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BionicHydrogenStorage

Applying Biologization to
Hydrogen Storage Concepts

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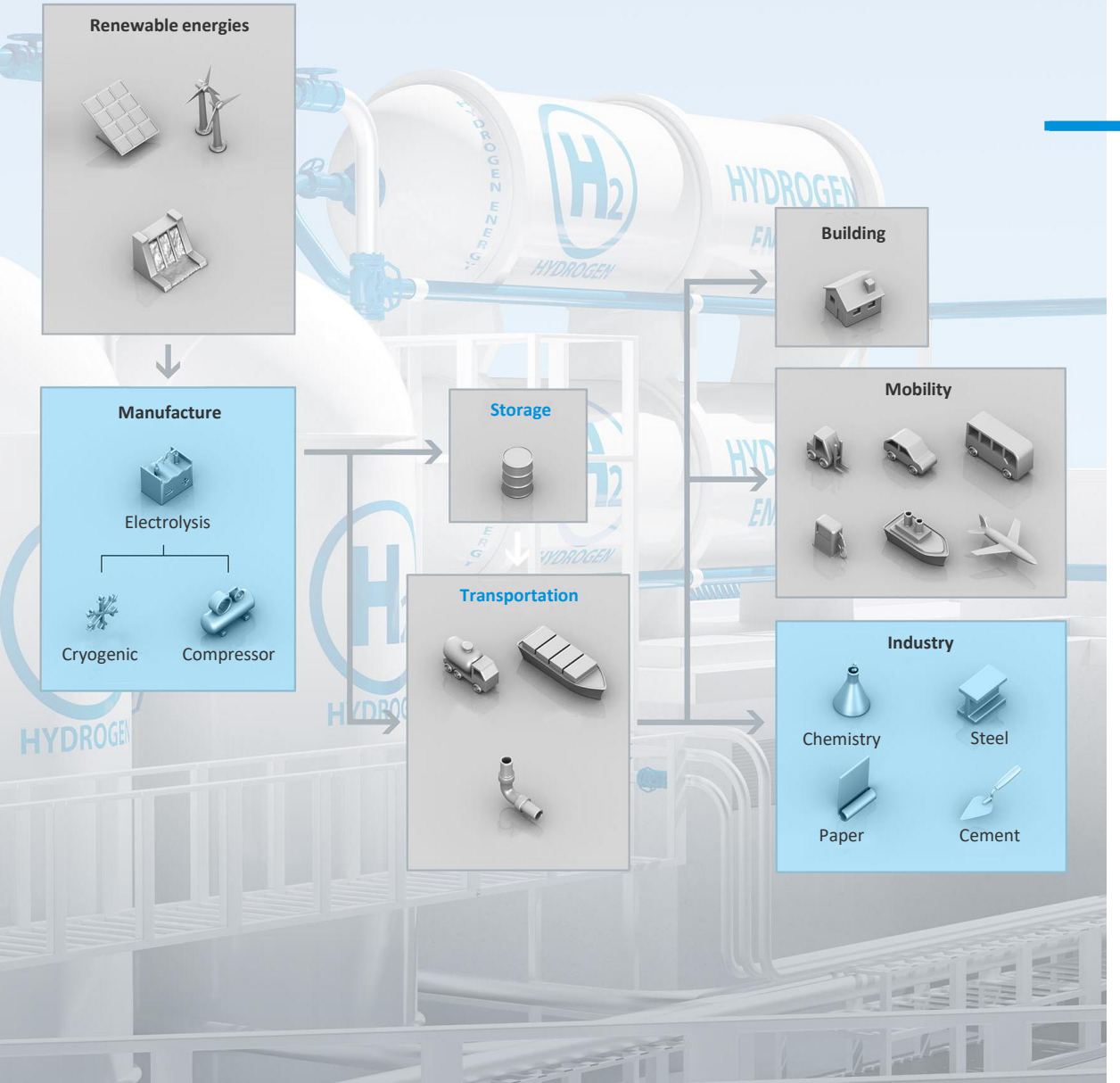
Corporate Bionic Projects

How can **biologization** contribute to the sustainable production of energy?



