

Fives, a pivotal player in the Hydrogen industrial ecosystem

2023

Fives is an international industrial engineering Group committed to demonstrate that “Industry can do it”

OVER
200 YEARS
OF HISTORY

CLOSE TO
8,500
EMPLOYEES

EMPLOYEES OF
81
DIFFERENT NATIONALITIES

Bn\$ 3.0
ORDER INTAKE

Bn\$ 2.2
SALES

2,267
CURRENT PATENTS IN 627 FAMILIES

2022 figures



OUR MISSION ON HYDROGEN

Be the **world class and #1 independent provider** of key **process equipment** required to **produce, convert, liquefy & transport Hydrogen**, in its various chemical states (e.g., LH_2 , NH_3 , GH_2)

Fives is playing a pivotal role in the Hydrogen value chain

ENERGY

Leading independent provider of equipment for Hydrogen industrial applications



**H₂
Liquefaction**

- Brazed aluminum heat exchangers
- Cold boxes
- Cryogenic pumps



**H₂
Combustion**

- Blend burners
- 100% H₂ burners



**H₂
Piping**

- Electrolyzer skids
- Piping for H₂ installations

MOBILITY

State-of-the-art technological solutions for Hydrogen manufacturing and assembly lines



**H₂ Tank
Testing Lines**

- Proof & cycling tests
- Leak tests & leak test systems



**Laser
Welding**

- Bipolar plates welding for electrolyzers
- Fuel cell components welding



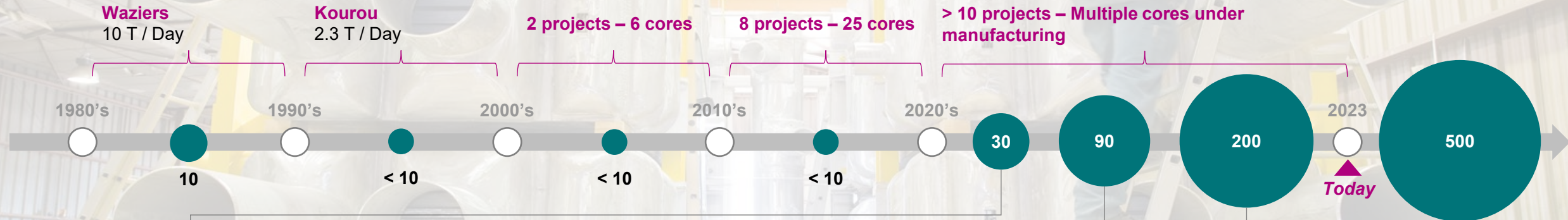
**Automated &
Robotic Systems**

- Automated lines for gigafactories of electrolyzers, tanks, fuel cells
- Material handling

