



Balancing the energy trilemma in Brazil

OTC Around the World: Brazil as the World High Spot of Clean and Decarbonized Energy Matrix

Rodolfo Saboia
Director-General

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#1

Overview



Brazil at a glance

Brazil plays a relevant role in the Global O&G Industry



The largest economy in **Latin America** 

9th
Largest economy in the world
(Austin Rating)

 **3rd** largest recipient of **Foreign Direct Investment** in 2022
(85 billion USD - OCDE)

 **9th**
Largest **Crude Oil and Condensate** producer
(BP Statistical Review 2022)


 **8th**
Largest **Oil Products Consumer**
(BP Statistical Review 2022)

 **4th** Largest **automotive fuel market** in the World

A domestic market of over **203** million inhabitants

Among the **10** largest crude oil exporters in the world

9th
Largest **Refinery Capacity**
(BP Statistical Review 2022)
But still need to import diesel, gasoline, jet fuel and LPG

 **8th**
In sales of **petrochemicals** worldwide
(Statista - 2022)

About ANP

ANP is the
Brazilian oil,
natural gas and
biofuels
regulator



ANP is an **independent regulatory agency**: board of 5 directors with fixed, staggered terms; mandatory RIAs, public hearings and consultations; administrative autonomy, etc. The government cannot overrule ANP technical decisions.



Regulate

Establish the regulation of the oil, natural gas and biofuels industry. ANP must assure **free competition, national supply, and consumers protection** in terms of price, quality and product offer.



Contract

Grant **authorizations** for the O&G and biofuels activities; to promote **E&P bidding rounds** and **sign contracts** on behalf of the Federal Estate.



Inspect

Enforce the standards and rules by the regulated industry. It covers the administrative process, judgment and sanction.

Brazil is taking a leading role in the E&P sector



Nowadays

Production: **3.4** Million bpd of **oil** production (Feb 2024) **148** Million m³/d of **gas** production (Feb 2024)

Reserves: **15.9B** Bbl in proved **oil** reserves (Dec 2023) **517B** m³ in proved **gas** reserves (Dec 2023)

 **90B** USD **investments** forecast (2023-2027)

Forecast

 **2025**

Potential to reach a production of more than


4 Million bpd of **oil**


195 Million m³ of **gas**


Brazil in the energy transition


A country of plenty and diverse energy resources and one of the world's leading player in the energy transition
 Brazil's electricity matrix is one of the cleanest in the world



 **49%**
 Share of **primary energy from renewable sources, 2022**
 World Average – 14% (MME)


 **4th**
 Largest **share of primary energy from renewables**
 1st – Iceland, 2nd Norway, 3rd Sweden (Our World in Data)

 **87%**
 Share of **electricity production from renewables, 2022**
 World Average – 28% (MME)

 **2nd**
 Largest Producer and Consumer of **Biofuels**
 (BP Statistical Review 2022)

 **2nd**
 Largest **Hydropower** generation in 2022
 (Our World in Data)




 **7th**
 Largest **Wind Generation Capacity** in 2022
 (Our World in Data)


Less than **10** 
 kgCO₂e/boe is the **carbon intensity in the pre-salt**

14 kgCO₂e/boe is the offshore average in Brazil

Compared to OGCI average – 19 kgCO₂e/boe

Biofuels market*

<p>Ethanol</p>		<p>357 Mills</p>	<p>401k m³/d capacity (+ 9% under construction)</p>	<p>35M m³ production (2023)</p>
<p>Biodiesel</p>		<p>61 Plants</p>	<p>41k m³/d capacity (+ 11% under construction)</p>	<p>8M m³ production (2023)</p>
<p>Biomethane</p>		<p>6 Plants</p>	<p>417k m³/d capacity (+ 213% under construction)</p>	<p>75M m³ production (2023)</p>

129 
Million tons
of CO₂ emissions avoided
until March 2024 through
Renovabio

*Mar/2024

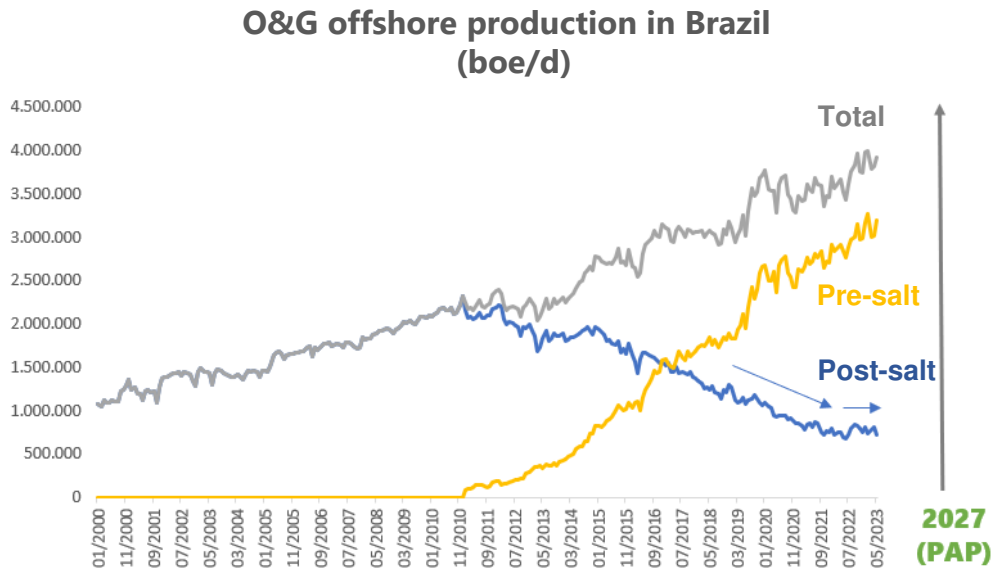
#2

E&P



Three different E&P environment

Pre-salt production will continue to increase



Pre-salt

Home to the largest offshore oil discoveries in the last decade. Poised to keep growing.

