

ENERGY. COMMITTED.



# Disclaimer

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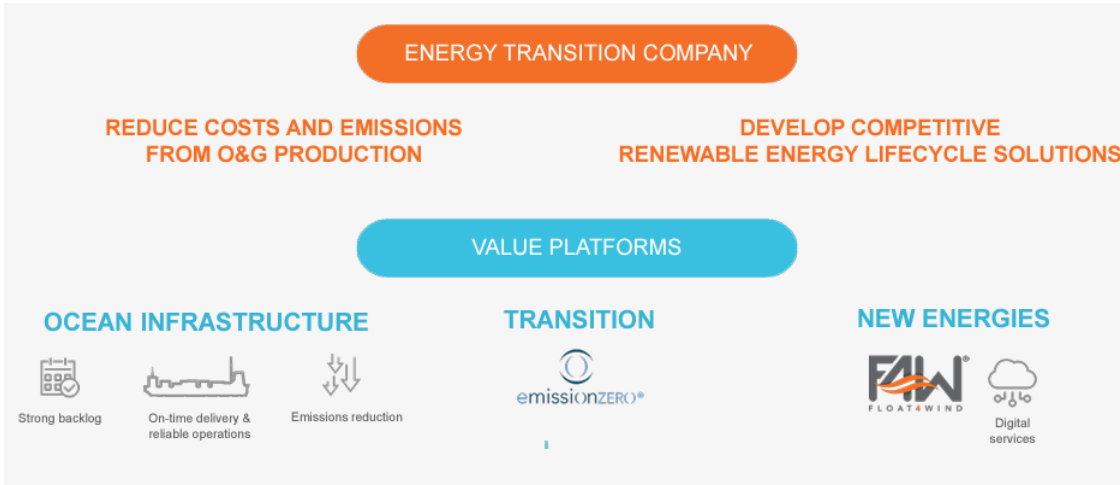
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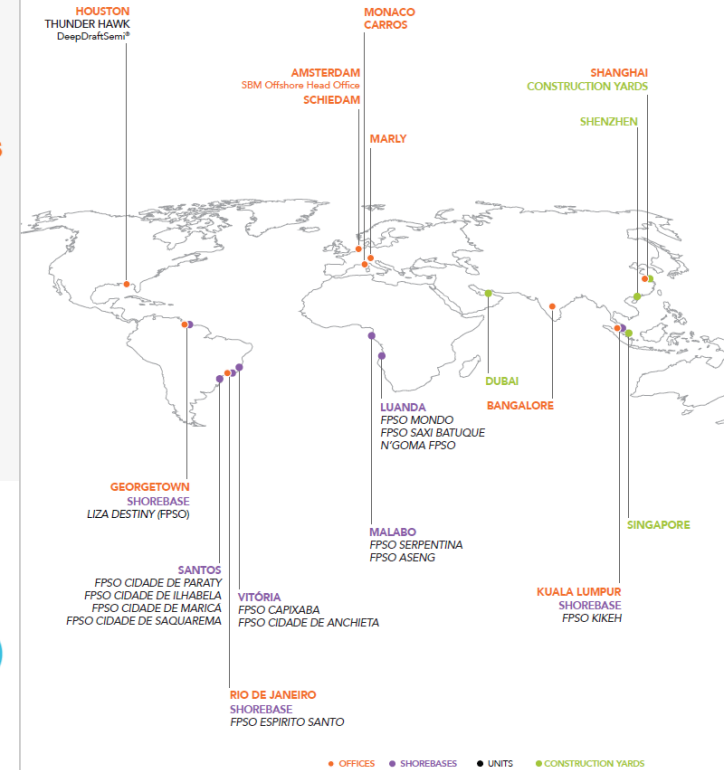
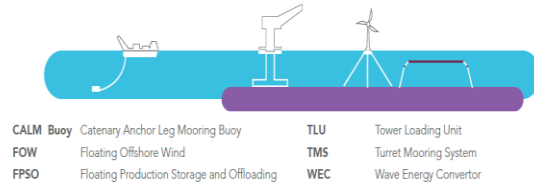
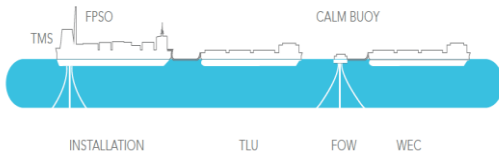
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# Delivering Safe, Sustainable and Affordable Energy