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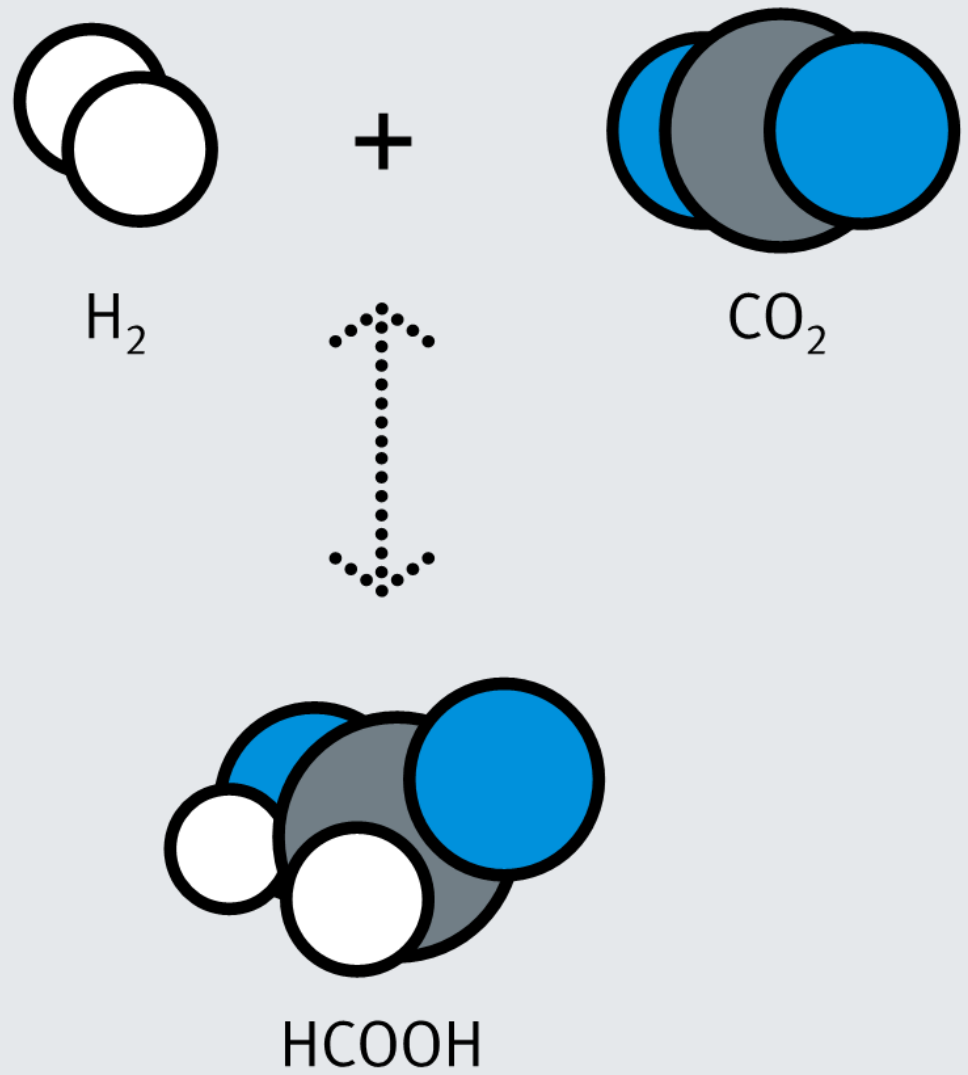
Should we look for other **storage concepts**?

