

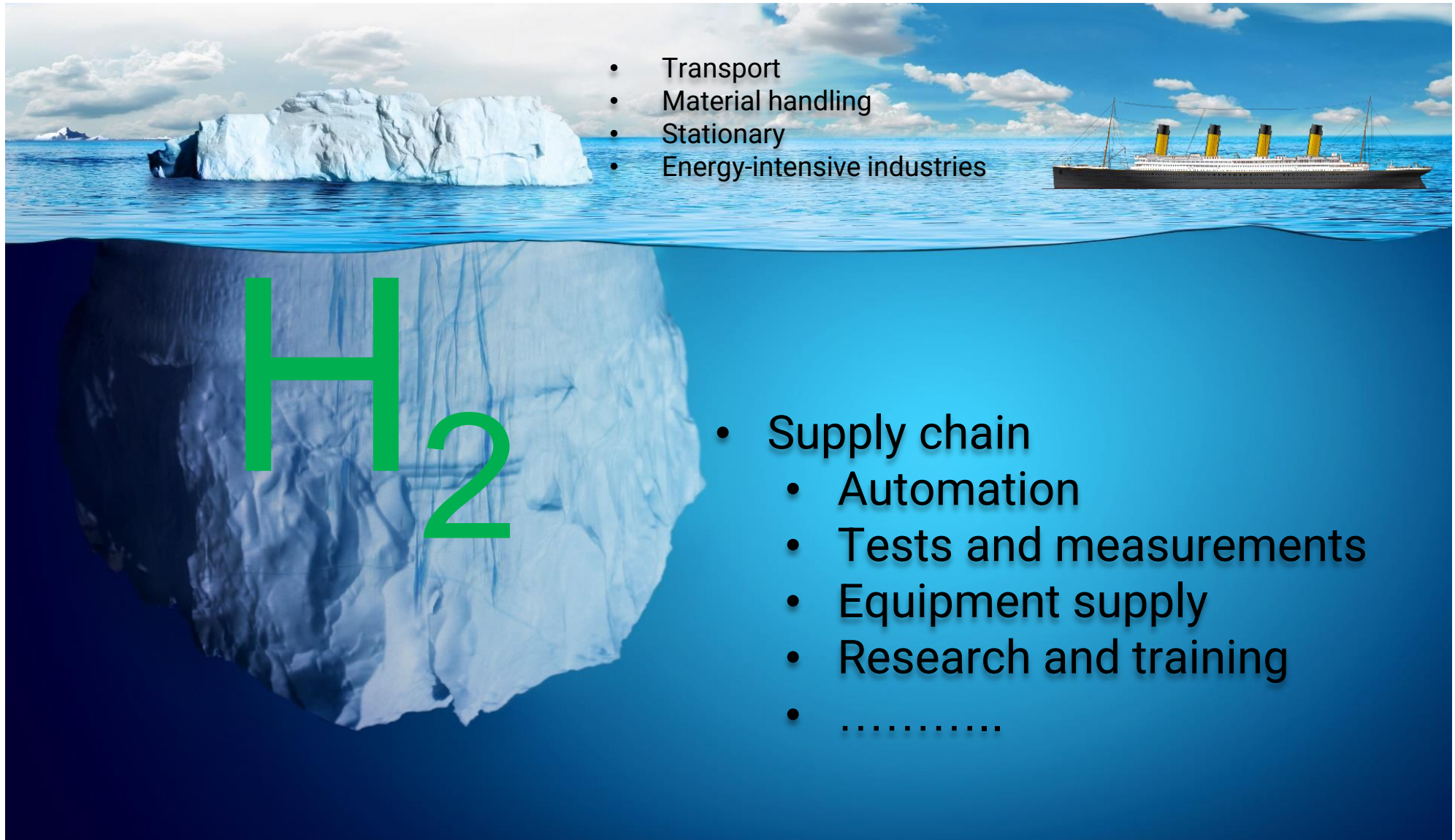


**10 - 11**  
**NOVEMBER 2022**  
**PIACENZA EXPO**

**“THE H2 BEYOND THE H2: THE NEED FOR AN INDUSTRIAL CHAIN”**

**MARCELLO ROMAGNOLI**

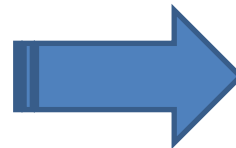
**Professor at Department of Engineering ‘Enzo Ferrari’ University of Modena and Reggio Emilia, Director of H2 Mo.Re Center**





