10 Years of PSAs in Brazil

+ Technological and Decarbonization Initiatives in the Pre-salt

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October, 2023

Pré-sal Petróleo

10 anos

An event organized by IBP and OTC

Disclaimer

PPSA presentations present the best estimates, based on available data.

However, there is no guarantee of achievement of the expected values.

Data, information, opinions, estimates and projections presented in this document are subject to change without prior notice.

About PPSA

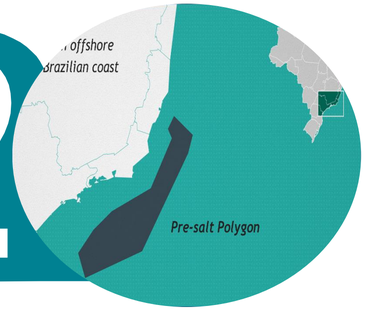
PPSA is a state owned company, linked to the Ministry of Mines and Energy (MME)

PPSA is responsible for maximizing economic results for the Brazilian State in the Pre-Salt Polygon and strategic areas

1

Manage Production Sharing Agreements, which includes be part of the consortium and audit the costs

2



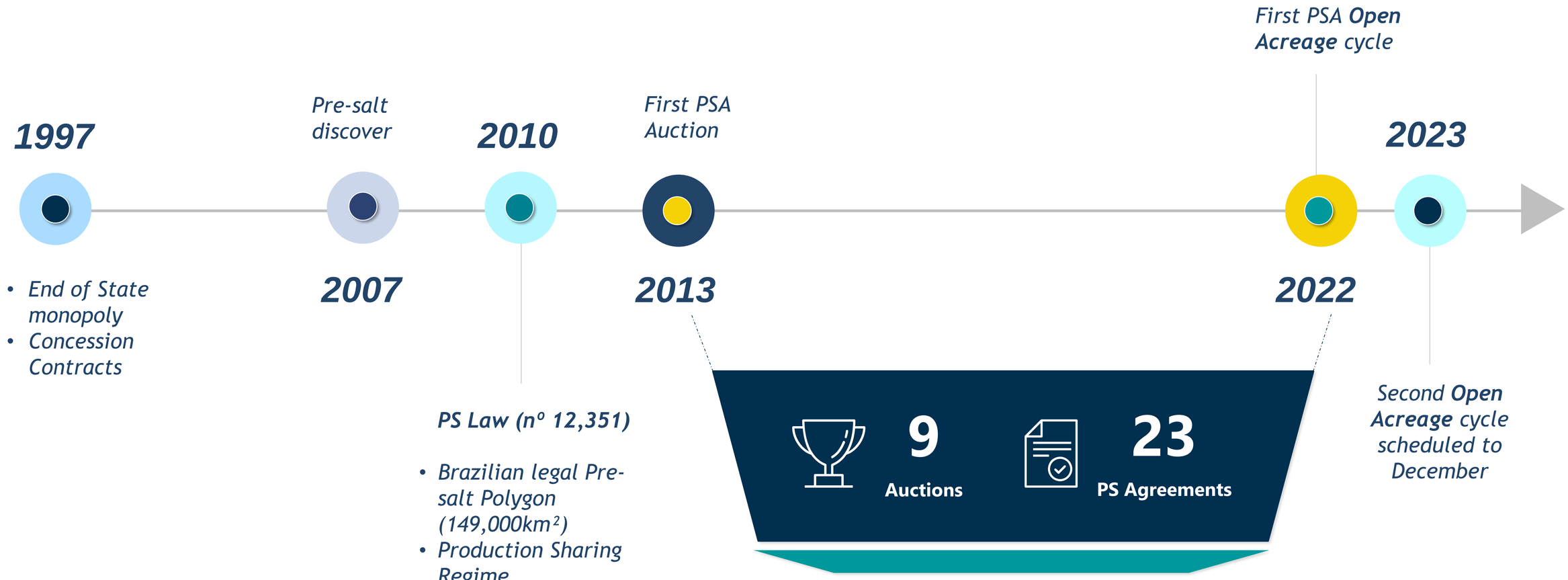
Negotiate the **Unitizations** inside the Pre-Salt Polygon and Strategic Areas, representing the Brazilian State

3

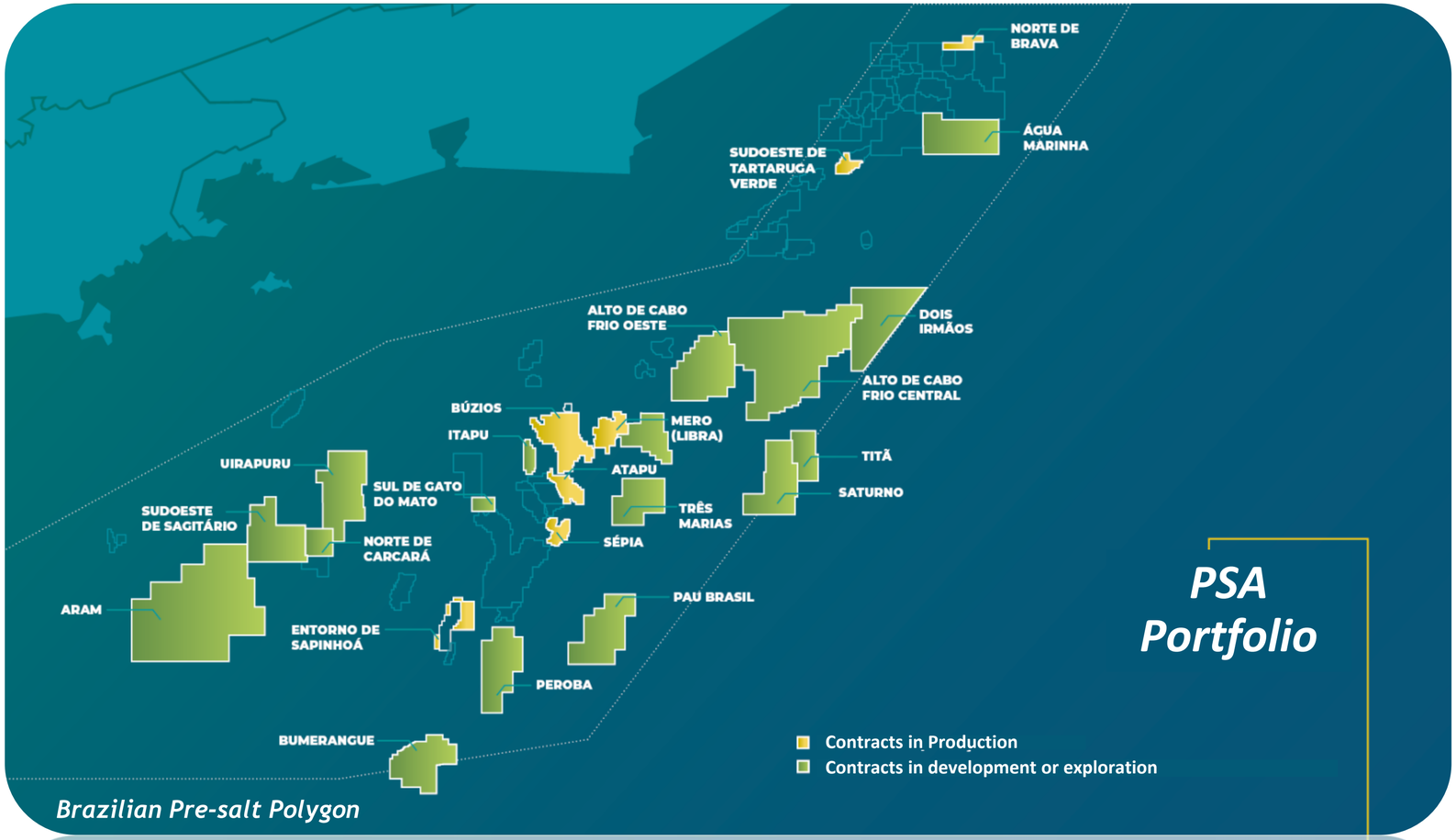
Trade the Brazilian State profit oil and natural gas share

THE PRODUCTION SHARING AGREEMENTS AND UNITIZATIONS WITHIN THE PRE-SALT POLYGON

Context and History



The production sharing agreements



23

PSAs

8

Blocks in production phase

1

Block in development phase

14

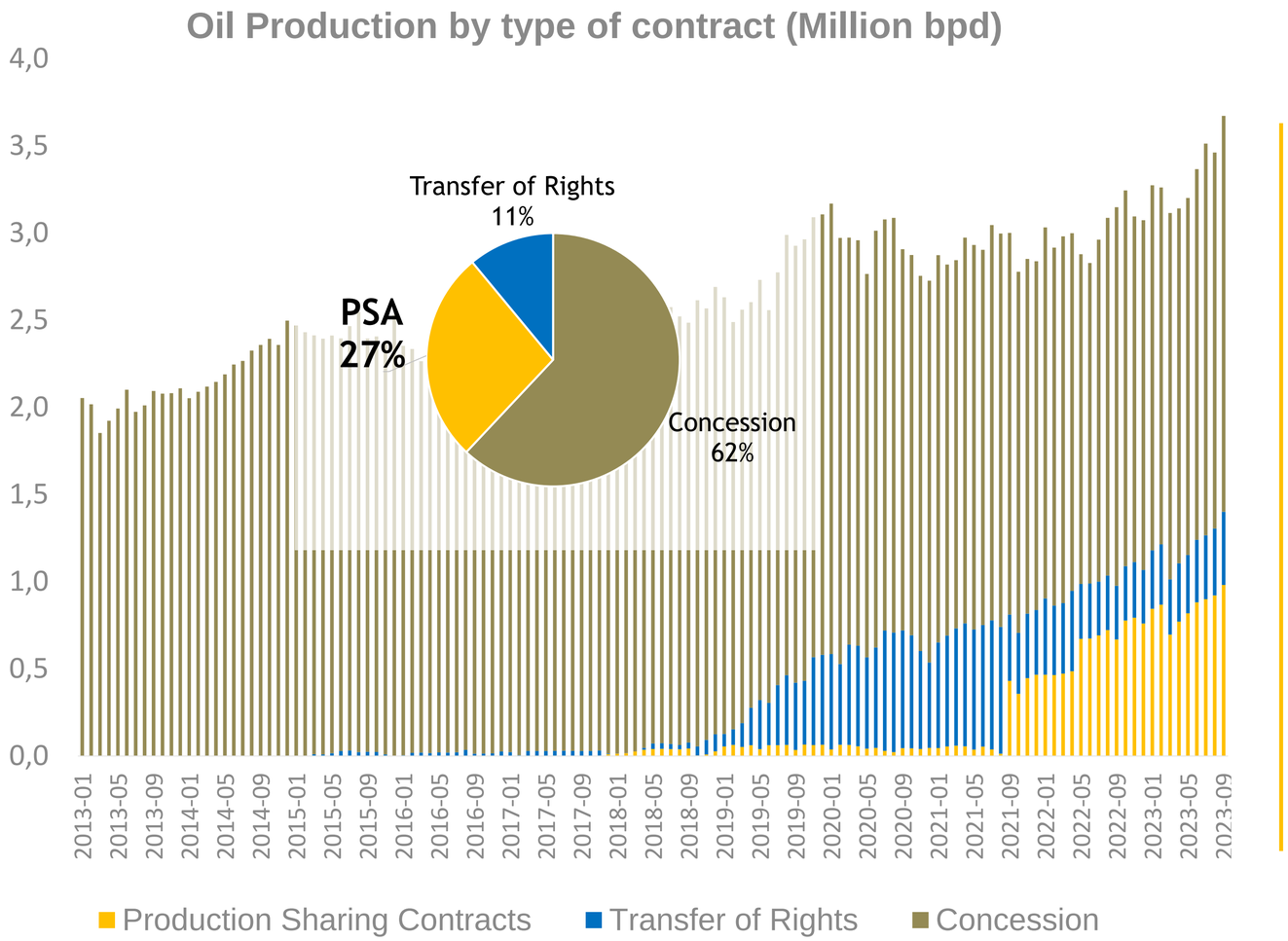
Blocks under exploration, 4 to be returned

PSA
Manager

15

companies,
5 operators

The PSAs production



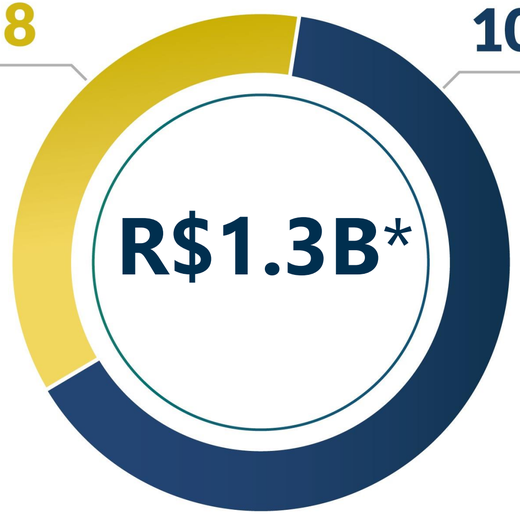
	Oil	Natural Gas (available)
Brazil Total Production	**3.5** MM bpd	**53** MM m^3/d
PSAs Total Production	**921** K bpd	**3.2** MM m^3/d
8 Fields in Production	**57** Wells in production	**14** FPSOs

Source: ANP (Aug, 2023)