76%
of total O&G production

148 wells in production



Post-Salt Offshore

All the offshore area besides the pre-salt region, including new frontier areas and a significant number of large mature fields

20%
of total O&G production

385 wells in production



Onshore

Mature fields and New Frontier Basins (mostly gas prone)

5%
of total O&G production

5,972 wells in production

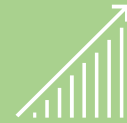
E&P strategic goals



**RIGHT ASSETS IN
THE RIGHT HANDS**



**INCREASE RECOVERY
FACTOR**



**INCREASE
EXPLORATORY
ACTIVITIES**




**MAKE MARGINAL
DISCOVERIES VIABLE**


We need to keep increasing **above ground competitiveness** in order to achieve our main goals

What have we already done and what is in the pipeline


DONE, among other measures:



Petrobras divestment plan




Free tech. data for onshore and select offshore basins



Royalties reduction*

*On incremental production, for small and medium companies, and for new contracts for mature and new frontier basins



Local content reduction and flexibilization

IN THE PIPELINE



Minimum exploratory program flexibilization

Work programs committed by companies in the bidding rounds for specific blocks may be carried out in other blocks

Regulatory impact analysis is done. A draft regulation is underway to be subject to public consultation



Larger exploratory blocks

Average area of offshore blocks in Brazil: 650 km²
In Uruguai: 13.000 km².

First draft estimated to be presented until the end of this year



E&P contracts extension

More than 100 requests already granted

Further incentives for marginal fields

ANP has already approved a definition of marginal fields

We are well positioned to remain competitive in the energy transition

01

Pre-salt: world class assets with **low breakeven** and **low greenhouse gas emissions**

 High productivity and low sulfur levels:

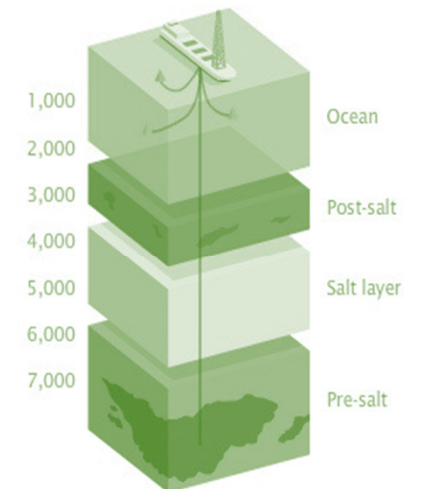
 **Carbon intensity: 9 – 10 kgCO₂e/boe**
Half of global E&P average (19,5kgCO₂e/boe em 2020)

02

Largest offshore operators, as Petrobras, are committed to net zero

03

ANP is publishing **upstream emissions**. Flaring is 2% of associated gas production.

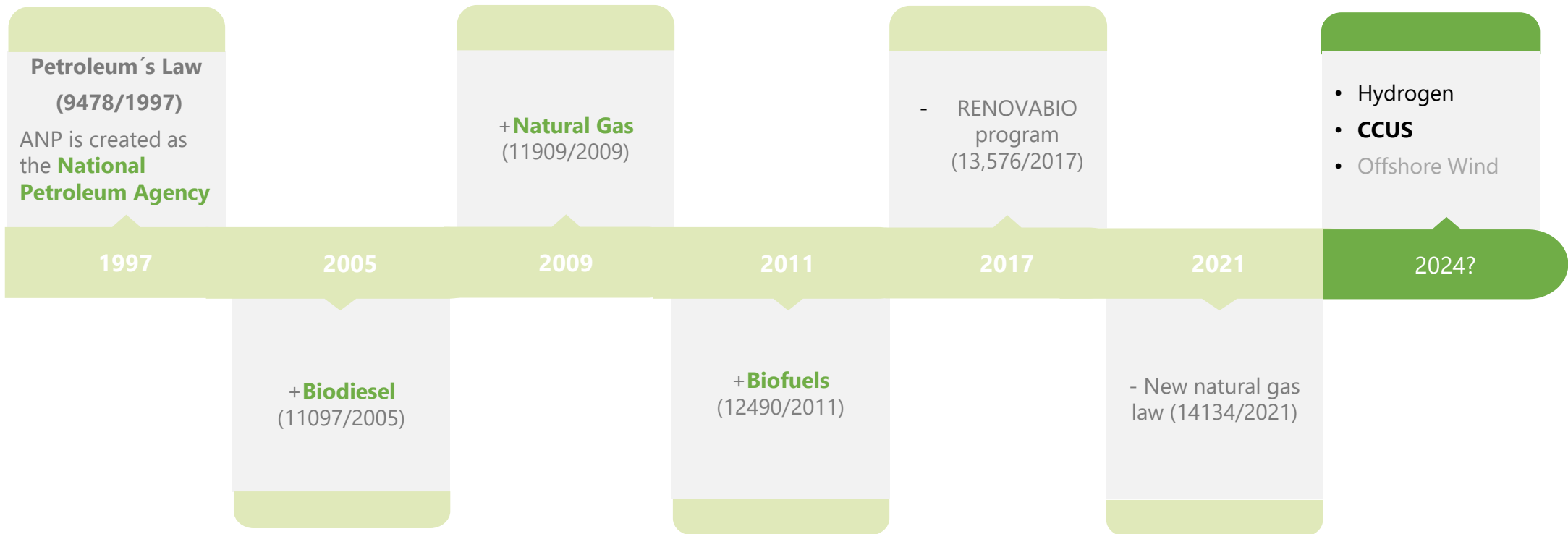


#3

Decarbonizing



ANP's historical role and the future...



