Production Sharing Contracts: challenges and opportunities in the Brazilian pre-salt

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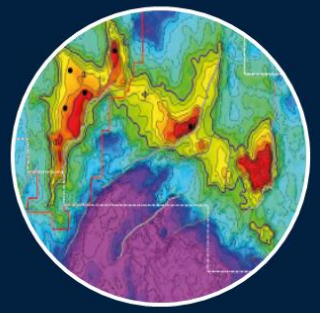
PPSA Roles & Responsibilities



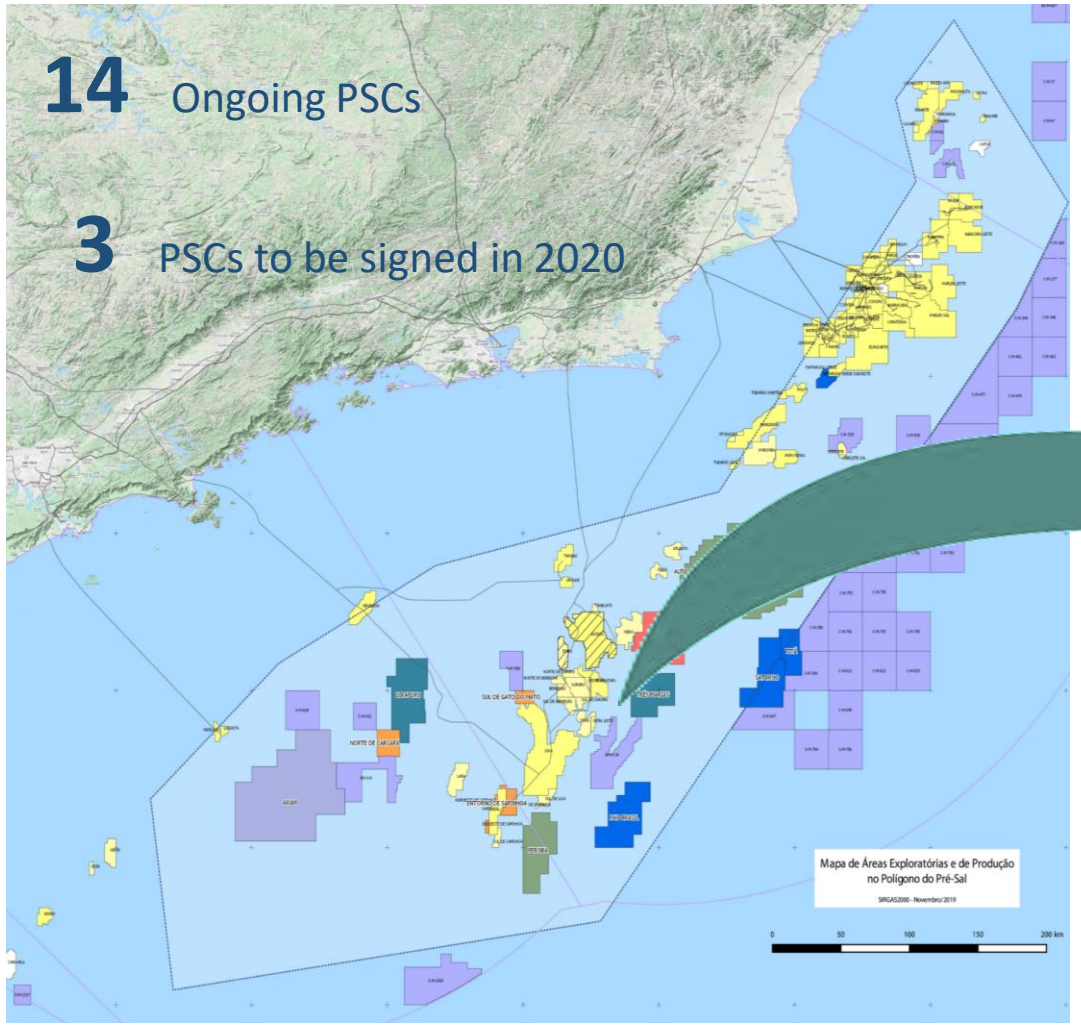
Production Sharing Agreement (PSA) management

Unitization on behalf of the Government

Commercialization of Oil & Gas Government share

Maximizing economic results from our activities

17 Production Sharing Contracts (PSC)



Case Study:
PPSA Forecasts

Pré-sal
Petróleo

Main assumptions

First oil & production curves - Development Plans

Exploratory Projects: First oil - 8 years after contract signature.

CAPEX from existing DP's.
Exploratory Projects: costs estimated and investments divided evenly in 4 years.

FPSO's - 50.000 to 220.000 bpd

Discount rate: 10% per year
Exchange rate: R$ 4 / USD

1 producing well per 20.000 bpd of FPSO capacity.
1 injector well per oil producer.
1 exploratory well per project.