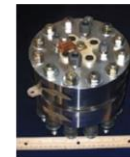
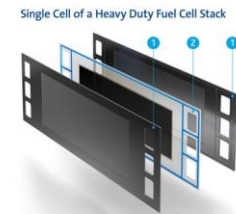


Oil dependency  
dependence



Fuel cell

<https://www.fst.com/fuel-cell/>



Compressors

[http://www.hydrogen.energy.gov/pdfs/review08/pdp\\_29\\_lipp.pdf](http://www.hydrogen.energy.gov/pdfs/review08/pdp_29_lipp.pdf)



Hydrogen tank

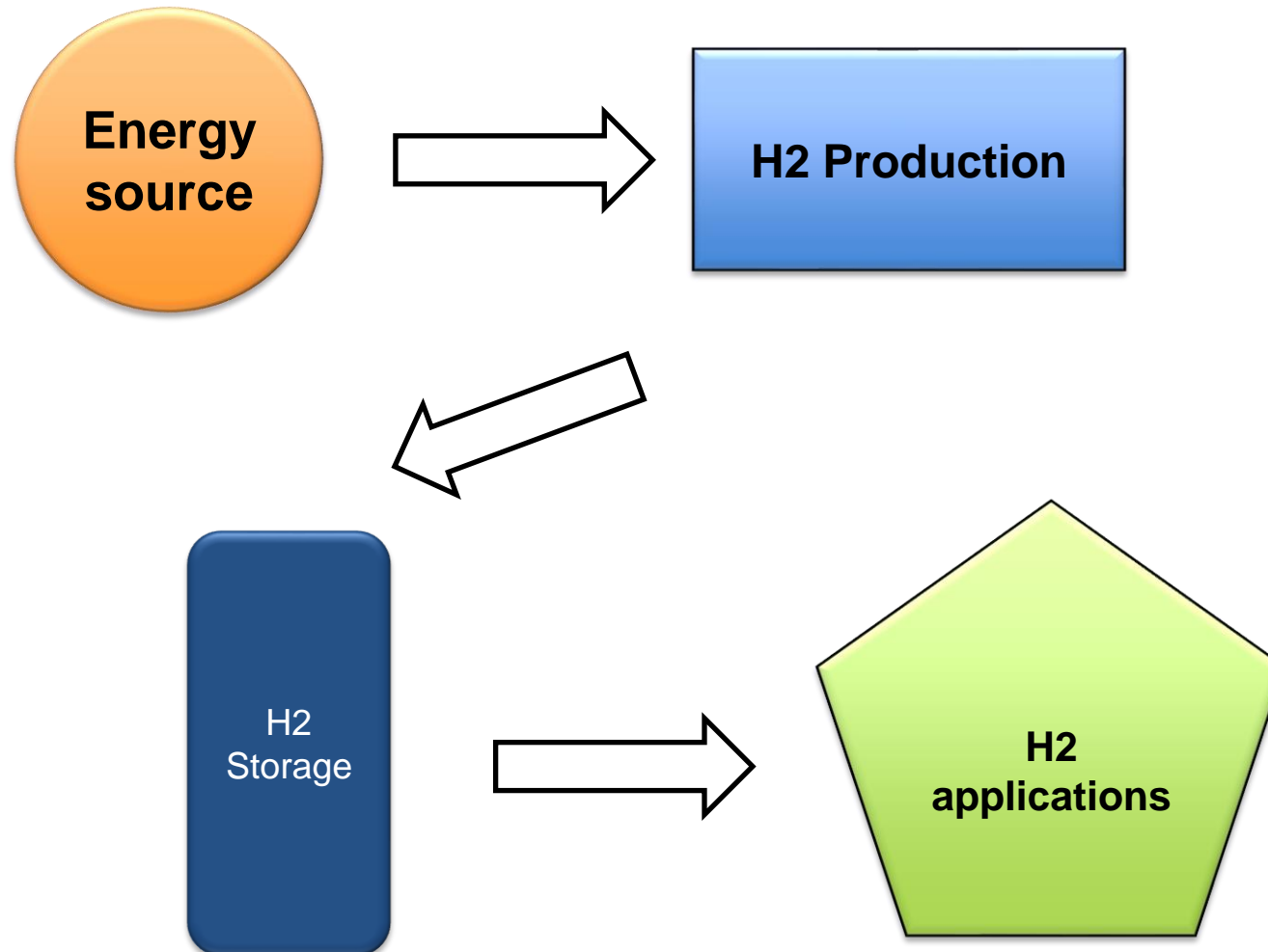
[https://en.wikipedia.org/wiki/Hydrogen\\_tank](https://en.wikipedia.org/wiki/Hydrogen_tank)

