BOSTON CONSULTING GROUP

BRAZIL CLIMATE REPORT 2024

Seizing Brazil's Climate Potential

BRAZIL CLIMATE SUMMIT EUROPE

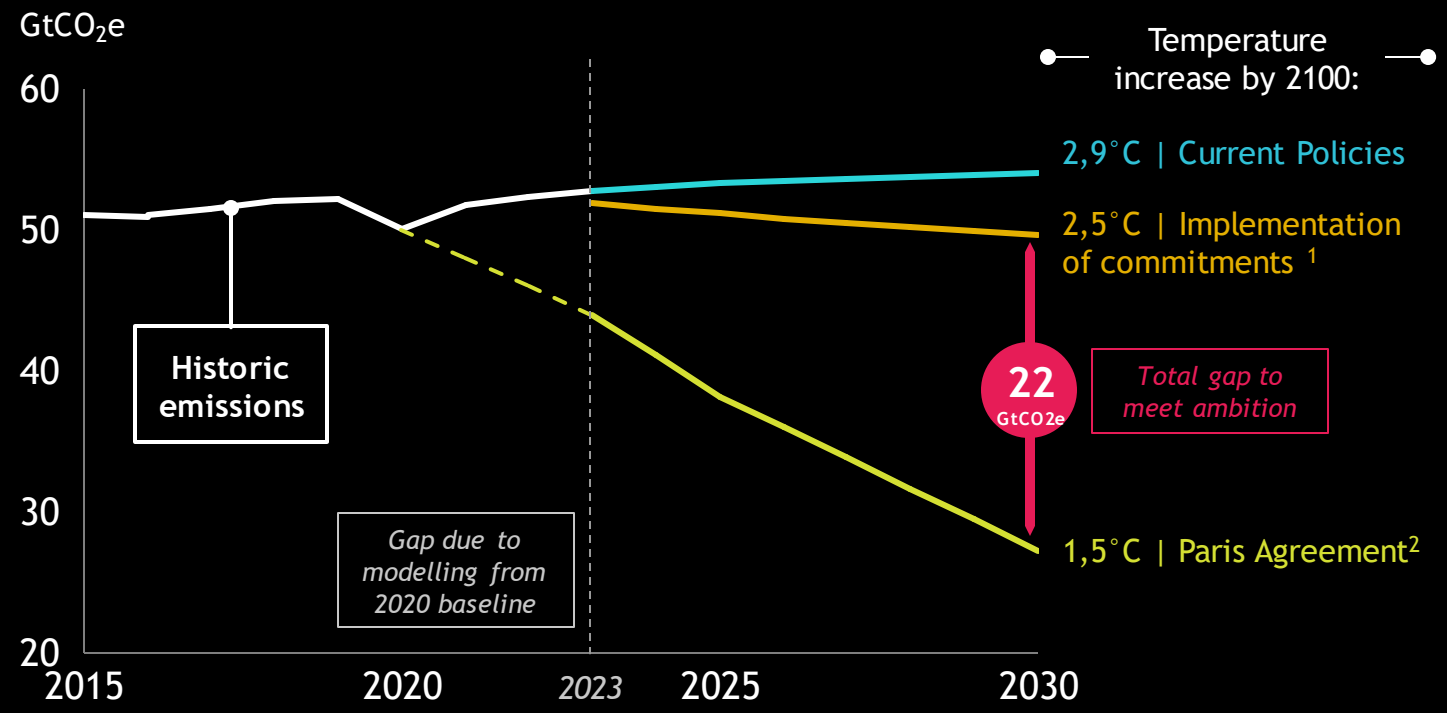
May 2024

Brazil Climate Summit.

Decarbonizing world's economy is urgent and crucial to avoid major disasters and loss of wealth in this century

Total emission per Warming scenario

World, GtCO2e



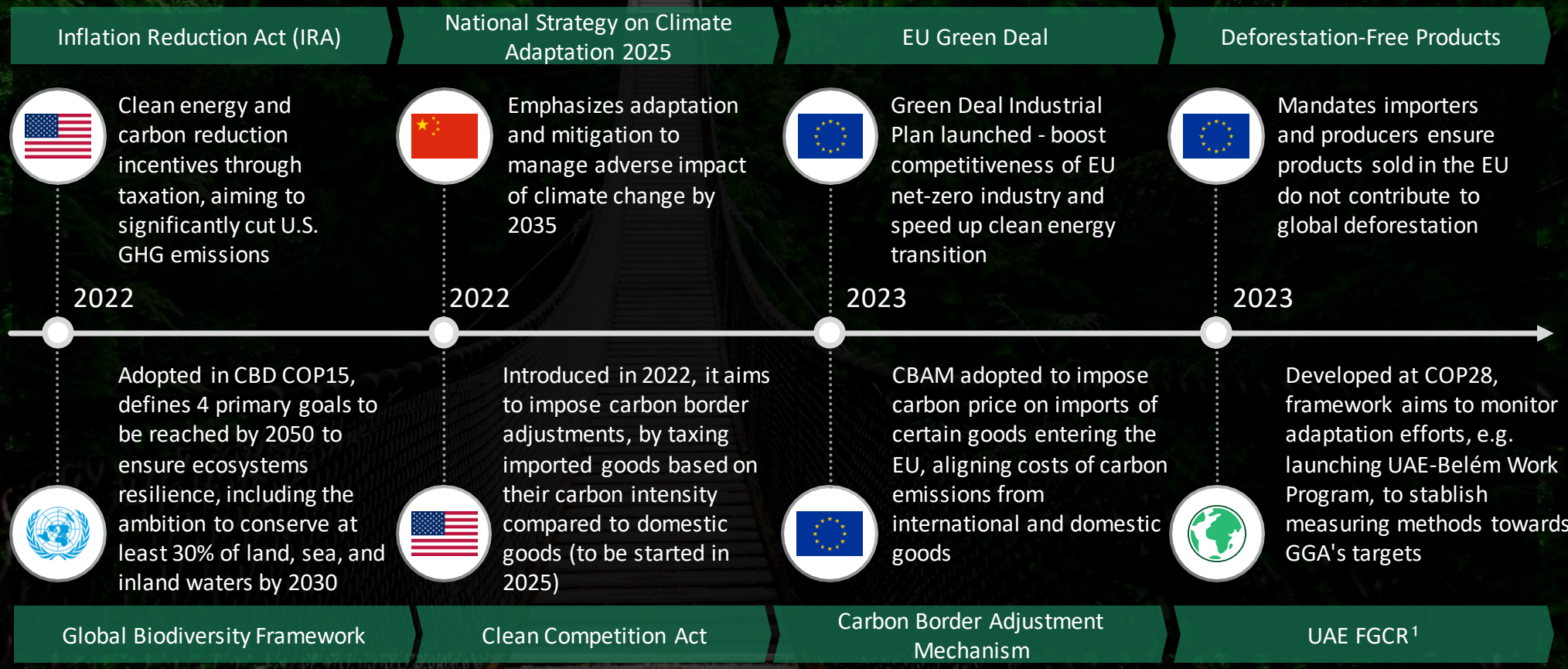
GDP loss (per capita) by 2100 due to disasters and Climate Change

>4.0°C	-30% GDP p.c.
2.0°C	-13% GDP p.c.
1.5°C	-8% GDP p.c.

1. Based on submitted NDCs. 2. Modelling conducted from 2020 baseline using projected 2020 emissions.
Note: Emission gap for 2°C pathway estimated to be ~14 GtCO2e (UNEP Emissions Gap Report 2023). Temperature increase refers to global warming by 2100; GDP loss (due to Global Warming impact) is per capita, vs. no additional global warming
Source: ClimateReanalyzer.org; Climate Change Institute; University of Maine; Climate Action Tracker, UN Intergovernmental Panel on Climate Change (IPCC); BCG analysis

Some advances in the global agenda over the last two years provide inspiration…

Relevant advances in the global regulatory framework & new polices



1. UAE Framework for Global Climate Resilience

… yet efforts to mitigate climate change are falling short of what is required

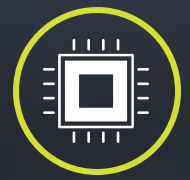
Nations

of emissions covered by decarbonization commitments by 2050

Companies

of top 1000 companies with targets aligned with +1.5°C

Technologies



of mitigation covered by cost-competitive technologies

Fundings

of total need for climate funding required

Transition to NZ will require massive investments over next three decades

Scale of change

in numbers

$100-150T

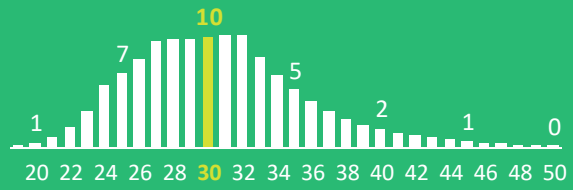
Total climate-aligned accumulated investments for the next 3 decades

$3-5T

Avg. annual investments in 2020-50 (peak of $10T per year around 2030)

Source: GFMA and BCG Report – Climate Finance Markets & The Real Economy Dec/2020; BCG analysis

Global Climate Financing Need (US$ T)



- Investment is expected to be highly frontloaded until 2035

Non exhaustive

Investments pursue Climate Solutions at scale (some of which are already viable)

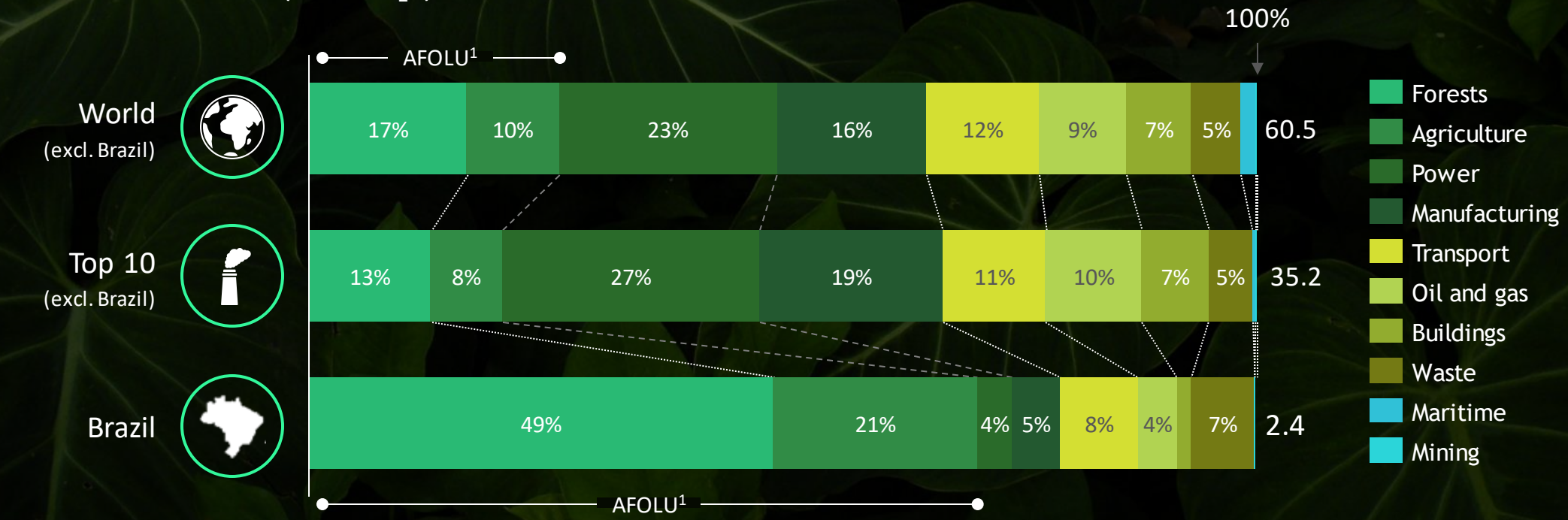
+ Commercially viable -

- Renewable energy
- Biomass & biofuels
- Sustainable agriculture
- NBS (carbon offset)
- Electrification & batteries
- Green Hydrogen (enabling low-carbon steel/cement)

Brazil's emissions & challenges highly differ from those in rest of the world

Total GHG emissions

2019, share of total (in Gt CO_2e)