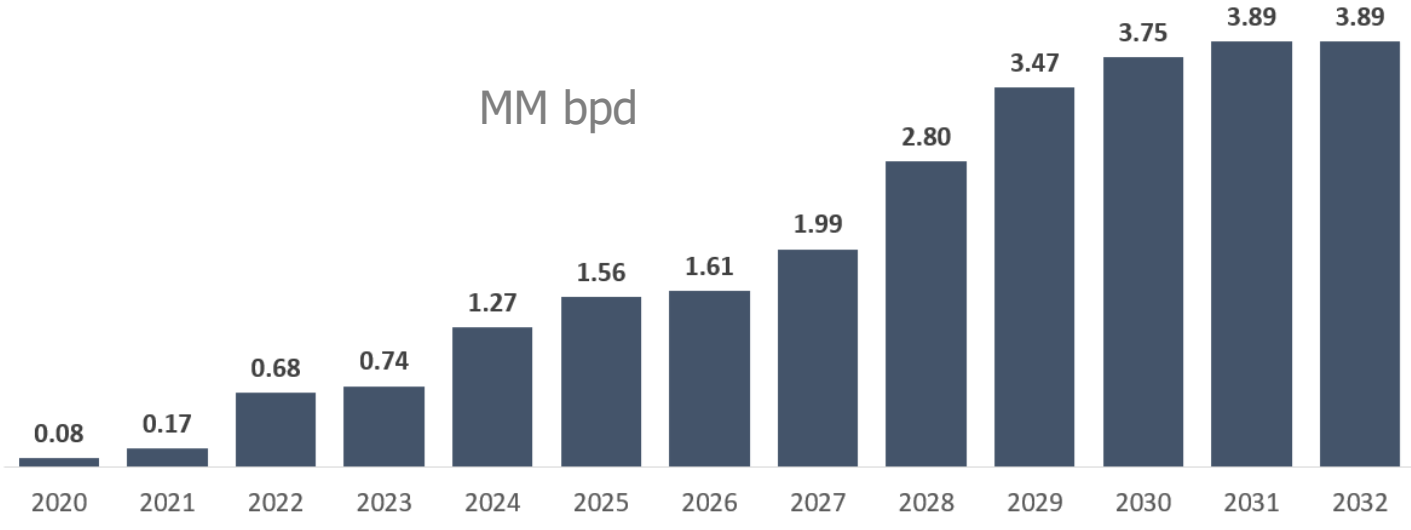
Oil price: USD 60 / bbl
Gas price: USD 5 / MMBtu

GULF QUEST

GLOBAL OFFSHORE BRAZIL SUMMIT

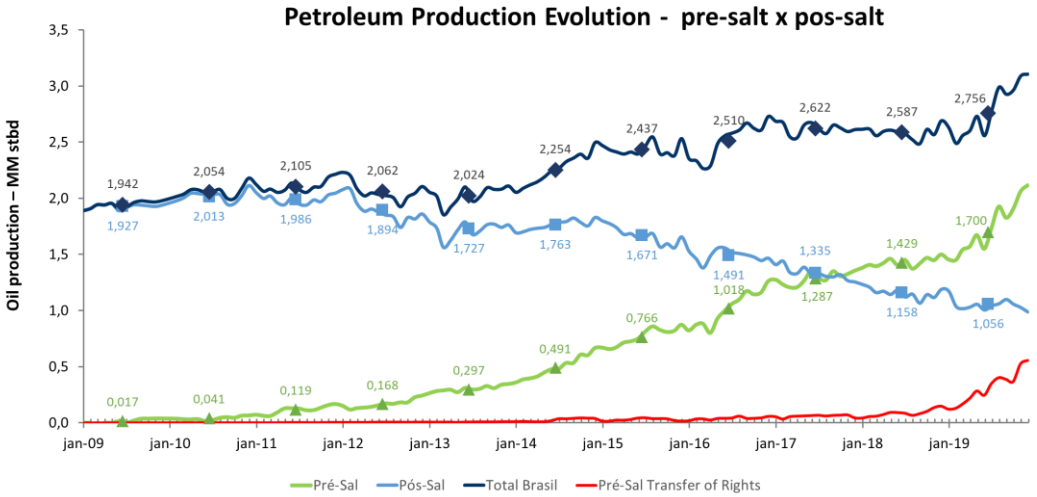
Daily oil production estimated from the 17 PSCs

3.9 MM bpd in 2032



Brazilian oil production:

3.1 MM bpd in Dec. '19



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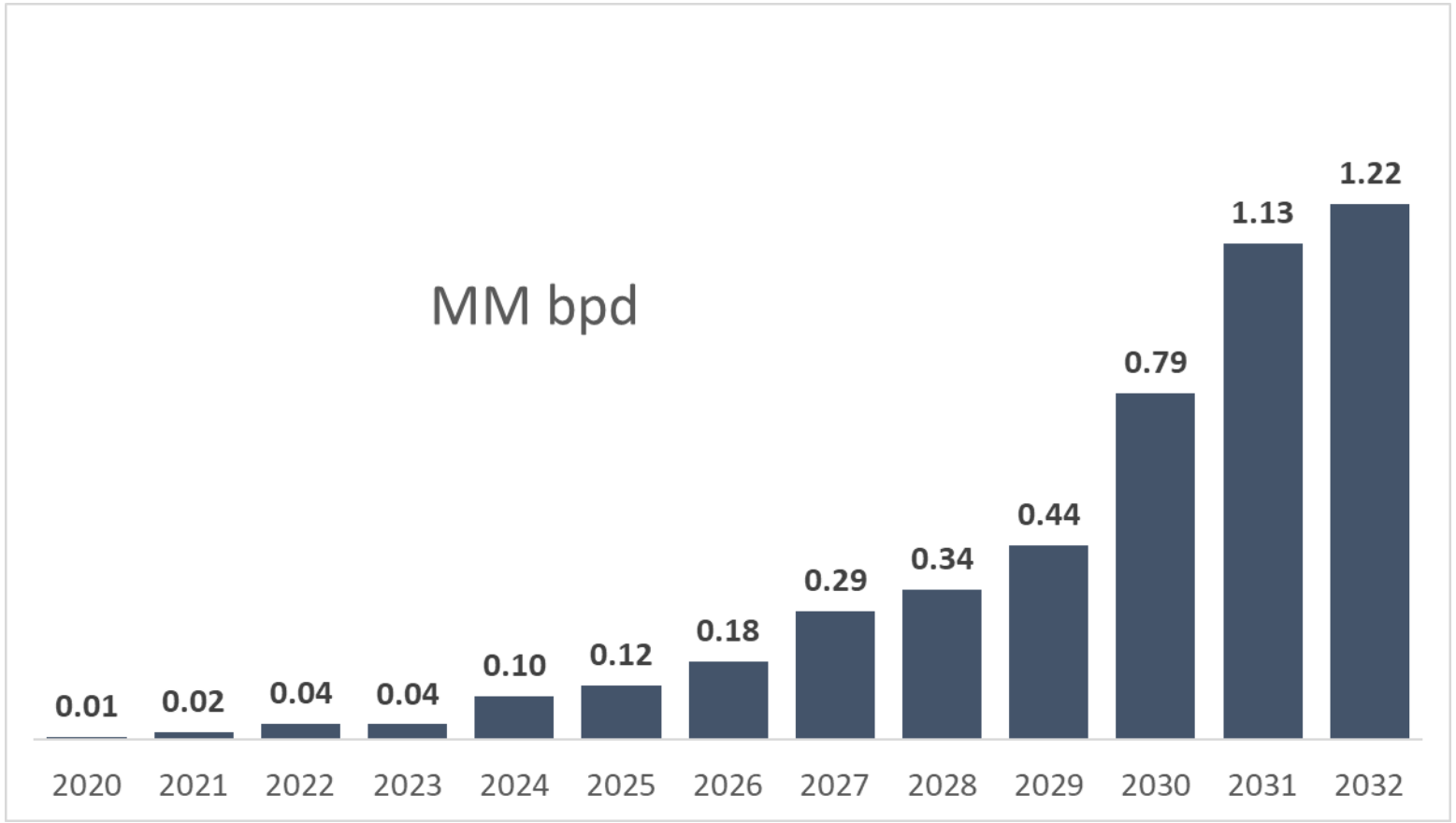
Forecasted government share

