FLEXYSHELL

Next-Generation Pressure Vessel

A BUILDING BLOCK

OF THE HYDROGEN ECONOMY

Hundreds of emerging hydrogen projects require 5–100 tonnes of onsite H_2 buffer storage

to bridge intermittent production and continuous industrial demand where pipelines or caverns are unavailable.

Hydrogen Producers:

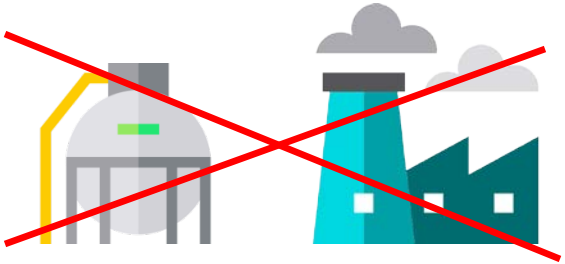
- **Electrolyser Hubs** Need multi-day buffer to deliver steady offtake to industry
- **Merchant Hydrogen Plants** Supply multiple customers with irregular pickup schedules
- **Blue/Turquoise H_2 Facilities** Storage balances upstream gas supply and downstream users
- **Chemical Complexes and refineries off-gas recovery** Buffer enables reuse rather than flaring or venting

Hydrogen Consumers:

- **Ammonia Production** 24/7 synthesis intolerant to supply dips
- **Methanol & E-Fuels** Stable feed pressure critical for catalyst life and quality
- **Green Steel Plants** Reduction shafts require uninterrupted feed of Hydrogen
- **Power Generation & Grid Services** Fuel cells/turbines for peak shaving need dispatchable stock
- **Pipeline Blending Stations** Batch injection requires local pressure buffers

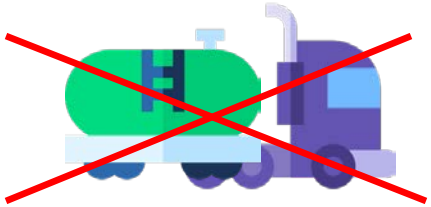
The 5–100 tonne buffer storage

is most demanded building block of the hydrogen economy, yet existing solutions are unworkable for this range.



Liquid Hydrogen (LH_2) , LOHC, Ammonia

- High liquefaction or conversion energy and operating cost
- Designed for **export-scale (≈1000 t+)**, not site buffers
- Unsuitable for daily cycling and frequent dispatch



Mobile Compressed/Liquid Hydrogen Tube trailers

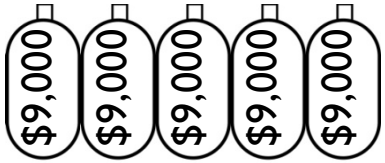
- Practical only for **sub-5 t** quantities
- Logistically inefficient for continuous industrial supply
- High transport and handling overhead

Stationary Compressed Hydrogen Storage – De-Facto Option

- Practically implemented as clusters of COPV/steel vessels
- Capacity scaled by multiplying many small tanks
- Multiplies maintenance, risk and failure paths
- Becomes impractical at multi-tonne industrial scale

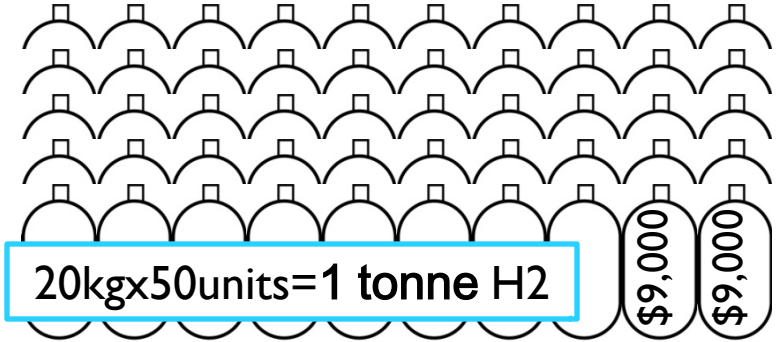
COPV cost scaling from 100kg to 1 tonne H2