Fives has more than 50 years of experience on H₂ liquefaction equipment

Small-scale liquefaction – R&D or Aerospace customers

Larger scale liquefaction – New type of customers



2020 – International Gas Company

- 1st large scale liquefaction units
- 30 TPD
- 5 cores

2021 – Korean Chaebol

- 3 x 30 TPD
- Large-scale liquefaction unit

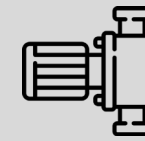
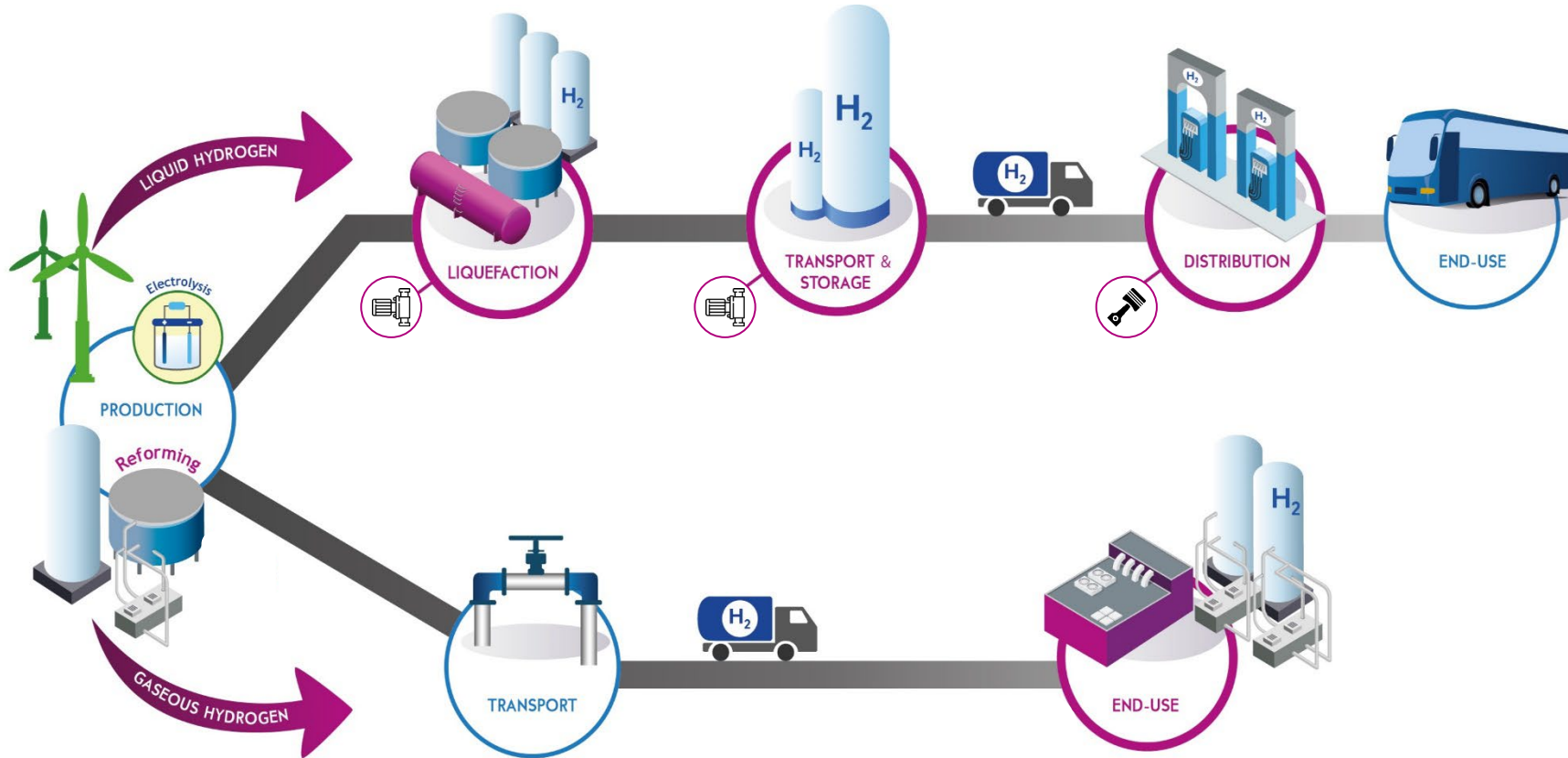
2022 – US New player

- Plans to build >200 TPD total capacity
- 15 TPD and 30 TPD
- Supply of both BAHX and Cold boxes

2025(?) – Oil company

- Plans to invest in 500 TPD, more than 1.5 x the existing global LH₂ capacity
- On going discussion

Our cryogenic pumps will cover all needs from the liquefaction of hydrogen to its distribution for mobility applications