1.22 MM bpd in 2032



> Government Profit Oil

Variable in each Project

Minimum share:
Sudoeste de Tartaruga Verde: 10.01%

Maximum share:
Entorno de Sapinhoá: 80%

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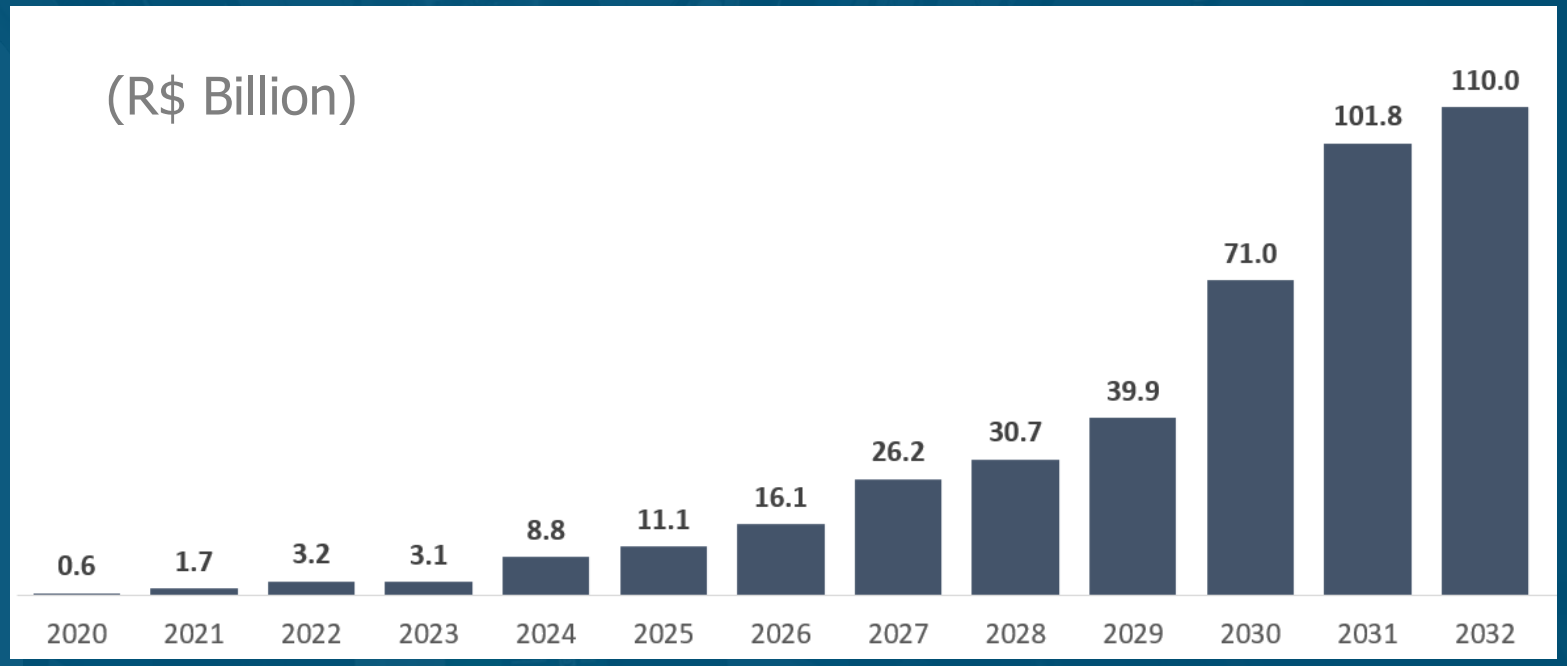
Profit Oil Revenue