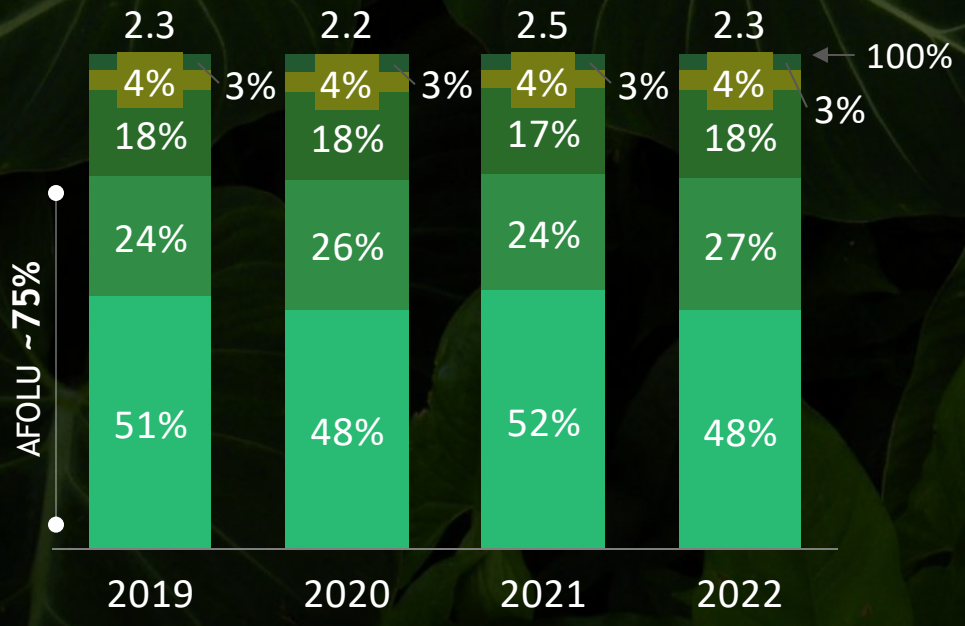


1. Combination of agriculture, forestry and other land use
Source: Climate TRACE; BCG analysis

Brazil's AFOLU remained steady from 2019 to 2022 both for gross and net emissions

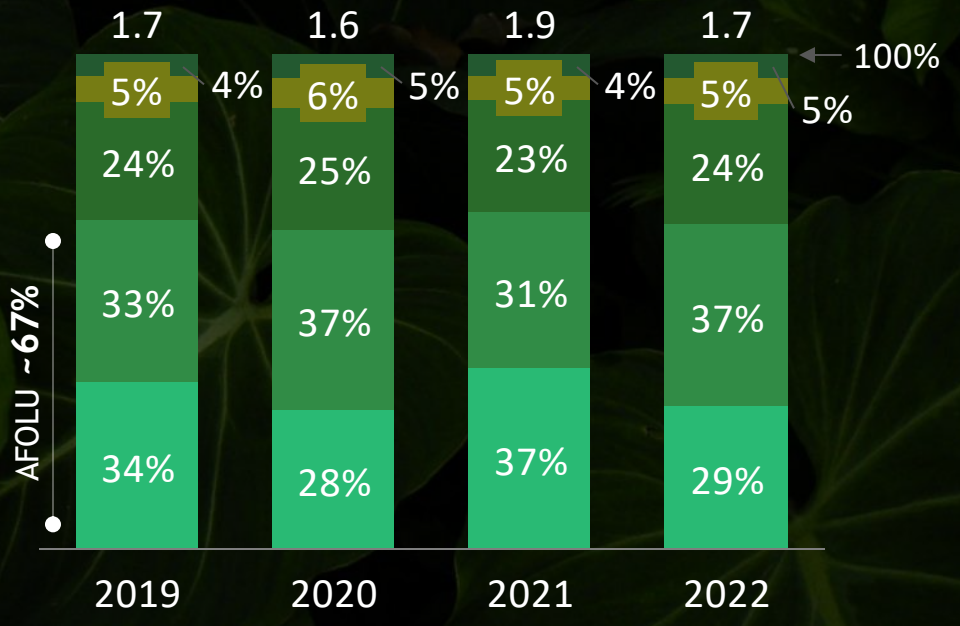
Brazil gross GHG emissions

Share of total (in Gt CO_2e)



Brazil net GHG emissions

Share of total (in Gt CO_2e)



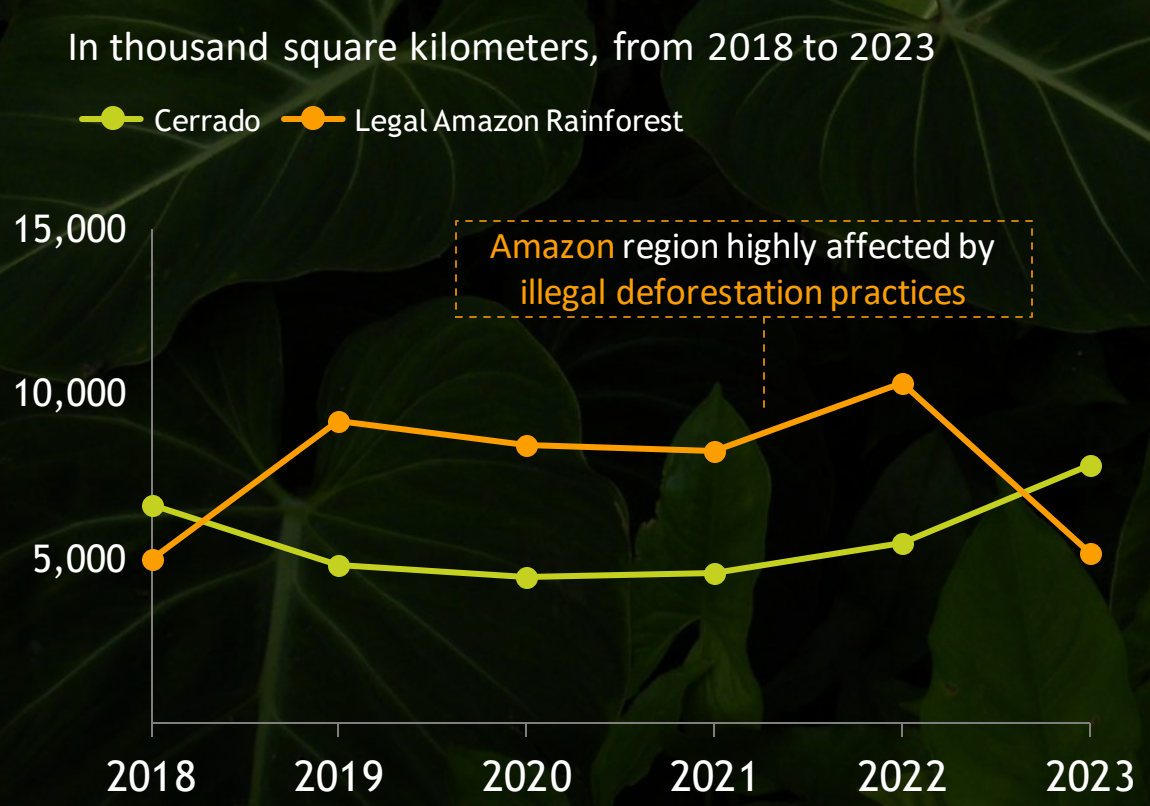
Change in Land Use and Forestry | Agriculture | Energy | Waste | Industrial Processes

Source: SEEG

Reintroduction of control policy shows reduction in deforestation in Amazonia, while Cerrado presents major increase

Increased deforestation across the BR Biomes

In thousand square kilometers, from 2018 to 2023



Amazon Rainforest

Within the Legal Amazon Area, landowners must **reserve 80% of native vegetation**, leading to mostly illegal deforestation

Reinstatement of the PPCDAm[1] reinforced monitoring in the Amazon Public Areas

Drop of ~ 50% in the deforestation alerts of Legal Amazon in 2023

Cerrado

Landowners must preserve **35-50%** of Cerrado area within Legal Amazon, and **20%** of other areas

Legal deforestation has risen, suggesting new deforestation spots & **expansion of agricultural frontier**

Increase of ~ 44% in the deforestation alerts in 2023

Changes in the Regulation on **Deforestation-free products**[2] might help control deforestation in the area

1. PPCDAm stands for Action Plan for the Prevention and Control of Deforestation in the Amazon; 2. The regulation focuses on forest areas, but will veto, as of Dec/2024, the import of products from all deforested areas, incl. Cerrado

Notes: All deforestation practices in Amazon Public Areas is considered illegal, and public area is approx. 75% of total Amazon Rainforest

Source: INPE DETER; Ibama; BCG analysis

Climate impact is increasingly alarming in Brazil, with severe floods and droughts throughout the country

Brazil faces critical economic and social risks from climate change, demanding immediate action…

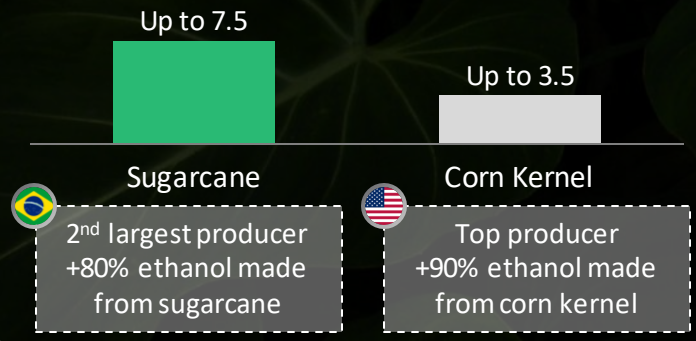
… Adaptation & Resilience initiates must be put into action to overcome challenges & avoid the cost of inaction

- A&R urgency was spotlighted in 2022, during COP27 in Egypt
- Brazil launched the first A&R program in 2016 (PNA[1]), covering 11 sectors, including agriculture, cities, disaster risk management, etc.
- BR is taking further steps to boost the initiative, e.g. directing R$ 10.4B to adaptation projects through the Climate Fund

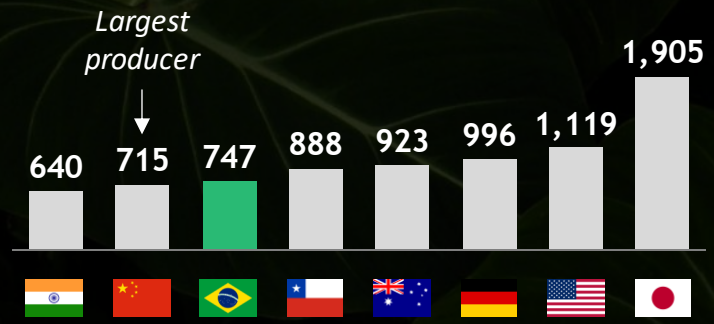
1. PNA stands for Plano Nacional de Adaptação à Mudança do Clima
Source: UNFCCC; BNDES; Ministério do Meio Ambiente; BCG analysis

Productivity drives cost competitive climate solutions for Brazil …

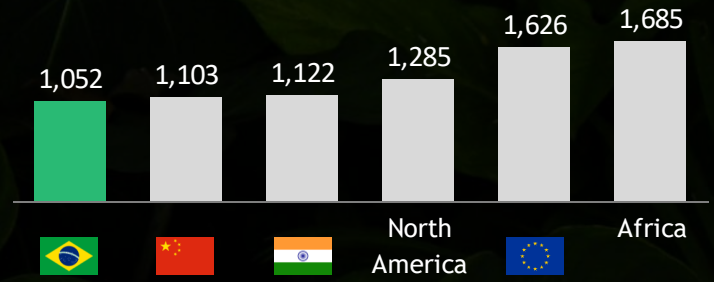
Ethanol productivity
(thousand L /ha)



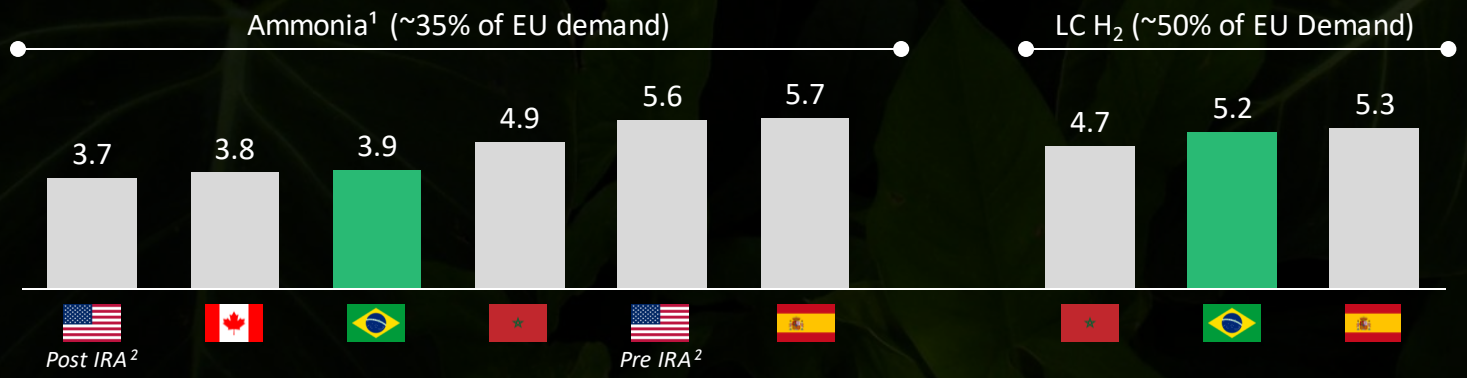
Total Set-up costs utility-scale solar PV
(USD/kW, 2022)