Low Carbon sectors benchmark in Brazil and bills coming...

Bill 576/2021
 Bill 725/2022
 Bill 1878/2022
 Bill 2308/2023

Bill 3173/2023
 Bill 3452/2023



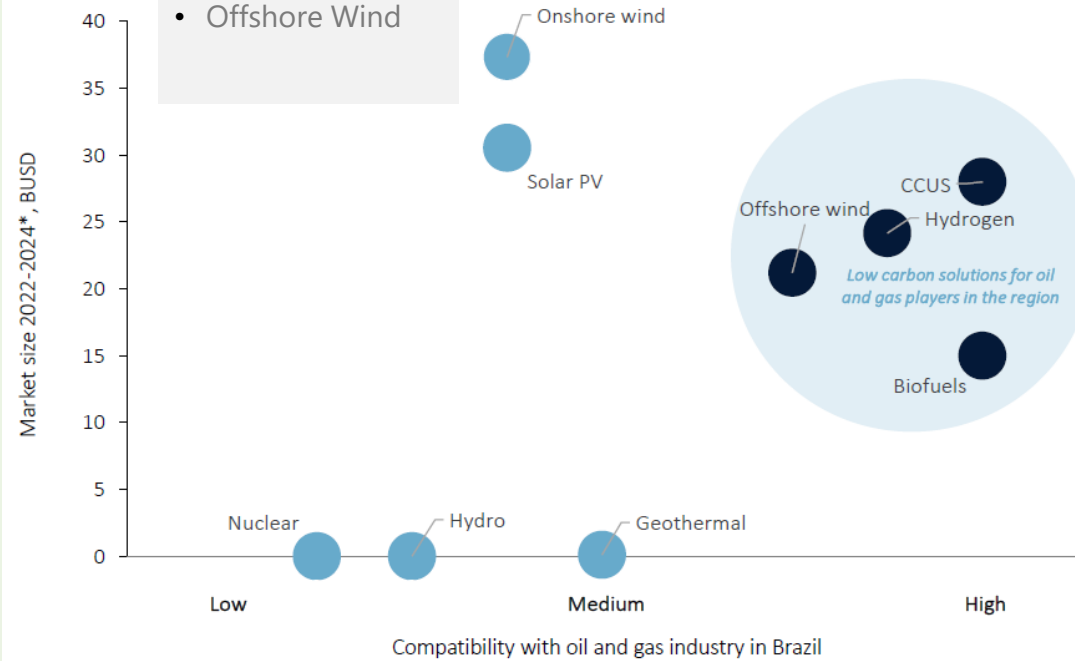
Bill 1425/2022
 Bill 4196/2023
 Bill 4516/2023



Bill 576/2021



- Hydrogen
- CCUS
- Offshore Wind



Rystad (2023)

Public Policy and Regulatory Advances

A number of bills deal with CCS and other decarbonization initiatives

Bill 1.425/2022

Senator Jean Paul Prates

- Approved by the Senate and currently at the lower house to be appreciated
- **ANP as regulator**
- Qualified Grant Term to up 30y

Bill 4.196/2023

Congressman Alceu Moreira

- Attached to bill 528/2020 (biodiesel) & required to be added to bill 4.516/2023
- **ANP as regulator**
- Authorization

