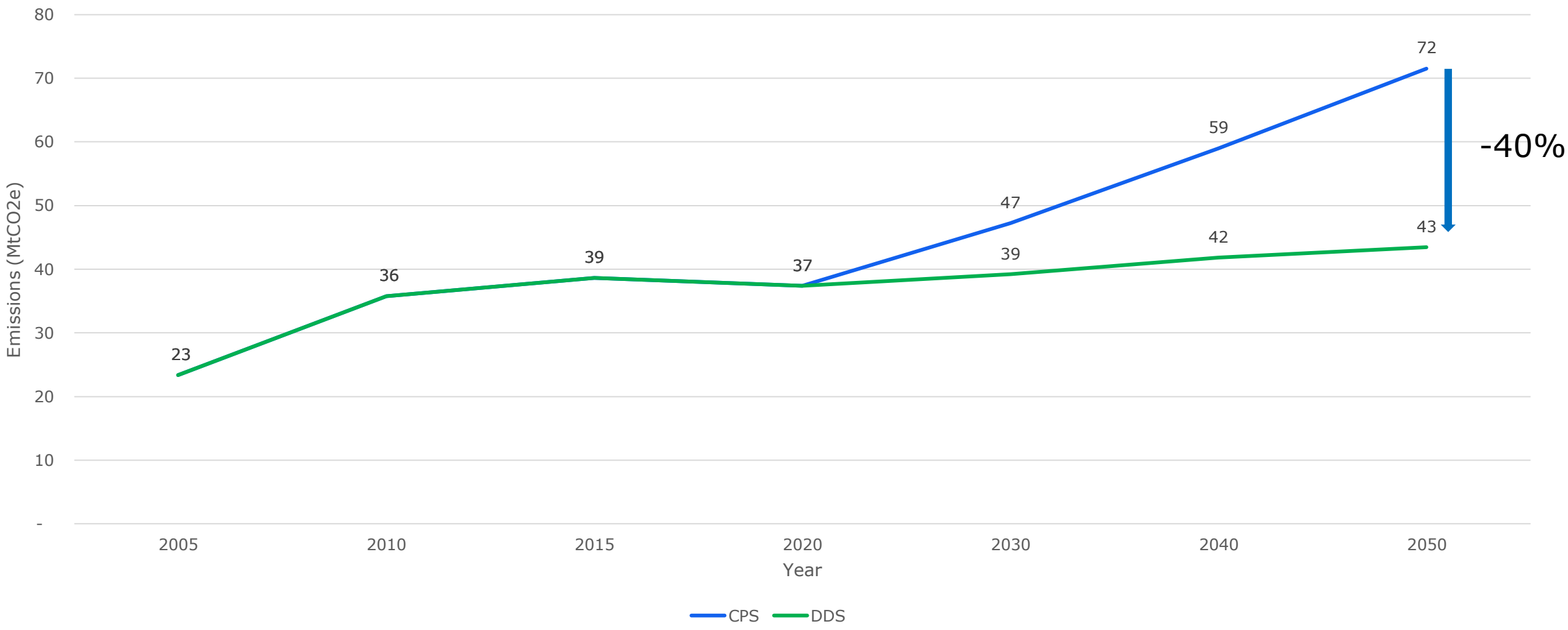
Results for the Cement Industry – GHG Emissions (MtCO2eq)



Indicators for the Cement Industry

Indicator	2015	2020	2030		2040		2050	
			CPS	DDS	CPS	DDS	CPS	DDS
Cement production (Mt)	65	63	80	73	100	86	122	95
Intensity (GJ/Mt cement)	3,0	3,1	3,1	2,8	3,1	2,6	3,0	2,3
Energy consumption (ktoe)	3.577	4.642	5.866	4.954	7.300	5.269	8.812	5.257
Ratio Clinker/cement	64%	64%	64%	58%	64%	53%	64%	52%
Emissions intensity (MtCO2e/Mt cement)	0,59	0,59	0,59	0,53	0,59	0,49	0,59	0,45
% biomass	3.8%	3.8%	3.8%	6.1%	3.8%	8.3%	3.8%	10%
GHG emissions (MtCO2e)	39	37	47	39	59	42	72	43

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Greenhouse Gas Emission Scenarios for Agriculture in Brazil until 2050