R$ 424 Billion from 2020 to 2032



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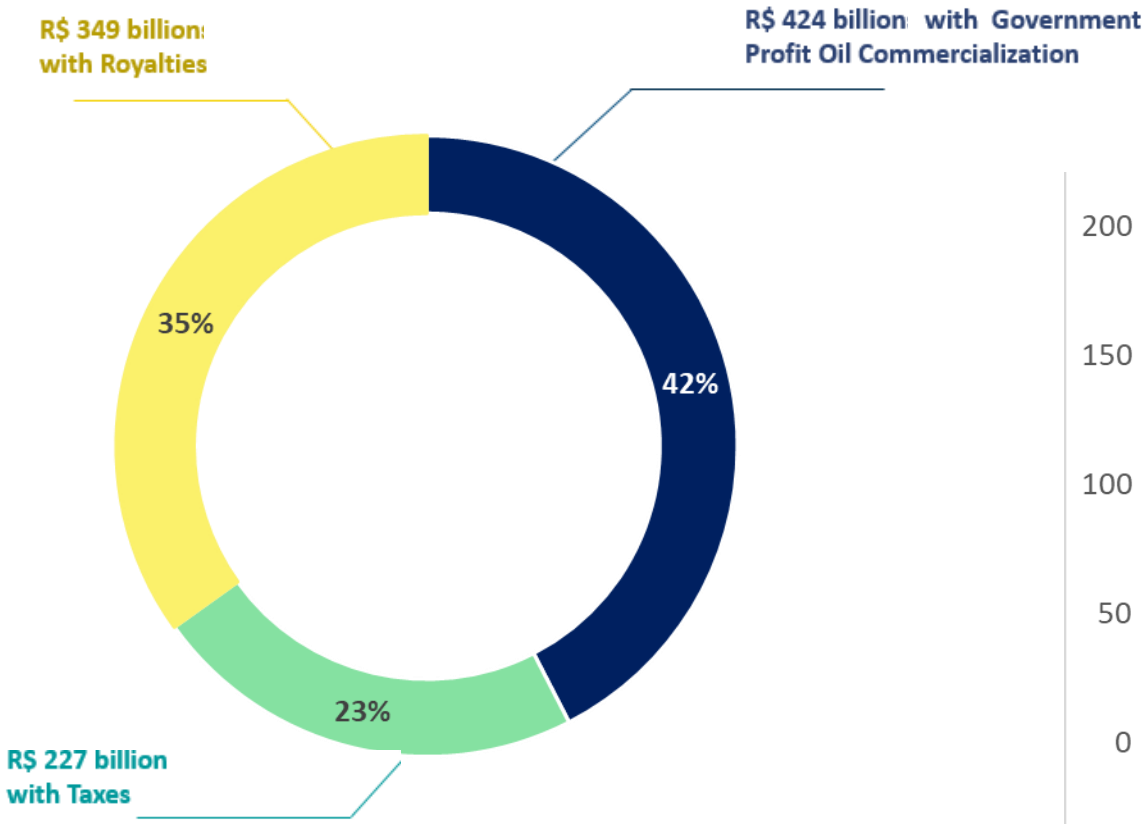
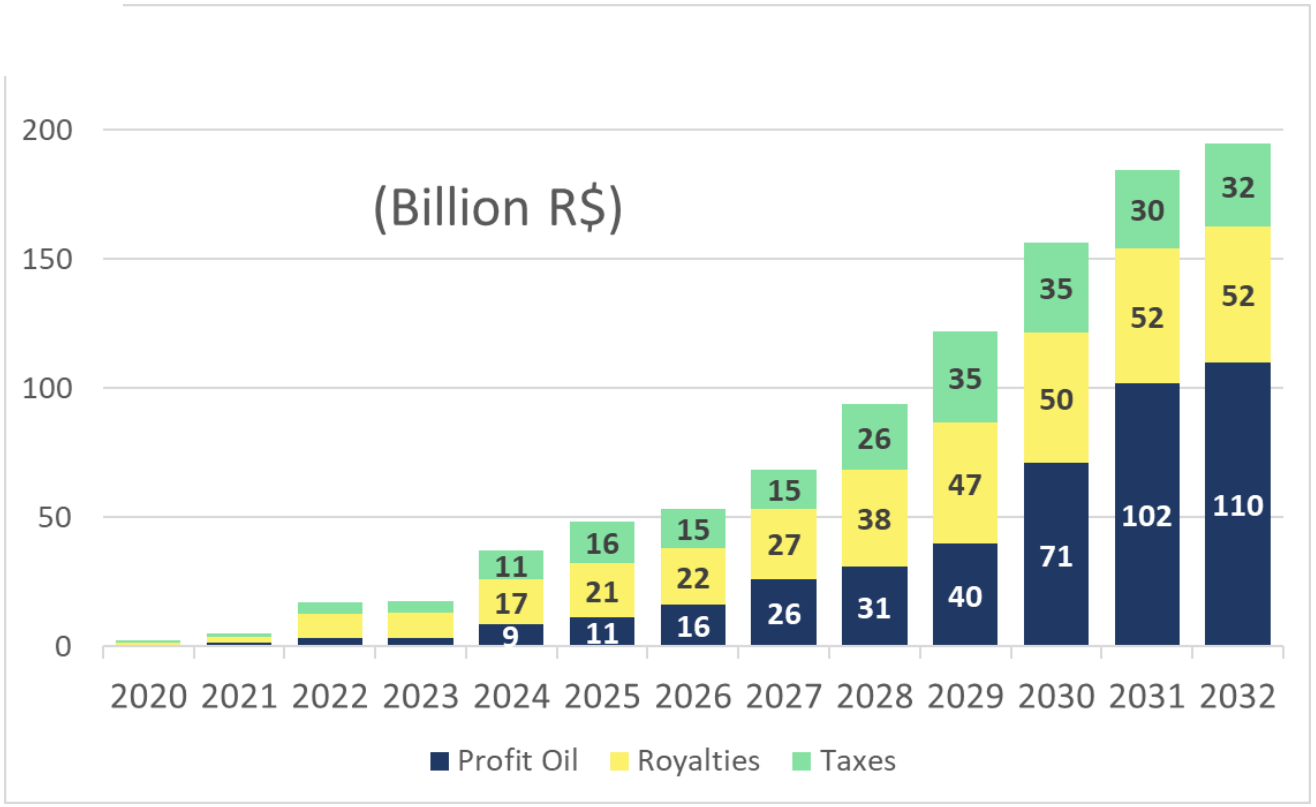
Government Take (2020-2032)