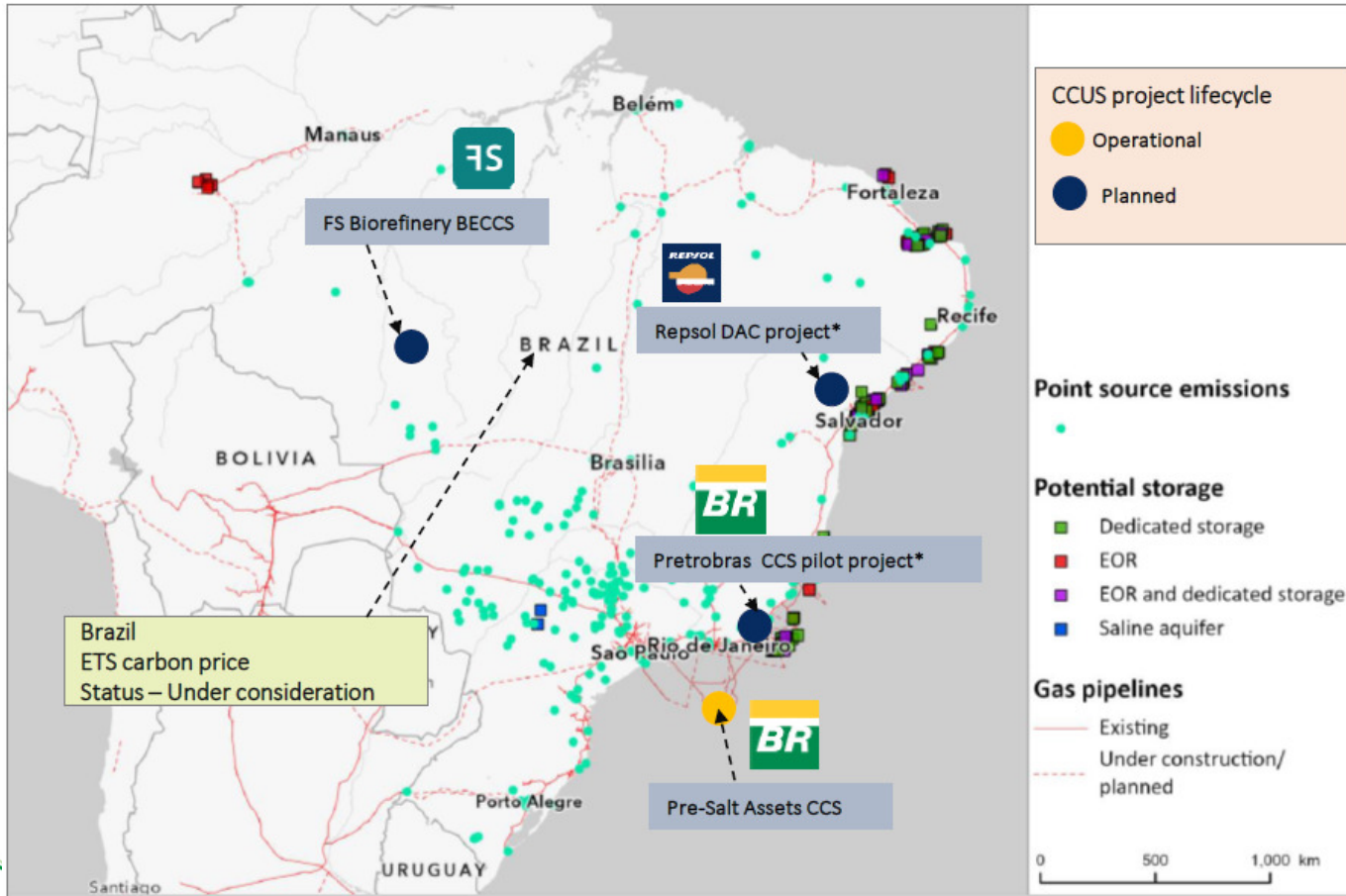
Bill 4.516/2023

Future Fuel Program

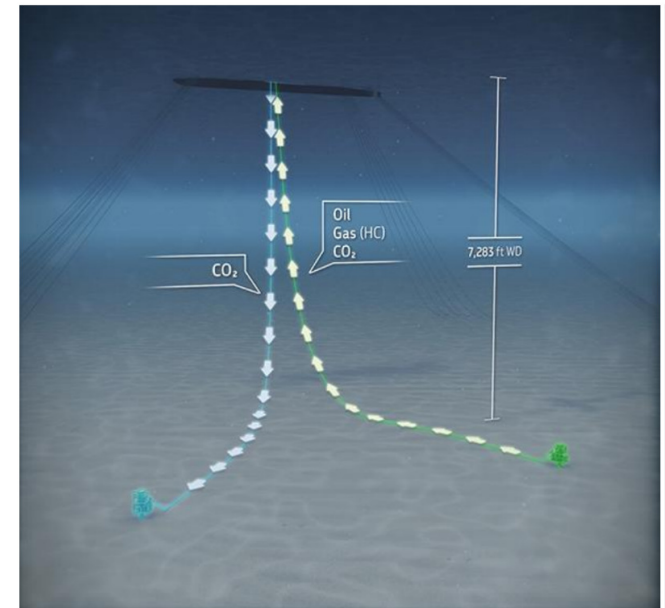
- Approved by the lower house and currently at the Senate to be appreciated
- **ANP as regulator**
- Authorization

Current CCUS landscape in Brazil

Mostly EOR, emission sources, infrastructure and major pilot projects



CCUS existing projects are mostly CO₂-EOR related

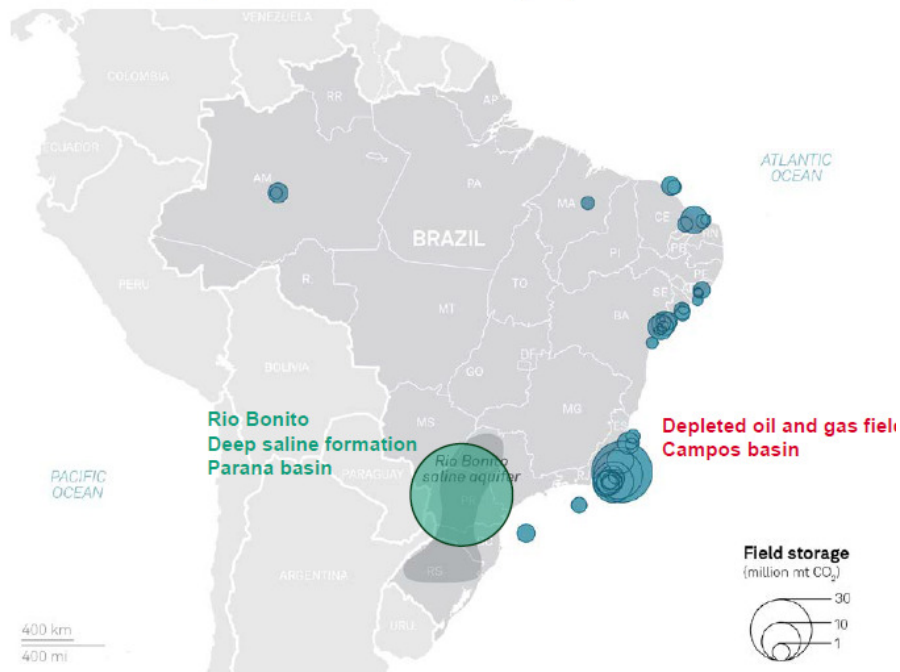


Petrobras: Lula field CCS-EOR started in 2011.