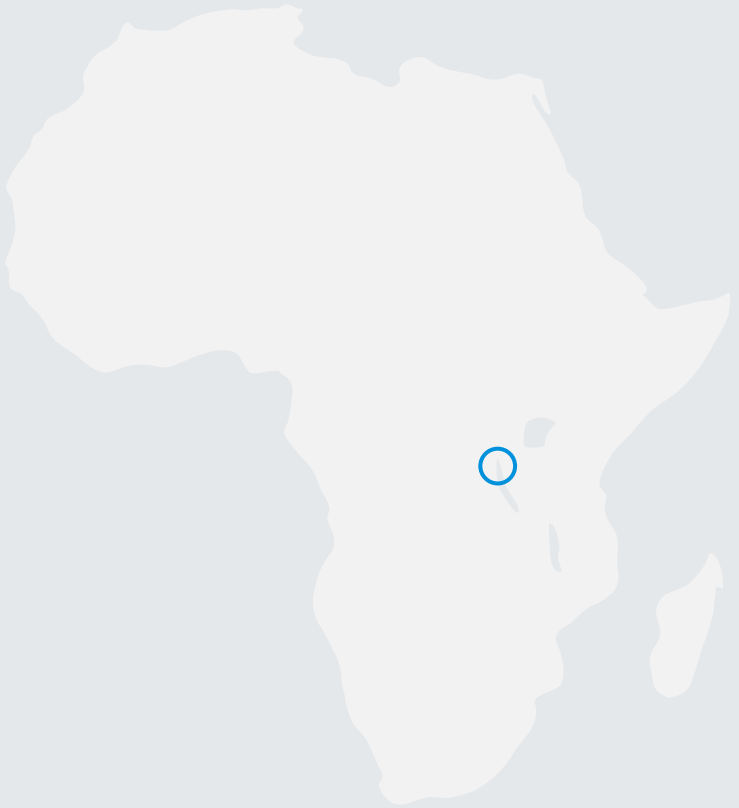
- Liquid hydrogen (-253 °C)
- Pressurized gas (100 bar, 200 bar or 700 bar)
- Methanol (250 °C)
- Ammonia (> 425 °C)
- Metal Oxides (Fe_3O_4/Fe) (670 °C)
- Metal Hydrides ($NaAlH_4$) (160 °C)
- …

Large-scale storage of hydrogen Joakim Andersson, Stefan Grönkvist (2019) International Journal of Hydrogen Energy 44 11901-11919 DOI: 10.1016/j.ijhydene.2019.03.063

How does the storage concept **work**?

- Enzymatic conversion to formic acid and back with the help of bacteria
- Compared to previous processes at mild temperatures (70 °C) and low pressure (1.5 bar)





Which **microorganism** is used?

Thermoanaerobacter kivui

Acetogenium kivui, a new thermophilic hydrogen-oxidizing acetogenic bacterium F. A. Leigh, F. Mayer, R. S. Wolfe (1981) Arch Microbiol 129: 275 – 280 DOI: 10.1007/BF00414697

The Future Concept **BionicHydrogenBattery**

- Fully automated process
- Low-risk
- Bacteria as renewable catalyst
- Compared to previous processes at mild temperatures and low pressure

The BionicHydrogenBattery was developed as part of the Bionic Learning Network in cooperation with the „Molecular Microbiology and Bioenergetics“ department at Goethe University Frankfurt.