The Unitizations inside the pre-salt polygon

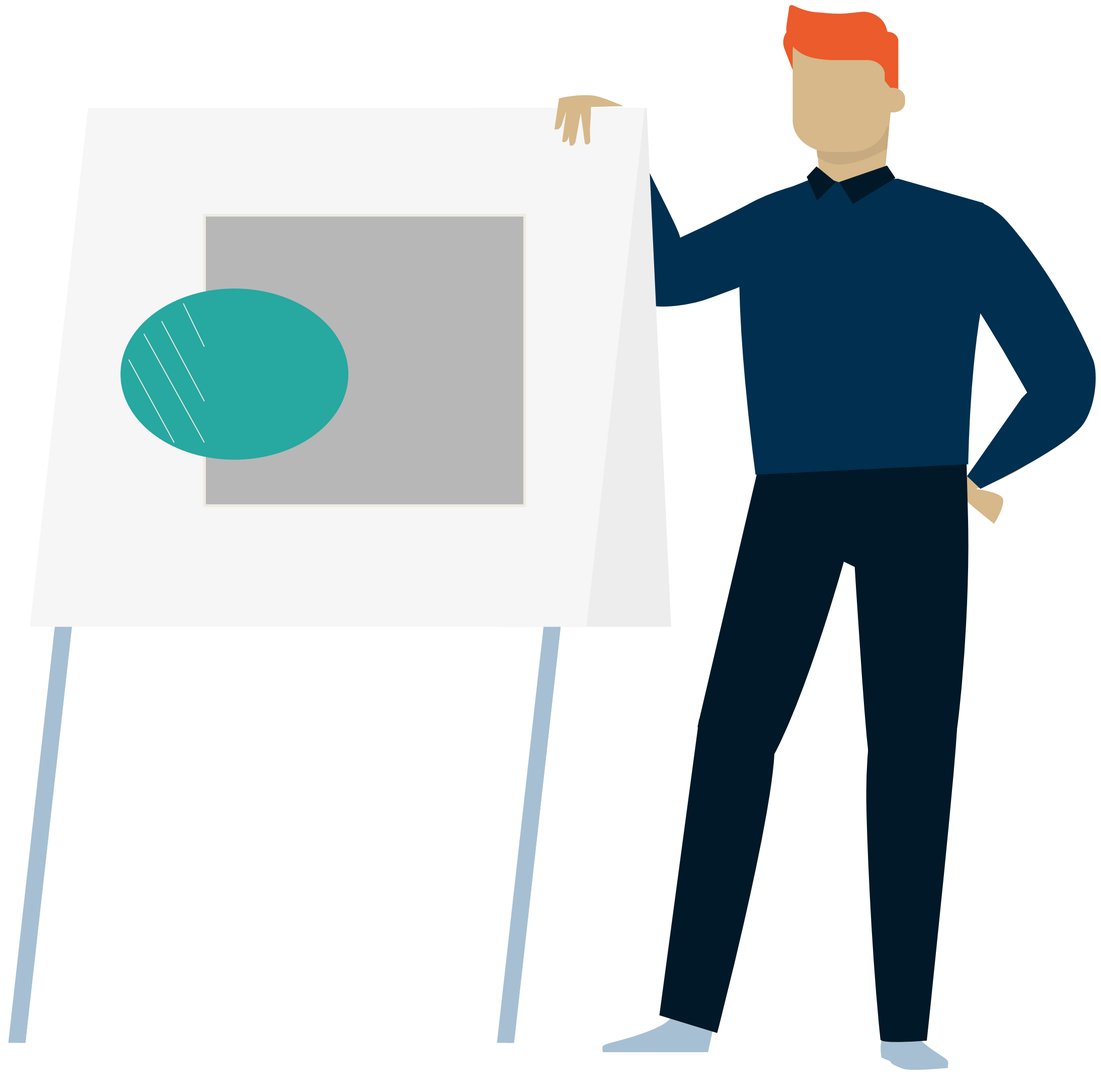
EM AVALIAÇÃO **8**

Gato do Mato
Caxaréu
Sagitário
Sul de Sapinhoá
Epitonium
Búzios
Jubarte
Júpiter



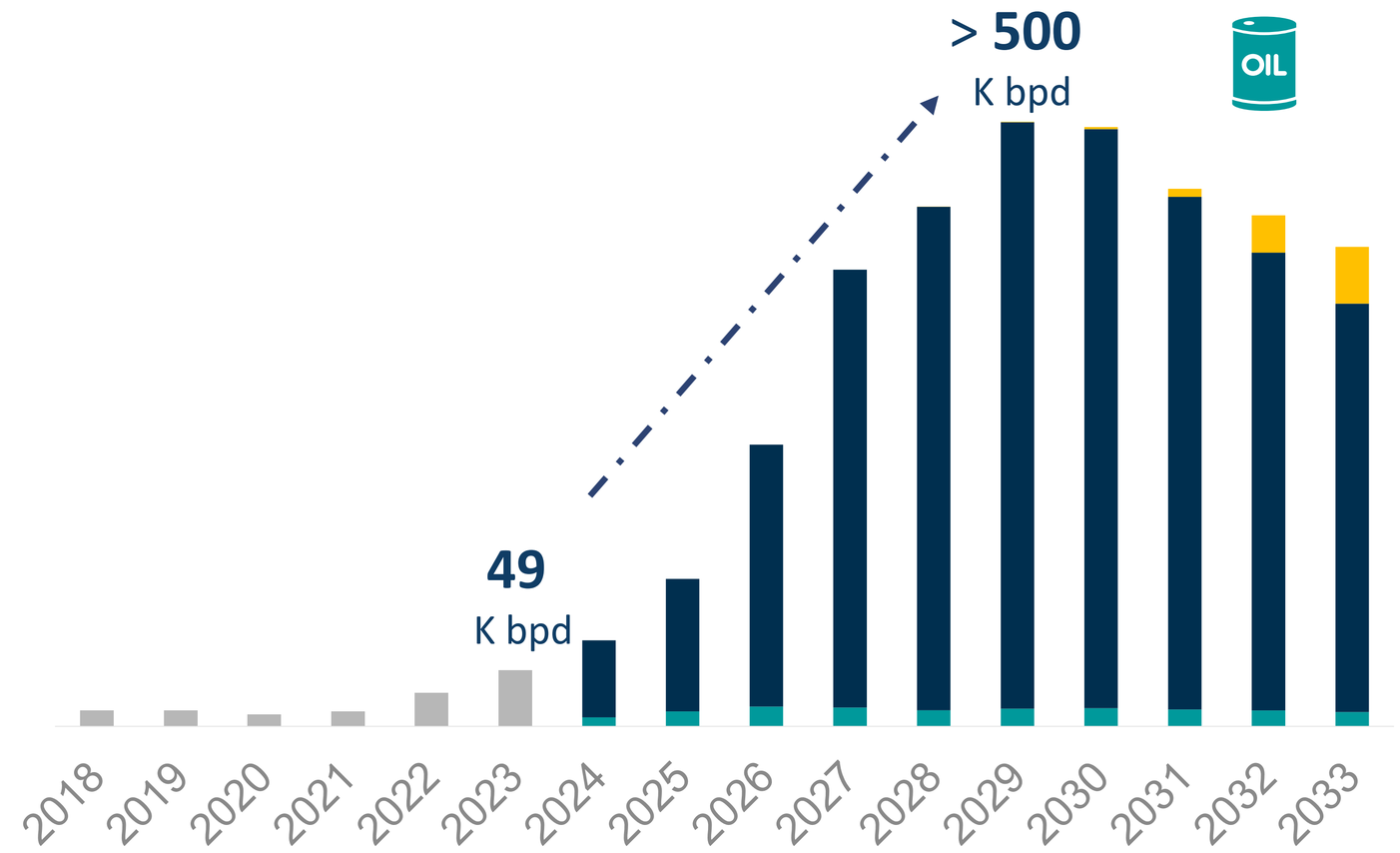
10 APROVADOS E EFETIVOS

Pré-Sal Albacora
Brava
Sapinhoá
Tartaruga Verde
Tupi
Argonauta
Atapu
Mero
Bacalhau
Sépia



**Financial equalizations with open areas*

The Brazilian State oil and gas production



Production	Today	2029
Brazilian State Oil	49 K bpd	> 500 K bpd
Brazilian State Gas	> 0.1 MM m^3/d	3 MM m^3/d

13 New FPSOs + **cost** recovery

Unitizations | Profit Oil - Commercial Areas | Potential Profit Oil – Areas In Exploration

LARGEST PRODUCERS IN BRAZIL - Aug, 2023

Potential to be:
2ND LARGEST PRODUCER UNTIL 2030

		K BOE/D			K BOE/D
1st	PETROBRAS	2,826	8th	REPSOL	78
2nd	SHELL	475	9th	CNODC	63
3rd	TOTAL	175	10th	PETRONAS	58
4th	PETROGAL	121	11th	PPSA	49
5th	PRIO	99	12th	SINOCHEM	37
6th	CNOOC	94	13th	QATAR	34
7th	EQUINOR	93	14th	KAROON	33

Source: ANP (Aug, 2023)

What do the commercial PSAs and unitizations represent to the society?

Around R$ 2 trillion in taxes, GT and O&G trading, plus ~R$ 700 billion in investments

Until 2023

O&G Trading

R$13B

Investments and Financial Compensation

R$ 353B

Taxes and Government Take

R$160B

Forecasted

O&G Trading

>R$800B

Investments

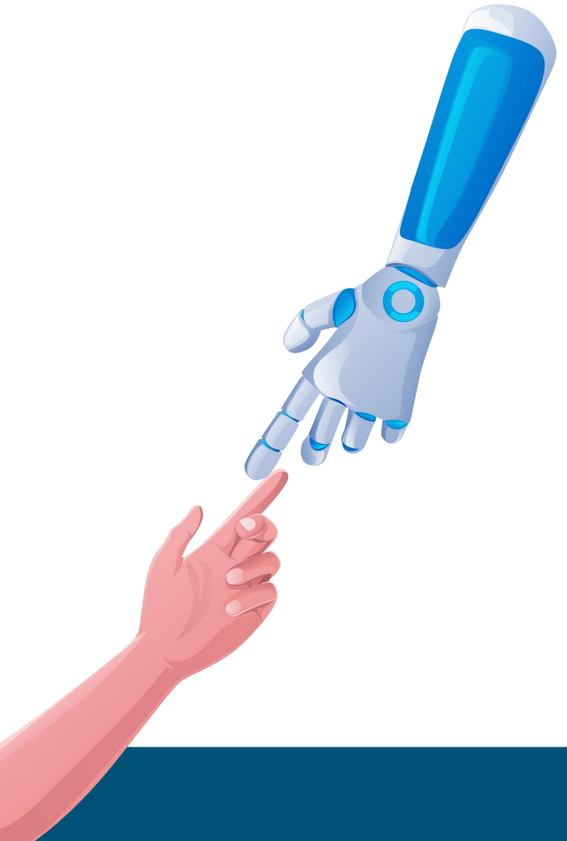
>R$ 350B

Taxes and Government Take

>R$1T

Oil price 70USD/bbl and exchange rate R$5/USD

Innovative and Impactful Technologies Applied in the Pre-Salt



Geosciences	OBN Seismic
	Complex Seismic Inversion
	4D Seismic
Reservoir Engineering	Pro-Active IC with AI Tools
	WAG
	Tracer Tests
Wells	Intelligent Open Well Completion (PACI)
	All-Electric Intelligent Well Completion
	Autonomous Inflow Control Devices (AICD)
Submarine Systems	HiSEP
	Daisy chain
	Subsea System Pre-Installation
Production Units	CO2/H2S Removal Membranes
	Combined Cycle Turbines
	Gas and Water HUBs
Offloading	CTV

Pre Salt Technological Highlights: Offloading Optimization

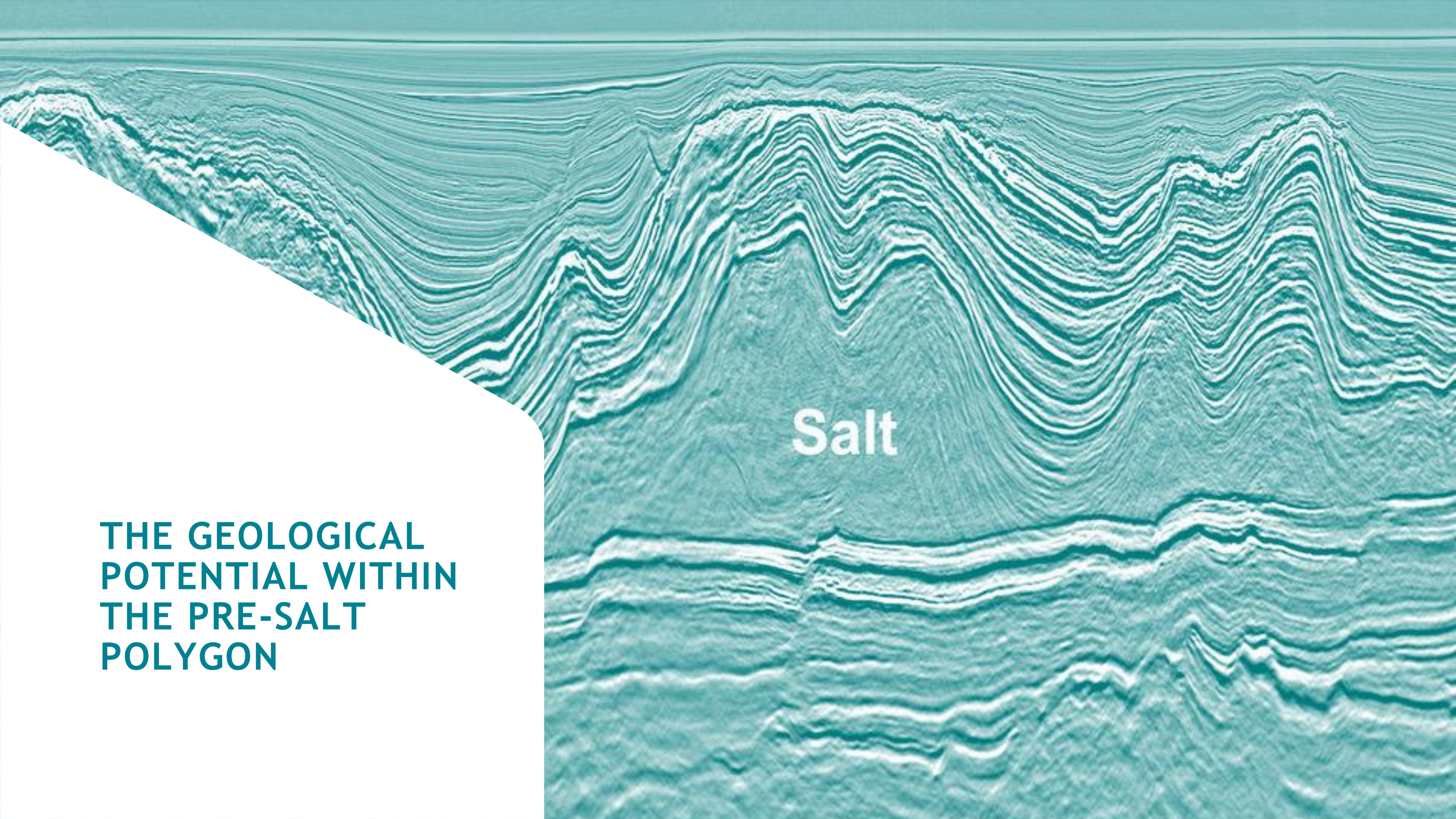
Source: Sealoading, 2023

The CTV (cargo transfer vessel) technology is a **cost efficient, flexible, safe and energy saving method of transferring oil** from offshore oil fields onto conventional tankers.

