

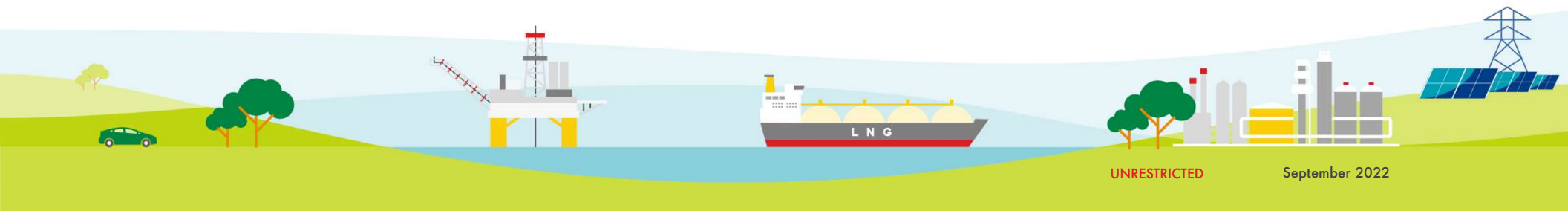


Polymers and Composites for Energy Industry An Operator's Perspective

Sept 27, 2022

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September 2022



Operators Interests in Polymers and Composites

Driven by

- Low Capex and Opex Cost
- Low weight
- Enabler for equipment design
- High reliability in operations
- Ability to operate in corrosive environments
- Ease of Manufacturing
- Carbon footprint