20kgx5units=**100kg** H2



Vessels cost

$9,000x5= $45,000



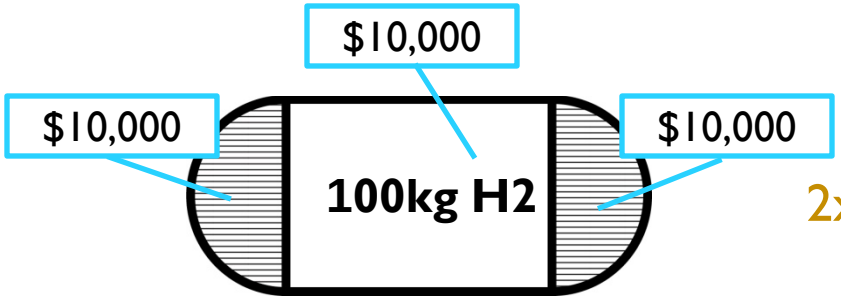
Vessels cost

$9,000x50= $450,000

Cost scaling

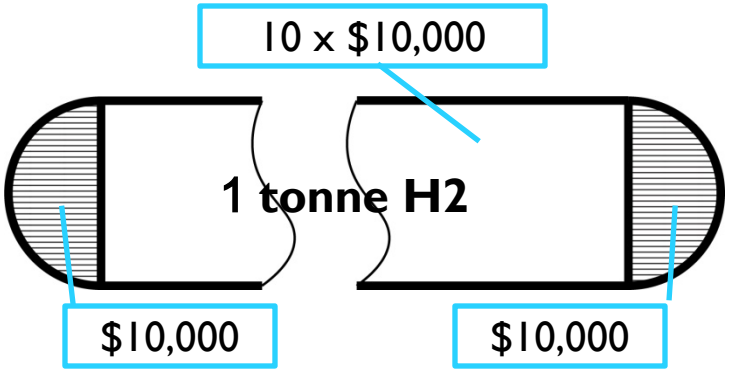
$45,000 ⟶ $450,000

FLEXYSHELL cost scaling from 100kg to 1 tonne H2



Vessel cost

2x$10,000 +$10,000= $30,000



Vessel cost

2x$10,000 +10x$10,000= $120,000

Cost scaling

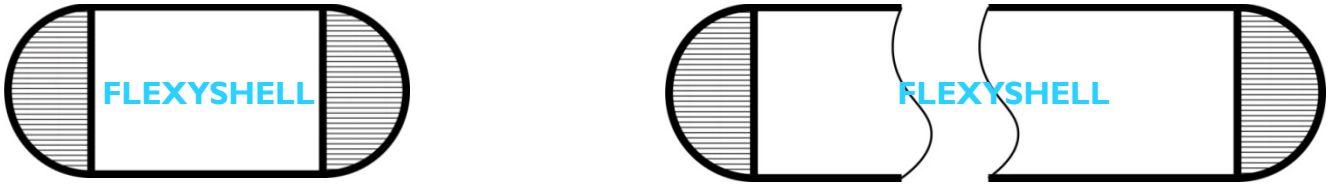
$30,000 ⟶ $120,000

900 kg H2 added for $90,000

FLEXYSHELL VS COPV

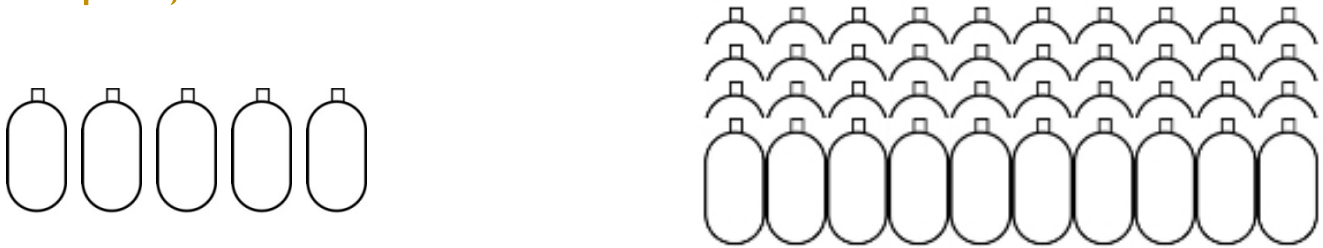
10x Volume increase by cheapest part extension

$ 30,000 → $ 120,000



10x Volume increase by multiplying the number of costly vessels

$ 45,000 → $ 450,000



Illustrative case:

10 tonnes compressed H2 facility reliability estimate.