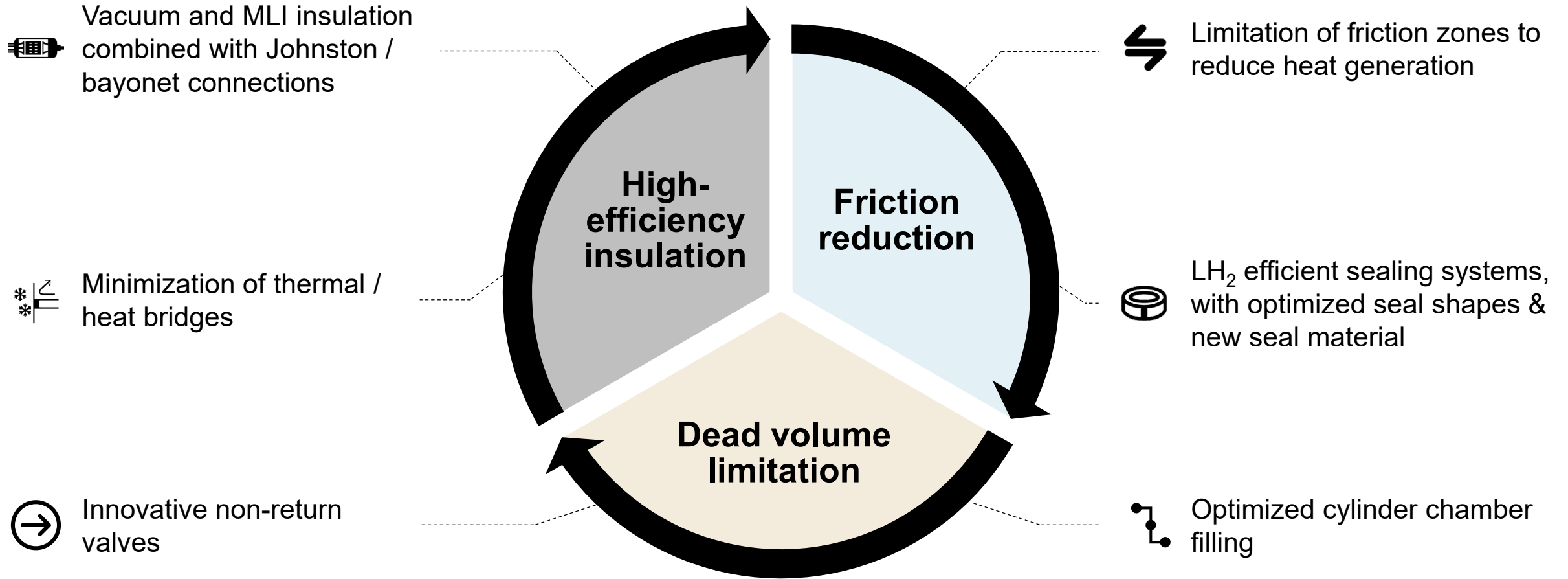
Transferring LH₂
between storage
tanks / trailers at a
low pressure