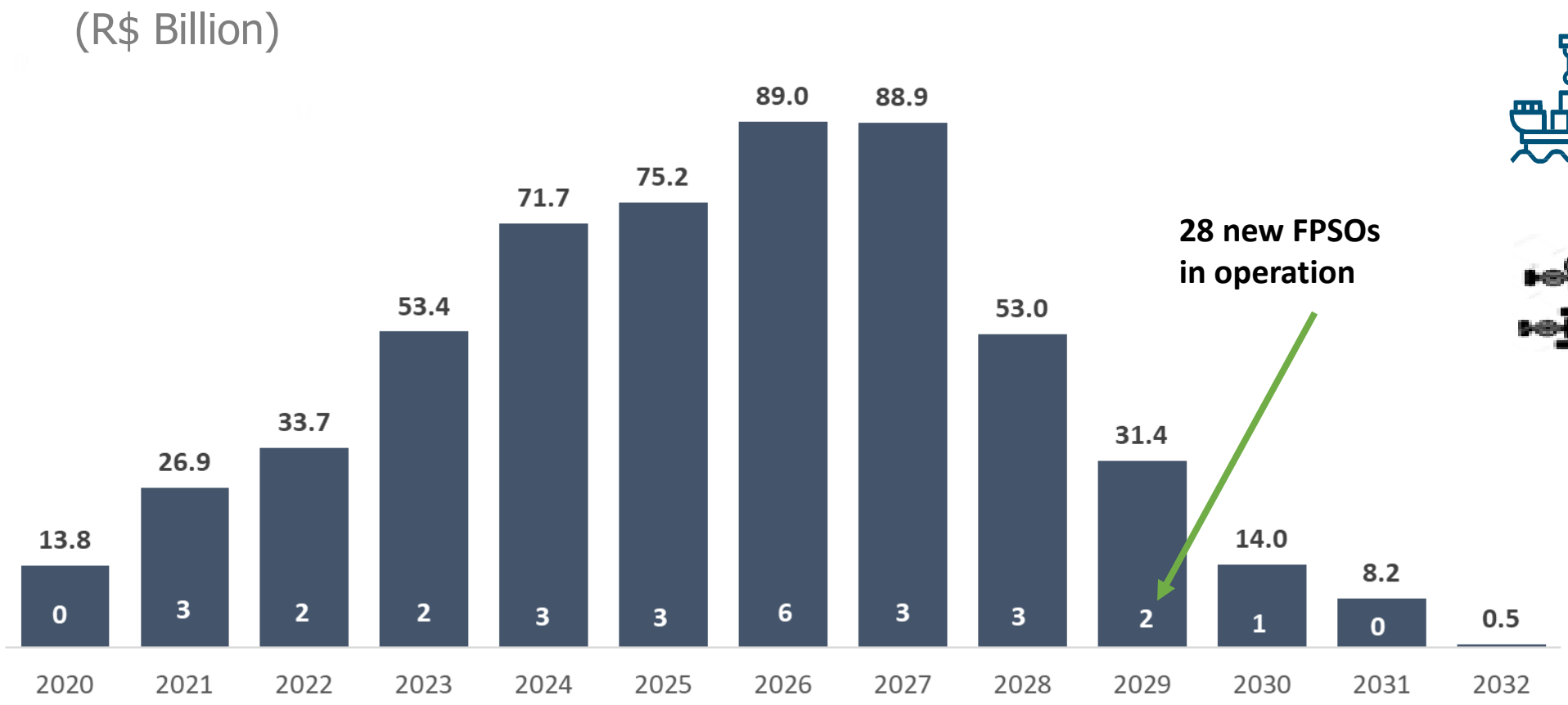


R$ 1 trillion up to 2032



Forecasted CAPEX

R$ 560 billion from 2020 to 2032



474 Wells

28 FPSOs

474 Wet Christmas Trees

2500 km
Subsea lines

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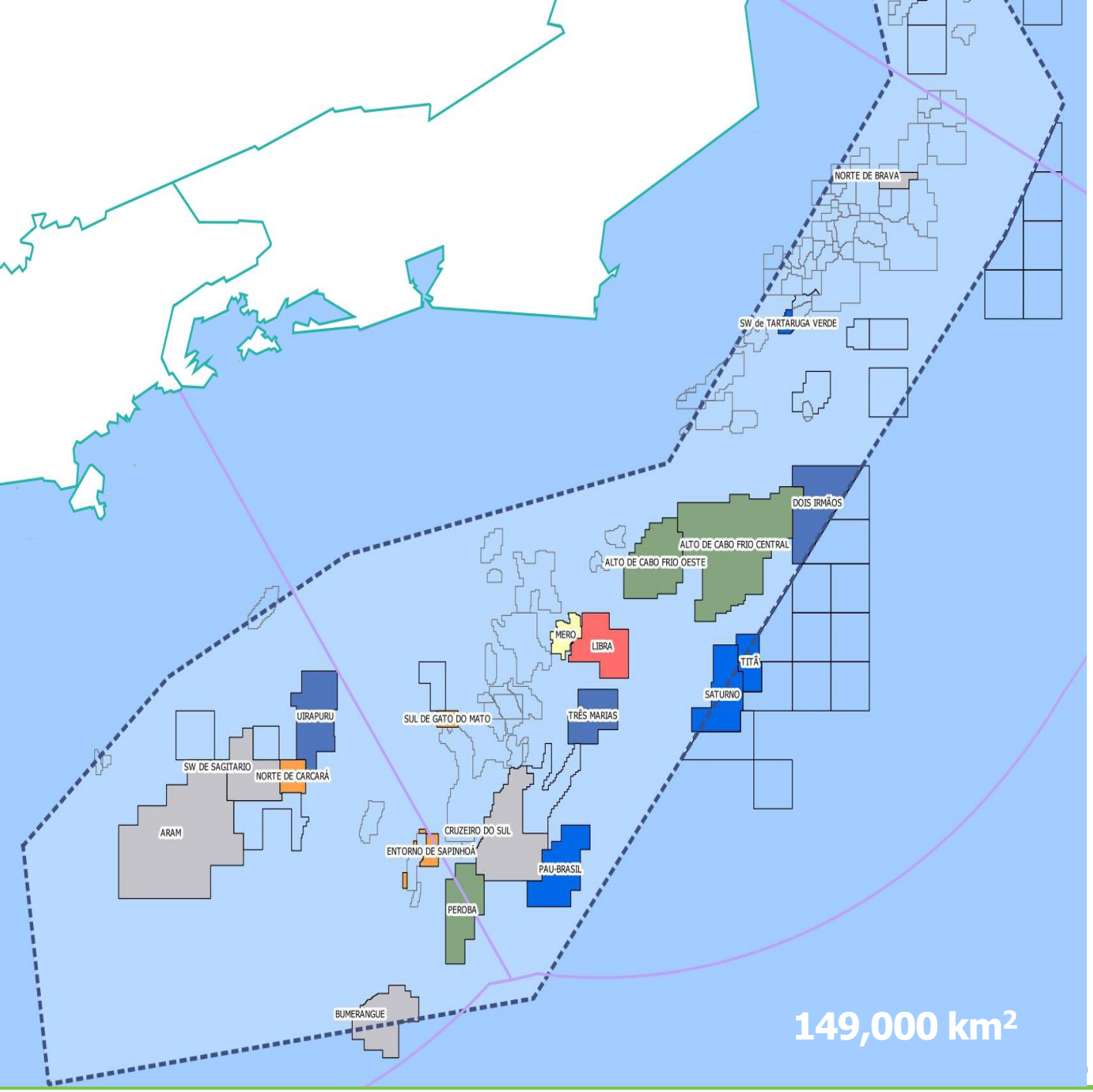