The industry attempts to solve a **system-level, tens-tonne magnitude problem** with **hundreds of small, tens of kilograms capacity pressure vessels.** That strategy is not only prohibitively expensive, it also fails mathematically, operationally, and from a risk standpoint.

Single vessel reliability assumptions

FLEXYSELL vessel

single vessel survival probability 99.995% assumed, based on industry statistics and

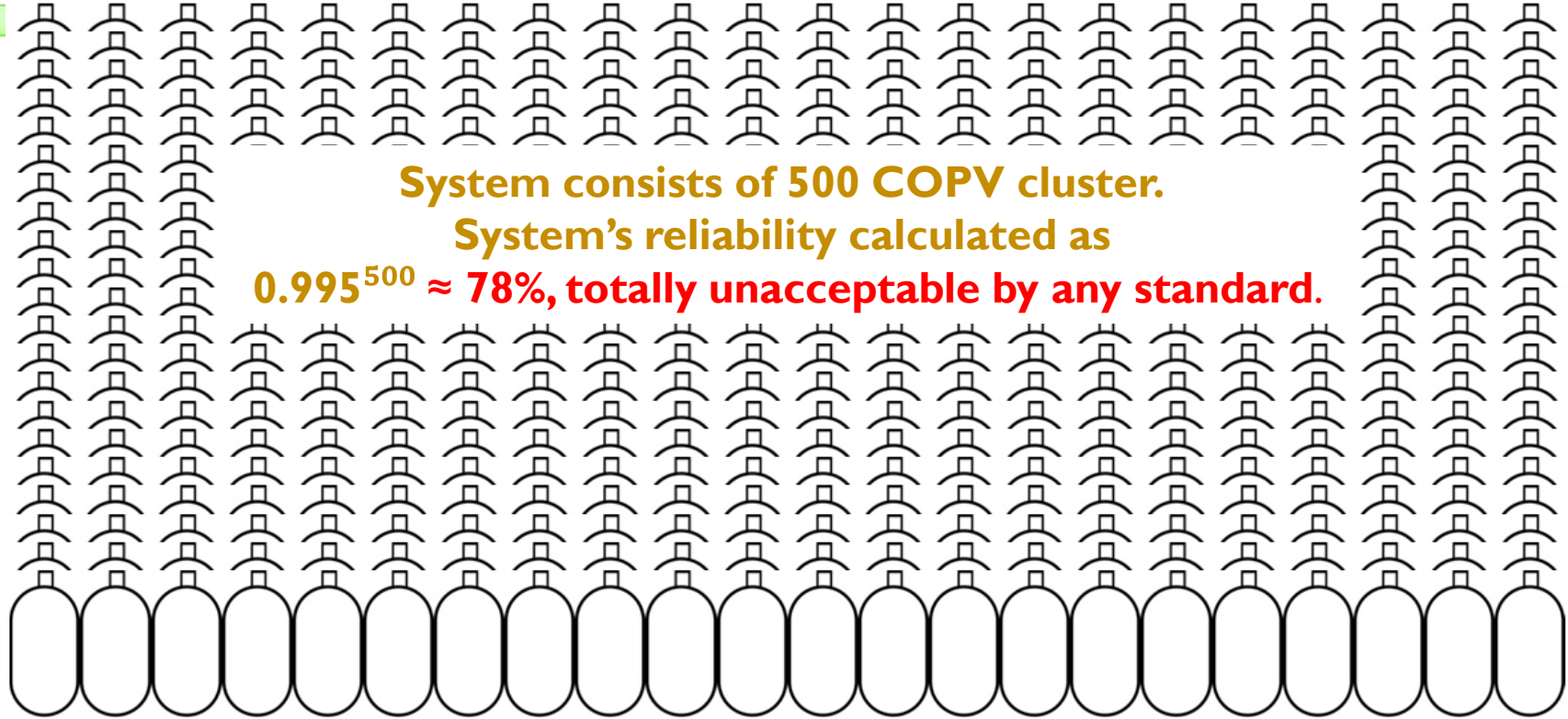
- Failure mode similar to steel-reinforced composite pipe
- **Bulge → gradual leak**, not sudden uncontrolled release