## SBM OFFSHORE ACTIVITIES



# Process live for Acid removal Membranes 2022



**Edson Teixeira Júnior**  
Gas Processing Process Engineer



**Jean-Damien ROLLIER**  
Digital Factory Manager





## Advanced Technology

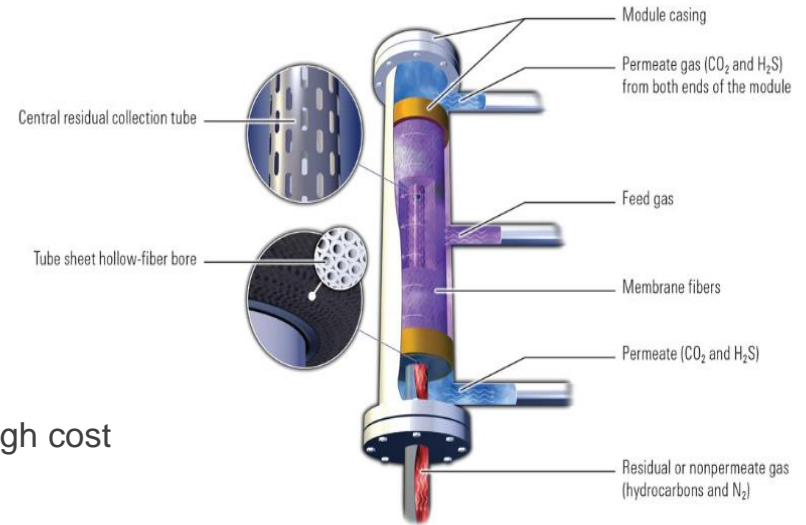
- Cidade de Paraty FPSO was Pioneer on 30" Membranes.

## System Monitoring

- Numerous heterogeneous parameters
- Complex modeling

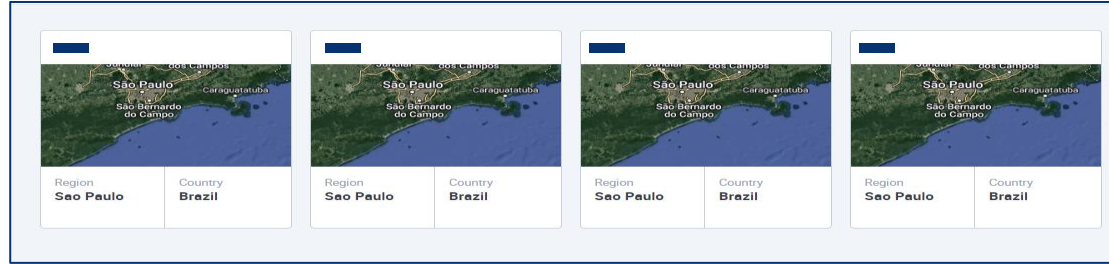
## Main challenges to be adressed:

- Is the performance as expected?
- How is the integrity status of the membranes?
- How to Predict process analysis and prediction;
- How to optimize capex considering the membranes high cost
- Replacement X Deployment Strategy;
- How aging of the field impacts on the capacity.