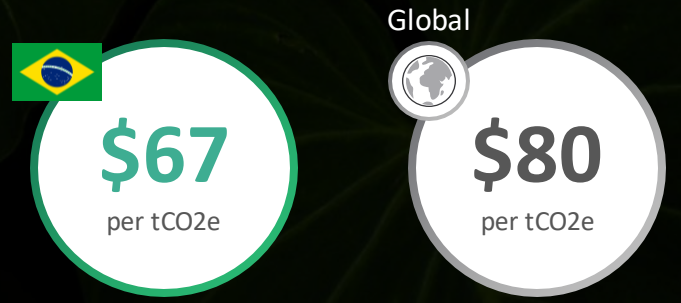
Avg. installed cost of onshore wind projects
(USD/kW, 2022)



Cost of supply LC H2 and derivates in Germany
(USD/kg, 2030)



Reforestation projects cost
(USD/tCO2e,)



1. Includes H2 derivatives (e.g. ammonia and methanol)); Blue H2 as ~15% of total LC H2 demand in Western Europe (2030). 2. Inflation Reduction Act
Source: Irena report 2022; USDA; UNICA; BCG analysis

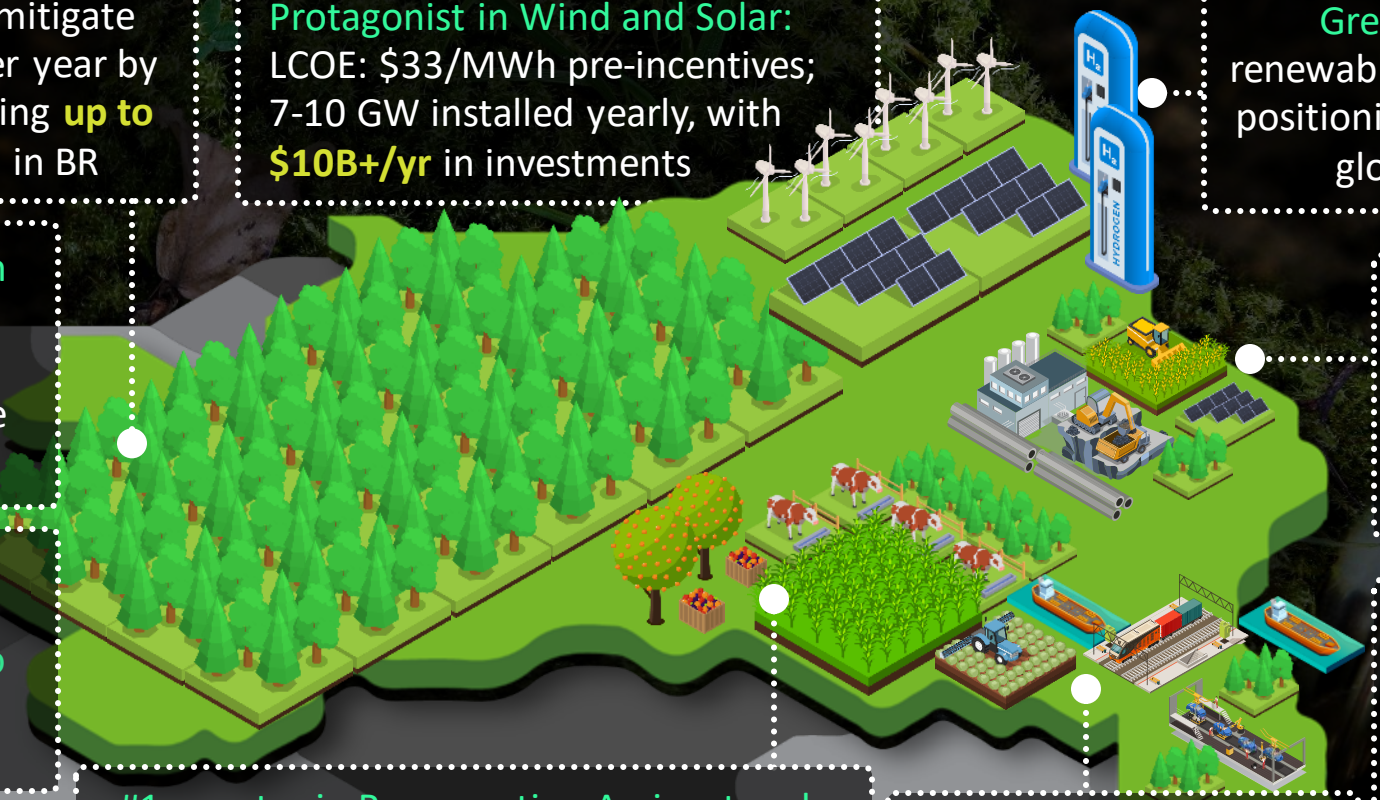
… securing a key global hub of climate solutions

#1 CO_2-offset supplier: mitigate from 0.15-0.5 Gt CO_2e per year by 2030 through NBS, creating **up to $50B** of revenue pool in BR

Protagonist in Wind and Solar: LCOE: $33/MWh pre-incentives; 7-10 GW installed yearly, with **$10B+/yr** in investments

Green H_2 : Competitive renewable grid and local demand positioning to capture 10-15% of global exports +2030

Zero illegal deforestation through command and control (tech + law enforcement) & effective fighting of natural fires



Leadership in Biomass allowing next gen fuels (SAF, HVO, RNG) for industry and mobility

Increased investment in mitigation & adaptation projects, with the Fundo Clima (up to $3 Bn in partnerships in 2024)

Worldwide Hub for low-carbon industrial products, benefiting from clean energy, competitive Green H_2, natural resources, NBS supply and circularity

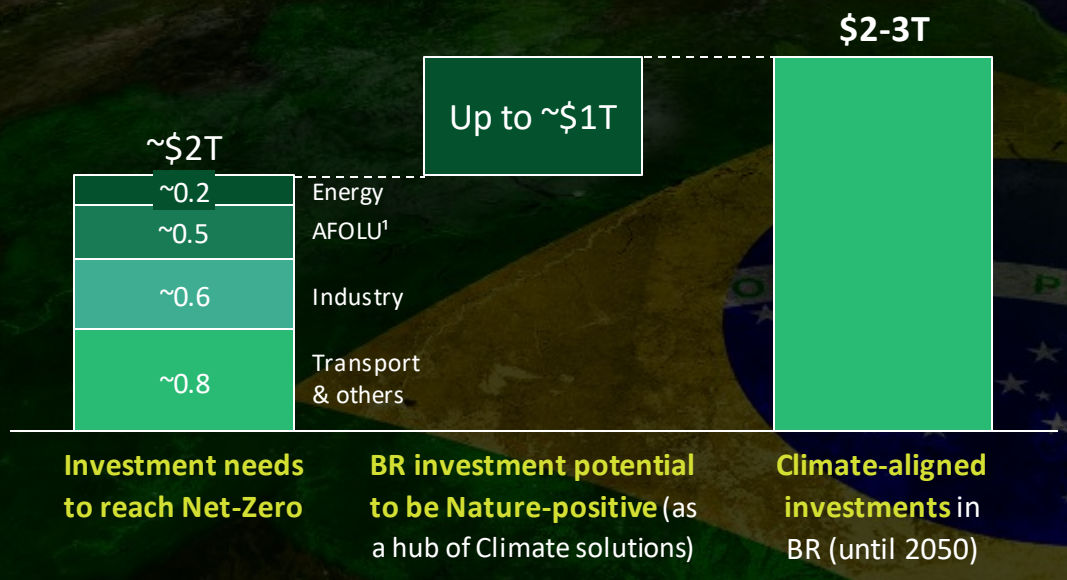
Increased Sustainability in wastewater treatment coverage and clean water supply

#1 country in Regenerative Agric. at scale (up to 100+ Mn hectares of Crop-Livestock-Forest Integration or no-till farming, +70% of cattle yields with pastureland recovery)

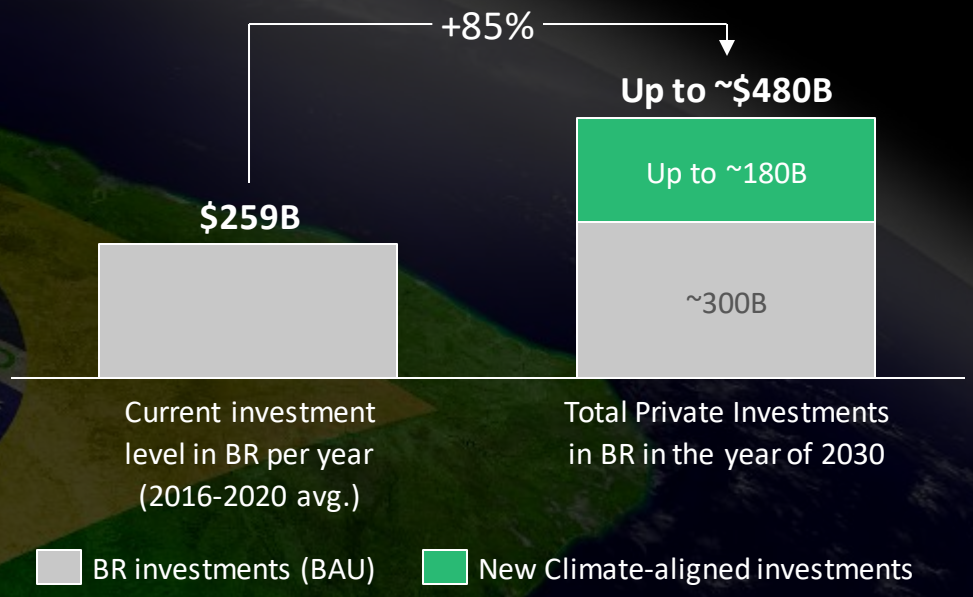
Expansion of efficient long-haul modals (waterway, rail) to reduce emission footprint

Brazil's climate hub potential goes beyond Net Zero, unlocking up to $3T in investments

BR Climate-aligned investments expected to sum $2-3T in until 2050 …



… potentially doubling Brazil's annual Investment Level



1. Agriculture, forestry & other land use. 2. Refers to additional investments in Brazil to support the World in the transition to Net-Zero (e.g., carbon credit supply from NBS)
Note: assumes Gross Fixed Capital Formation of Business-as-Usual growing in same pace as GDP, with 10% of climate investments occurring in 2030 and other 40% distributed between 2028-2037;
Source: Oxford Economics; BCG Report – Climate Finance Markets & The Real Economy; FMI; Sebrae; BCG analysis

That will enable Brazil scale up low emission economy pillars

1

Nature

BR is #1 country in reforestation globally, holding ~10% of world's NBS mitigation potential (up to 1.5 Gt CO_2e per year)

