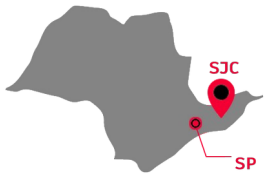
# Building Strategic Composite Technologies for the Energy Transition

Type IV Pressure Vessels and Towpreg Developed in Brazil with FAPESP Support

Victor Leitão, CEO

# Forza Composites: Building a new Industrial Base through Advanced Composites




Parque Tecnológico **Univap**

São José dos Campos, SP

**Aerospace**

AI applied to NDT inspections in composites.

EMBRAER

**Oil & Gas**

Special sensors based on carbon nanotubes.

PETROBRAS

**13**
Professionals

**7**
PhDs and postdoctoral researchers

**600 m2**
of installed facilities

**3**
ISO 7 and ISO 8 clean rooms*

**Forza has been supported by FAPESP since the very beginning.**



**Project 1: Type IV Pressure Vessel**

- PIPE 1 (2022)
- PIPE Invest (2023)
- PIPE 2 (2023)

**Project 2: Towpreg**

- PIPE 2 (2025)

*Manufacturing and R&D laboratories, Prototyping and pre-series production laboratory for Type IV composite pressure vessels and Towpreg.

# Why this matters?

*Strategic solutions for gas logistics infrastructure and advanced composites supply chain sovereignty*