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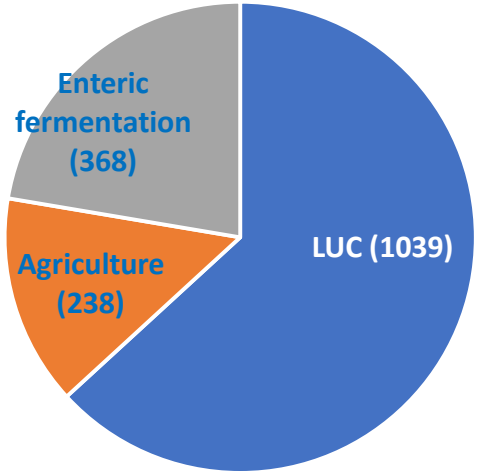
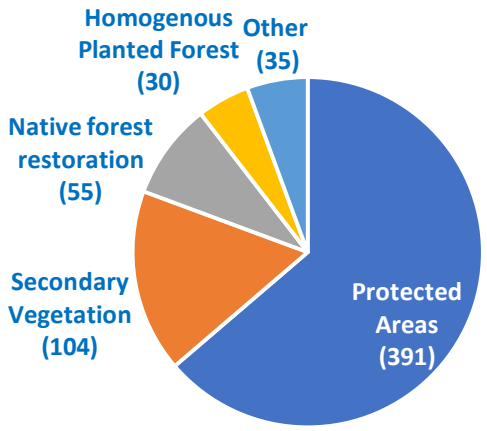
Results: Gross and Net AFOLU Emissions

AFOLU Emissions (Mt CO_2e)	2010*	2019	2020	2030	2040	2050
Gross Emissions- CPS	1154	1494	1558	1589	1605	1645
Gross Emissions - DDS				1161	734	571
Net Emissions - CPS	841	900	951	1012	1007	1031
Net Emissions - DDS				**459**	**-67**	**-475**

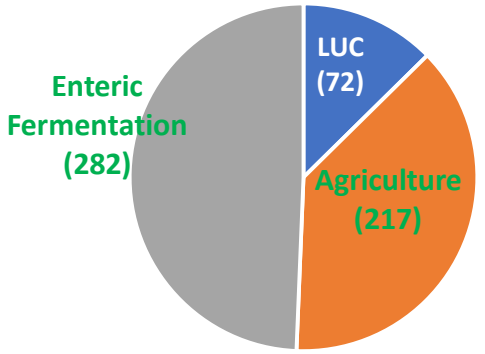
Gross emissions CPS-2050 (1645 Mt CO_2eq)



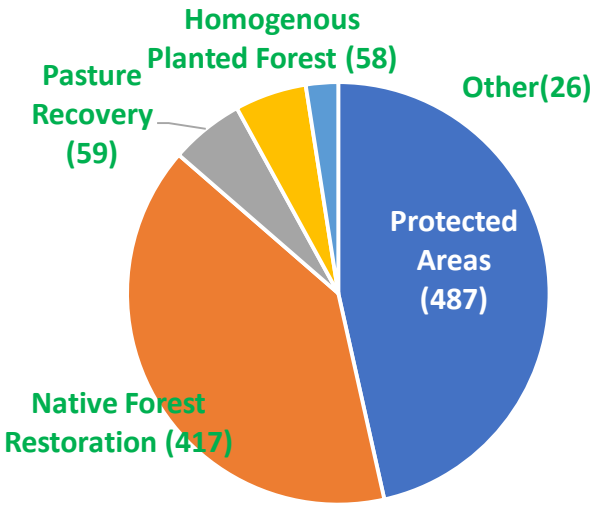
Removals CPS -2050 (614 Mt CO_2eq)



Gross Emissions DDS -2050 (571 Mt CO_2eq)



Removals DDS -2050 (1046 Mt CO_2eq)



* Data adapted from the 3rd National Communication (Brazil, 2016); Agriculture: includes agricultural soils, rice cultivation, burning of agricultural residues and waste management.
LUC: Land Use Change

Indicators (main emissions drivers)

Indicator	2010	2019	2020	CPS			DDS		
				2030	2040	2050	2030	2040	2050
Livestock Integration Systems – with forestry component (Mha)	0,9	2,6	2,8	3,3	3,8	4,0	3,6	4,3	5,1
Recovered pastures (Mha)		11	12	17	24	30	27	44	60
Average stocking rate (head/ha)	1,11	1,31	1,31	1,37	1,45	1,56	1,39	1,56	1,96
Cattle herd (million head)	210	214	215	225	229	244	217	208	185
Carcasse weight (Kg/head)	222	242	242	247	257	270	254	284	351
Slaughter age				37 meses			27 meses		

Key Findings

- DDS is just one among many pathways for Brazil to reach climate neutrality by 2050;
- Underlying assumption: use of available technologies only; huge mitigation potential at low costs in Brazil even before the deployment of technological "*breakthroughs*";
- DDS allows to reach carbon neutrality while keeping slightly better economic and social development results than in CPS (smart recycling of carbon pricing revenues);
- 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.
- 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;
- Native vegetation restoration in public and private areas have a significant abatement potential and lower costs than mitigation actions in other sectors.
- Decarbonization milestones and benchmark indicators are provided at the sectorial level to monitor, report and verify (MRT) the progress towards achieving targets.