- Reforestation & Restoration
- Avoided forest conversion

2

Sustainable Agriculture

- Biological Fertilizers
- Regenerative Agriculture
- Low-carbon protein

3

Renewable Energy

- Biomass & Biofuel
- Renewable Energy
- Green H_2

4

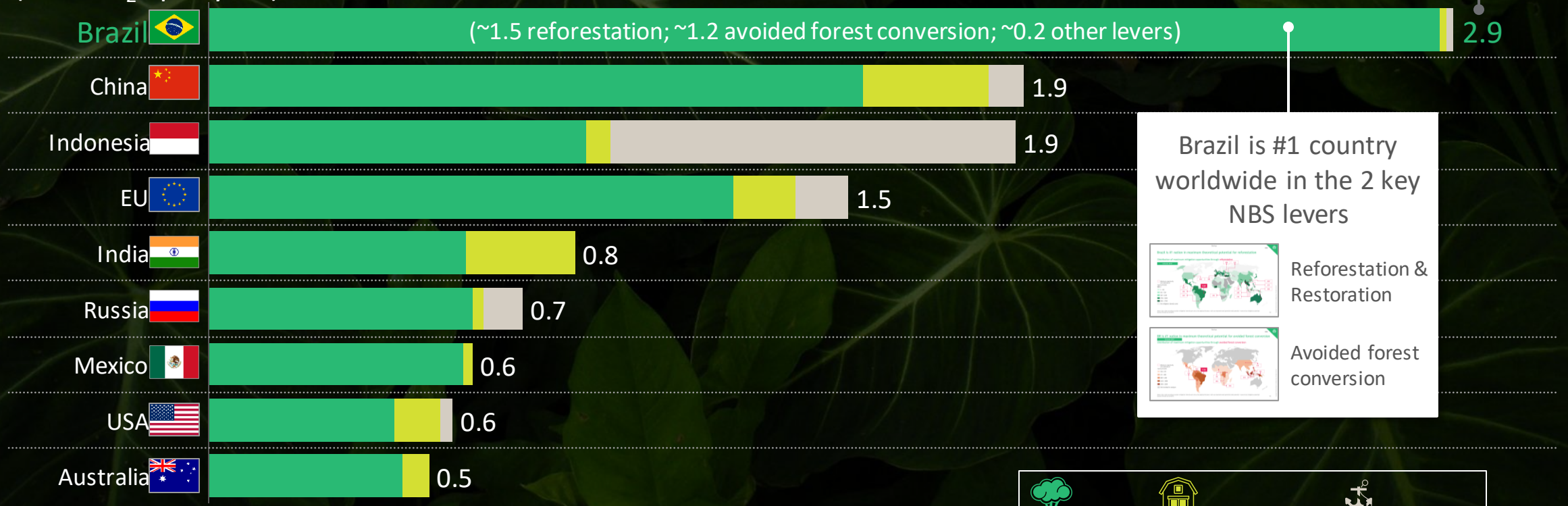
Green industrial products

- Low-carbon basic items (e.g., Steel, Cement…)
- Green BR Industrial products

Brazil is the country with the highest maximum theoretical potential for Nature Base Solutions

Griscom 2017

Global maximum theoretical potential for NBS levers in the main 8 countries and EU (in $GtCO_2e$ per year)



1.3~1.7

Gt CO_2e of cost-effective[1] potential per year in BR

Brazil is #1 country worldwide in the 2 key NBS levers

Reforestation & Restoration

Avoided forest conversion

1. Annual cost below 100 USD per tCO_2e mitigated or captured - Griscom et al (2020) and Roe et al (2021) reviewed the cost-effective potential to 1.35 and 1.65 GtCO2e/year. Source: Griscom et al (2017), Roe 2019, BCG analysis

+ $ 120M
Reflecting momentum of major restoration and reforestation projects commitments

re.green
Microsoft
(2024)

- **Microsoft** signed an offtake agreement for the purchase of **3 million** carbon credits over 15 years
- **re.green** will restore **16,000 hectares** of private land (acquired by the startup) in the Atlantic Rainforest

AXA & MOMBAK
(2023)

- The French insurer **AXA committed $49 million in reforestation** projects through the **startup Mombak in Brazil**
- The startup will recover over 10,000 hectares of degraded pastures, to **generate up to 6 million carbon credits**

AstraZeneca
ambipar | BIOFÍLICA
& IPÊ INSTITUTO DE PESQUISAS ECOLÓGICAS
(2023)

- AstraZeneca dedicated **~$ 70 million** to help **restore the Atlantic Forest** in Brazil, by planting 12 million native trees across 6,000 hectares
- **"AR Corredores de Vida" project**, one of the best carbon credit project globally according to Environmental Finance
- AstraZeneca partnered with **Biofílica Ambipar and the IPÊ (Institute for Ecological Research)** for this initiative, creating +400 jobs and enhance the protection of endangered fauna and flora

amazon & The Nature Conservancy
(2021)

- The Nature Conservancy (TNC), Amazon & the World Agroforestry Centre (ICRAF) launched a project to **promote agroforestry and ecological restoration in Pará**
- **Agroforestry and Restoration Accelerator** aims to transform 18,000 hectares of degraded land into productive agroforestry systems, engaging **3,000 local farmers**, with potential to **remove 9.6 Mn tons of carbon** over 30 years

Source: Infomoney; The Nature Conservacy; Ambipar; Capital Reset

That will enable Brazil scale up low emission economy pillars

1

Nature

2

Sustainable Agriculture

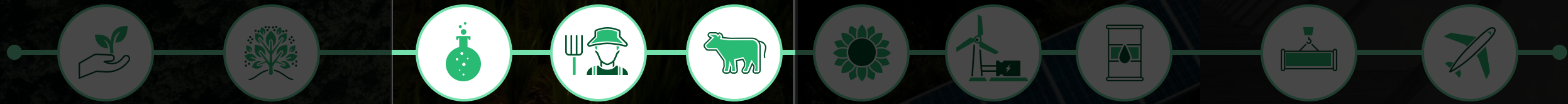
#1-2 exporter of most commodities (soy, orange juice, sugar, meat, corn), BR can continue scale-up while reducing emissions

3

Renewable Energy

4

Green industrial products



Reforestation & Restoration

Avoided forest conversion

Biological Fertilizers

Regenerative Agriculture

Low-carbon protein

Biomass & Biofuel

Renewable Energy

Green H_2

Low-carbon basic items (e.g., Steel, Cement…)

Green BR Industrial products

Brazil has the resources and comparative advantages to grow sustainable food at scale

Sustainable resources

1 # exporter of many foods and in **CO_2seq potential**

89 Mha of pastureland suitable for **sustainable intensification**

High productivity

3x is the **Brazilian crop yield** ratio *vs.* world average

2 **harvests** on average per year (up to 3 in some regions)

Advanced techniques

1.7k **AgTechs** in Brazil, 50% increase in last 3 years

2 # in no-till farming & pioneer in regenerative practices

1. Land used for cultivation of crops only. It does not include land potentially cultivable but not normally cultivated
Source: Index Mundi, World Bank, Observatory of Economic Complexity, FOFAO, IPEA, BCG analysis

Brazil has a mature and robust agriculture ecosystem

Non-exhaustive

Financial institutions

Responsible for delivering gov. financial subsidies to producers across the country + incremental financial products

bradesco, Banco do Brasil, Sicredi, Rabobank, SICOOB, Itaú

Corporations

Major input producers or food industries who negotiate directly with mid-large producers

BASF, Corteva agriscience, ADM, Bunge, Syngenta, Bayer, LDC, Cargill

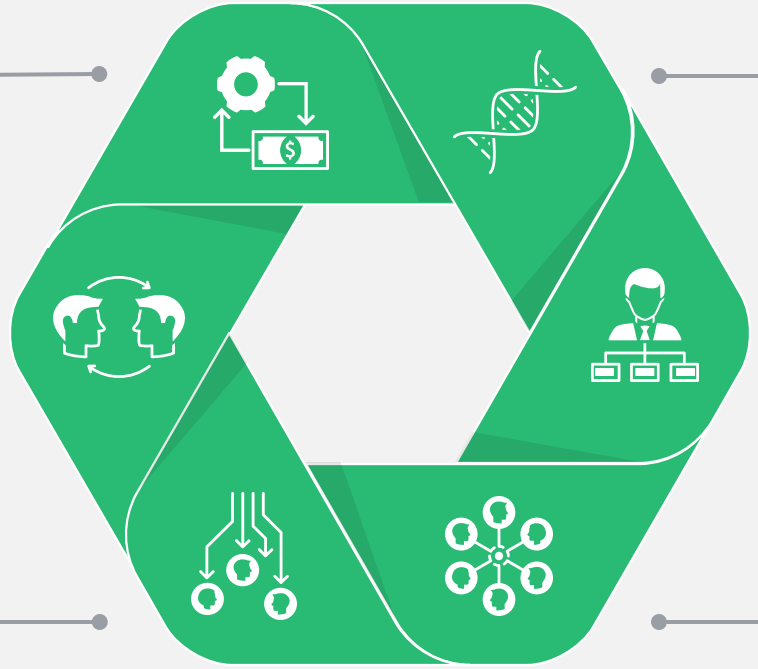
Associations

Smaller agents focused on creating network of producers for topics of interest

GAAS, CNA Brasil, Famato

Embrapa

Embrapa as main scientific entity



Universities/extension services

Focused on conducting academical research & spreading knowledge of new techniques

Fundação MS, Emater Minas Gerais, Senar Mato Grosso, Instituto Federal Mato Grosso, Esalq, USP

Production Cooperatives

Usually responsible for distributing inputs, providing technical support and selling members' products

Coamo, Holambra, Cocamar, Coopasul

Distributors (indirect sales)

Retailers, who act as intermediary between corporations and producers, when a coop is not present

Lavoro, Agro Galaxy, Agro Amazônia

Source: IPEA, BCG analysis

Sustainable practices can increase productivity, resilience, and reduce dependency on chemicals and GMO cultures

1 **Enhanced Soil Health:**

RegAgri focuses on improving soil health, thus potentially reducing the need for GMO crops (engineered for increased nutrient uptake or pest resistance)

2 **Natural Resilience:**

RegAgri make crops more resilient to stress, like drought and disease, by enhancing the organic matter in the soil and improving water retention

3 **Reduce chemical use:**

RegAgri can reduce 60-70% use of synthetic fertilizers and up to -80% use of pesticides, which are often used in tandem with GMO crops

4 **Biodiversity:**

RegAgri promotes biodiversity in both crops and native species, helping to create a more resilient and self-sustaining agricultural environment, decreasing the need for GM crops

Brazil has +56 Mn ha of GMO crops…

… RegAgri practices can ***reduce GMO dependency*** *improving soil health and quality of cover crops*

Source: CropLife Brasil; The Organic & Non-GMO Report; BCG analysis

Brazil has 2x the size of France of **underutilized pastureland** that can be converted to sustainable production

289 Mha, **over a third** of the Brazilian territory, have already been **converted**...

5.5x Spain

73% (619 Mha) of Brazil's land is the Amazon and Cerrado, **which is 27% (173 Mha) converted**

4x California

+90 Mha of pastureland suitable for **sustainable intensification**

2x France

That can be sustainably destinated to...

Not exhaustive

Soy & agriculture expansion

Meeting world's demand by utilizing cleared pasture in the Cerrado

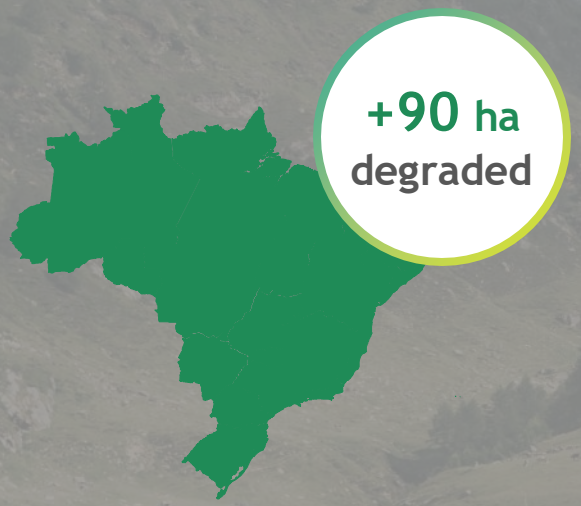
Regenerative Agriculture

Regenerating environment to draw carbon into soil & profit from benefits

Sustainable Cattle Breeding

Meeting rising demand with Crop-Livestock-Forestry Integration Systems (CLFI)

The recovery of pasturelands represents a path to sustainably meet future food demand



Degraded pastureland are either…

- Underutilized
- Below optimal productivity capacity

Degraded pastureland recovery is the technique with the greatest potential :

Impacts of Degraded pastureland recovery

+70%	+2k	~110
Unit/ha	$/ha	M ton CO2e
Potential increase in yield	Total potential increase in revenue[1]	Emissions reduction potential[2]

Key transitional production models

Productivity increase

- Soy and agriculture expansion over already-cleared pastureland — up to **30%**
- Sustainable intensification of cattle production — up to **3 cattle head/ha**

Meet **the demand for soybeans** by utilizing **already cleared pastures** in the Cerrado

Know-how and capital-intensity are the main difficulties faced in Brazil, demanding powerful investments mechanisms, such as blended finance & private investments