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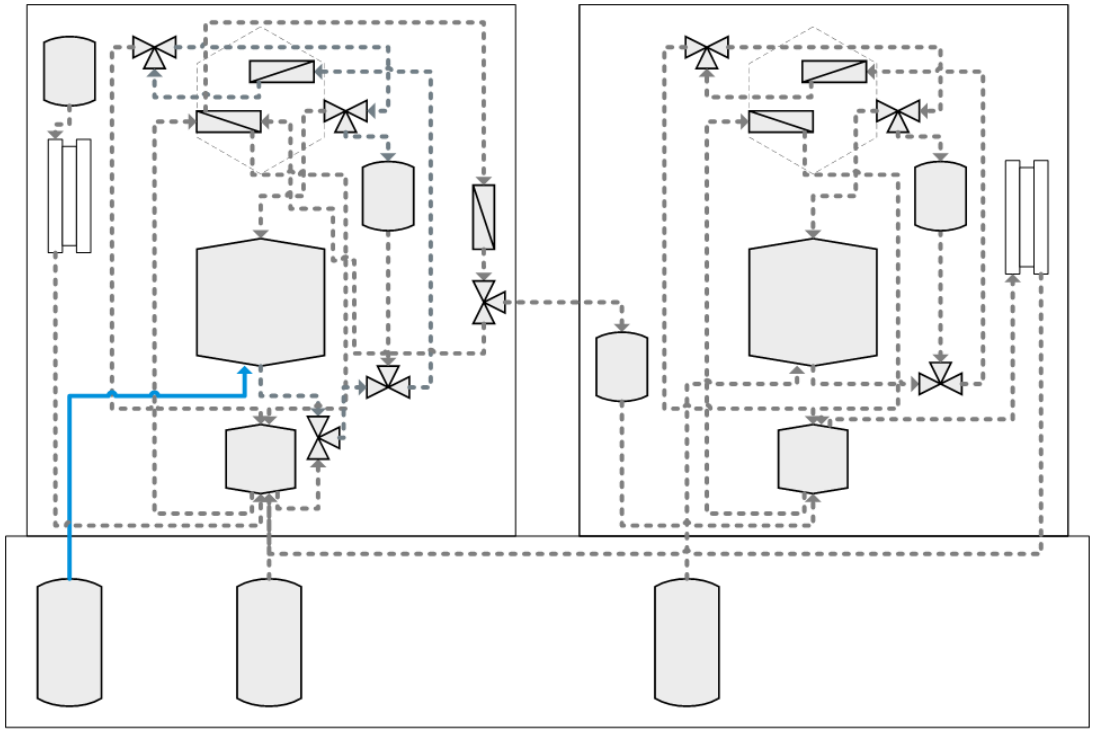
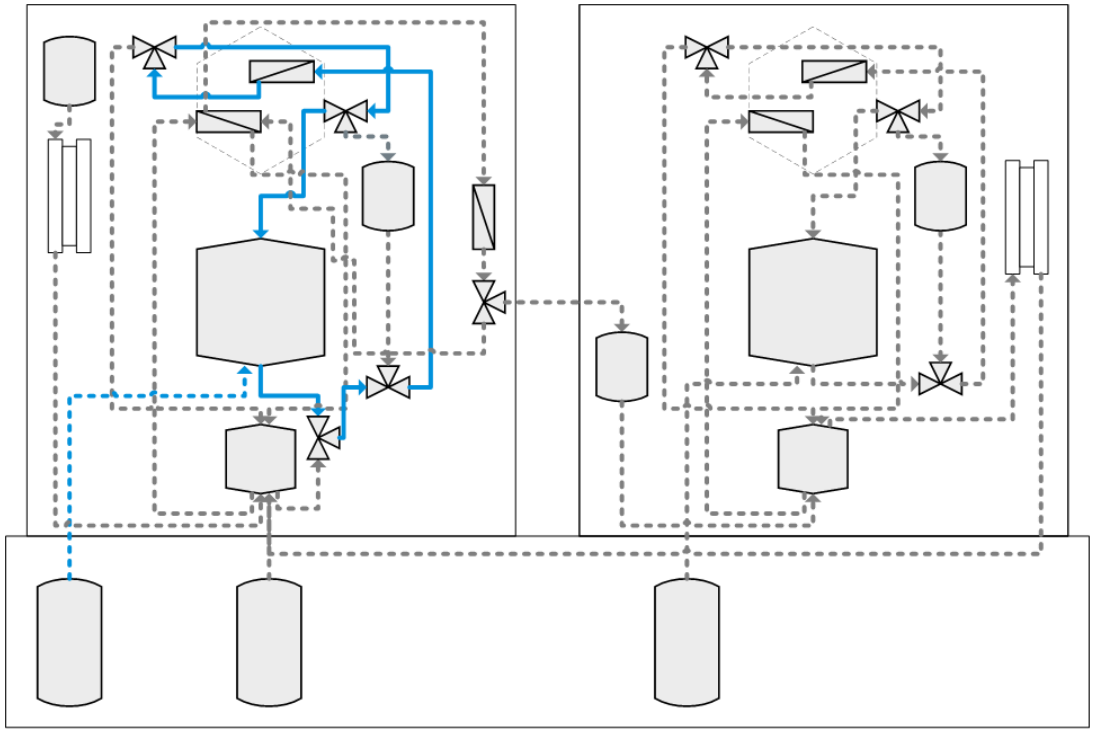
How are the bacteria **grown**?