2-3 days from FPSO to trading tanker

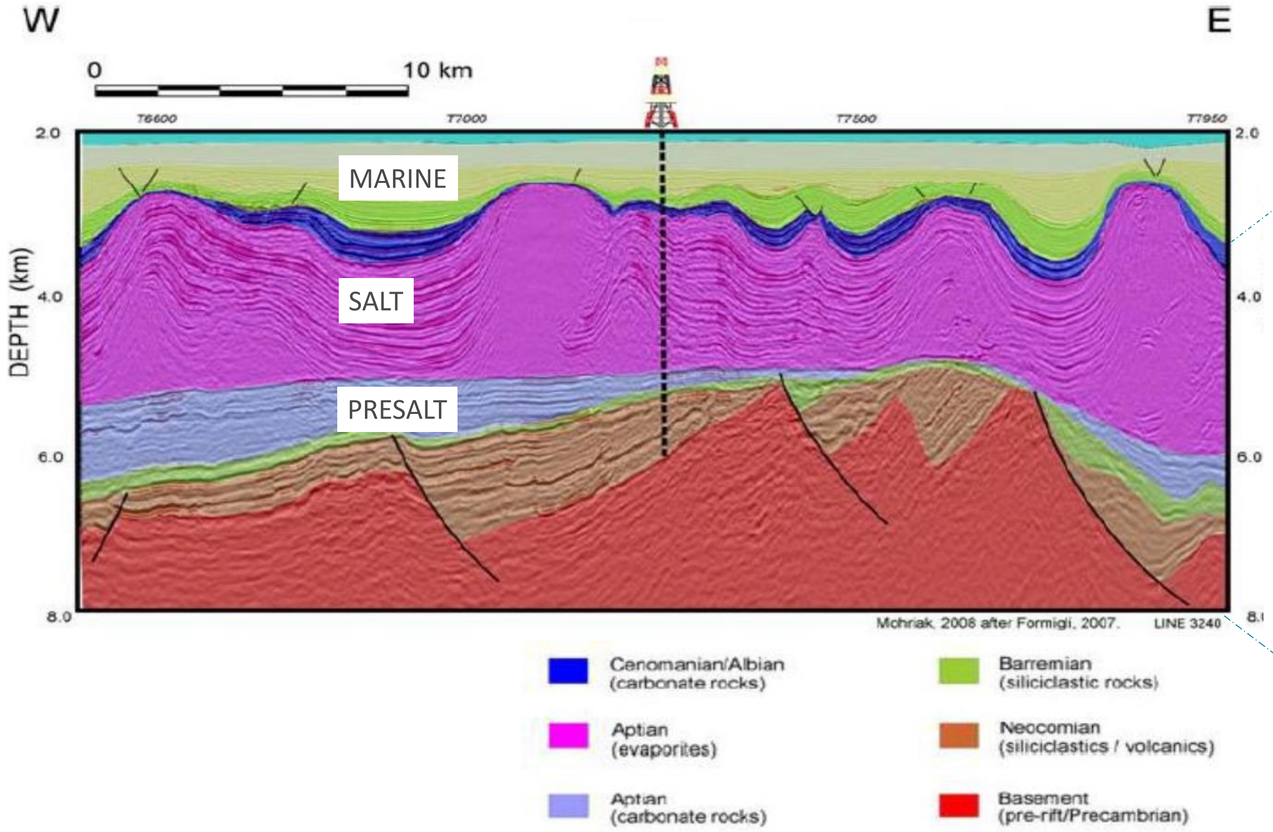
60-90% emissions and time savings

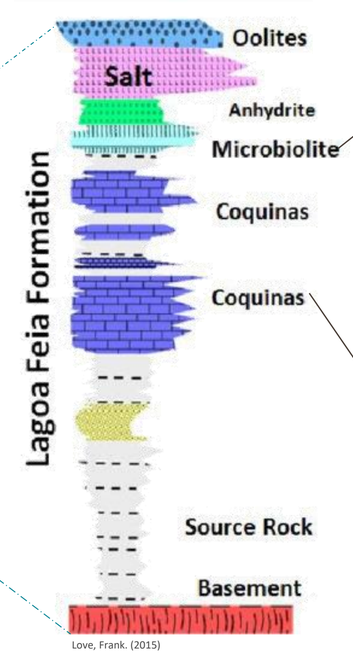
THE GEOLOGICAL POTENTIAL WITHIN THE PRE-SALT POLYGON



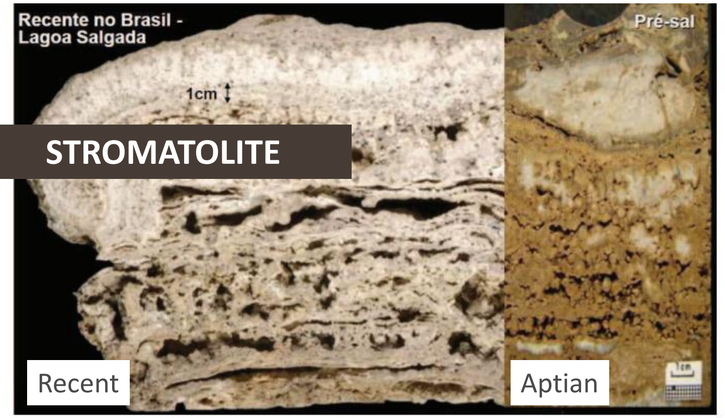
The Brazilian Pre-Salt PLAY

High quality Carbonate Reservoirs underneath the salt layer





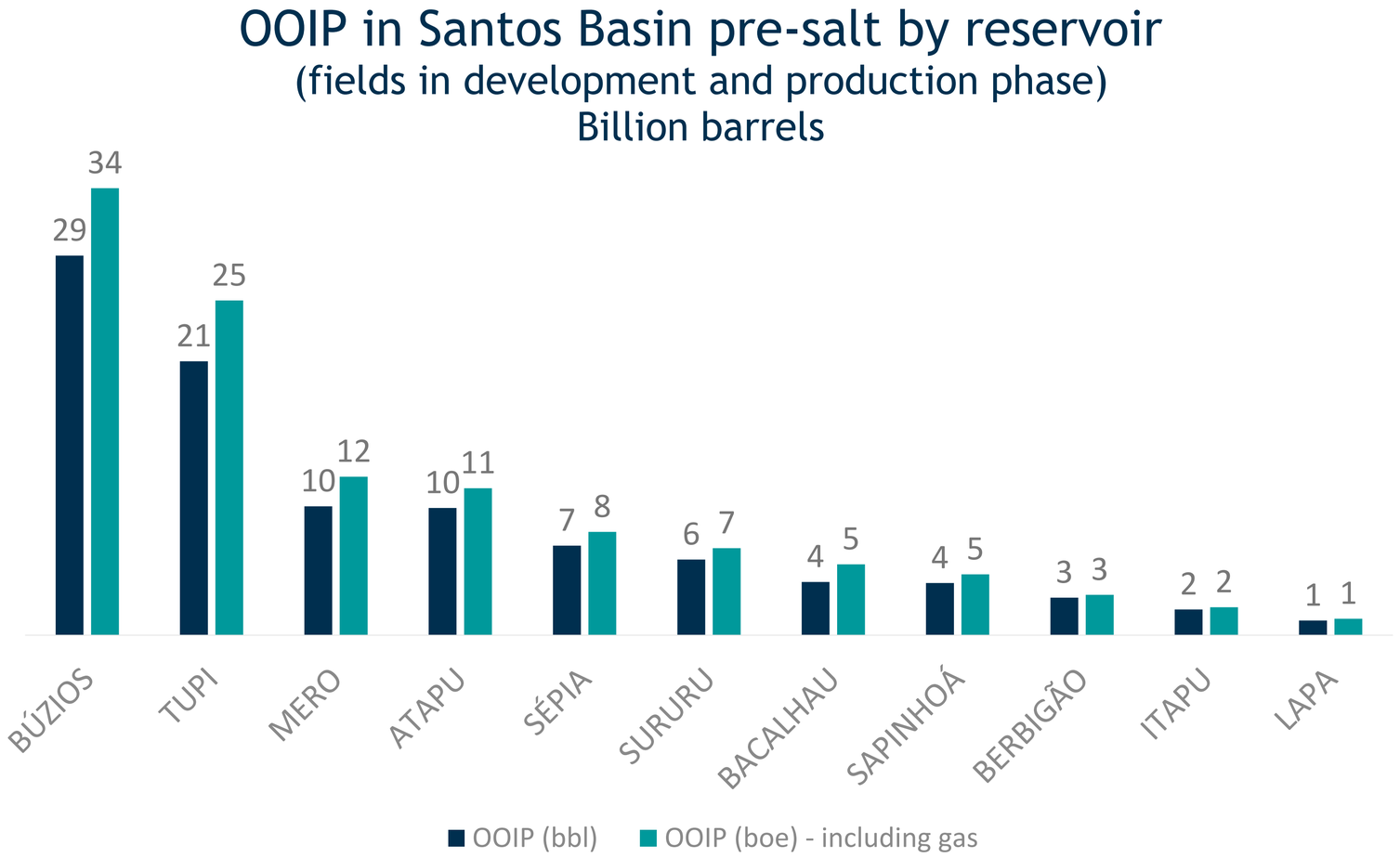
Love, Frank. (2015)



(Formigli, 2008).

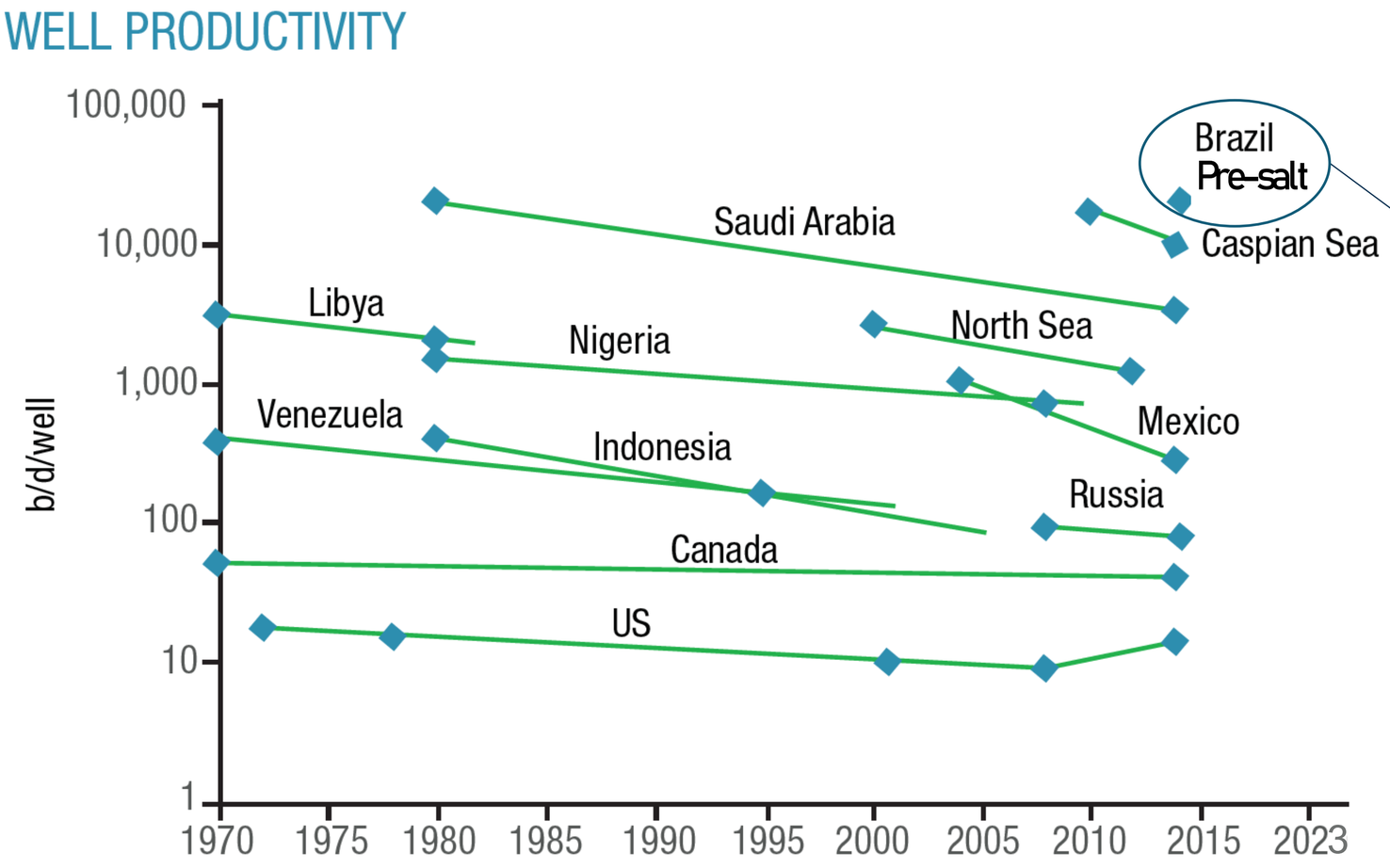
anp

~100 billion barrels of oil in place were discovered in the Santos Basin pre-salt and are commercial