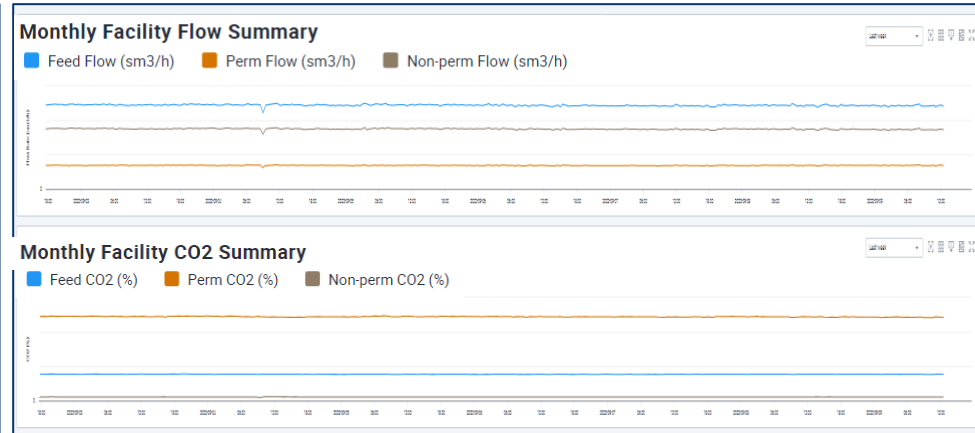
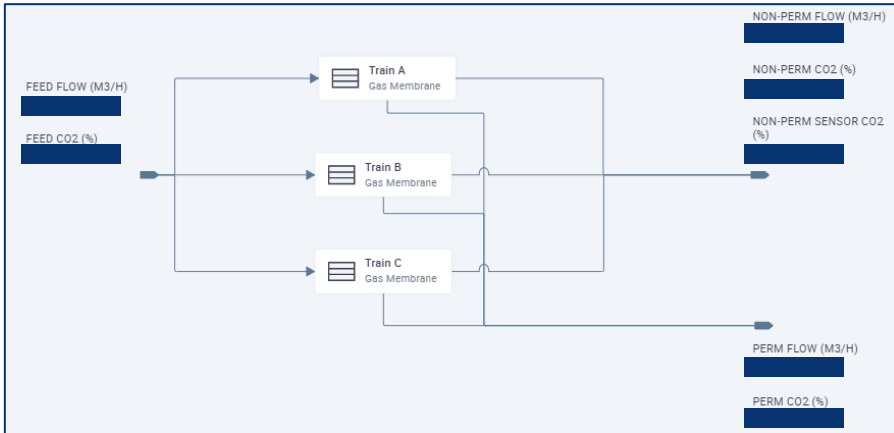


## Fleet View

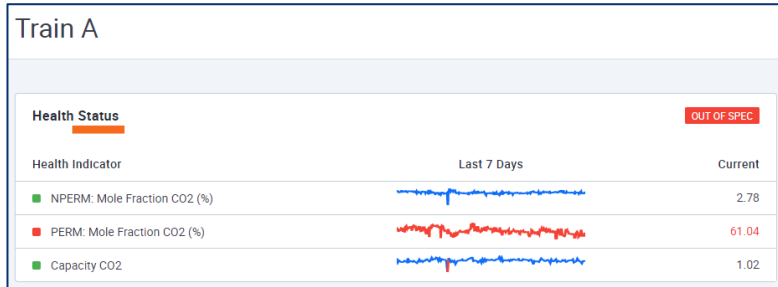
- 4 Units monitored
- Current conditions
  - 10%-20% CO<sub>2</sub>
  - Gas Flowrate 150-250 ksm<sup>3</sup>/h



## Quick & easy access to system configuration and main parameters + trends



## Health Indicators



➤ Ease troubleshooting to improve reactivity

**Health Forecast**

Health Indicator	End of Life
■ NPERM: Mole Fraction CO2	2028-09-07
■ Capacity CO2	2028-09-07

➤ Prediction of Remaining Useful Life

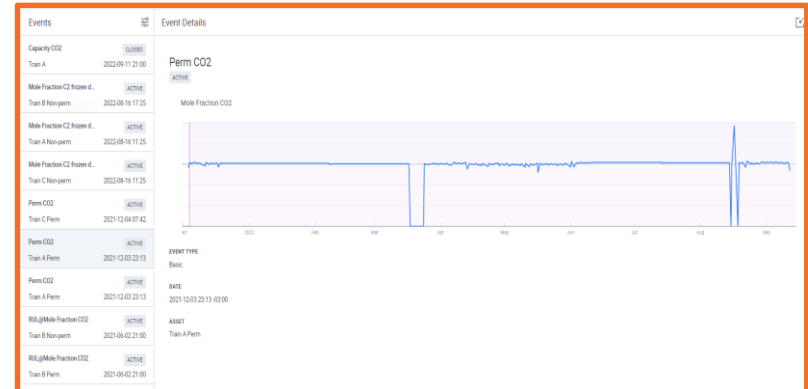
## Active and Historical Events

Overview | Monitoring | Forecast

Active Events		Closed Events	
3		1	
Event	Type	Date	
Mole Fraction C2 frozen data	Frozen	2022-08-16	
Perm CO2	Basic	2021-12-03	
Perm CO2	Basic	2021-12-03	