Pre-Salt Polygon Challenges

- Harsh meteocean conditions
  - Offloading difficulties
- Large oil production rates and high GOR
  - High capacity FPSOs
  - High loads in the FPSO due to heavy risers
  - Gas export feasibility
- High CO_2 content
- High pressure reservoirs
- Ultradeep water

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NEW TECHNOLOGIES BEING DEVELOPED FOR THE BRAZILIAN PRE-SALT

R, D & I Levy: 1% Gross Revenue

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Libra Acid Gas Processing

HISEP™

Dense Phase CO_2 Separation - **HISEP™**: gravitational bulk CO_2 separation

PILOT PLANT

HISEP Development together with the partners:

AkerSolutions

FMC Technologies

OneSubsea
A Cameron & Schlumberger Company

SAIPEM

Description

Subsea dense gas separation and boosting

Subsea bulk gas removal for topside gas plant debottlenecking to extend oil production plateau

Risks and Challenges

Hydrate mitigation in start and shutdowns

Dense gas phase pump performance

High pressure separation at sea bottom

Operational philosophy (process control)

Potential/Captured Benefits

FPSO processed GOR reduced from 420 to ~150 m3/m3

FPSO: Reduction of weight, footprint and power requirement

Oil production increase

Source: Petrobras

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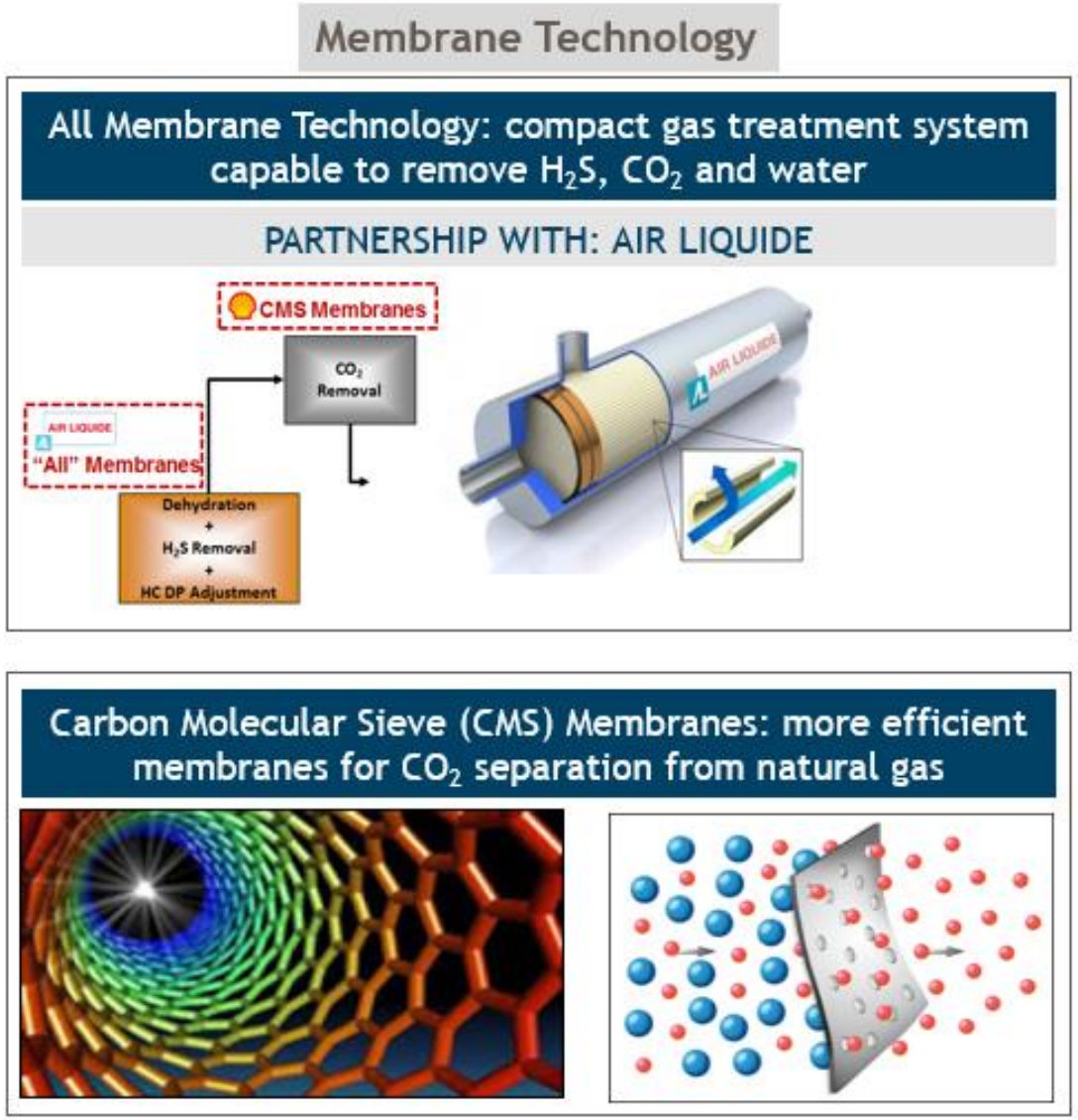
Acid Gas Processing