Note: Degraded pastureland have a stocking rate of 1 cattle head/ha
Source: Plano ABC+, EMBRAPA, Climate TRACE, Experts interview, Finance for a Forest-Positive Future - IFACC (2022), BCG Analysis

Recent investments & initiatives have boosted **sustainable agriculture and pastureland recovery** in Brazil

Source: World Bank; Poder360; Rabobank

Renova Pasto

- Launched by AGRI3 Fund and Rabobank, the initiative provides long-term financing & assistance to cattle farmers for **recovery of low productivity and degraded pastures**
- **+ $22 M have been mobilized** to finance projects with goals that combine sustainable agriculture, forest protection (or reforestation) and the reduction of CO2 emissions

JUNTOS: People + Forests + Livestock

- JBS fund for Amazon launched program to invest **+$20 M** (over the next 10 years) in **low-carbon livestock practices**
- It focuses on **degraded pastureland recovery** increasing the quality and productivity of small cattle breeders

Vertentes do Cerrado Project

- **World Bank invested +$24 M** to implement Sustainable Land Management (SLM) approach in the soybean and beef cattle
- The project aims to promote **sustainable & resilient** practices to reclaim areas of degraded pastureland…
- … **covering +47 M ha** in states of Bahia, Goiás, Mato Grosso, Mato Grosso do Sul, and Minas Gerais, and in the Federal District

That will enable Brazil scale up low emission economy pillars

1

Nature

2

Sustainable Agriculture

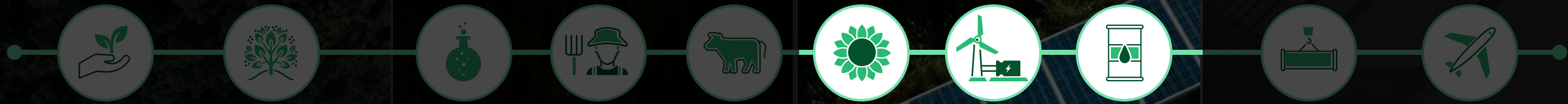
3

Renewable Energy

+90% of renewable power (vs. 33% world); Availability & low costs on wind, solar, biomass enabling low emission footprint

4

Green industrial products



Reforestation & Restoration

Avoided forest conversion

Biological Fertilizers

Regenerative Agriculture

Low-carbon protein

Biomass & Biofuel

Renewable Energy

Green H_2

Low-carbon basic items (e.g., Steel, Cement…)

Green BR Industrial products

Recent investments in Renewable Energy in Brazil include a wide variety of subsectors

Non-exhaustive

Raizen invested ~$480 M to build two new 2G ethanol plants and expects to invest a total of $4.8B in 20 new plants until 2030

Unilever invested ~$10M in the construction of a biomass power plant to supply its unit in São Paulo reduce emissions by 37,000 tCO2e/year

The ethanol & sugar producer **Atvos** plans to invest +$70 M in a biomethane plant in Mato Grosso do Sul, with inputs from the sugarcane chain

Eletrobrás invested +$400M in its Wind Plant, with an installed capacity of 29.4 MW

Casa dos Ventos announced $2.4B into renewables and plans to add 1GW solar generation to its wind assets

2023 2024

Federal government announced the investment of +$40 B in biofuels, destinated to: SAF, HVO, ethanol, biodiesel & carbon capture & storage

EU pledges to invest ~$2B to develop green hydrogen in Brazil, boosting transition to clean energy

Mubadala Capital, fund that controls Atvos & Acelen, announced its intention to investa total of + $13.5 B in biofuels in BR

BYD and **GWM** announced the first Electric and Hybrid Vehicles plants in Brazil with a total investment over $2.5B

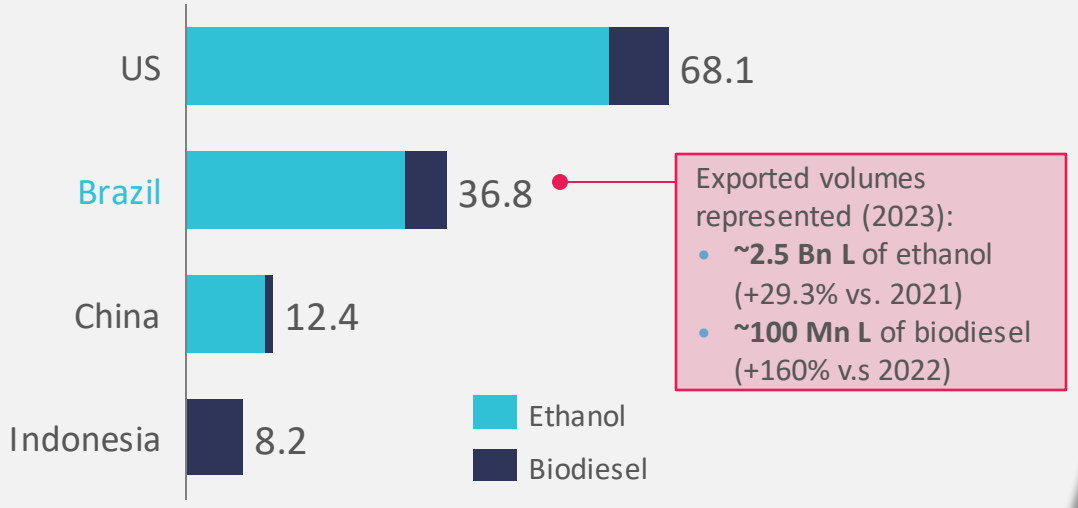
Biofuel Biomass Biogas Green H2 Solar Wind EVs

Source: Hydrogen Insights; Reuters; Brasil Agro; Forbes; Canal Energia; Exame

Brazil is already a main biofuels producer & exporter, with potential to increase this role even more

Brazil is the 2nd largest producer of ethanol/biodiesel...

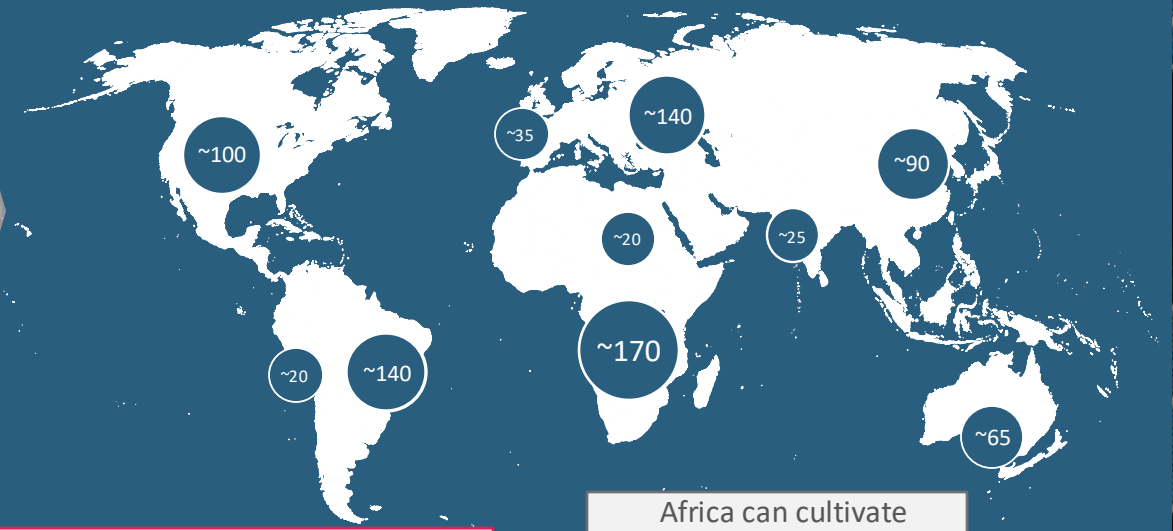
Top 4 ethanol/biodiesel producing countries (Billion L, 2022)



Exported volumes represented (2023):
- **~2.5 Bn L** of ethanol (+29.3% vs. 2021)
- **~100 Mn L** of biodiesel (+160% v.s 2022)

... and should increasingly become relevant due to its large biofuels production potential

Forecasted biofuels capacity[1] for 2050 (EJ)



LATAM expected to hold 2nd largest potential by 2050, with Brazil representing >85%[2] of it

Africa can cultivate several types of bioenergy crops, but must tackle current issues in productivity

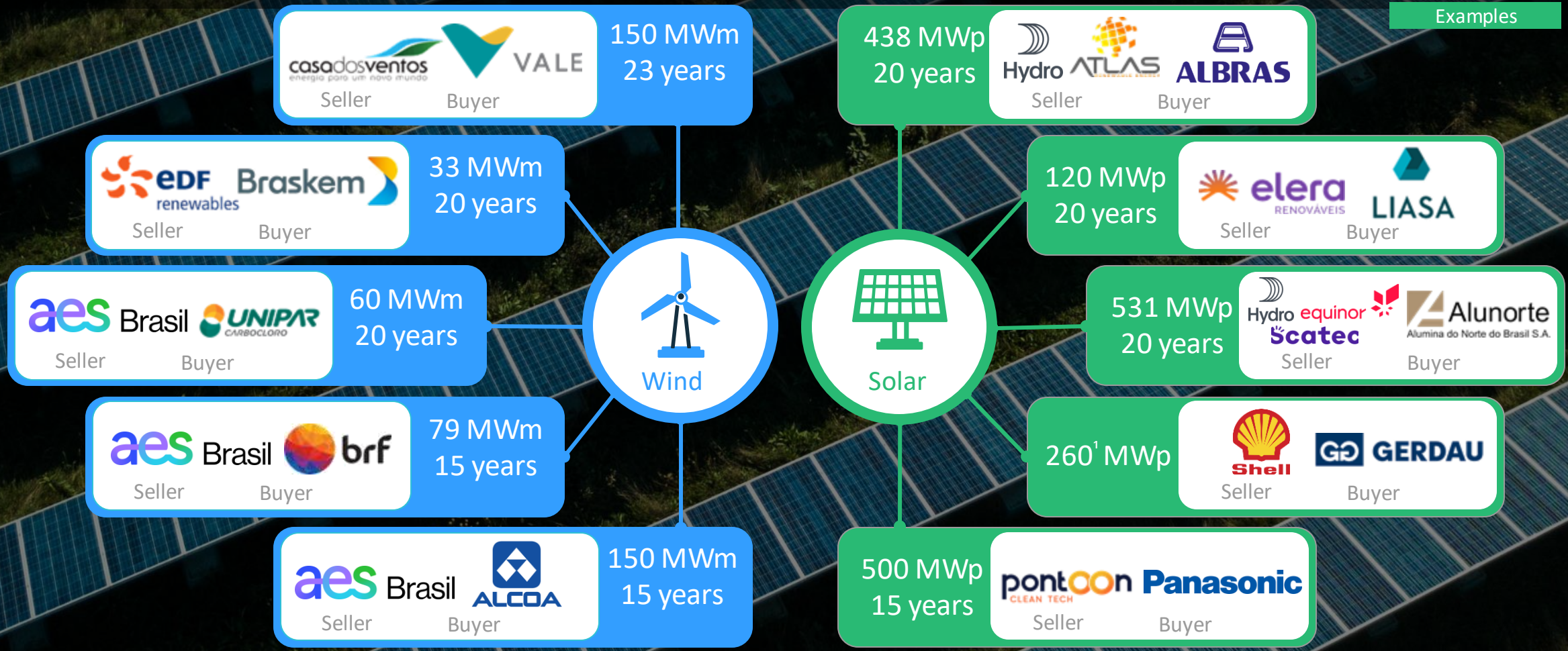
1. Estimated based on bioenergy crops production potential; 2. Assumes current ethanol production market share will be maintained until 2050.
Note: Market shares by revenue estimated based on ethanol production market share and domestic supply of heating and power biomass sources, in EJ.
Source: Smeets & al. (2007); Naik & al. (2010); World Bioenergy Organization; USDA; Statista; Renewable Fuels Association; Biodiesel BR; BCG analysis

The country faces sound opportunities on all biofuel categories

	Traditional Biofuel	HVO/SAF	Biogas	Residual biomass
Key figures	Ethanol is **expected to grow 3.9% a.a.** in Brazil, while Biodiesel growth will be led by **larger blend mandates,** reaching 15% in 2025 (currently at 14%)	Expected **+40% productivity** of soybean in the next 10y can turn **Brazil into a key player** meeting HVO/SF demand by 2030	**+20% production** from 2015 to 2022, due to an increase in **biomethane**, which has a promising scenario, with **plants growing +3x until 2027**	Biomass expected to grow, with **black pellets** addressable market reaching **from 6-12 M ton by 2023**, and emerging as an alternative to coal
Initiatives example	JBS Biodiesel is testing the use of B100 (biodiesel 100%) as fuel for its truck fleet	Petrobras is investing $1.5B in the BioRefino Program to develop sustainable fuels, incl. HVO/SAF from soybean oil and beef tallow	Ultragaz started biogas (bioGLP) distribution, made from soybean oil, will expand the distribution of biomethane	Cargill is investing in biomass as power matrix to its soybean processing plant, to reduce 30% of emission per ton of product