Application of Polymers in Deepwater

Wells

- 350F, 15Ksi Well Completions

Subsea

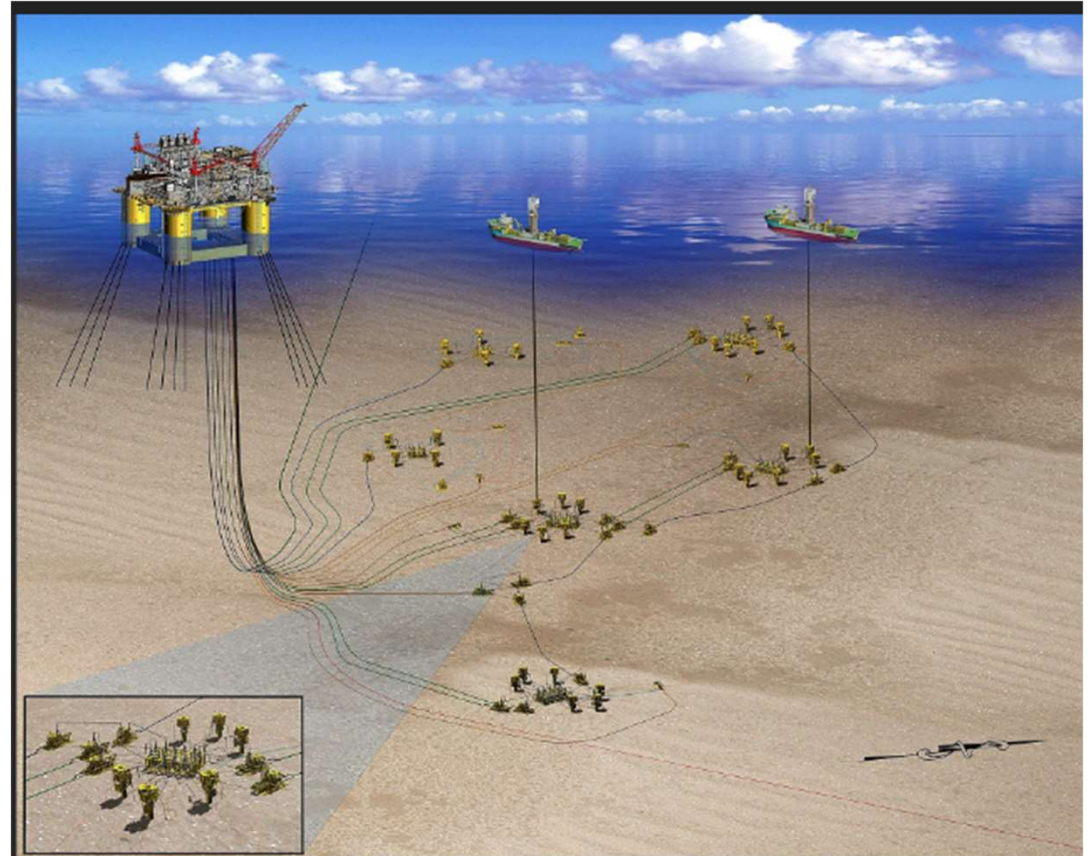
- 350K, 15K Tree and subsea equipment

Pipeline

- HT, Deepwater Insulation and Coatings

Topsides

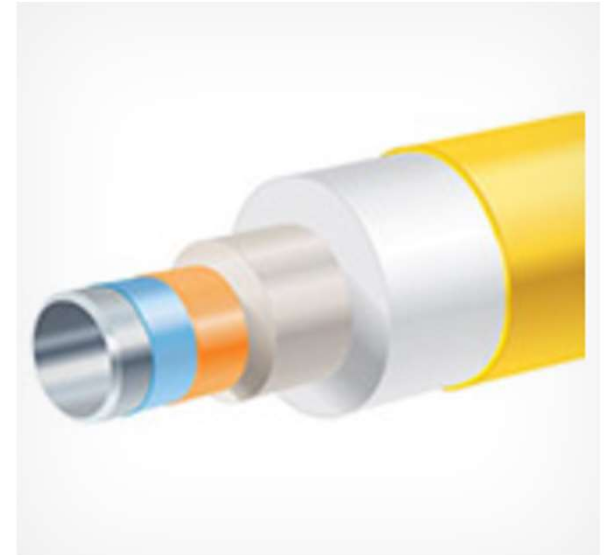
- Fabric Maintenance



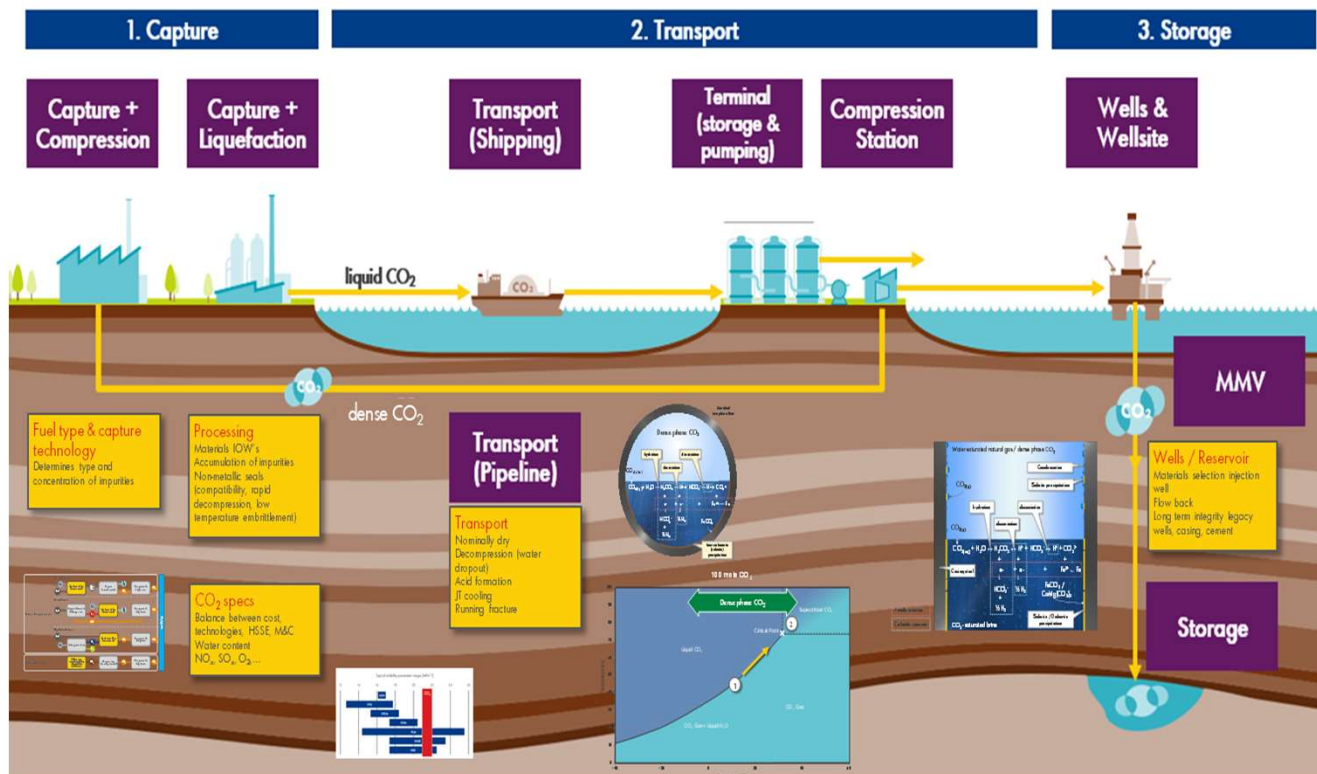
Deepwater Insulation and Coatings

Key Requirements

- Low Cost
- 25yrs Design Life
- Installation Method Compatible
- Thermal Performance
- Quality Application and Installation
- Enable low cost deployment



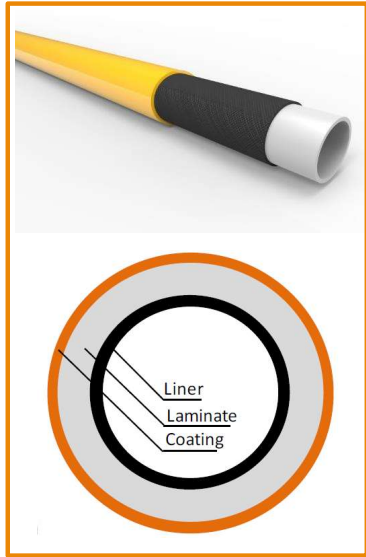
Applications by Sector- CCUS



Key Technologies of Interest

- Nonmetallic Pipes
- Nonmetallic wells components
- MMV- Monitor, Measure, Verification
- Integrity- Storage

Applications-Brazil: Flexible and Composite Pipe

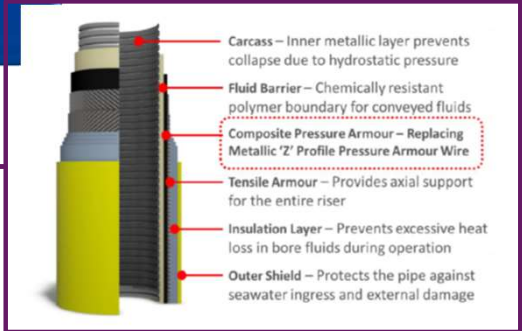
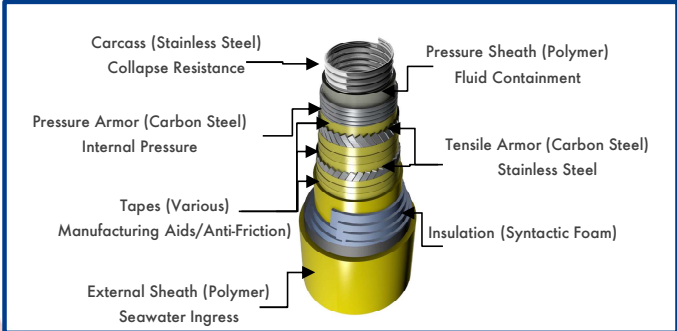


Increased Demand for H₂S and CO₂ Resistance

Thermoplastic Composite Pipe

Unbonded Flexible Pipe

Hybrid



Select Example – Energy Transition

Corrosion Protection Strategy

- Design life is minimum 25 years
- Coatings and Cathodic Protection
- Maintenance free for more than 25 years
- Non-accessibility of offshore structures
- Offshore conditions not favourable for coating maintenance



Key Challenges – Nonmetallic Opportunities- Brazil

Challenges

- CO2-SCC
- 20K HPHT Subsea
- Polymer Fluid Interactions
- Manufacturing at Scale
- Nonmetallics Inspection- tools, guidelines
- HPHT Wells 350F, 15K
- Fabric Maintenance
- Automation
- 3D Printing
- Industry Standards
- Low-Cost Subsea Insulations

Opportunities

- New Polymers Development
- HPHT Seals
- Nonmetallic Pipes
- Inspection Technologies
- Asset integrity monitoring

Brazil and Global Collaborations

- Industry Standards
- JIPs
- Brazil Universities: e.g. UFRJ, UFRGS
- Companies: Flexibles, Inspection, Modeling



Thank You