Distributing LH₂
from a storage tank
to end-user tanks at
high pressure*

**LH₂ then vaporized to fill gaseous hydrogen tanks*

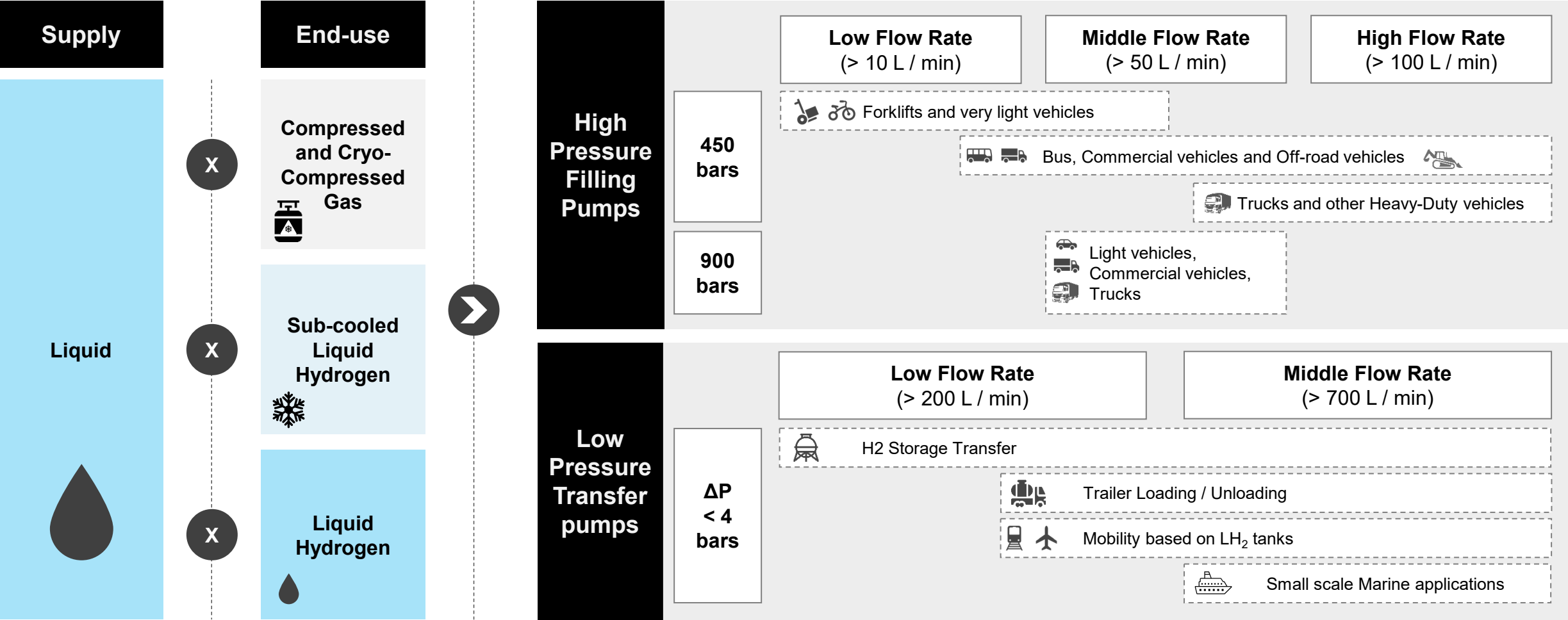
The current development relies on strong and superior technological knowledge, applied to the specificities of LH₂



Our fit-to-H₂ designs show superior efficiency while targeting a high reliability

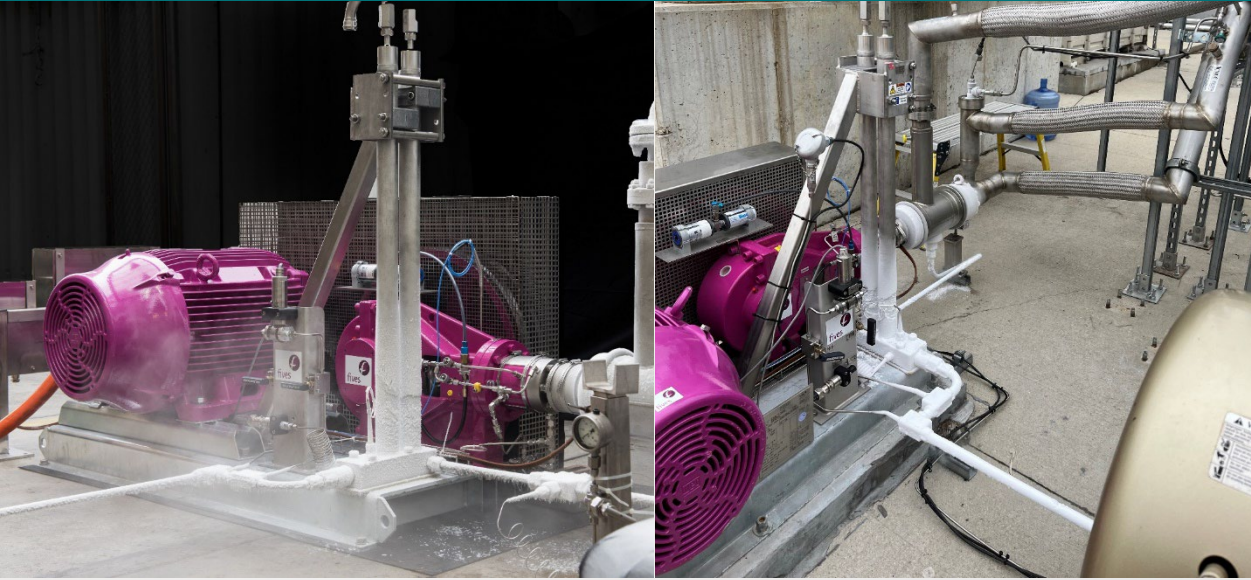
Fives develops a comprehensive and fit-to-H₂ range of Cryogenic pumps for all applications