Estimated storage potential in Brazilian basins

according to S&P Global (2023)

Brazil underground carbon storage potential



Source: S&P Global Commodity Insights

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S&P Global
Commodity Insights

1. High level of uncertainty exists on the capacity estimates in the deep saline aquifer in the Rio given the limited information available. Several other deep saline aquifers can offer similar storage were not quantified.
Source: S&P Global study developed for OGCI

Brazil has potential to store 2470 MtCO₂.
(i) saline aquifers and depleted O&G fields from **Campos Basin** and (ii) **onshore Paraná** are the main reservoirs currently under study.

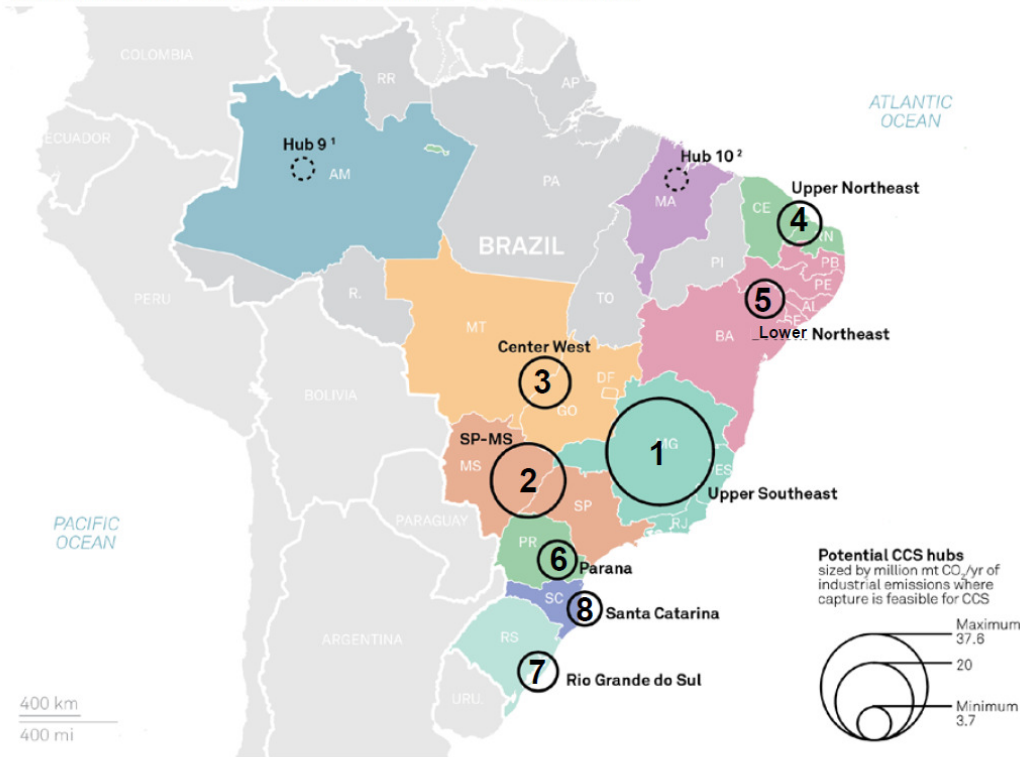
BECCS and renewable energy to feed CCS relevant opportunities that differentiates Brazil in the international scenario.

ANP recently published a report on CCS

The Southeast region holds approx. 66% of Brazil's total CCS potential

According to S&P Global (2023)