Source: ANP-2023/Reserves Report

High productivity wells in the pre-salt



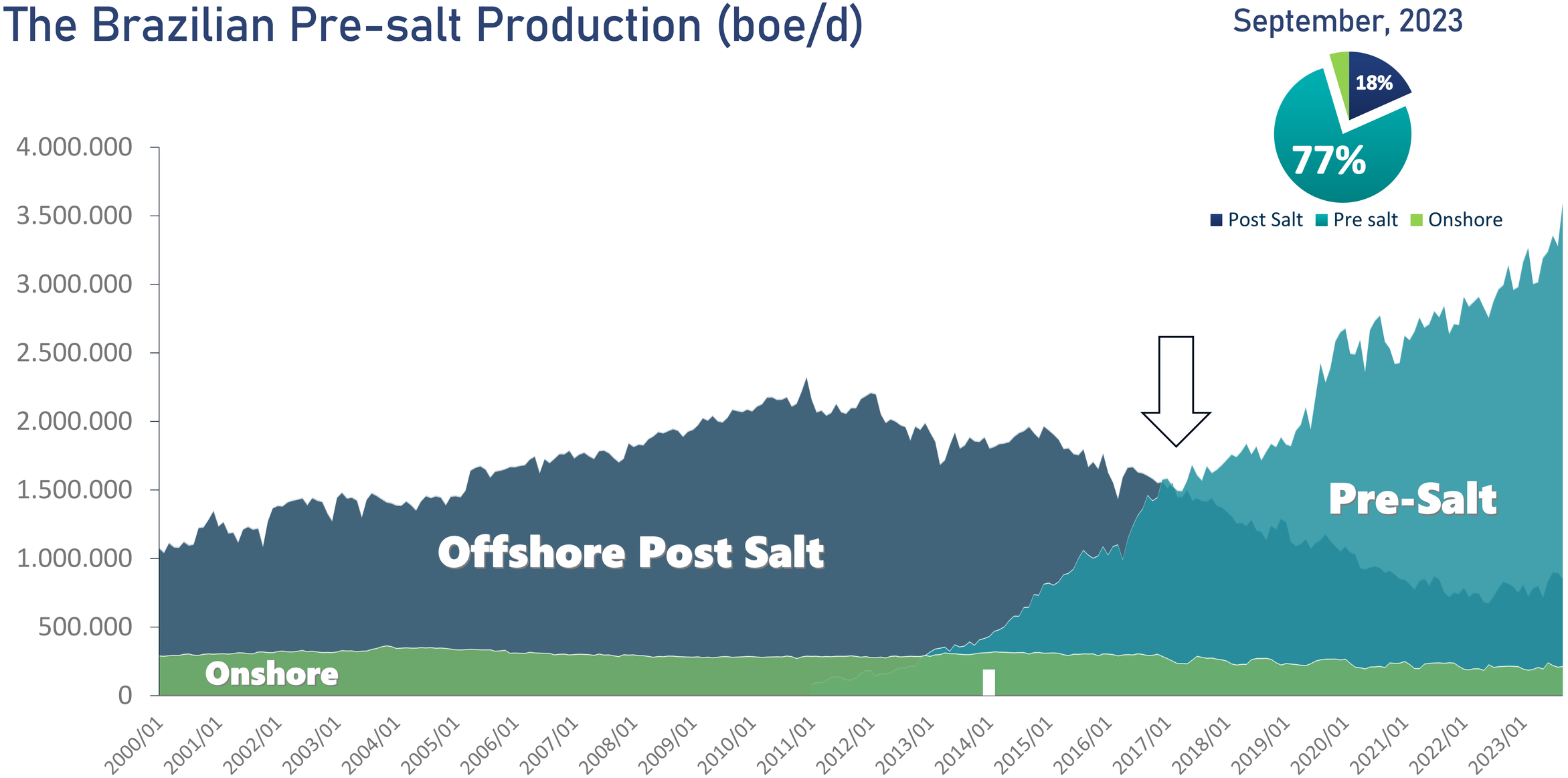
Pre-salt wells in Brazil:

Field	kbbl/d
Atapu (7-ATP-6-RJS) – 03/23	56.8
Itapu (1-BRSA-116-RJS) – 05/23	51.3
Mero (7-MRO-10B-RJS) – 08/23	50.5
Sépia (9-BRSA-1254-RJS) – 06/23	50.3
Búzios (7-BUZ-33-RJS) – 08/23	50.2

Source: ANP, 2023

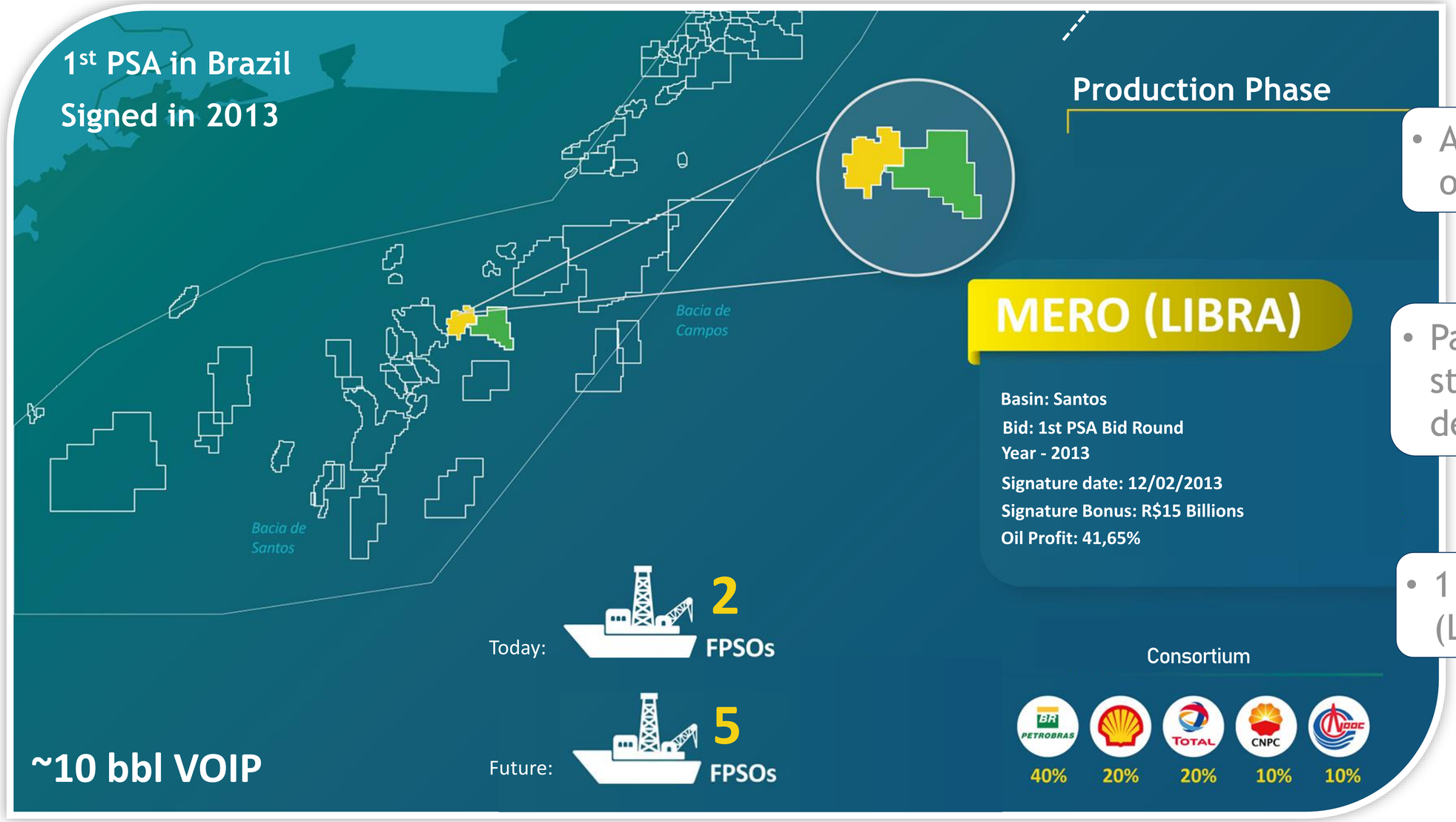
* Modified by Sandrea and Goddard, 2016, *New reservoir-quality index forecasts field well-productivity worldwide*, Oil & Gas Journal, 7 p

The Brazilian Pre-salt Production (boe/d)



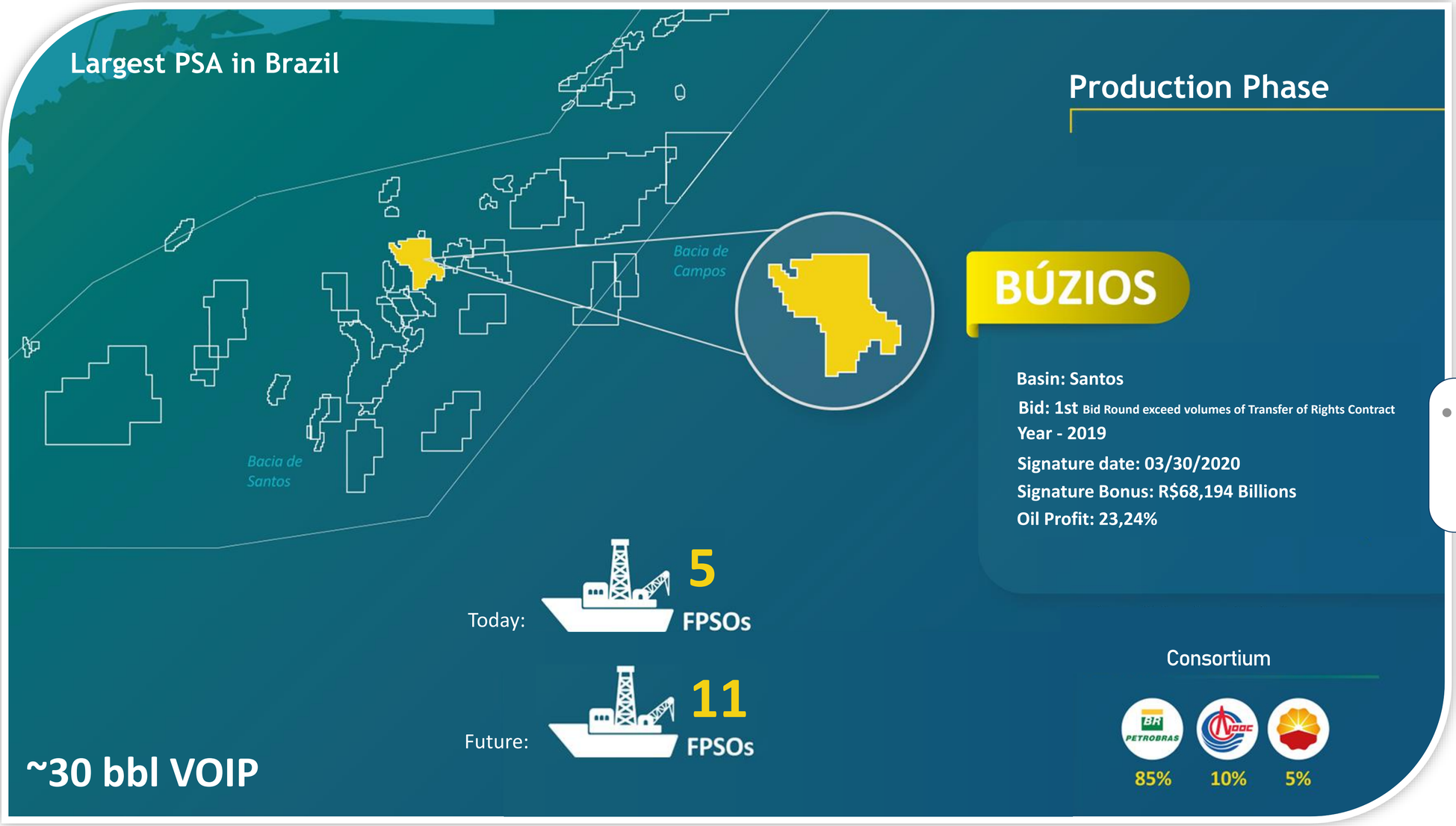
Source: ANP-2023

Libra 100% PSA



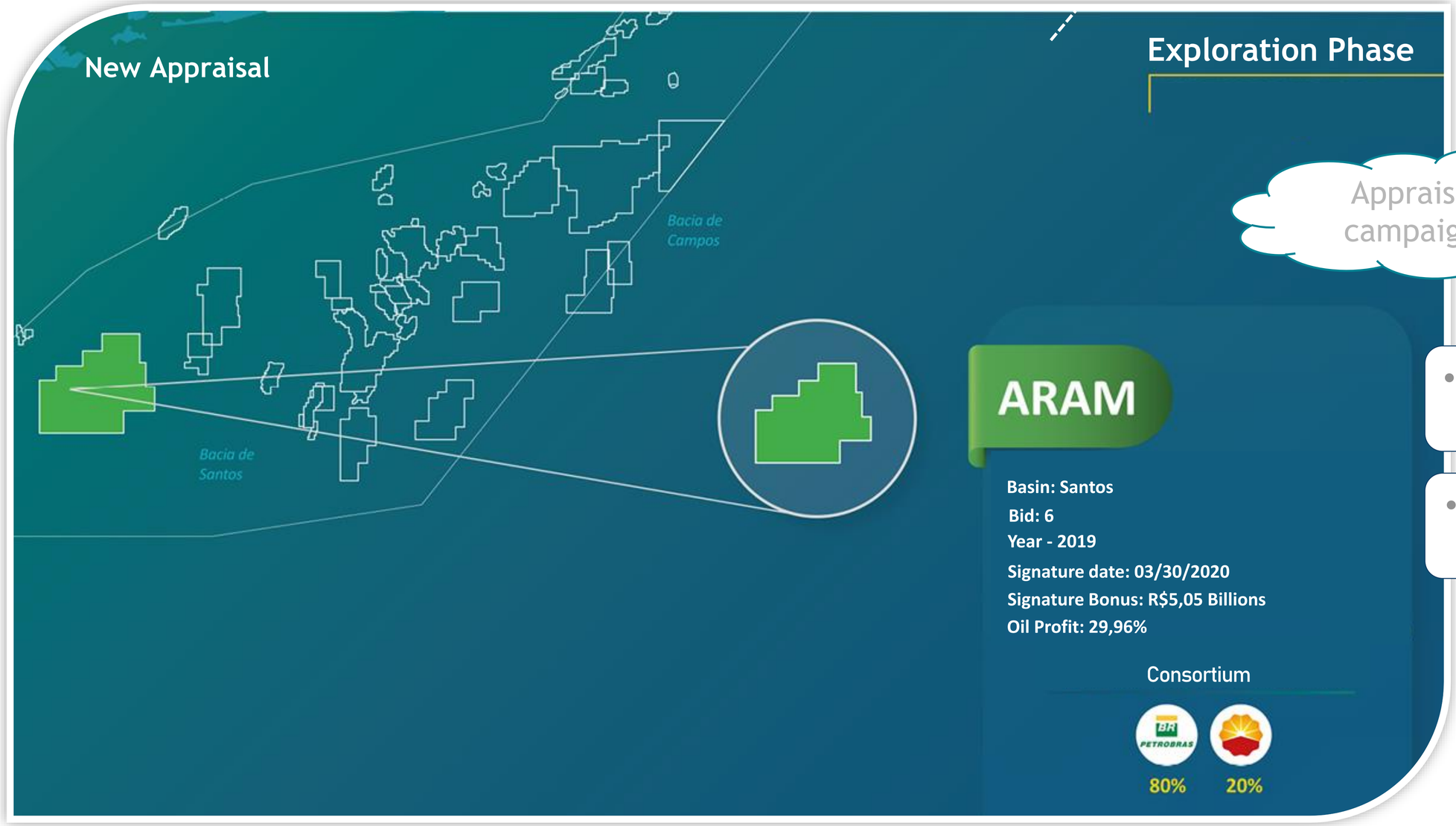
- Average 183 kbbl/d on 1stQ 2023
- Part of Mero field still under development
- 1 exploration area (Libra Central)