[See All](#)

➤ Full event detail at a glance



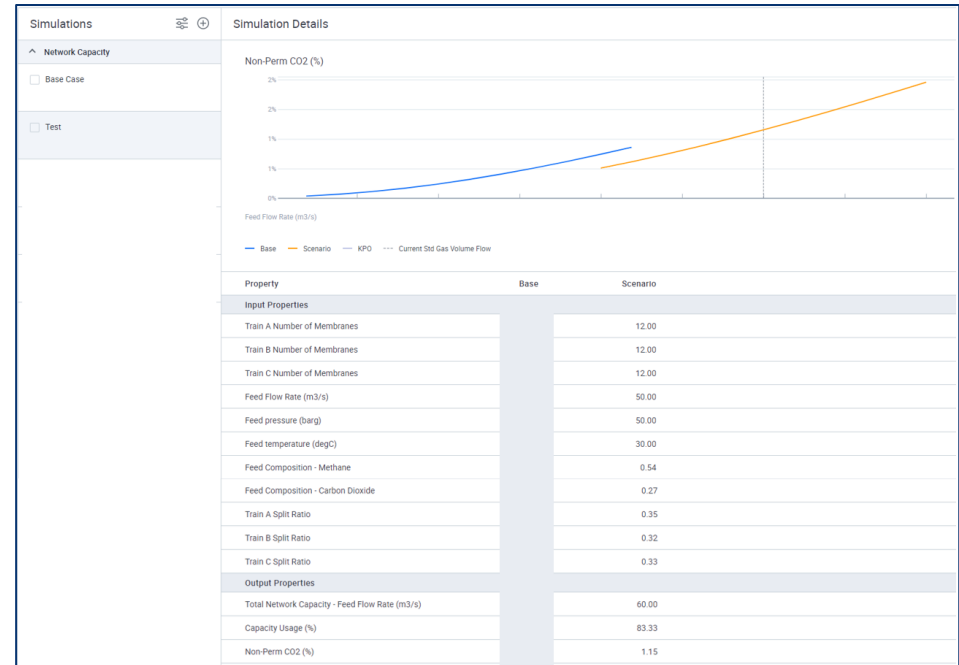
## *Extra tools Deployed on Process Live*

- Scenarios Simulation
- Monthly Reports
- Live discussions / support
- Events Notification



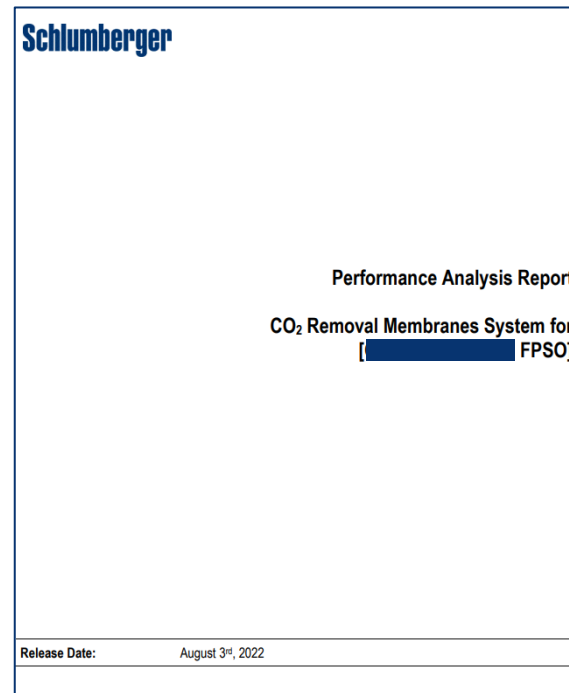
## Address Optimizations and do sense check on process variables and configuration impacts

- **Input variables:**
  - Inlet Temperature
  - Inlet Pressure
  - Feed flow rate
  - Feed composition
  - Number of membranes
  - Train Split Ratio
  
- **Simulation outputs:**
  - Total Network Capacity
  - Capacity Usage
  - Non-Permeate CO2 %



## Monthly report main sections

- **Executive Summary**
  - ✓ Distribution on Quartile on the treated Gas KPI;
  - ✓ Predicted Remaining useful life (RUL);
- **Operations Parameters**
  - ✓ Feed Pressure;
  - ✓ Permeate Pressure;
- **Acid Gas Membrane performance**
  - ✓ CO<sub>2</sub> concentration split;
  - ✓ Relative Capacity;
- **Expert Analysis and Recommendations**



- **Easy access to Schlumberger team SME**  
 (via discussion channel or through call Request).
  