Industrial emission hubs evaluated

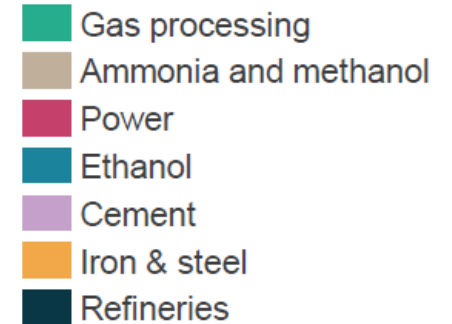
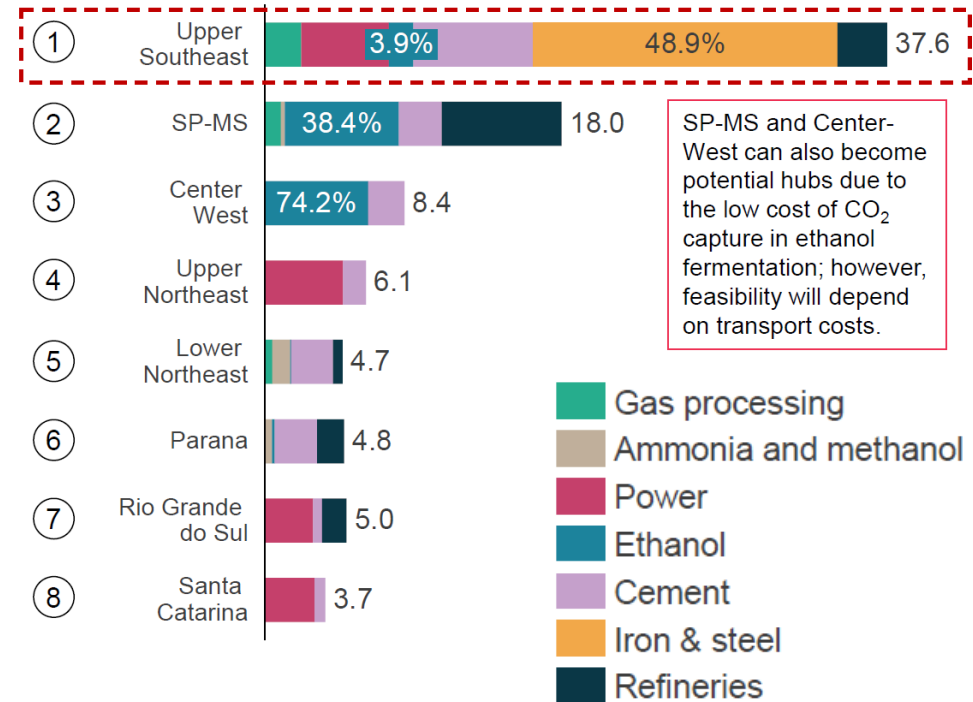


Source: S&P Global Commodity Insights, SEEG, Global CCS Institute

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Industrial sectors identified for potential CCS hubs^{1,2}

Million mtCO₂/yr of industrial emissions where CCS is competitive



CCS Regulatory Challenges



TECHNOLOGY

R&D in place (and intensifying). Petrobras EOR experience. Pilot plants (research) is a risk mitigation tool (prior to “commercial” regulation).



REGULATION

Legal framework ongoing. Aware of the challenges to overcome through the regulatory framework. Best practices already in place to anchor.



COSTS

EOR and BECCS are low hanging fruits. Legal framework for carbon market is necessary for energy-intensive capture.



TRANSPARENCY

A lot of data needed for monitoring. Need communication strategies to guarantee (and maintain) the SLO.

Hydrogen



ANP is taking part in the federal program for hydrogen



There is a taskforce for establishing a national strategy for hydrogen



A number of studies are being undertaken as Congress discusses a hydrogen bill. Legislative proposals have been recently presented by both chambers of Congress. The executive branch is also working on a related bill.

Offshore wind power

Offshore wind power is regulated by the Brazilian National Electric Energy Agency– ANEEL

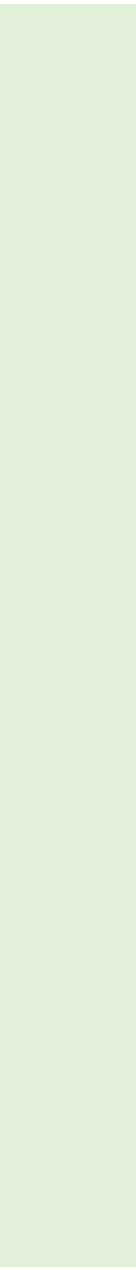
ANP is responsible for certifying projects will not interfere with oil and gas exploration