Buzios 73,4057% PSA



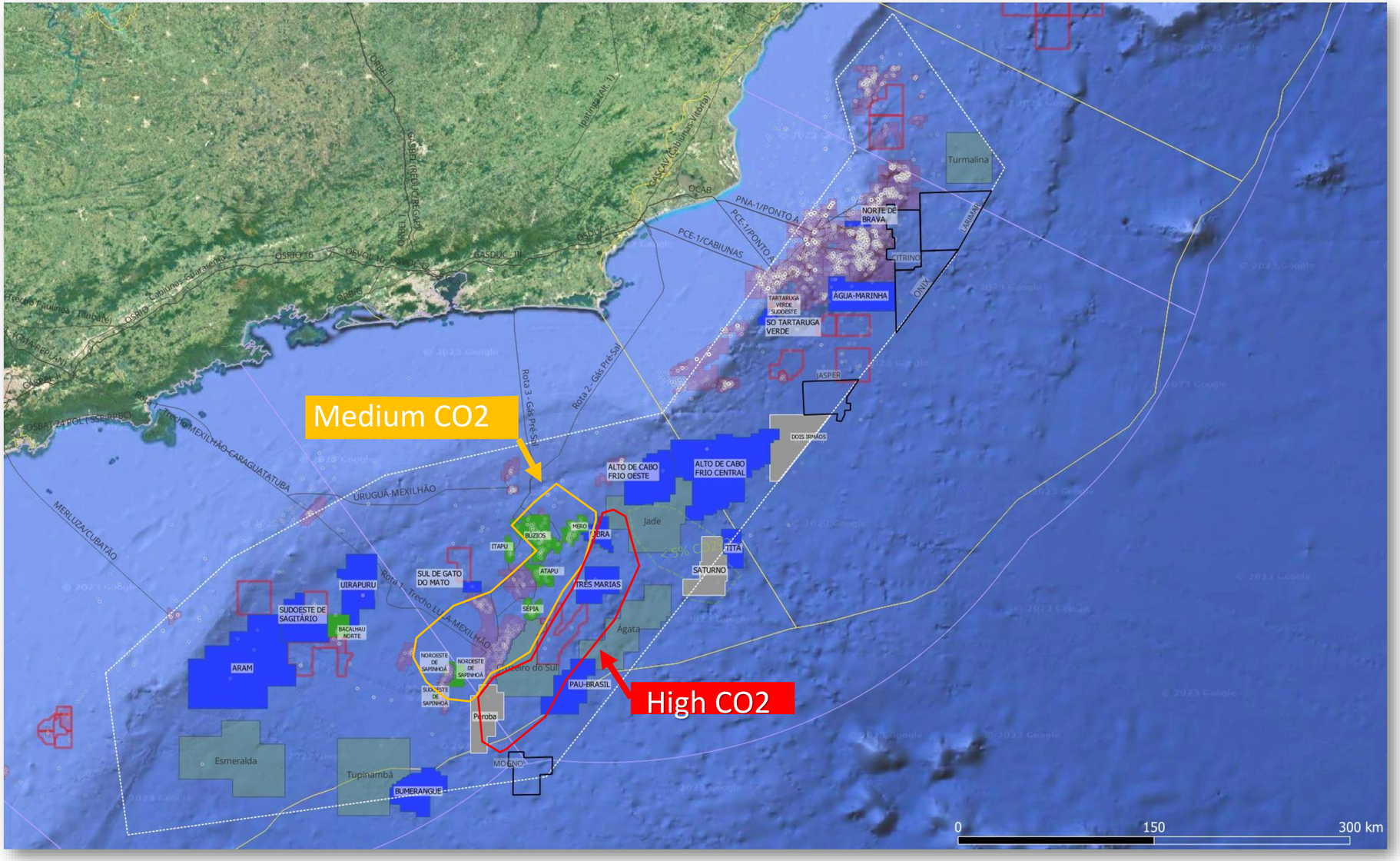
- Part of Buzios Field still under development

Aram 100% PSA



- 1st oil discovery on 4thQ, 2021
- 2nd well test on 2ndQ, 2023

We better know our challenges – CO2 example



The exploration within the pre-salt polygon

Like any exploration path, nowadays we better know our risks and opportunities within the pre-salt polygon

Past

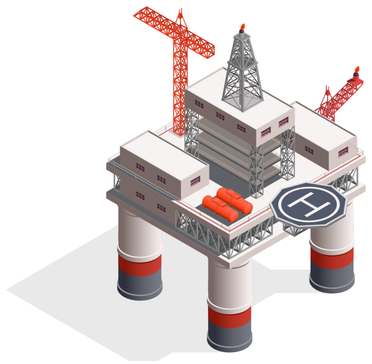
1. Giant Discoveries in the pre-salt
2. Lower Risks in the pre-salt
3. High Government Take applied
4. Post-salt exploration forgotten
5. OOIP commercial 2022 (pre-salt and post-salt):
   118 B boe in Santos Basin
   97 B boe in Campos Basin

Today

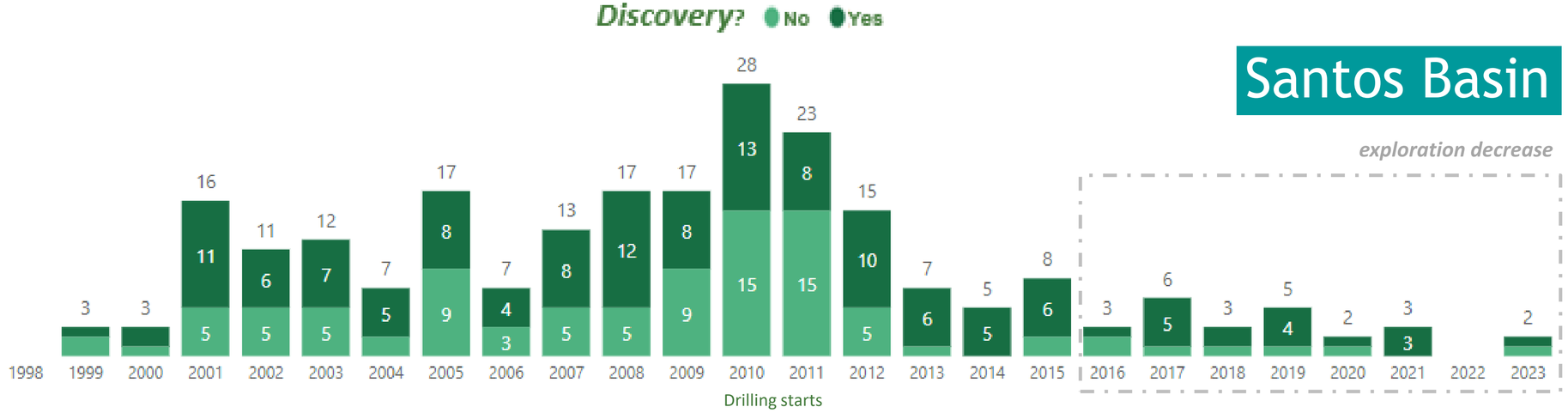
1. Normal and smaller discoveries, but still have many opportunities
2. Exploratory risks as the world average
3. Other risks mapped --> e.g. high CO2%
4. BID Parameters adjusted
5. Post-salt opportunities being target

We need to keep increasing Brazilian O&G projects attractiveness to face the new exploration reality

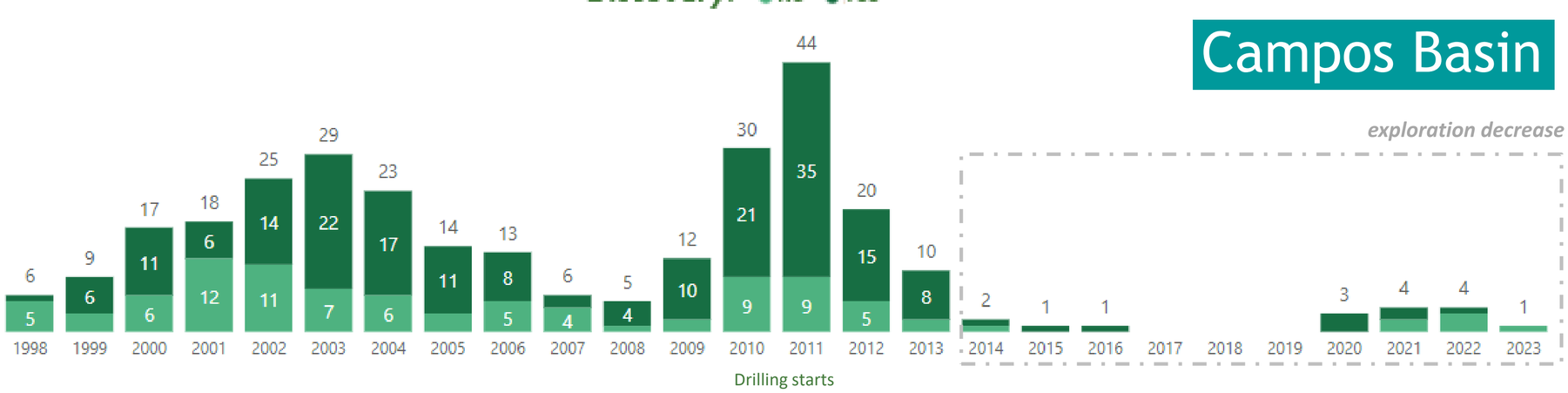
We need to continue exploration within the pre-salt polygon



Brazil's Offshore Exploratory Wells



Brazil's Offshore Exploratory Wells

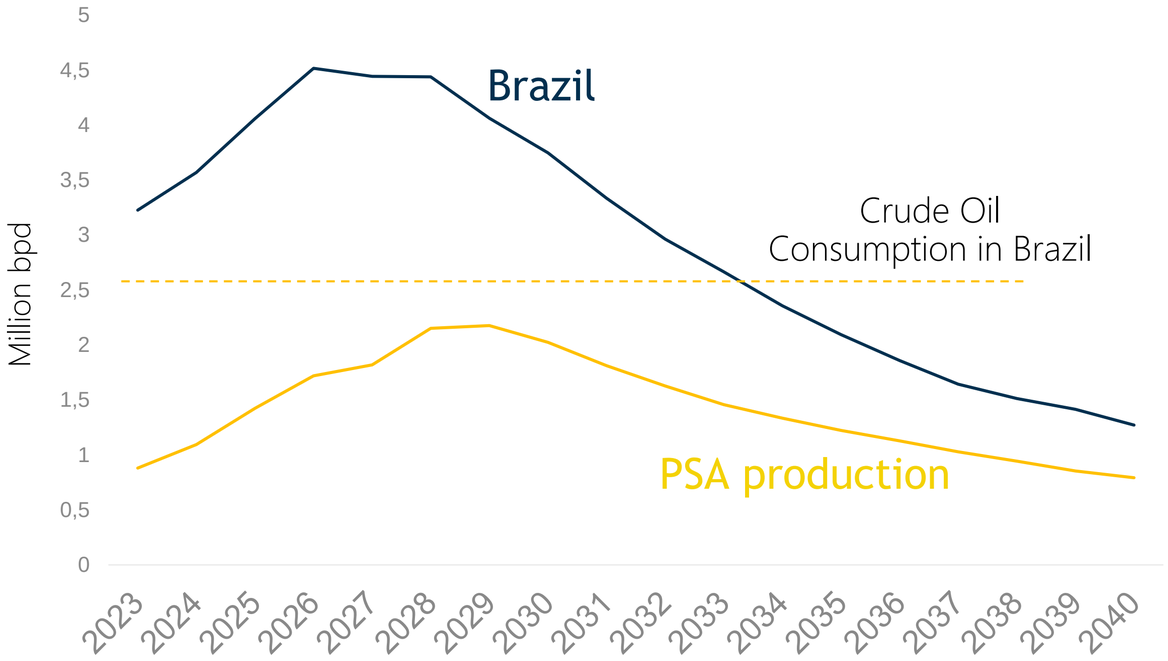


Source: ANP, 2023

We need to continue exploration in Brazil to make sure we supply our demand in the future

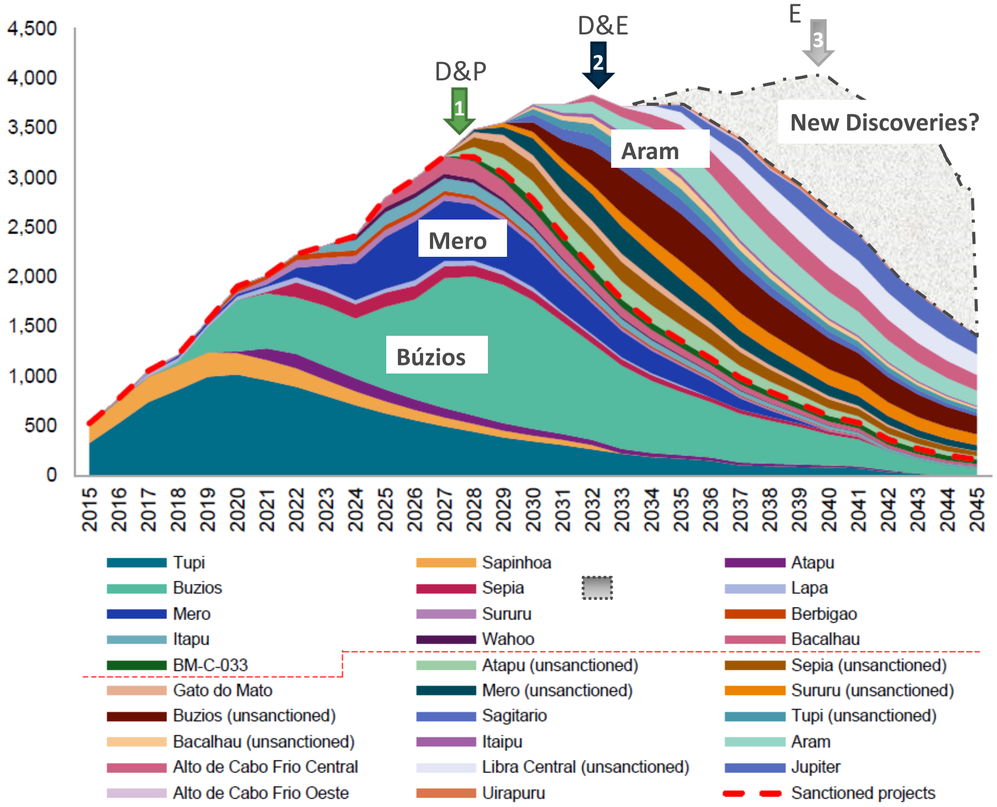
We should remember that a contract, when it is successful, it takes at least 7 years to start production