How are the bacteria **concentrated**?



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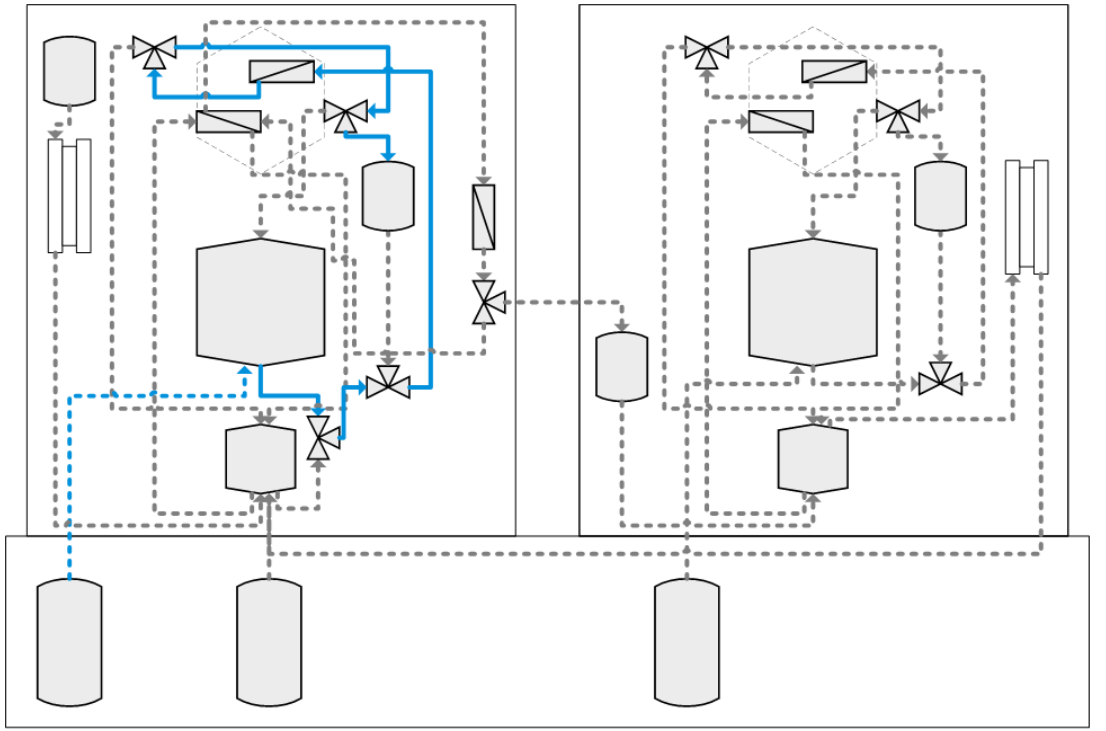