Moreover, Brazil also has outstanding potential for wind and solar, with multiple investments in the recent years…

Examples

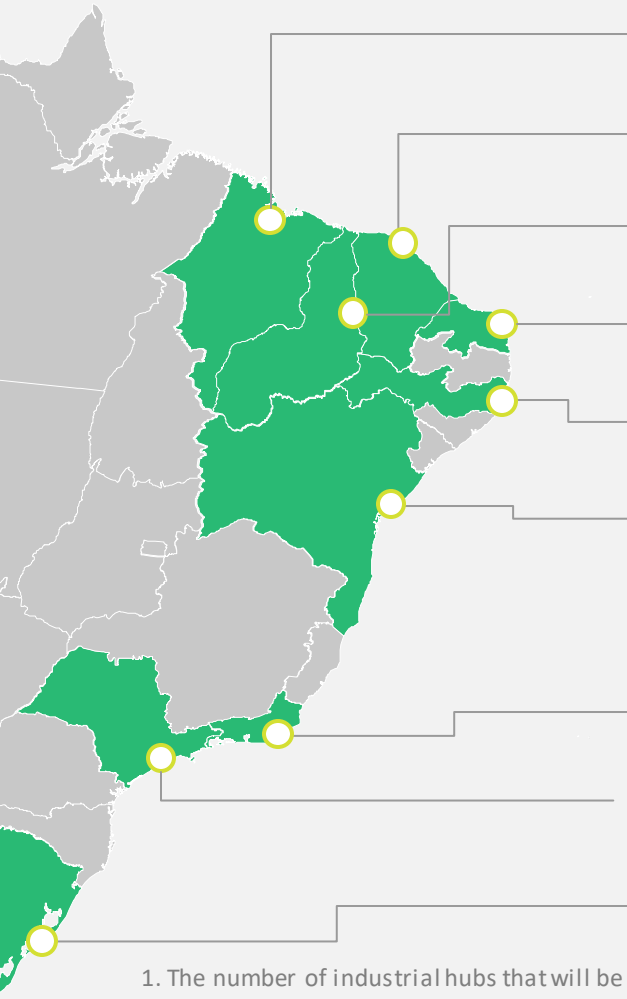


1. 50% destined to Gerdau and the remaining to the ACL

Note: The years presented are the duration of the contract between the company and the renewable energy supplier

Source: ANEEL; CCEE; DCIDE; BCG Analysis

… which contribute to favorable conditions for the development of several green H2 projects



Maranhão	Eletrobras
Porto de Pecém, CE	Fortescue Future Industries, TransHydrogen Alliance, edp, enegix, Qair, eneva, aes, ENGIE, Eletrobras
Parnaiba, PI	Green Energy Park, Eletrobras
Rio Grande do Norte	Enterprize Energy, ier, Neoenergia
Porto de Suape, PE	Qair, Neoenergia
Camaçari, BA	Unigel, thyssenkrupp
TBC[1]	Vale, H2 green steel
Porto do Açu, RJ	Fortescue Future Industries, Shell, Neoenergia
São Paulo	Shell, raízen
Porto de Rio Grande, RS	Neoenergia

Non-exhaustive

USD +30B in MOUs[2] **to produce green H2**, for local consumption and exporting…

…however, projects still in ***early-stage, without concrete development yet***

Energy source:	Solar; Wind Onshore; Wind Offshore
End product:	H_2; Ammonia

1. The number of industrial hubs that will be built, their location and production capacity will be defined following feasibility studies to be developed jointly by Vale and H_2 Green Steel; 2. Memorandums of Understanding
Source: Press releases; BCG analysis

That will enable Brazil scale up low emission economy pillars

1

Nature

2

Sustainable Agriculture

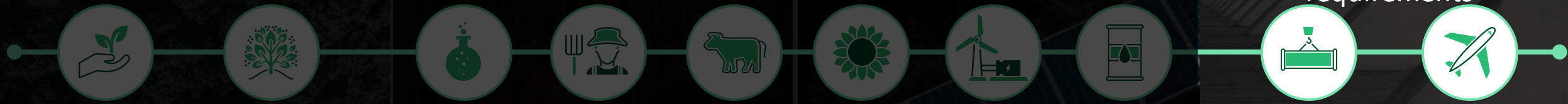
3

Renewable Energy

4

Green industrial products

Leverage of natural resources, clean energy and biodiversity to supply low-carbon industrial goods addressing world regulatory requirements



Reforestation & Restoration

Avoided forest conversion

Biological Fertilizers

Regenerative Agriculture

Low-carbon protein

Biomass & Biofuel

Renewable Energy

Green H_2

Low-carbon basic items (e.g., Steel, Cement…)

Green BR Industrial products

Investors and Lenders are increasingly seeking companies committed to net-zero…

Managers pursuing more sustainable investment strategies…

BlackRock.

"In the long run, we will see evidence that sustainable investments will be at least equivalent to core investments. Personally, I believe they will be bigger".

(Larry Fink, CEO of BlackRock, 2018)

Group of 30 of the world's largest managers ($ 5 T AuM[1]) have pledged to reduce 30% of emissions from their portfolios by 2025

… and commercial banks seeking to mitigate climate change

Morgan Stanley
ABN·AMRO
Itaú
citi
bradesco

120 financial institutions have committed to measuring and reporting GHG emissions associated with their credit and investment portfolios (39% of global banking assets)

citi

Citi Group alone allocated **$250B** to invest in low-carbon transition between 2020 - 2025

1. Assets under Management

Source: Global Carbon Accounting Partnership (PCAF); Net Zero Banking Alliance; Press Search; BCG Analysis

… while main users of industrial inputs are choosing low-emitters suppliers to meet their reduction emission targets

Select examples

Automotive

- Target of reducing emissions by 40% by 2030 across the production chain
- Drawing strict sourcing criteria and establishing long-term contracts to encourage investment

- Target of reducing emissions in 40% by 2030 across the production chain
- Investment plan of ~$14B by 2025
- CO_2 emissions will be key criteria for closing contracts with suppliers

- Goal to have the entire CO_2-neutral fleet in 2039

Construction

- 2030 targets set according to the UN SDGs, without numerical emission reduction targets
- Partnership with Ekos[1] Institute to offer discount to suppliers who want to offset emissions (scope 3 represents 95% of emissions)

- Announcement of the company's first GHG emissions inventory, which will include scopes 1, 2 and 3
- Targets will be announced after inventory

- Target of 47% reduction of scope 3 emissions by 2030

1. NGO created to preserve biodiversity and promote sustainability projects

Source: Sustainability reports; Press Search; Interviews with Experts; BCG Analysis

Sustainable resources enable Brazil to become a world provider of low emission industrial products

Select examples

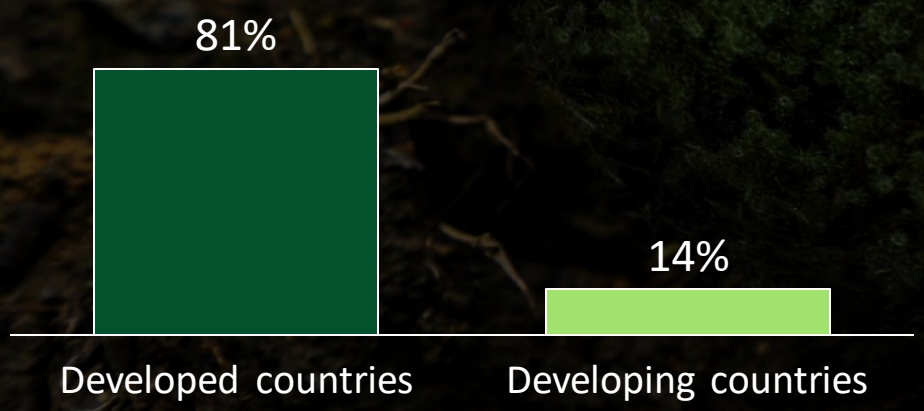
	Low-carbon Steel	Low-carbon Cement	Low-carbon Mining	Low-carbon Chemical
Key figures	**Brazilian steel emits ~35% less than world's average** (1.7 vs 2.7 t CO_2e/t steel)	**Brazil is the lowest emitting country** in the world, with 11% lower GHG emissions than world's avg.	Brazil **reduced by ~5%[1] GHG emissions by volume** in mining sector (2018-2020)	Brazil **reduced by 44% GHG emissions** in chemical industrial processes (2006-2016)
Initiatives	Gerdau has +250k Ha of forests in MG, being the largest producer of plant-based charcoal in the world (+ high use of scrap metal)	Votorantim set a NZ goal by 2050 through replacing fossil fuels with biomass and municipality waste	Vale has signed an agreement with the government of Pará to build a "green" crude iron plant in the city of Marabá	Braskem committed to becoming NZ by 2050[2] by increasing use of green plastic and clean energy, amongst other initiatives

1. Estimated based on Vale, whose estimated market share is ~55% (in revenue, 2020) 2. On scopes 1 and 2, scope 3 not included. Source: SNIC, CNI, Citi GPS, Raizen Ethanol Sustainability report, expert interview, press releases, BCG analysis

However, Brazil has room for steering investments towards the green economy

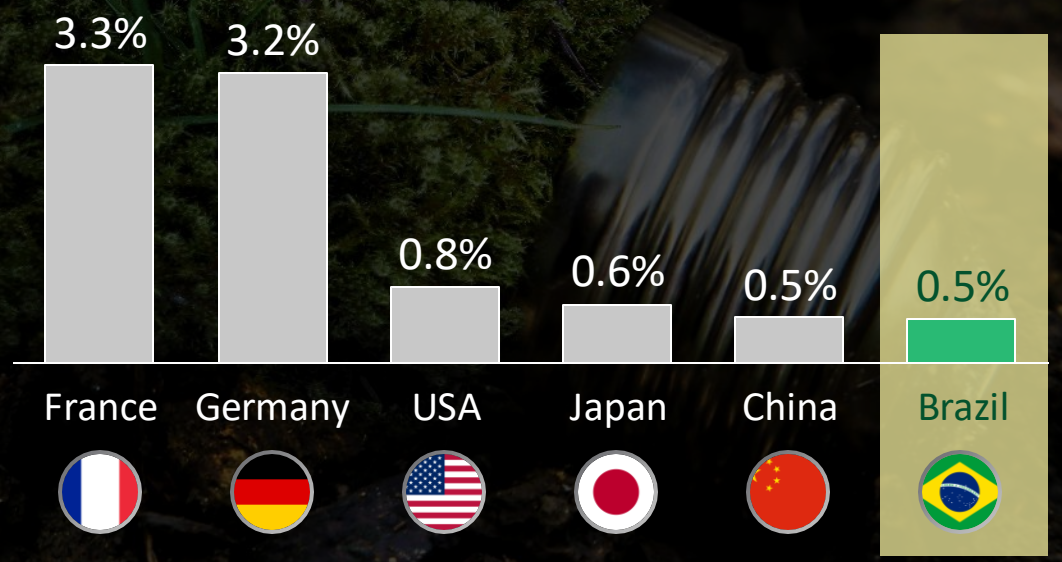
Brazil can significantly increase the Private sector share of green investment

Private sector participation in green transformation projects (%)[1]



Green bonds are an example of financial solution that can be further explored

Green bond market as a % of total investment[2]



1. Persaud (2023); 2. Average of cumulative green bond market from 2014 to 2023 normalized by Gross fixed capital formation per country (2022)
Source: Brazilian Ministry of Finance; Climate Bonds Initiative report 2023; World Bank; BCG analysis

Looking ahead, policies and legal framework evolving towards a sustainability pathway for private sector investments

Congress is advancing climate bills discussions…

- **Nov/23** — Hydrogen Law approved by the Chamber of Deputies to regulate the production and use of low-carbon and renewable hydrogen
- **Dec/23** — Carbon Market Bill approved by the Chamber of Deputies to establish Brazil's carbon market
- **Feb/24** — Bill to regulate offshore wind energy production approved by the Chamber of Deputies
- **Mar/24** — Fuel of the Future approved by the Chamber of Deputies to increase the volume of biofuels in transportation matrix

1. Considering total area, not only protected areas, 2023 vs 2022
Note: VCM stands for voluntary carbon market)
Source: Imazon; ANEEL; ONS; (all 2023 data); Senado, CNN Brasil; Notícias Agrícolas; APAS; InvestNews; Exame; ABEEólica; BloombergNEF; Climate Focus

… **while Government** initiatives started to show results …

- **Apr/23** — Ecological Transition Plan launched to guide sustainable development through mitigation strategies
- **Jun/23** — Agricultural Plan 2023/2024 to support sustainable farming practices and tech advancements in Agri
- **Dec/23** — Degraded Pasture Recovery Plan initiated to restore degraded pastures into Sust Agri and forestry systems
- **Feb/24** — Eco Invest Brazil program to mitigate green investments exposure to exchange rate ("*hedge cambial*").