Description

New membrane technology for CO_2 separation

Carbon sieves with slit-like microporous lead to higher CO_2 selectivity and permeability

Risks and Challenges

Difficulty to handle for scale-up

Brittleness

Ongoing pilot test at a Petrobras site in Sergipe

Potential/Captured Benefits

FPSO: Reduction of weight, footprint and power requirement

Reduce HC losses

Capable to remove H_2S, CO_2 and water

GULF QUEST

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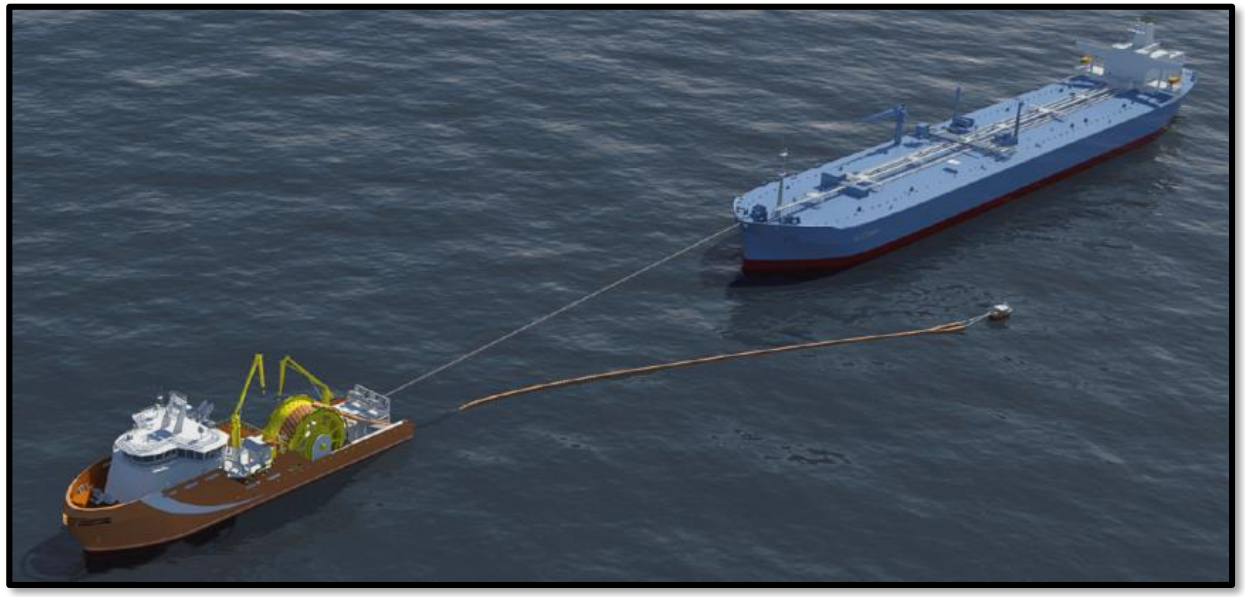
CTV – Cargo Transfer Vessel



Description

Evaluate the Cargo Transfer Vessel (CTV) as an alternative to the DPST's (Dynamic Position Shuttle Tankers) - Libra base case for offloading today - in the Santos Basin environment