**1. Type I vessel weight limits growth across high-potential markets**

Excessive weight

Logistic Gap

Limited range

Prohibitive import costs

**2. Structural import dependency on Towpreg blocks energy transition**

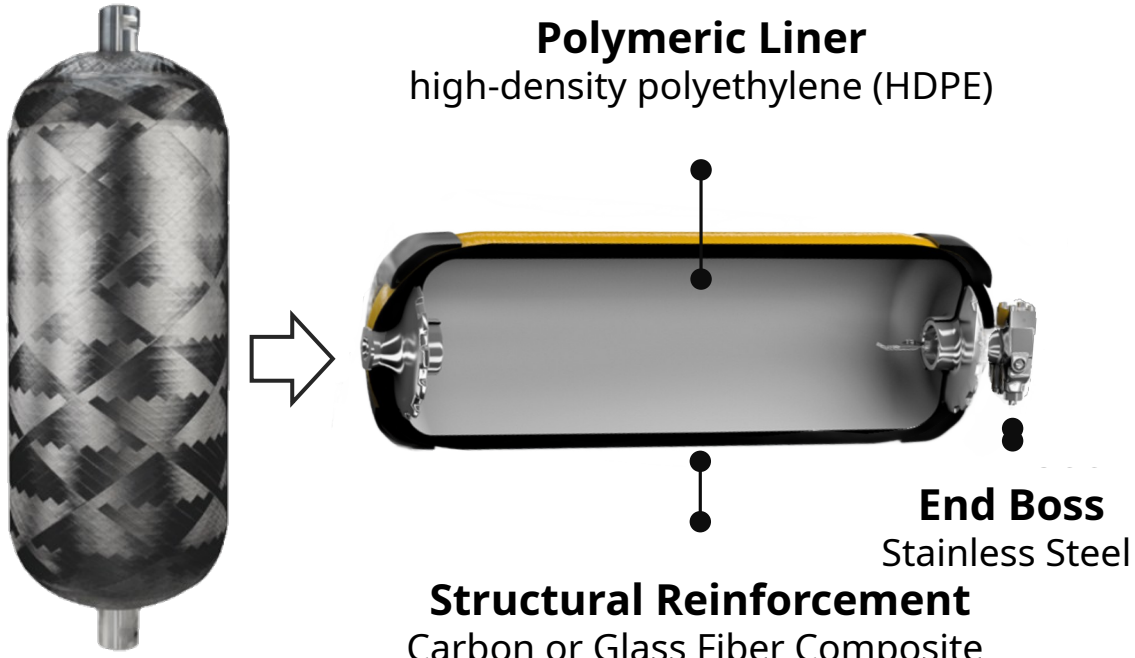
Supply chain bottleneck

Reduced shelf life

Quality degradation

Prohibitive import costs

# 1. Type IV Composite Pressure Vessel: Unlocking the Energy Transition




## Weight, efficiency, infrastructure

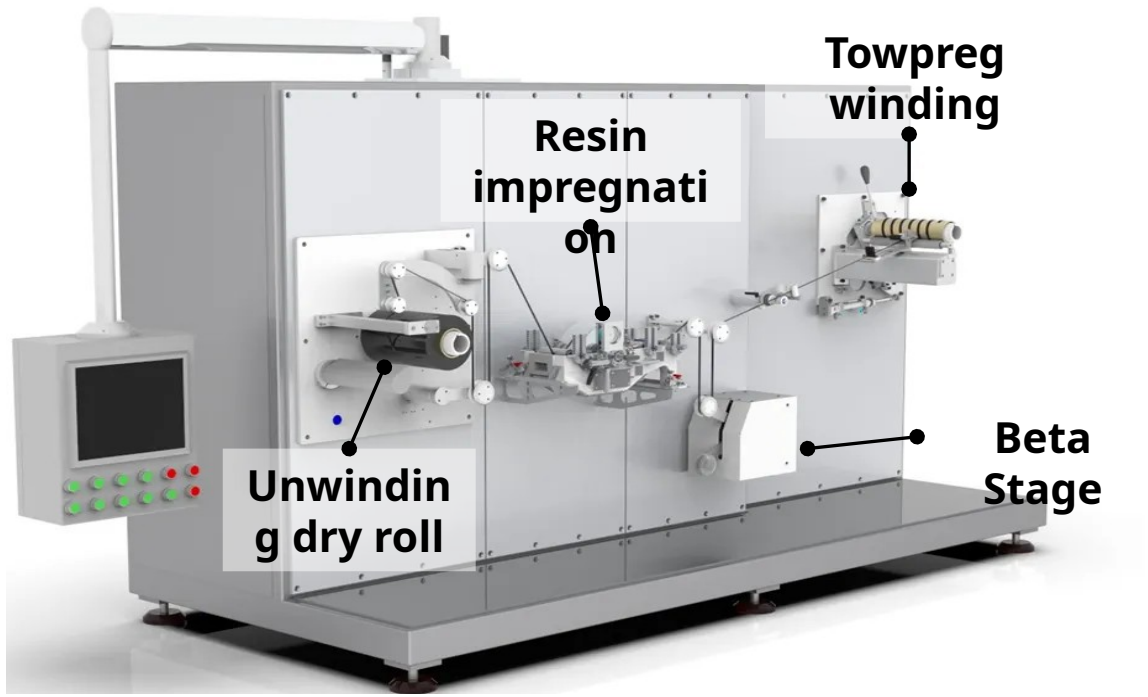
Up to **60%**
lighter than Type I

**+50%**
more gas per trailer

Up to **20%**
lower system weight

Up to **45%**
lower transport cost per $m^3$

# 2. Towpreg: The Enabling Technology




## Supply chain, market demand, productivity

Up to **30%** material savings*

Up to **45%** productivity gains*

Up to **25%** shelf-life improvement**

Up to **40%** cost reduction**

*versus conventional wet winding.
**versus imported Towpreg

# Brazil's perfect storm for gas infrastructure

| Favorable market conditions | Immediate applications |
| --- | --- |
| **Biomethane**<br>120 billion $m^3$/year by 2050 | **Agribusiness: production logistics**<br>+8 million CPV units |
| **Natural Gas**<br>Production will double by 2035 | **Industrial decarbonization and logistics**<br>+6 million CPV units |
| **Regulation**<br>“Future Fuel Law” already in effect | **Billionaire Market**<br>+$1,5 billion/year by 2050 |