- **Historical exchanges stay accessible**  
 (improving follow-up and traceability).
  
- **Accelerate SBM learning curve on operating acid gas removal membranes**  
 (through continuous exchanges).

### Discussions

<b>Edson Junior</b> CO2 Content
<b>Edson Junior</b> CO2 Content
<b>Edson Junior</b> CO2 Content
<b>Edson Junior</b> Co2 Membranes Ex...
<b>Edson Junior</b> Membrane Replac...
<b>Edson Junior</b> CO2 Unit performan...

### Add Discussion ✕

**Subject \***

**Query \***

B I U ▲ ▶ ≡ ≡ ≡

Drop here or click to attach image

Request call with Schlumberger SME

**Duration**

30 minutes
▼

Cancel
Add

Notifications alert on “abnormalities detected” and or “failed communication”.  
 Configuration ongoing on events to be reported on e-mail and at which frequency.

Notifications						
Name	Type	Status	Asset Name	Asset Type	Date	
Mole Fraction IC4 frozen data	Frozen	CLOSED	Train B Perm	Stream	2022-08-26 15:45 -03:00	<input type="checkbox"/> Only with comments
Mole Fraction IC4 frozen data	Frozen	CLOSED	Train C Perm	Stream	2022-08-26 08:45 -03:00	Closed
Mole Fraction NEC5 frozen data	Frozen	CLOSED	Train A Perm	Stream	2022-08-23 07:45 -03:00	Last week
Mole Fraction NEC5 frozen data	Frozen	CLOSED	Train C Perm	Stream	2022-08-23 07:45 -03:00	
Mole Fraction NEC5 frozen data	Frozen	CLOSED	Train A Perm	Stream	2022-08-22 18:45 -03:00	
Mole Fraction IC5 frozen data	Frozen	CLOSED	Train B Perm	Stream	2022-08-22 18:45 -03:00	
Mole Fraction IC4 frozen data	Frozen	CLOSED	Train B Perm	Stream	2022-08-22 18:45 -03:00	
Mole Fraction NC4 frozen data	Frozen	CLOSED	Train C Perm	Stream	2022-08-22 18:45 -03:00	
Mole Fraction NEC5 frozen data	Frozen	CLOSED	Train B Perm	Stream	2022-08-22 16:45 -03:00	
Mole Fraction NEC5 frozen data	Frozen	CLOSED	Train C Perm	Stream	2022-08-22 15:45 -03:00	

- Flow split and process **parameters optimization** prior new membranes deployment.

➤ **stay on-spec until next planned shutdown**

- Membrane **capacity management** over time as field ages.

➤ **Data driven Membrane deployment continiuous Strategy review**

- ☐ Capex better prediction
- ☐ Optimize Shutdown planning

- Ongoing improvement on the aging process model performance considering actual historical data.

➤ **Dynamic model performance improvement**

Year	Expected CO2% on Treated Gas				
	Number of extra Membranes				
	0	+1	+2	+3	+4
X+1	Yellow	Yellow	Green	Green	Green
X+2	Pink	Yellow	Yellow	Green	Green
X+3	Pink	Yellow	Yellow	Green	Green
X+4	Pink	Pink	Yellow	Green	Green
X+5	Pink	Pink	Yellow	Yellow	Green
X+6	Pink	Pink	Yellow	Yellow	Green
X+7	Pink	Pink	Pink	Yellow	Green
	Pink	Pink	Pink	Yellow	Green
	Pink	Pink	Pink	Yellow	Yellow

On spec with safety margin  
 On spec below safety margin  
 Out of Spec

The logo for SBM Offshore, featuring the letters 'SBM' in a bold, white, sans-serif font. The 'S' and 'B' are connected, and the 'M' is composed of two vertical bars. The background is a dark blue gradient with glowing particle trails.

**OFFSHORE**

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DIGITAL  
FACTORY