Risks and Challenges

Maneuverability in congested area including emergency situations

Keep at least the same safety level as DPST's

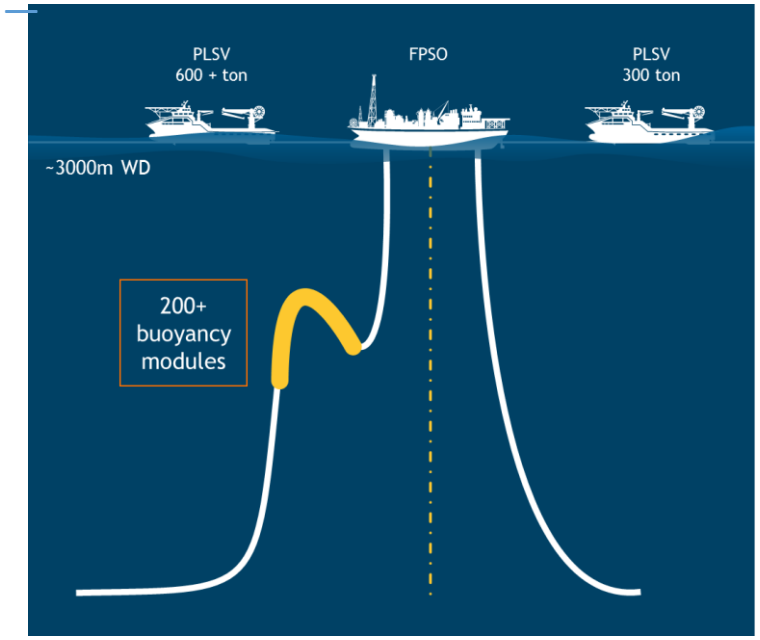
Potential/Captured Benefits

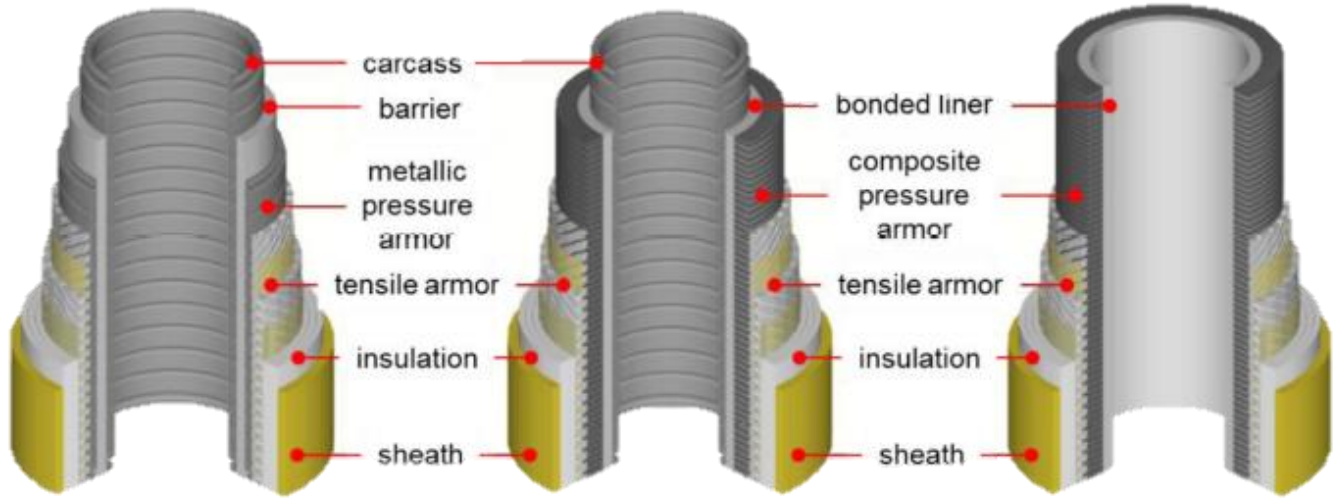
Optimization in offloading will lead to cost reduction

Source: Petrobras

Free Hanging Catenary – Next Generation of Flexible Pipes

Hybrid Composite Flexible Pipes





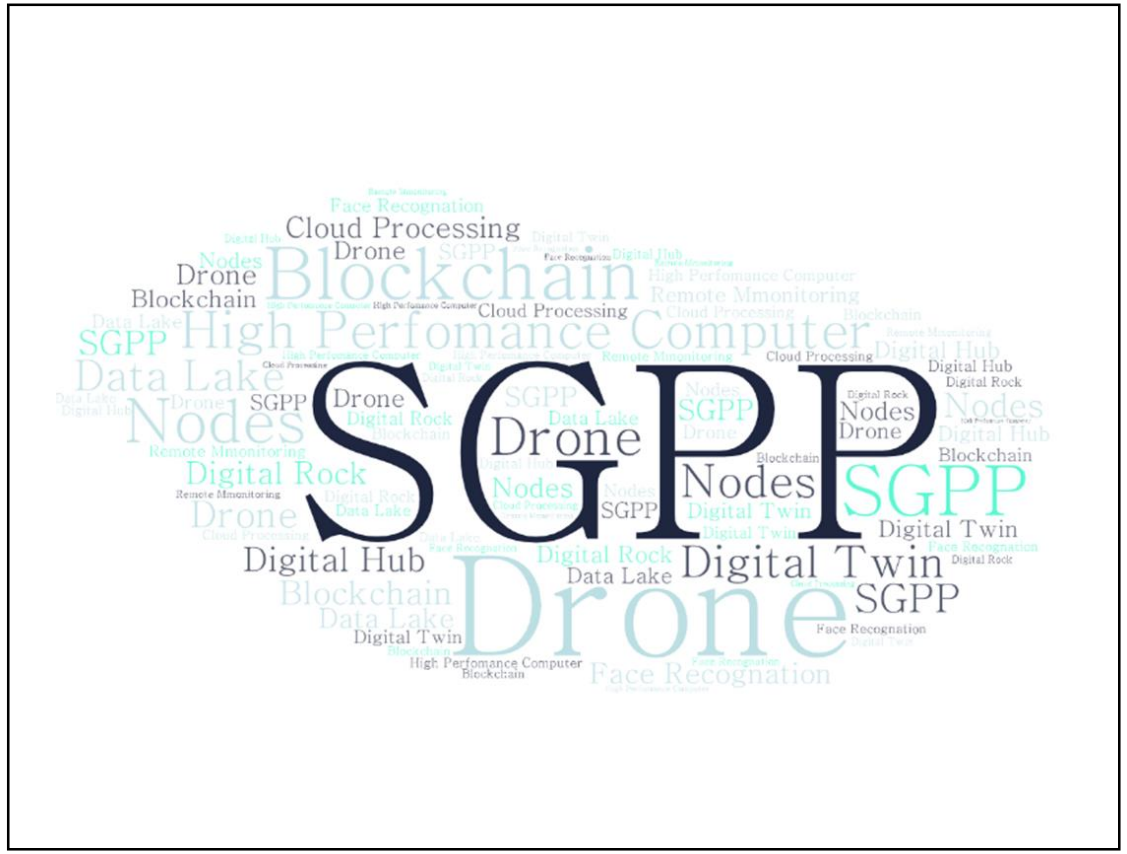
CONVENTIONAL FLEXIBLE PIPE

COMPOSITE PRESSURE ARMOUR HYBRID FLEXIBLE PIPE

- Less installation time (up to 40%-50%)
- Less HSE exposure
- Reduces overall riser installation CAPEX by 20% to 30%

Source: Petrobras

Digital Transformation



Description

Customized system to support our activities: PSC management, HC commercialization and Unitized reservoirs production control

Risks and Challenges and

Process mapping of the company

Input of individual contract data into the system

Potential/Captured Benefits

Online monitoring of contracts

Improvement of traceability, transparency and performance

Simulation of the State oil and gas cargo schedule

Next step: Analytics and artificial intelligence

Source: Petrobras

Final Remarks

Industry

- Oil production: 3.9 MM bpd in 2032.
- R$ 560 billion CAPEX in the next 12 years
- 28 new FPSOs

Technology

- High loads in the FPSOs ➔ Employment of new materials (composite)
- High GOR and CO_2 content ➔ Subsea separation (HiSep), molecular sieves, new membranes
- Offloading optimization ➔ CTV
- More efficient PPSA ➔ Digital revolution - SGPP

Thank You

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