Brazil Oil Production Forecast, 2P reserves (Dec, 2022 - *Fields in D&P phase)*



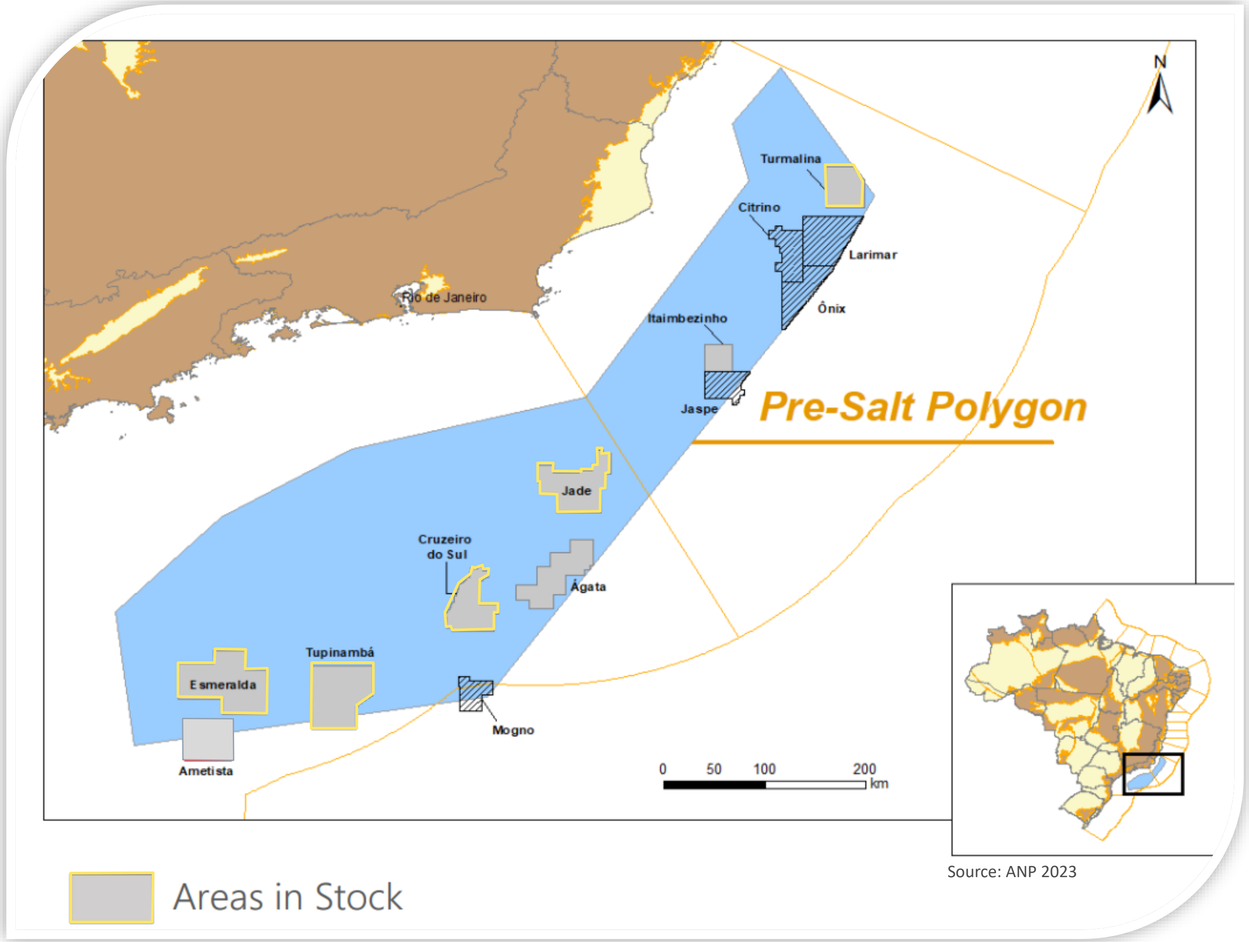
Source: ANP, 2023

S&P Global: Brazil's pre-salt production oil rate (K bpd)



Modified by "Operators prepare to test the limits of Brazil's presalt" © 2023 by S&P Global Inc.

We still have many opportunities within the pre-salt polygon



Source: ANP 2023

6 areas in stock

5 blocks in the 2nd Open Acreage Cycle (PSA)

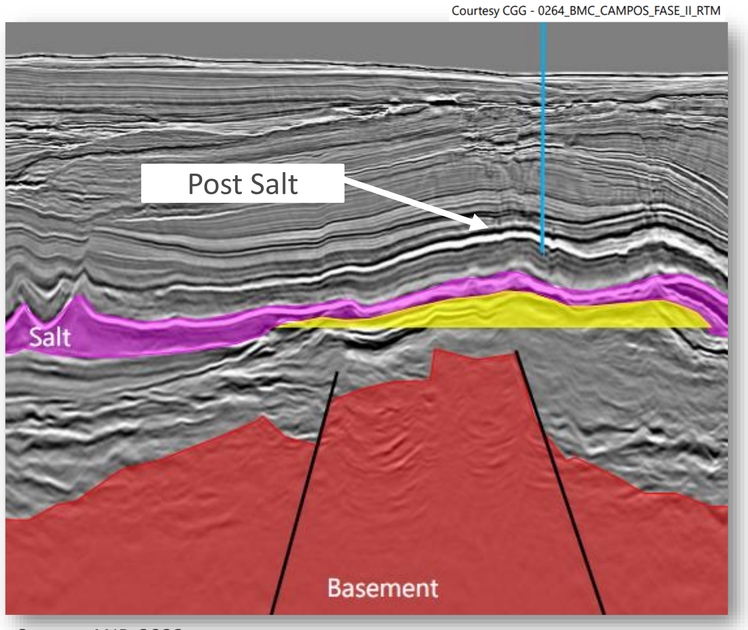
The public bidding session is scheduled to **December, 13th**

+8 new areas

recommended by ANP and to be approved by CNPE

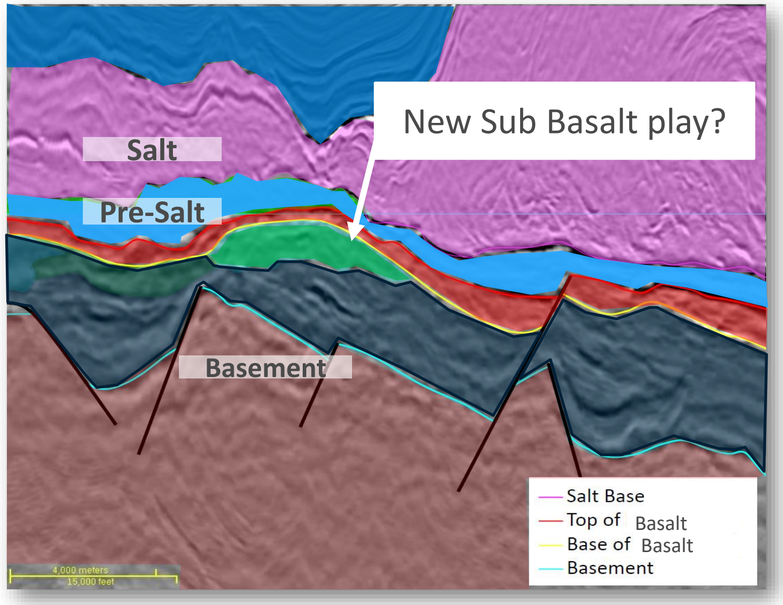
Other opportunities within the pre salt polygon

Post-Salt (Infrastructure Led Exploration)



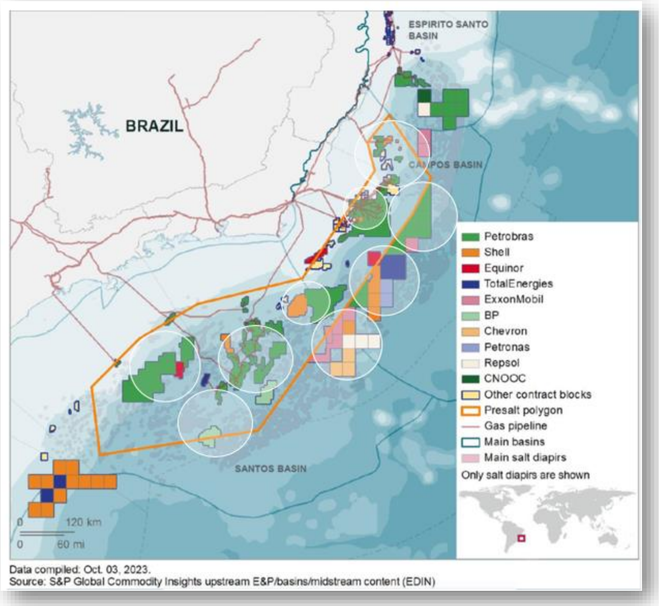
Source: ANP, 2022

New Sub Basalt Play?



Modified from Consortium studies

Synergies



Modified from © 2023 S&P Global Inc.

Beyond the pre-salt potential, study **post salt opportunities** within the pre-salt polygon and **encourage operators to study synergies**.

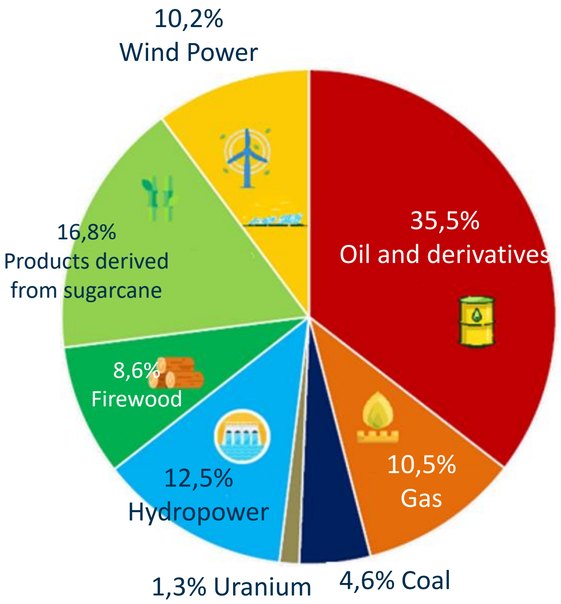
NG opportunities within the pre-salt polygon.

DECARBONIZATION INITIATIVES

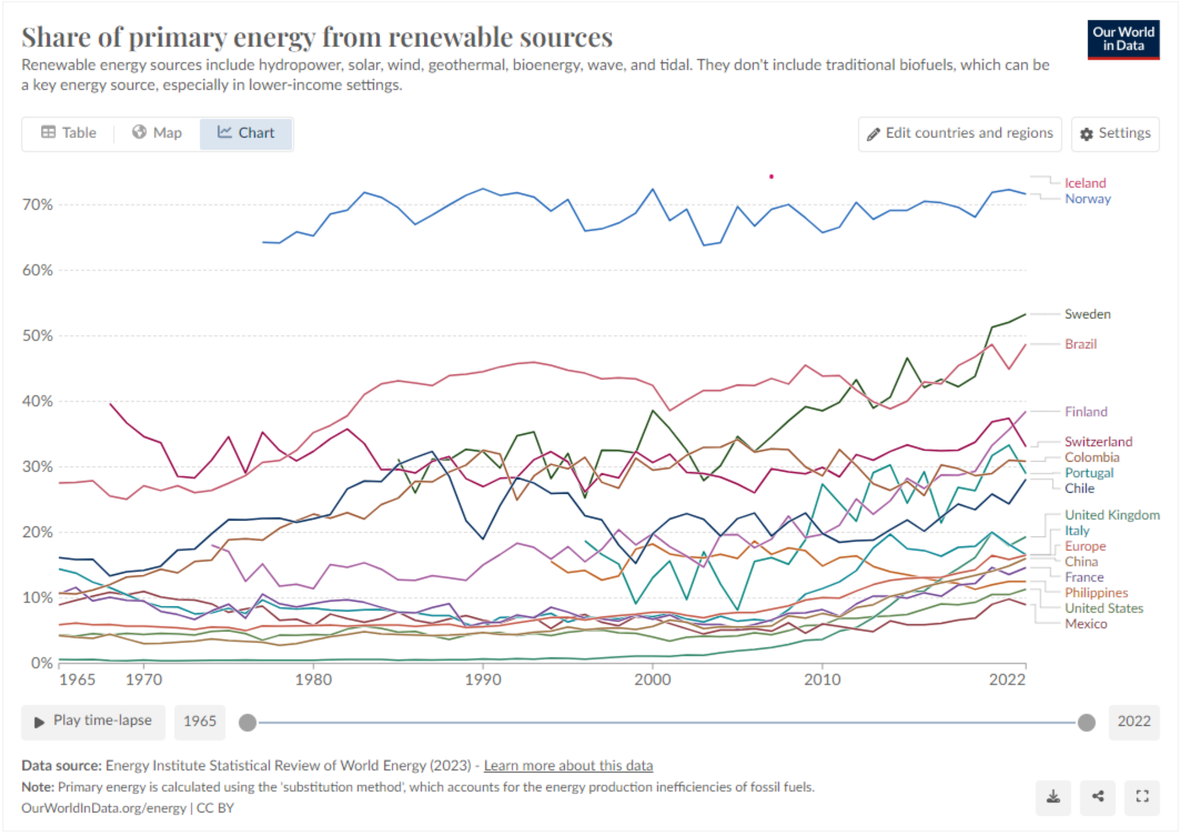
Energy Transition in Brazil

Energy makes up nearly three-quarters of global emissions, but in Brazil it represents less than 30% of the total emissions
A country with an abundance and diversity of energy resources and one of the main global players in the energy transition
Around 49% is the share of renewables from primary energy (4th in the ranking – Iceland, Norway and Sweden)