COPV tank

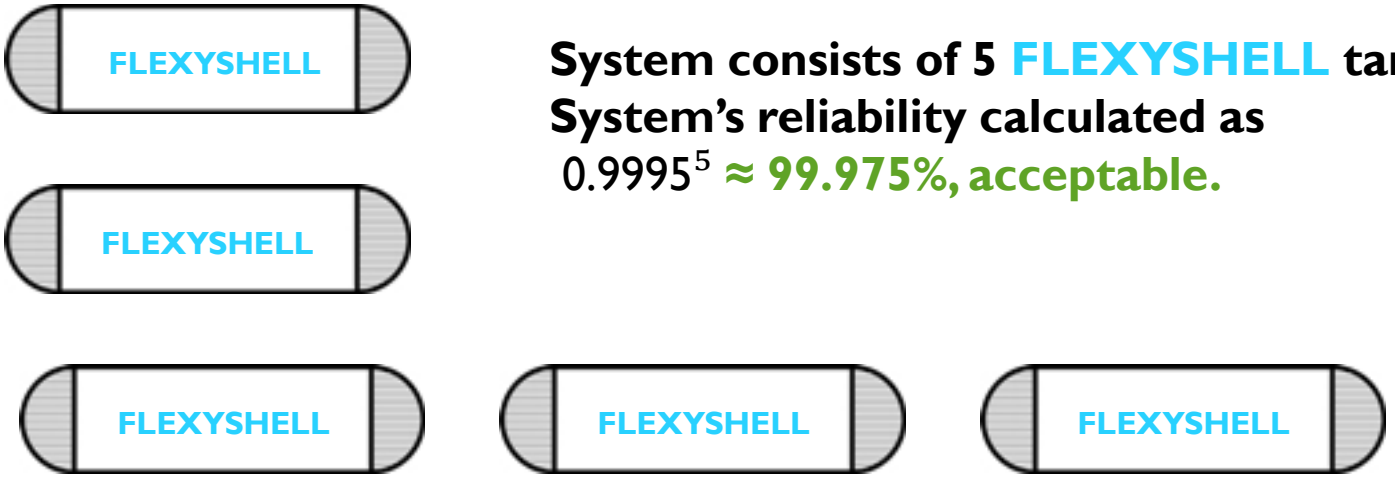
single vessel survival probability 99.95% assumed, based on industry statistics and

- Sudden failure mode, **no leak-before-burst**
- Failure = immediate loss of containment with serious consequences

A 10-tonne facility needs 500 COPV tanks rated at 99.95% reliability.



A 10-tonne facility needs 5 FLEXYSHELL tanks rated at 99.995% reliability.



System consists of 5 FLEXYSHELL tanks.
System's reliability calculated as
$0.9995^5 \approx 99.975\%$**, acceptable.**

Flexyshell *DIRECTLY FILLS THE MISSING MIDDLE RANGE STORAGE SEGMENT*

Designed for 5–50 tonnes buffer storage required by hundreds of planned hydrogen projects

Replaces tank clusters with a small number of large vessels

Step-change in economics

Target CAPEX ≈ **$200 per kg of stored H_2** vs industry norm **$400–600 per kg** for COPV/steel clusters

Lower balance-of-plant, inspection and lifecycle costs through reduced component count

Step-change in safety

Benign failure behaviour with **gradual leak-before-burst characteristics**

System risk stays acceptable with several vessels, not thousands of pressure tanks and valves

Far fewer leak paths, simpler permitting and insurability

Outcome

A practical, safe and affordable storage solution enabling the next wave of hydrogen deployment where existing technologies cannot operate.