12 projects are already under analysis at ANP and other federal agencies



#4

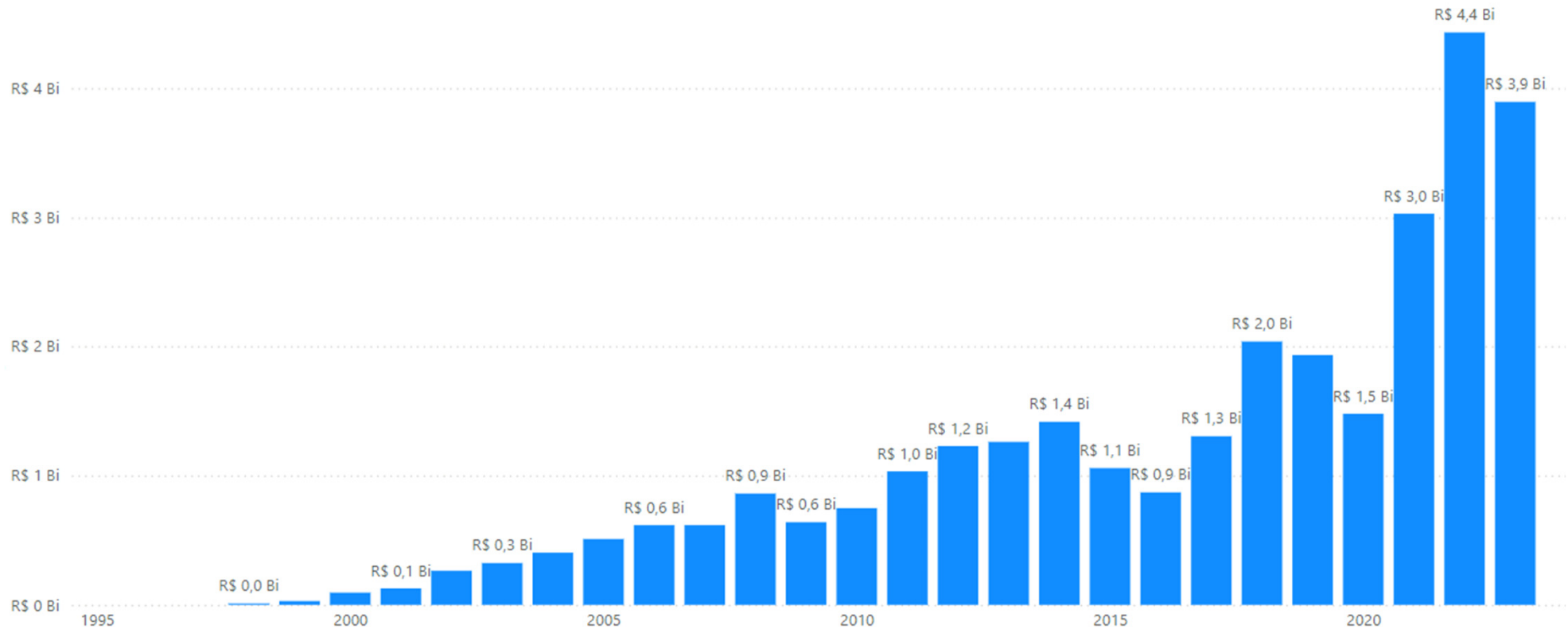
R&D



Mandatory RD&I Investments

Contractual obligation to invest in research, development and innovation (RD&I) in Brazil currently account for roughly US\$ 800 million per year

Value of mandatory investment in R&D



Mandatory RD&I Investments

Current regulation

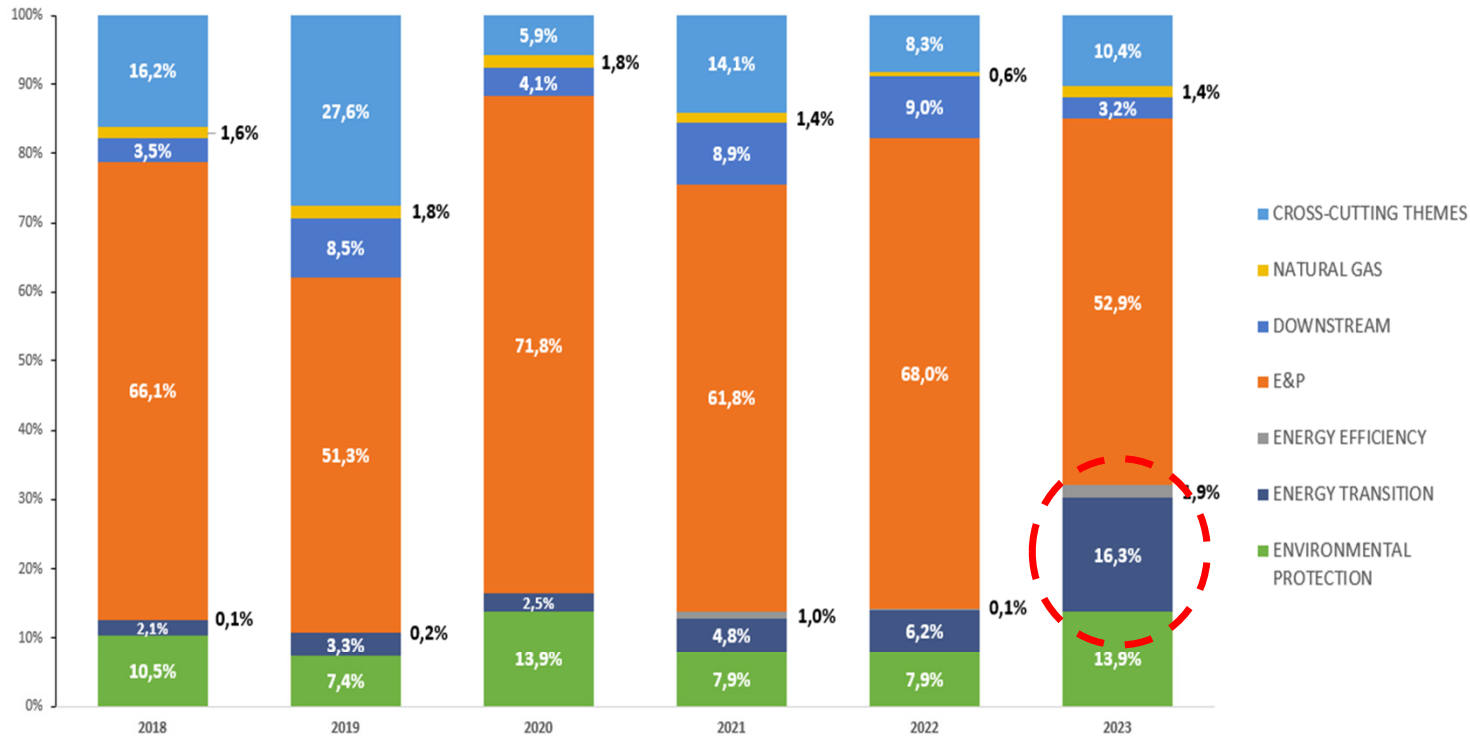
- Includes environmental, social, human & life sciences and research in information and communication technology
- Shed light on investments in RD&I to promote **energy transition**
- Enables investment in supply chain technical training
- **Entrepreneurship Program:** aiming startups in the sector's priority production chains

Current contracts

- Supplier opportunities: 30 – 40% of investments can be allocated to product or process innovation in Brazilian companies