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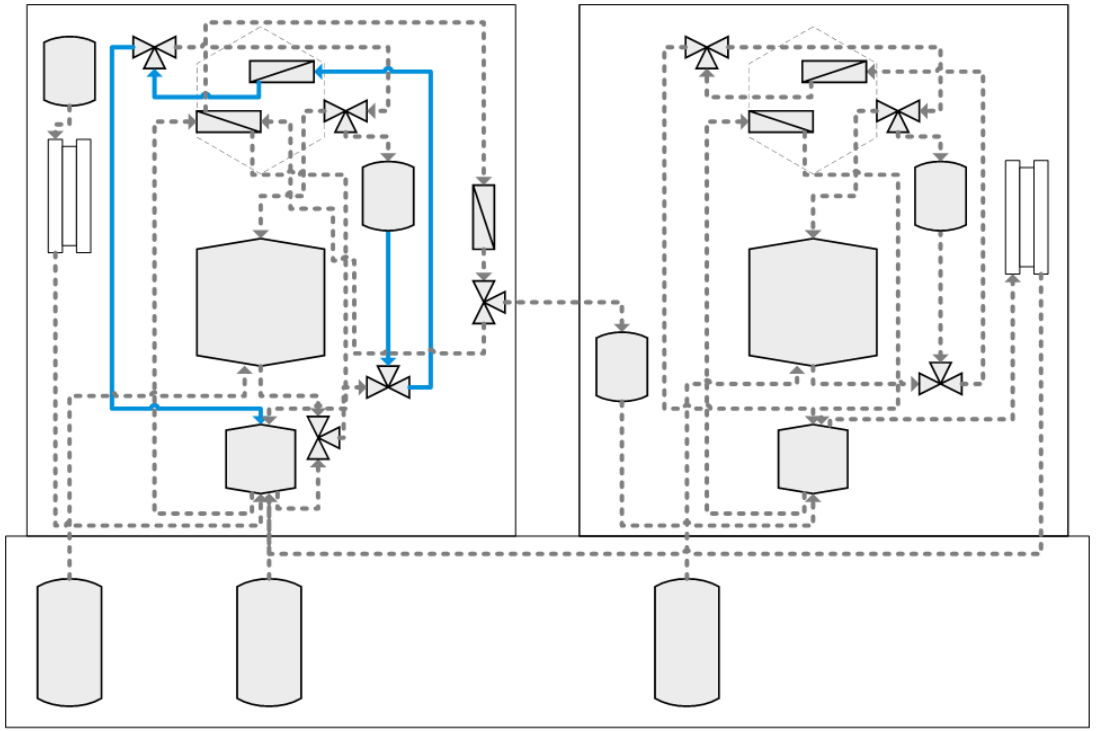
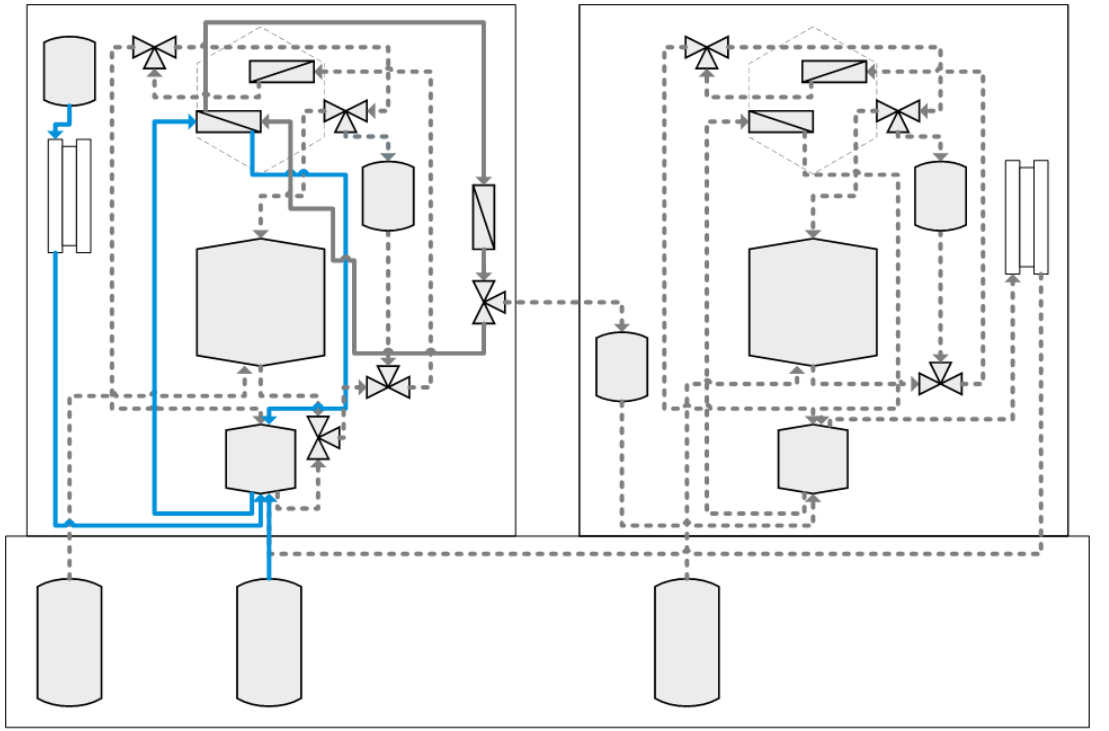
How are the bacteria **transferred**?