62% less deforestation in the Amazon[1] as a result from intensified monitoring & deforestation control

1.2 B USD pledged to the Amazon Fund, with additional USD 150M raised after resuming activities in 2023

… and **private sector** initiatives emphasize commitments

Voltalia signs pre-contract for the production of green hydrogen in Ceará

Gerdau invests R$3.2 billion in sustainable mining platform in Minas Gerais

Suzano, Marfrig, Rabobank and Vale invest R$80 million in forest preservation company

Yara announces investment of R$90 million in factory in Sumaré (SP)

In Cubatão, fertilizer giant will start commercial produc

AstraZeneca announces investment of R$350 million in the restoration of the Atlantic Forest

Raízen announces investment of R$1.3 billion to produce E2G in Caarapó (MS)

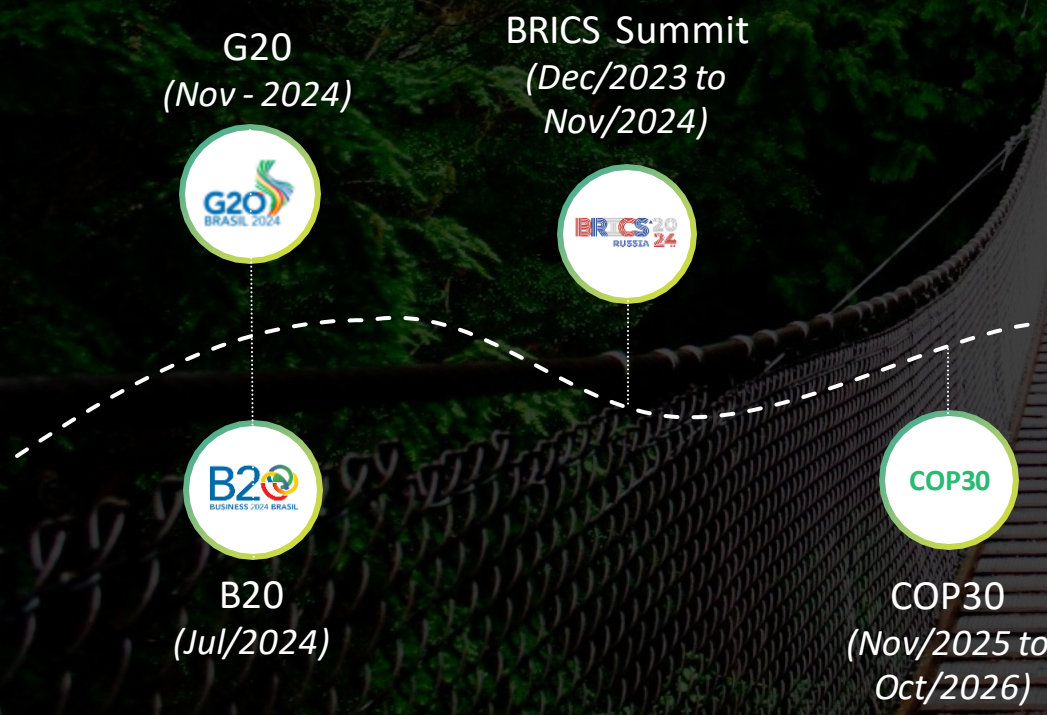
Top 3rd largest increase in installed wind power capacity

Top 6th Country to invest in energy transition ($35B)

27% of total BR companies with Net Zero commitments (*in 2022*)

Besides catalyzing investments, Brazil's hosting of G20/COP30 to foster ambitious countries commitments

Brazil leadership in global events will enhance its role in advocating for decisive actions …



… providing environment for dialogue that leads to substantial shifts in all countries commitments towards 2030/2035 …

… given that major progress is needed on concrete actions for global energy and climate transition (e.g. climate finance) …

… at the same time, offering concrete and ambitious projects to materialize Brazil's key comparative advantages…

… presenting a business opportunity to boost and fund global Net Zero efforts

Source: World Economic Forum, World Bank, BCG analysis

Case Study: Recovery of degraded pasture lands & Agri Resilience

Brazil plays a crucial role in meeting the rising global food demand…

Global crop demand is projected to **increase by ~50%** from 2020 to 2050

Brazil ranks #1 in **soy production and export** & is the world's largest **exporter of beef**

Brazilian beef demand to rise by ~35% in the next 2 decades

Cerrado farmland for **soy is set to increase by 40%** by 2030

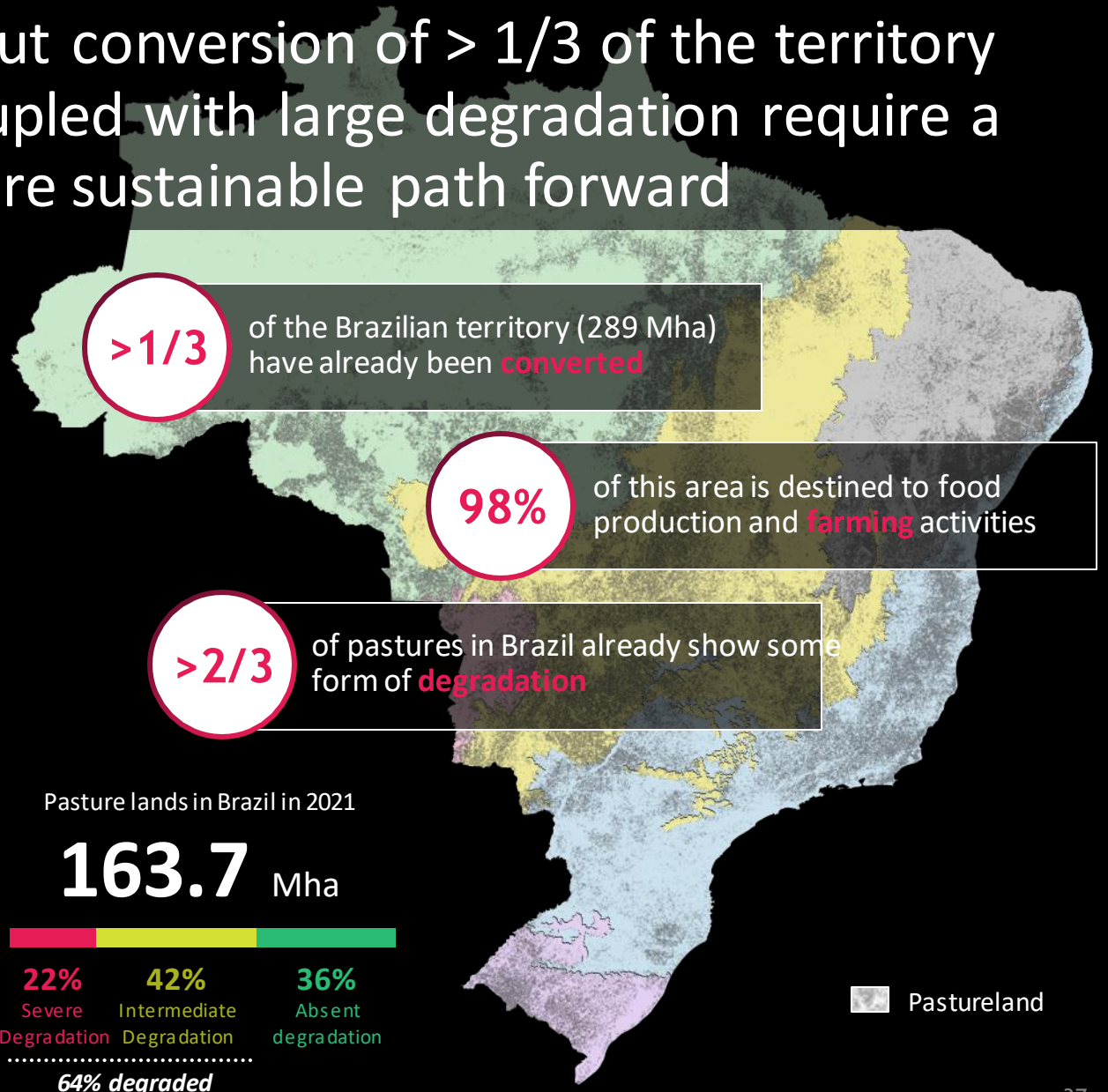
Source: Atlas das Pastagens 2022, MapBiomas Brasil, United Nations, BCG analysis

…but conversion of > 1/3 of the territory coupled with large degradation require a more sustainable path forward

>1/3 of the Brazilian territory (289 Mha) have already been **converted**

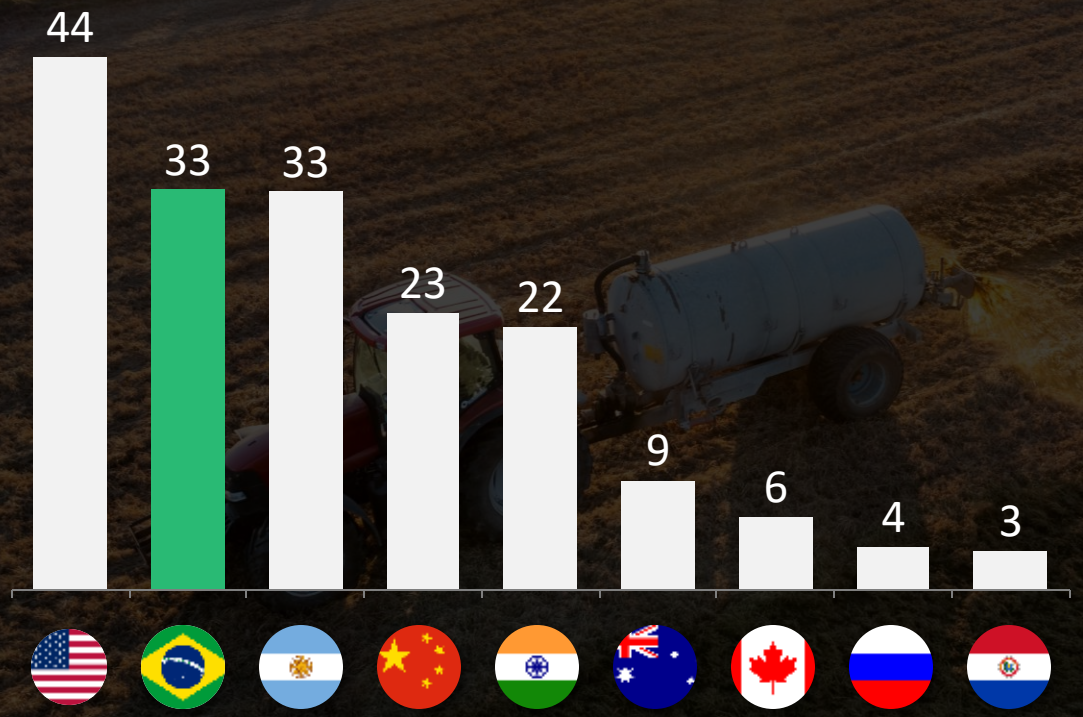
98% of this area is destined to food production and **farming** activities

>2/3 of pastures in Brazil already show some form of **degradation**



Brazil already explores SustAgri techniques…

Total no-till area per country 2018/19 (M ha)