Brazil's Energy Matrix in 2022

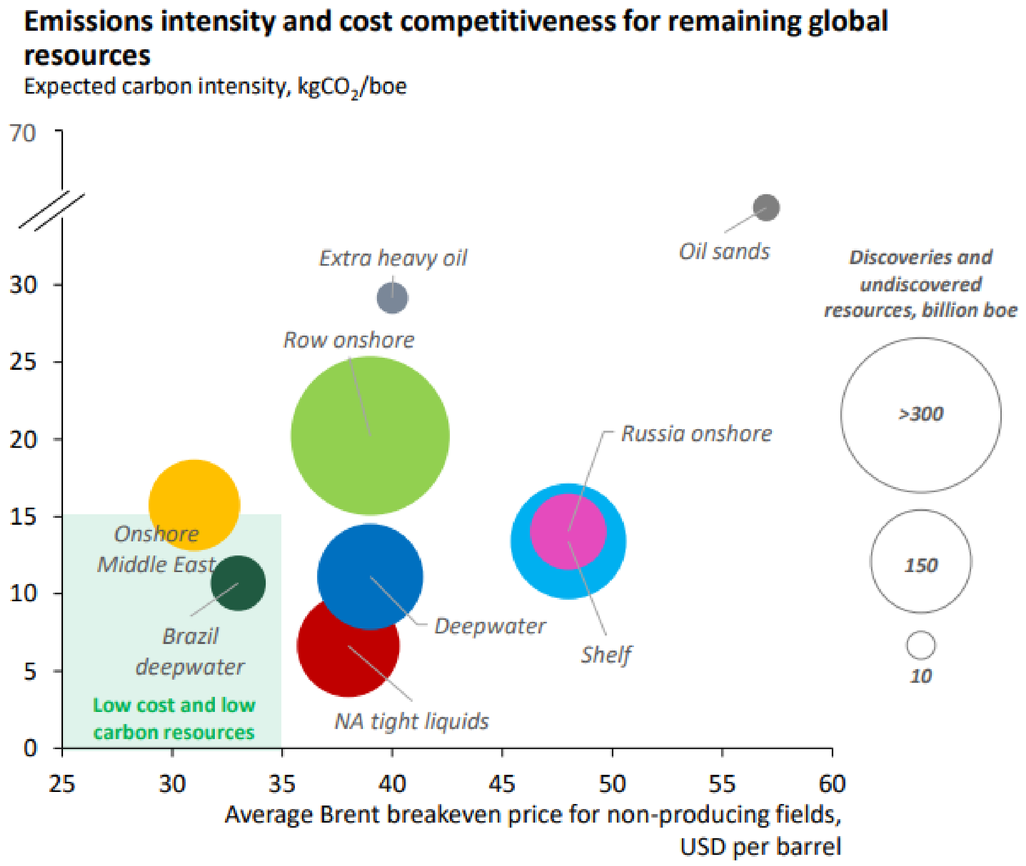


Source: MME, 2023

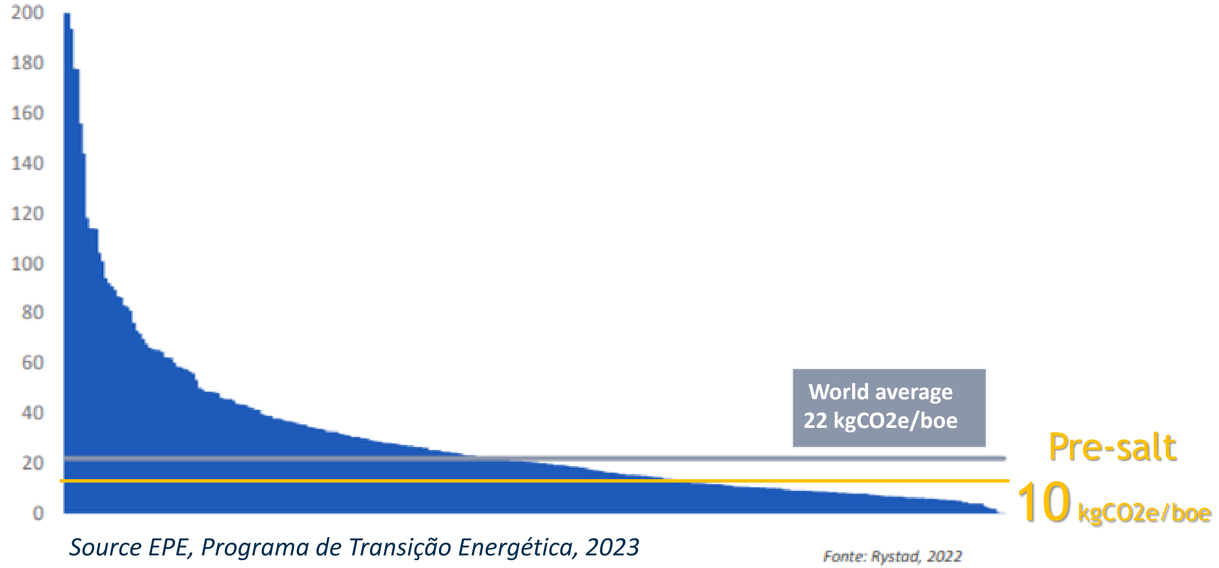


Brazilian pre-salt projects

Triple resilience (technical, economic and environmental)



Oil Carbon intensity in the world (kgCO2e/boe)



In the pre-salt, the oil is lighter and has a low sulfur content.

Oil remains a vector to meet energy security and, even in the carbon neutral scenario, it will be necessary to satisfy the demands of sectors that are difficult to decarbonize and for non-energy purposes.

Painel Dinâmico de Emissões
Bacias Marítimas

Year

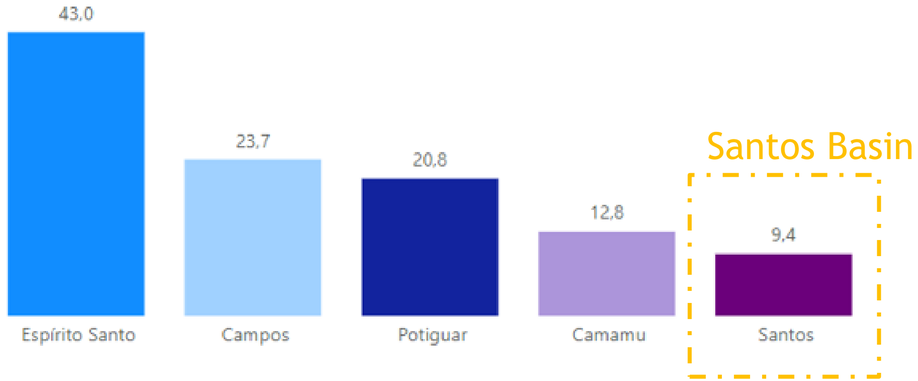
2021 **2022**

ANP Dynamic Emissions Panel (**Offshore Basins**)

Offshore

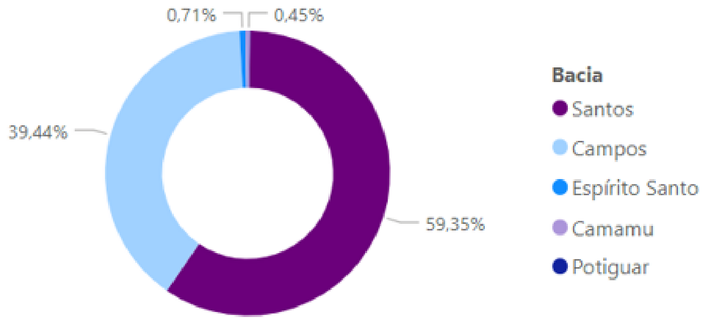
Instalações de produção	Produção de óleo [MMbbl]	Produção de gás [MMboe]	Intensidade média de GEE [kgCO2eq/boe]	Emissões de GEE [MMt CO2eq]	Eletricidade gerada [Twh]
107	1072,05	269,33	12.46	16,70	15,39

Intensidade média de GEE (KgCO2eq/boe)



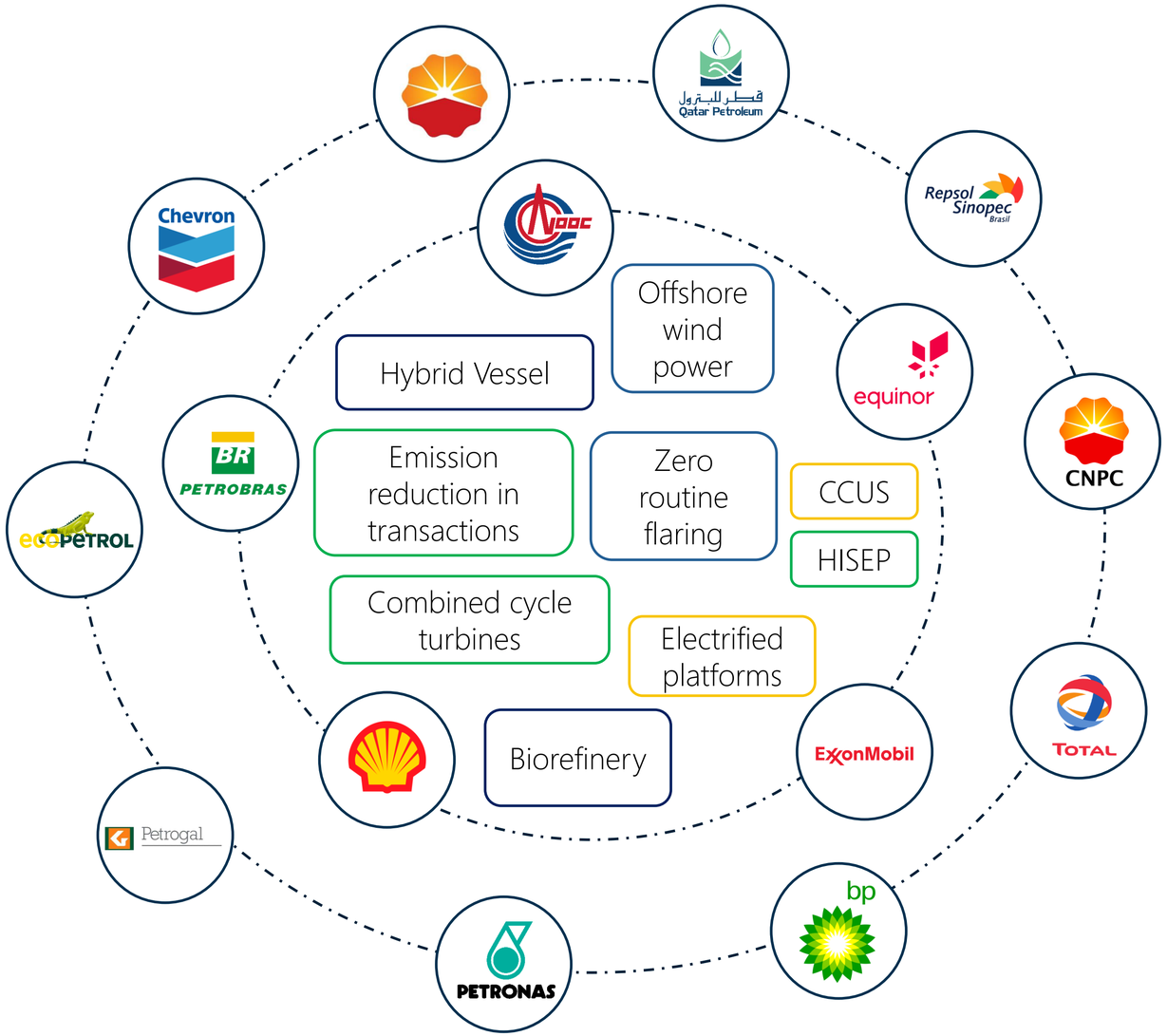
Santos Basin

Emissões de GEE (%MMt CO2eq)



Bacia	Ano	Ambiente Instalação	Emissões de escopo 1 (tCO2eq)	Emissões de escopo 2 (tCO2eq)	Emissões de CO2 (t)	Emissões de CH4 (t)	Consumo de combustível líquido (m^3)	Eletricidade gerada (Twh)	Instalações de Produção
Santos	2022	Marítimo	9.912.066,51	14,05	9.507.012,32	21.161,41	103.928,98	8,36	27
Potiguar	2022	Marítimo	8.739,63	0,00	8.588,42	6,04	3.285,60	0,00	17
Espírito Santo	2022	Marítimo	118.846,08	0,00	109.397,96	377,95	7.130,64	0,00	3
Campos	2022	Marítimo	6.510.321,61	84.138,01	6.148.293,97	14.914,41	347.751,47	7,03	59
Camamu	2022	Marítimo	75.380,99	65,10	55.116,88	808,82	82,41	0,00	1