How is the hydrogen **stored** and **released**?



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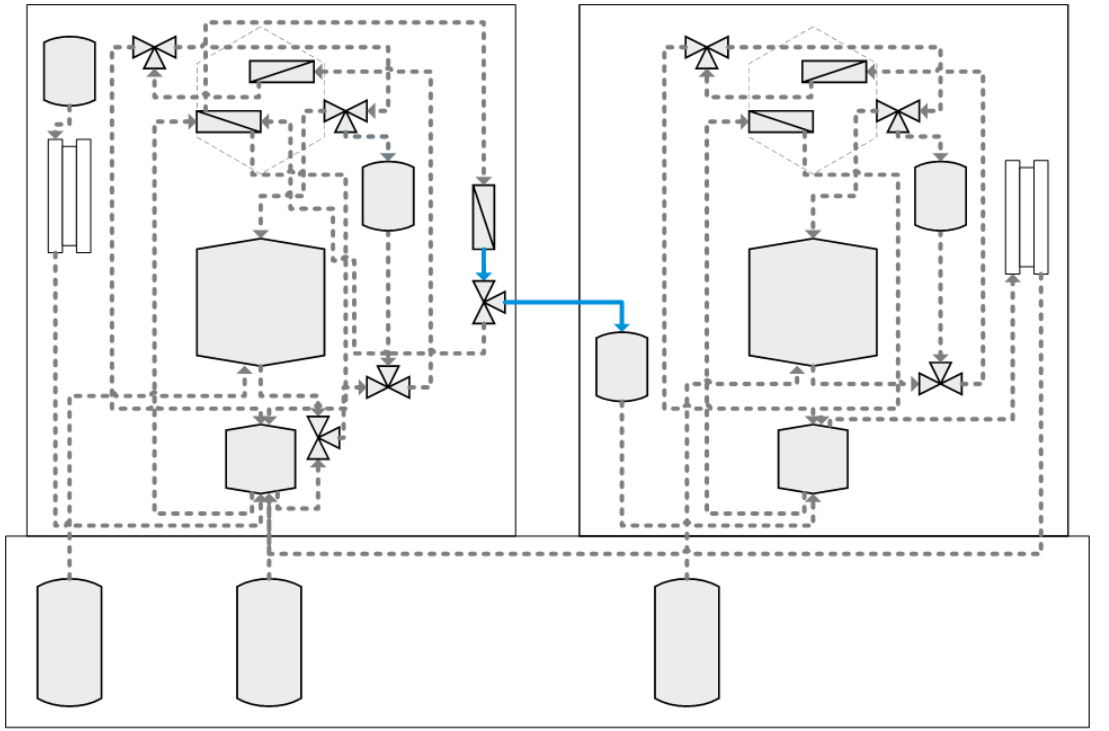