Electrolysers



<https://cdn.offshorewind.biz/wp-content/uploads/sites/6/2022/09/13/21015/Worlds-largest-electrolyser-arrives-in-Norway-to-scale-up-green-hydrogen-projects1.jpg>

Technological





**Energy  
source**



Coal



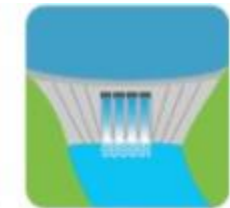
Wind Energy



Uranium



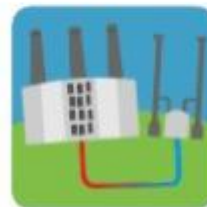
Petroleum



Hydropower



Solar Energy



Geothermal



Biomass



Electricity



Natural Gas



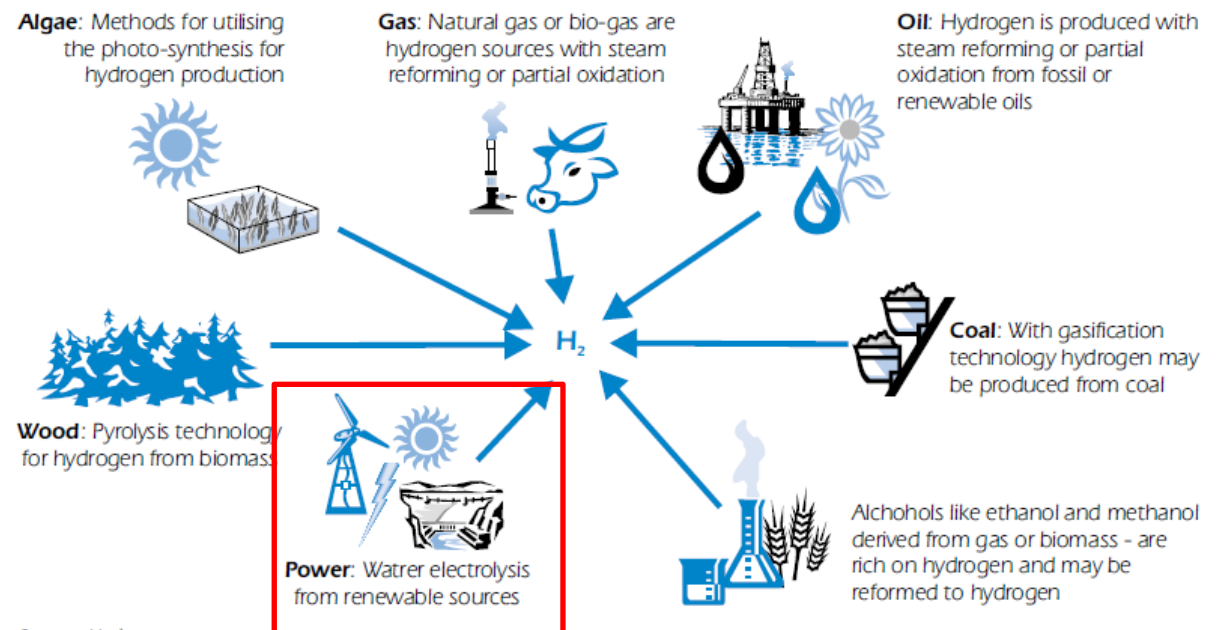


## H2 Production

**Figure 1**  
Some feedstock and process alternatives



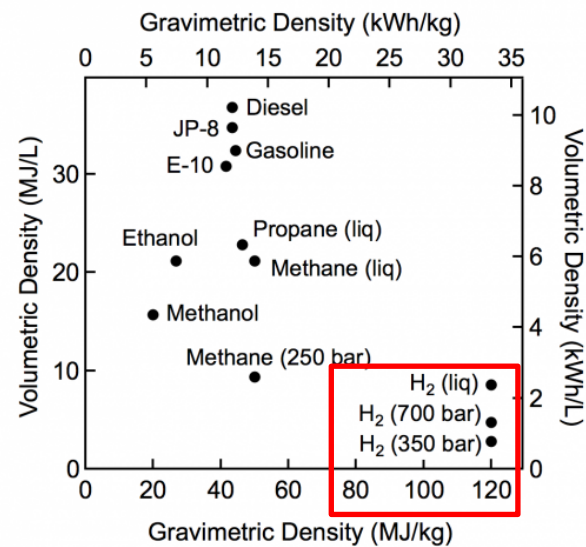