# Type IV Pressure Vessel – Results (Jun/26)

*TRL 5 validated, with TRL 6 targeted by year-end*

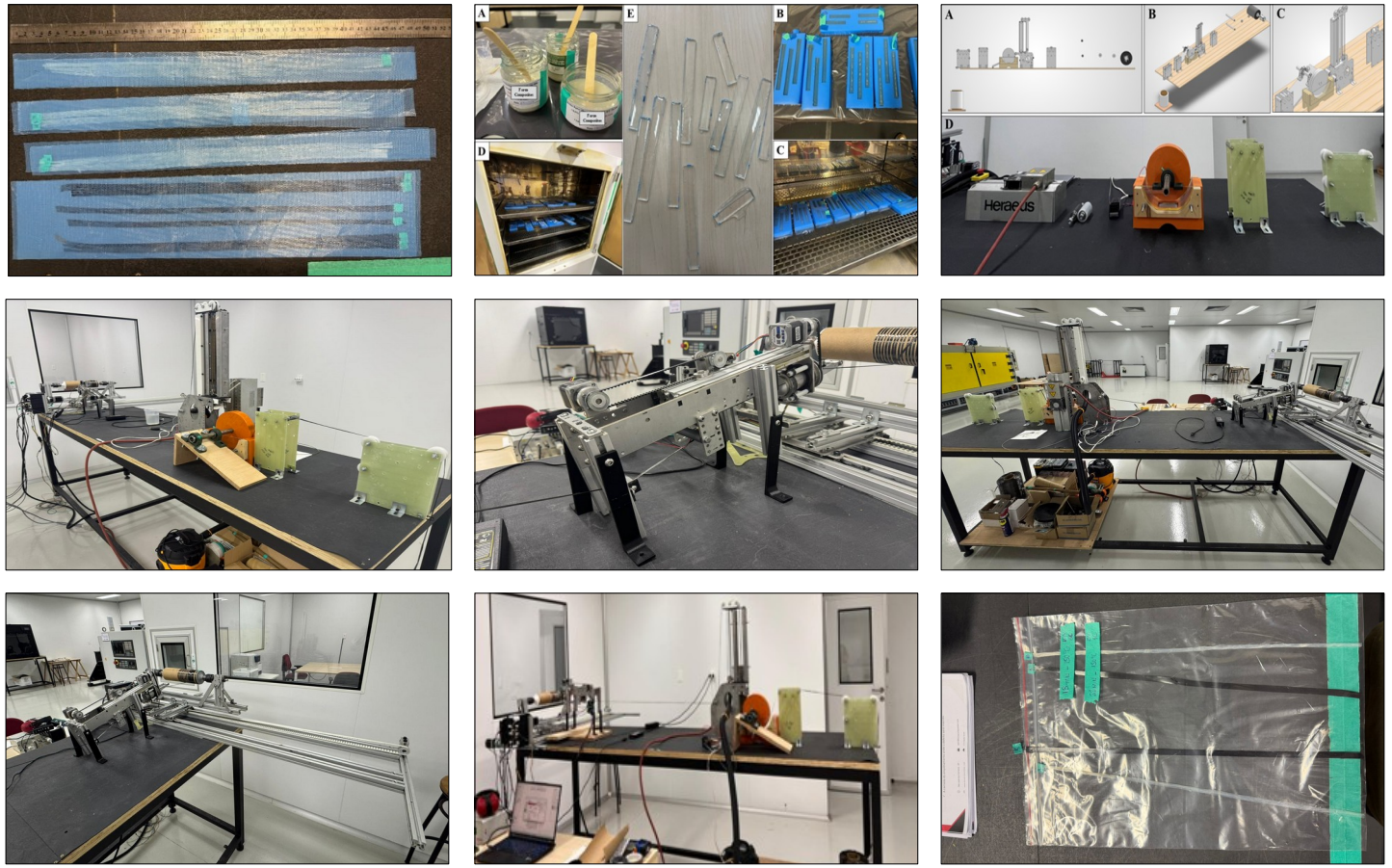


**Pilot-Scale to Pre-Series Production:**

- Polymeric liner architecture defined with material and manufacturing route.
- Patent filings for hybrid end boss and blow molding process.
- Filament winding capability for Type IV vessels up to 240 L.
- Global carbon fiber suppliers benchmarked and validated.
- 5 L prototype validated through burst and pressure testing.
- Technology risk reduced, advancing toward industrial-scale implementation.

# Towpreg – Results (Jun/26)

*TRL 5 validated, with TRL 6 targeted by Jun/27.*



**Pilot-Scale to Pre-Series Production:**

- Two latent-cure epoxy formulations with impact-enhancement agent and Tg up to 131°C, compatible with Type IV pressure vessel applications.
- Epoxy formulations with storage capability without refrigeration for up to 120 days while maintaining thermal and rheological stability.
- Thermal windows established for industrial control of β-stage (30–60% pre-cure).
- Enhanced tack performance for filament winding applications.
- Technology maturity advancing to semi-industrial production scale.

# One Technology Platform: Two Innovations, Multiple Markets

*Building Brazil's sovereign industrial base through technology, manufacturing, and certification.*



**Type IV Composite Pressure Vessel**

CNG Transport and Distribution

Trucks

Agricultural machinery

River push boats and other vessels

Hydrogen-powered drones



**Towpreg**

Pressure Vessels

Energy

Aerospace & Defense

Automotive

Marine & Sports Equipment



# Thank you!

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