2022 to 2024 R&D development program



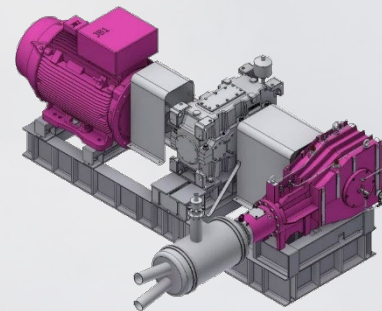
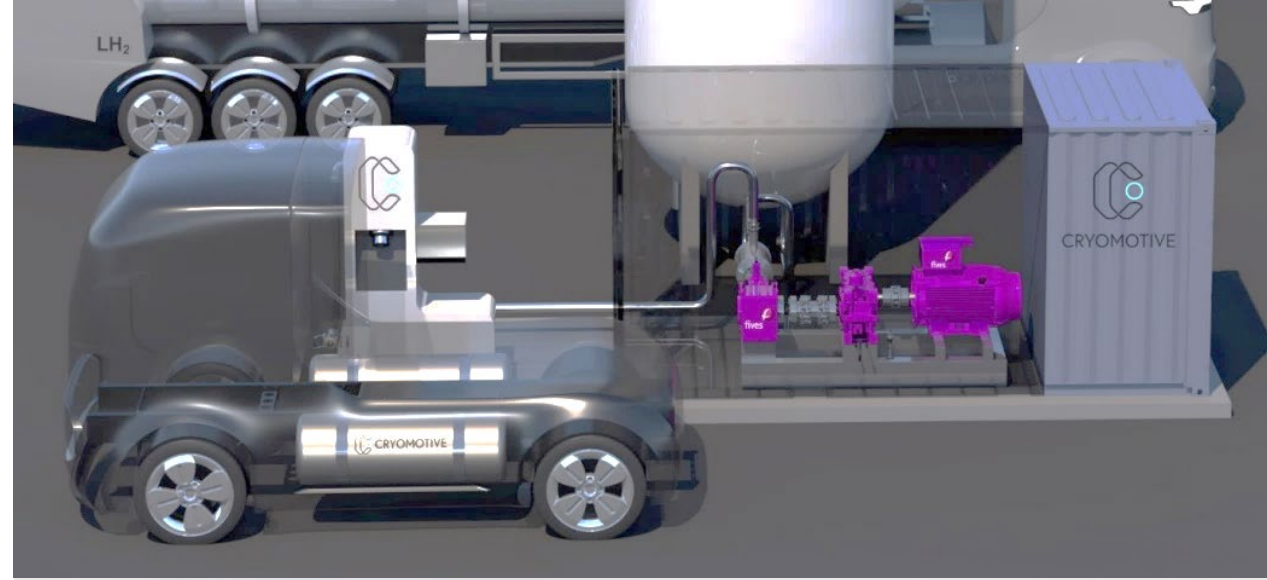
How Fives is supporting mobility players for their Hydrogen projects

EXAMPLE #1: FOR CAPTIVE FLEET



- **Commercialized pump** – Industrial ready
 - Pressure up to 420 bar
 - Flow rate of 12 l / min
- **2 min for Hydrogen refueling**
(vs. 15 min for EV battery charging)

EXAMPLE #2: FOR HEAVY DUTY VEHICLES



- **Based on Cryo-Compressed Hydrogen Gas (CCH₂)**
- **On-going development towards 2024**
 - Pressure up to 450 bar
 - Flow rate of 120 l / min
- **10 min for truck refueling**



Fives

Brent West – brent.west@fivesgroup.com

www.fivesgroup.com