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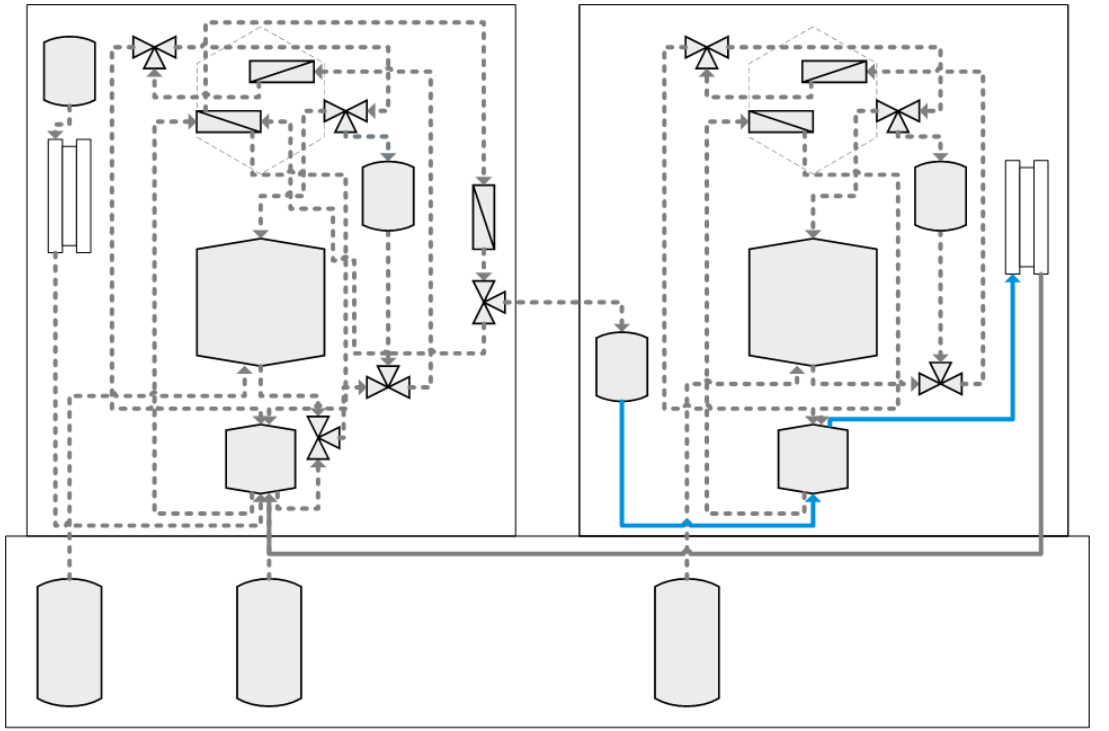

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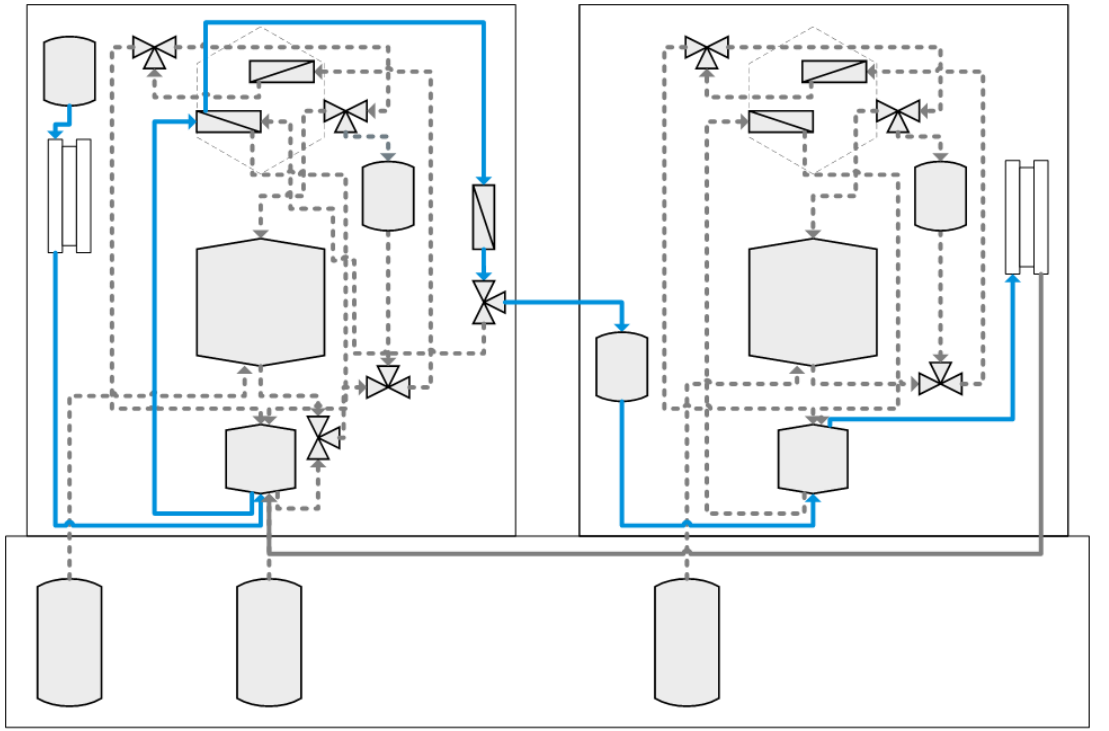

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Thank you