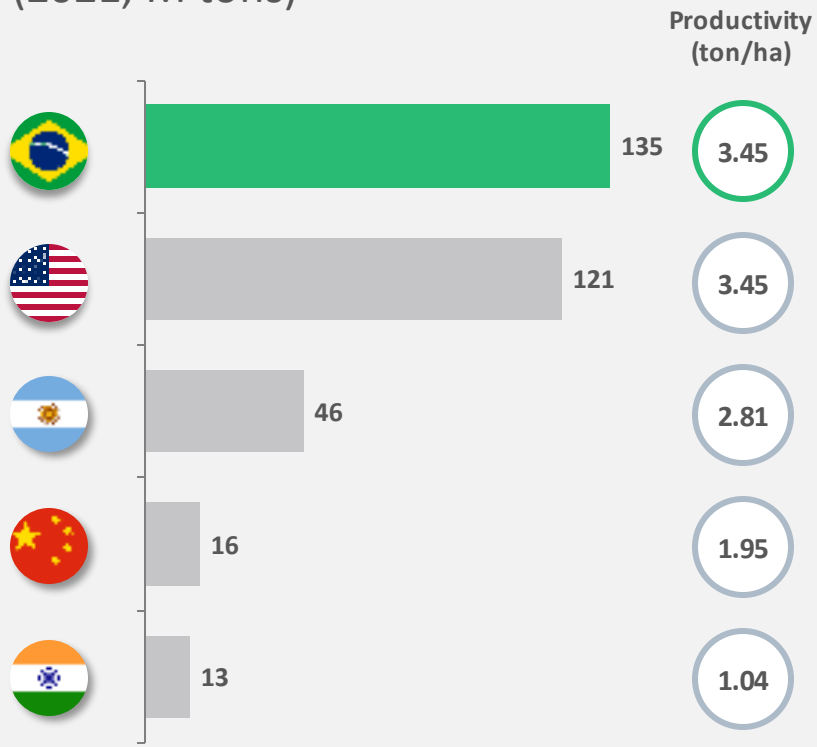


Source: Associação de Plantio Direto; Verra; Our World in Data

…which contributes to a high crop productivity

Example

Top 5 Soybean producers (2021, M tons)



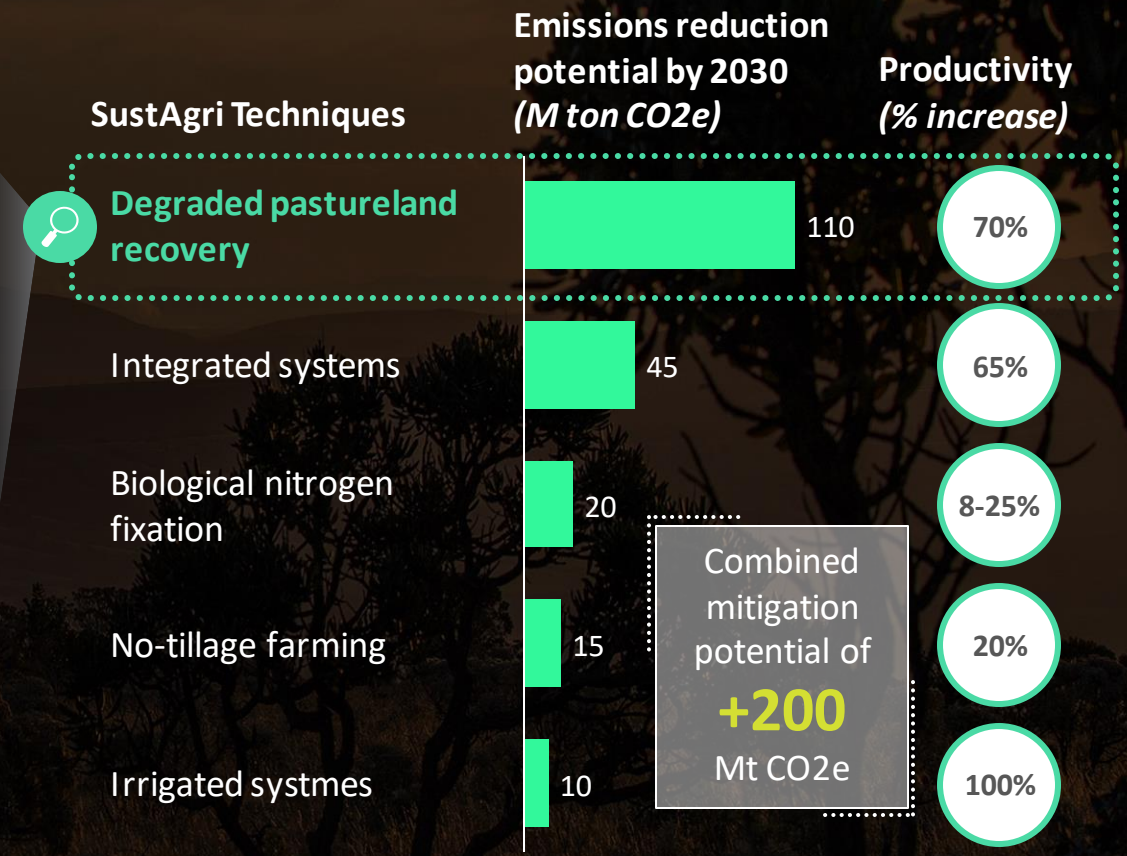
Today, Brazil stands as the only country in the world capable of meeting food demand by recovering degraded pastureland

An opportunity exists to **meet the demand for soybeans without resorting to additional conversion** by utilizing already cleared pastures **in the Cerrado** (**>2x** of the required area is already available)

Key transitional production models

	Productivity increase:
Soy and agriculture expansion over already-cleared pastureland	up to **30%**
Sustainable intensification of meat production	up to **3 cattle head/ha**

Recovering degraded pastureland holds the greatest potential for emissions reduction and the largest dedicated area (~90Mha by 2030)



Note: Degraded pastureland have a stocking rate of 1 cattle head/ha
Source: Plano ABC+; EMBRAPA; Climate TRACE; Experts interview; Finance for a Forest-Positive Future - IFACC (2022); BCG Analysis

However, know-how & financial challenges must be surpassed…

Financial

Livestock producers face challenges in securing financially viable and sustainable opportunities, mainly due to the capital-intensive profile of recovery initiatives and the medium to long-term horizon for breakeven

Know-How

Multi-generational farmers stick to traditional land practices, social pressures discourage adoption of regenerative innovations, and there is a lack of clear understanding regarding the benefits for farmers

…to create the conditions for sustainable growth

- Structure combining diverse funding sources to build track record & unlock private financing
- Attractive fiscal and financial instruments for deforestation conversion activities
- Financial and administrative assistance to formalize producer's land ownership
- Compensation for producers to preserve areas that they could legally clear and convert
- Technical assistance for producers to recover pastures and adopt SustAgri techniques

Source: BCG Analysis

Emerging trends promise great potential for the expansion of SustAg & degraded pastureland recovery to further improve Brazil leading role

Not exhaustive

New business models

- Recovery of degraded lands for **Macaúba** cultivation (biofuel)
  - **80%** CO_2 reduction vs fossil fuels
  - **5-7x** oil output vs soy

Global green demand

Increase of **green mandates** from main importers: e.g. EU's "Deforestation-Free Products", traceability & sustainable production of Cocoa

National traction

+$2 billion on financing for degraded pastures by 2030 via ABC+ plan; National Plan for the Conversion of Degraded Pastures

Deep-dive ahead

Source: Acelen, Plano ABC+, BCG analysis

Deep-dive

Macaúba fosters land recovery & high biofuel productivity

The native Brazilian palm tree is highly adapted to the "*Cerrado Brasileiro*" …

1. 4Fs stand for food, feed, fiber and fuel
Source: Acelen; WWF; Capital Reset; Biodisel BR, S.oleum; BCG analysis

Advantages of the Macaúba:

- Up to **7x more productive than soy**, Macaúba palm tree can produce **~6.000 L of oil/ha** (vs. 500 L soy oil/ha)
- Considered 100% usable, the fruits meet the 4Fs[1] and can be destinated to **biofuel, food, pharmaceutical and animal feed** production
- Palm tree can be **cultivated in degraded land** and tolerates drought and temperature variation

Overview of Acelen project:

- Acelen & MulticanaPlus launched in 2023 the first project in the world to produce **+1B L of HVO and SAF** made from Macaúba **per year**, to supply 1.1 million vehicles
- The initiative will promote the **restoration of 200,000 ha** of degraded areas in Bahia and Minas Gerais, **generating + 90,000 jobs**
- **+ $2.42B will be invested** over the next 10 years,
- The high-quality biofuels **emits -80% CO2 vs. fossil fuels**
- Planting of the Macaúba fields and construction of the processing plant began in 2024, and will **operate by the end of 2026**

Other opportunities & players:

- Established in 2019, the company used **RegAgri to cultivate Macaúba** in degraded areas, promoting reforestation through Agroforestry Systems
- S.OLEUM's nature-based products include **Advanced Vegetable Oils (AVOs)**, Proteins & Carbohydrates, and **Carbon Credits**

Estimated growing area

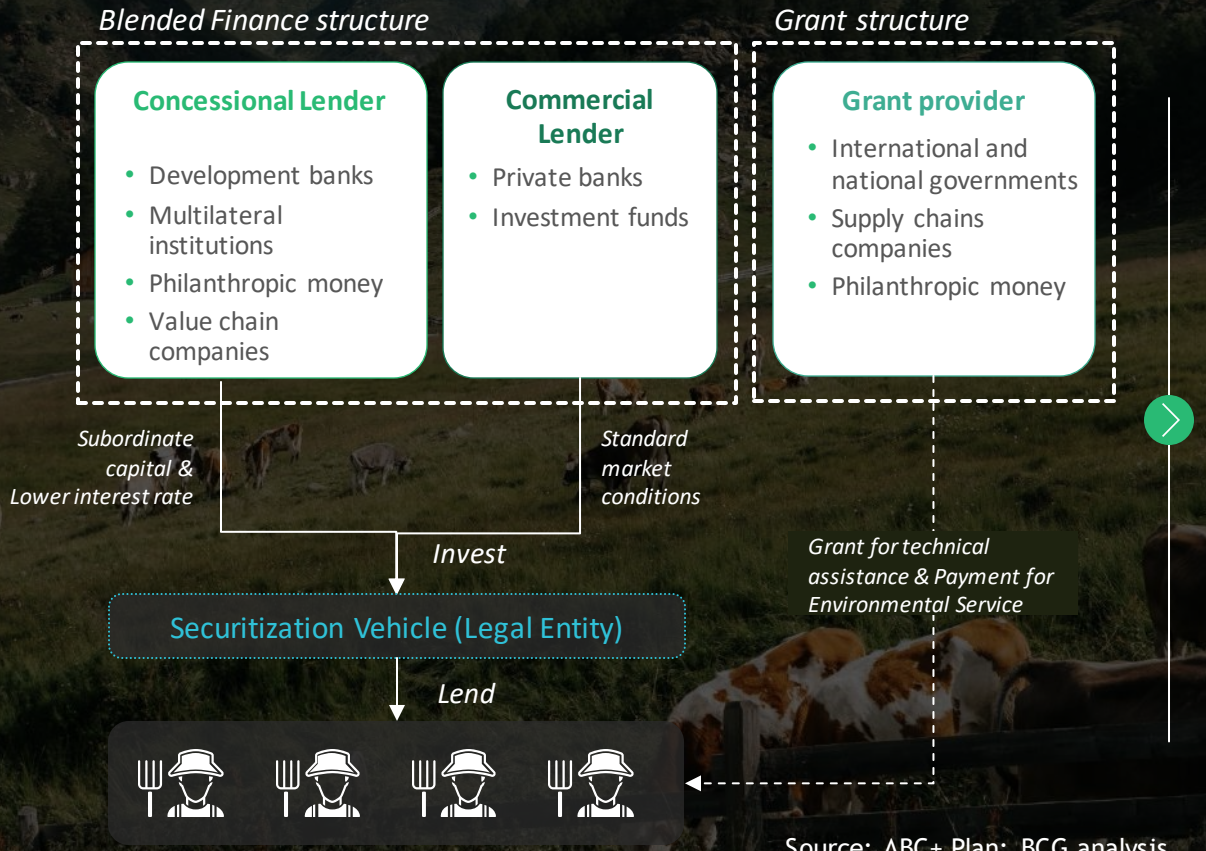
Blended finance models are pivotal to achieve recovery ambition, attracting private investments

Brazilian government committed to recover 40M ha…

Estimated cost of $2,500-3,000/ha

Total investments of **~ $100B**

Blended finance mechanisms are vital to attract and retain private investments in green projects in Brazil….



Catalytical capital will promote de-risk of investments to further unlock private capital

Source: ABC+ Plan; BCG analysis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Thank You
Brazil Climate
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