Decarbonization practices in the pre-salt

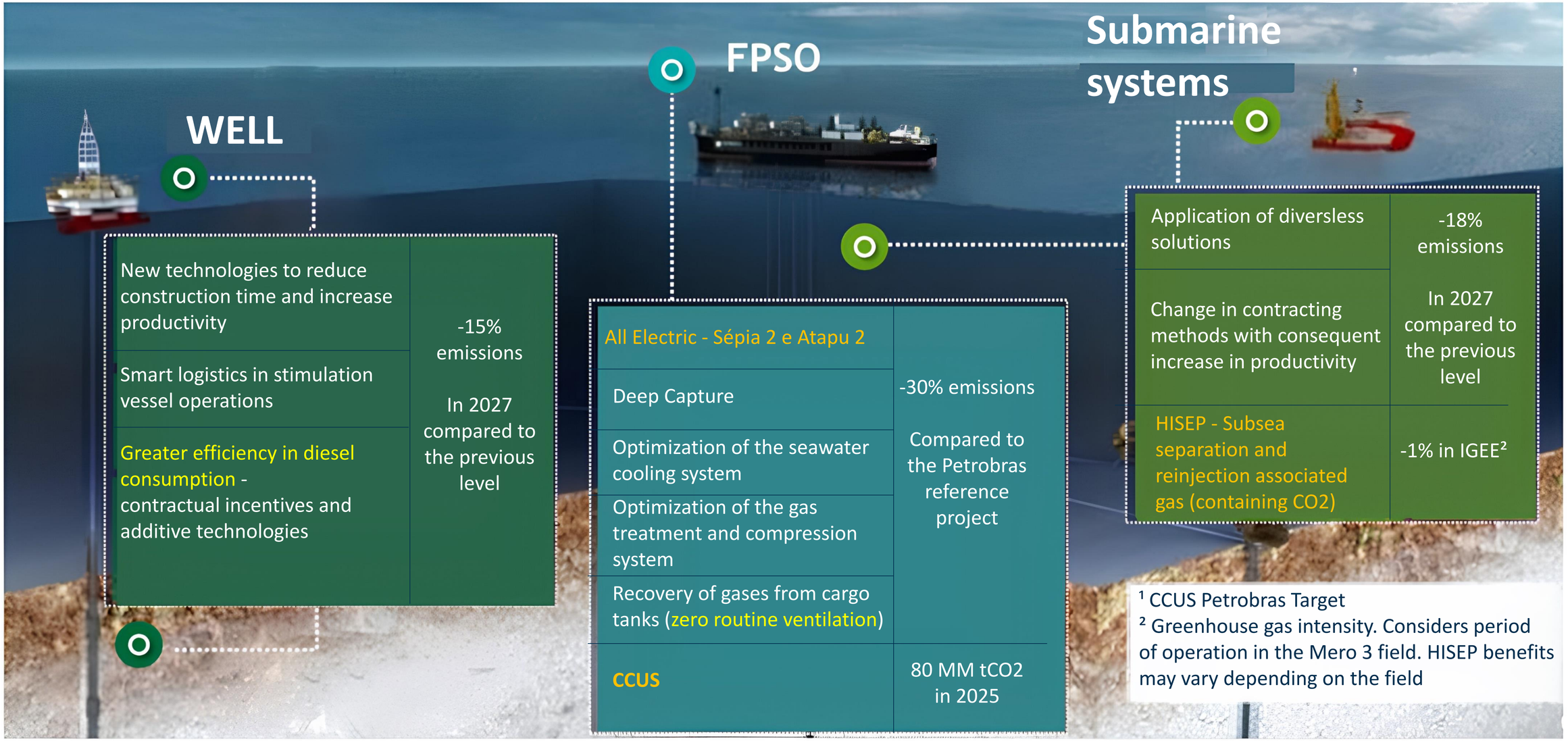


Operators already allocate a large part of their investments to decarbonization

Common goals:

- Reduce emissions by 50% by 2030
- Reach NET ZERO by 2050

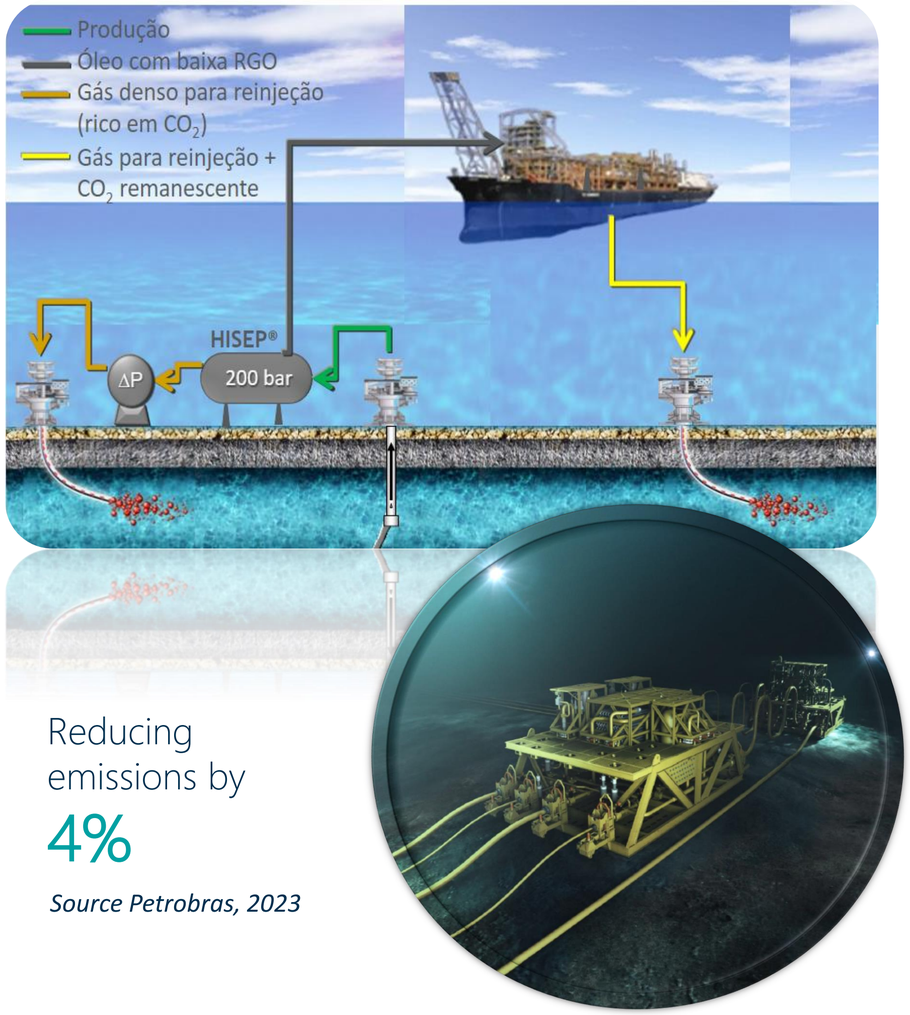
Initiatives and Technologies to reduce emissions at Petrobras



Source: PE 23-27 da Petrobras

Technological highlights: HISEP®(PETROBRAS)

High pressure CO2 separation technology



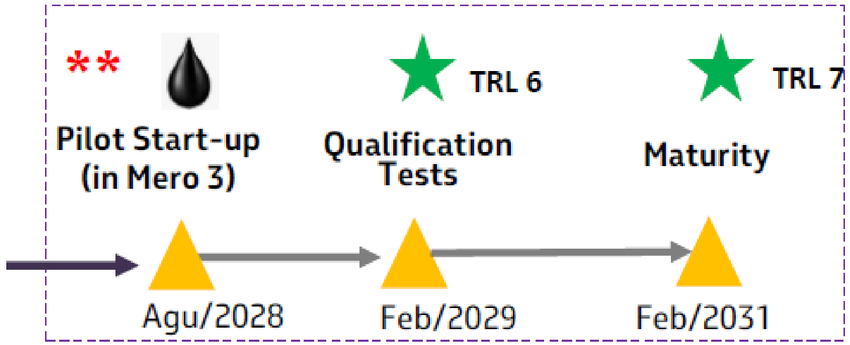
Reducing emissions by

4%

Source Petrobras, 2023

The high pressure CO2 separation technology (HISEP) is a solution that allows the gas leaving the reservoir to be separated and reinjected from a system located on the seabed.

This technology debottleneck the topside gas processing plants, resulting in oil production acceleration and recovery factor increase in fields with high GOR and high CO2 concentration, in addition to allowing for lower greenhouse gas emissions for each barrel of oil produced.



Technological highlights : Combined Cycle Turbine and Hybrid Vessel

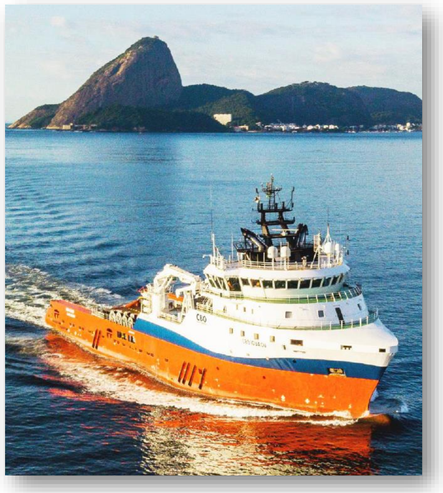
The Bacalhau FPSO will be the first in Brazil to use a combined cycle to increase energy efficiency and reduce CO2 emissions

Source: EQUINOR SPE SSU Workshop, 2023

The Bacalhau FPSO will be the **self-powered FPSO** with the lowest GHG emissions in the world.

The use of this technology increases energy efficiency and reduces **110 thousand tons of CO2** per year (-25%).

Less than **9kgCO_2/boe** throughout life.



Source: EQUINOR, 2023

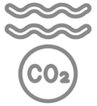
Hybrid Vessel @Equinor: average reduction in diesel consumption between **12%** and **17%.**

Technological highlights: CCUS

Large-scale CCUS is a fundamental condition for NET Zero

Some pre-salt fields have a high CO2 content. To allow the production, the development plan included CO2 reinjection. This solution combines CCUS with advanced oil recovery (CCUS-EOR). Injecting the gas into the reservoir increases production efficiency and reduces the effective GHG emissions, based on emissions per barrel produced.

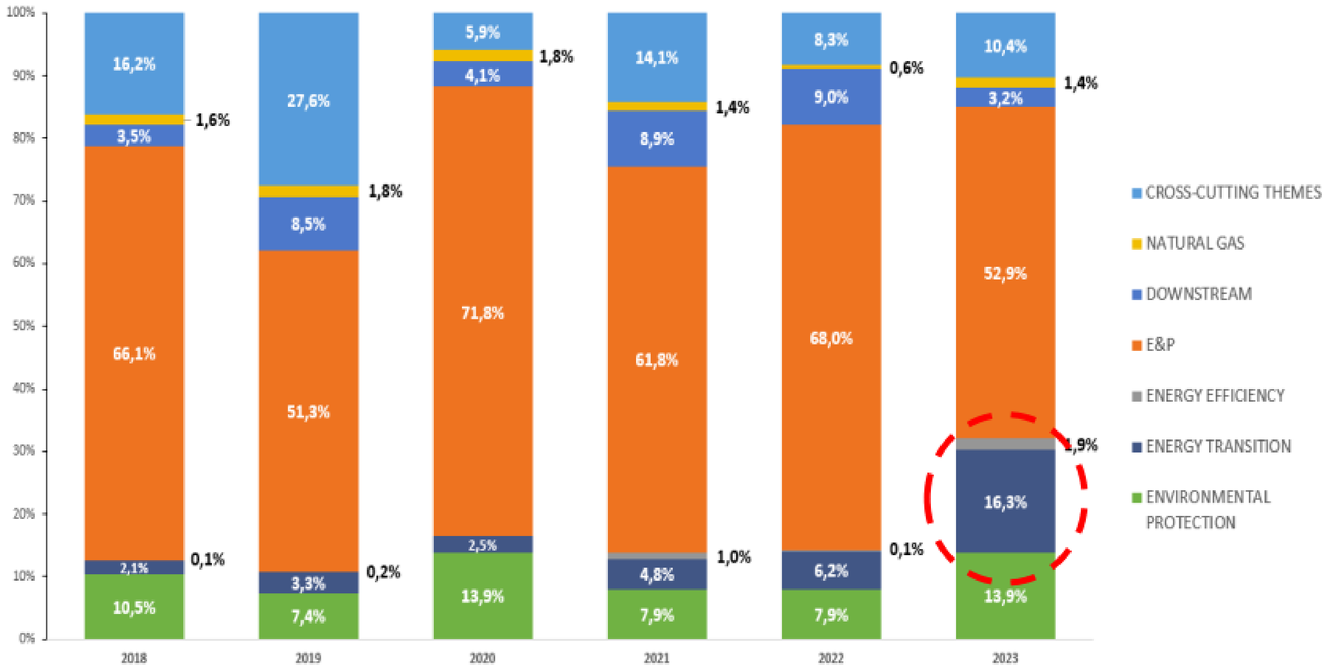
Today, Petrobras is responsible for the largest CCUS project in the world in the pre-salt region. 23 platforms are equipped with CCUS.



More than 40 million tons of CO2 were reinjected into reservoirs until 2023. The goal is to reach 80 million tons by 2025. Meanwhile, learning from this solution will be crucial to develop CCS projects.

R&D investments in renewables and decarbonization themes

In the last 25 years, investments in R&D reached R$26.25 billion, which R$ 4,4 bi were in pre-salt and R$ 1,8 bi in PSA.
In 2021, CNPE published a resolution (nº 2/2021) guiding the ANP to prioritize the allocation of R&D resources to themes linked to the energy transition.



Source: ANP, 2023

R&D Trends:

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

ANP Regulation n° 918/2023 reinforced the strategic planning

Highlights

Oil and gas will be important to enable the energy transition.

The next decade will be influenced by pressure to tax carbon emissions and encourage investments in clean energy.

The carbon footprint will directly affect the oil price.

Credit pricing for companies is already being done based on ESG criteria and the NET ZERO journey.

For decarbonization, investments in technology and regulation is crucial. Operators will require efforts to increase operational efficiency, reduce routine flaring/fugitive emissions, electrification, integration with renewable projects etc.

FINAL REMARKS

PSAs Overall Results

PSAs in Brazil proved to be:

- **viable** to capture the huge opportunities in the Brazilian Pre-salt Polygon, with major energy companies signing PSA contracts;
- **a driving force** to create value for the Brazilian society.

PSAs will be one of the largest contribution for **increasing the Brazilian production** over the medium term.

What’s next?

- **New PSAs contracts** and new unitization agreements
- “*Potencializa E&P*” – MME Program discussing **measures to increase attractiveness** in the pre-salt polygon – Also, **efforts to convert existing exploration areas into production fields**.
- “*Gas para Empregar*” – MME Program discussing **drivers to PPSA acts in the gas market**
- PPSA studying **NG opportunities** inside the polygon, beyond **pre-salt and post-salt opportunities**
- PPSA intends to be a relevant actor in the pre-salt polygon, **promoting best practices and technologies** with consortia.
- PPSA will be proactive when it comes to **reduce GEE emissions inside the pre-salt polygon** (decarbonization discussions will be approached in the long term Strategic Planning 2024 – 2028)


Nov, 22nd
Bacia de Campos
Bacia de Santos
Fórum Técnico
Pré-Sal Petróleo
10 anos de história
Reserve a data
22/11, das 8h30 às 13h
Pré-sal Petróleo
10 anos

JOIN US!

Thank You!

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