R&D investments in renewables and decarbonization themes



- Artificial Intelligence
- Machine Learning
- Digital Transformation
- Smart Completion
- CCUS**
- Hydrogen
- Biofuels
- Environmental Protection

ANP Regulation n° 918/2023 reinforced the strategic planning

R&D investments in renewables and decarbonization themes

Number of projects (2019-2023)



Solar	15
Biofuels	104
CCUS	20
Environmental impact of E&P	41
Hydrogen	22
Tidal power	4
Wind power	25
Hybrid systems	29
Greenhouse gas emissions	46
Waste reduction	12
Environmental impact prevention	39
O&G impacts monitoring	16
Recovery of affected areas	26
TOTAL	399

#5

Final remarks



Brazil can be a world-class power house



Our Strengths

Sanctity of Contract

Geological potential and incentives for O&G

Highly decarbonized energy matrix

Great potential for renewables and CCS

Incentives for R&D investment in innovation

Market opening in the midstream (New Gas Law) and downstream

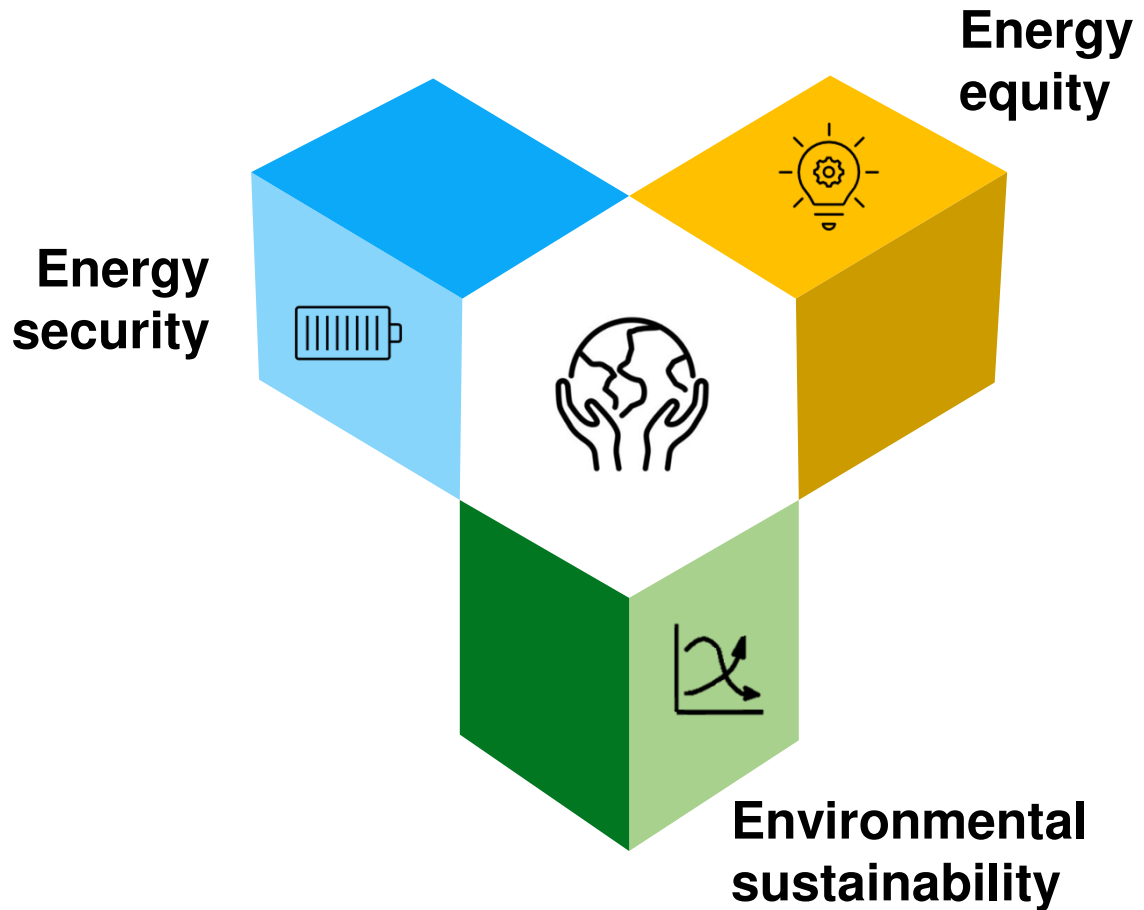
One of the worlds largest fuel markets

Balancing the energy trilemma

Brazil's stage in the energy transition allows for increasing oil and gas production

Brazilian O&G may supply the country and the world with less-than-average carbon footprint

Meanwhile, the country should benefit from technologies such as CCS, hydrogen and offshore wind



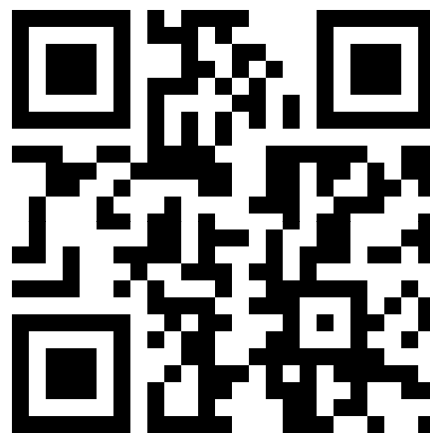


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Av. Rio Branco 65, 21st floor – Rio de
Janeiro – Brazil
Phone: +55 21 2112-8100



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