<https://www.power-technology.com/news/shell-selects-thyssenkrupp/>



Source: Hydro.

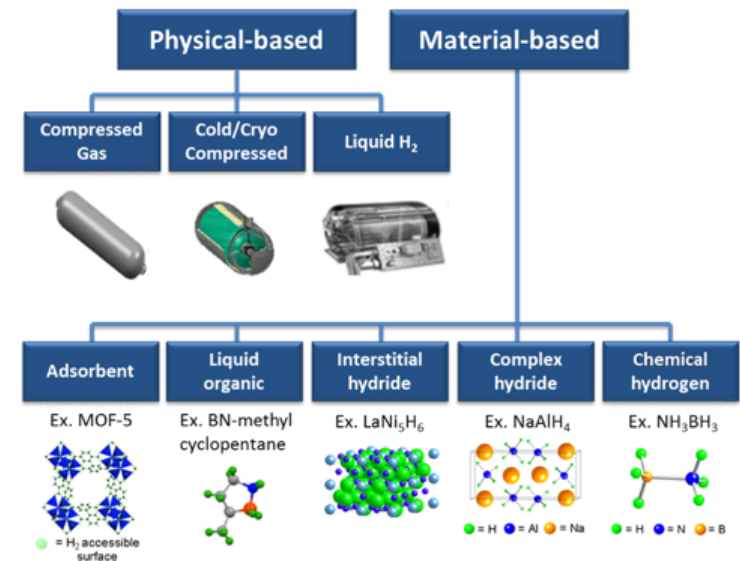


## H<sub>2</sub> Storage



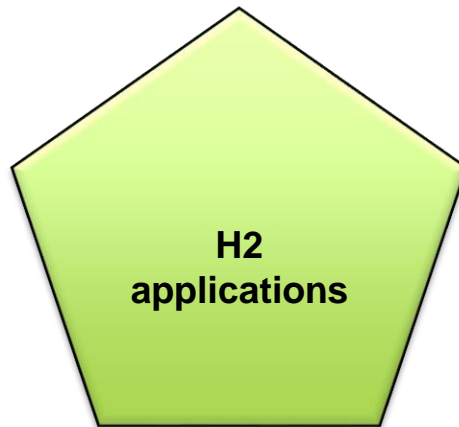
Electrochemical  
compressors

## How is hydrogen stored?



[http://www1.eere.energy.gov/hydrogenandfuelcells/storage/metal\\_hydrides.html](http://www1.eere.energy.gov/hydrogenandfuelcells/storage/metal_hydrides.html)

[http://www.hydrogen.energy.gov/pdfs/review08/pdp\\_29\\_lipp.pdf](http://www.hydrogen.energy.gov/pdfs/review08/pdp_29_lipp.pdf)



[https://www.deutz.com/fileadmin/contents/com/media/press\\_relaeses/EN/2021/20210812\\_DEUTZ\\_PR\\_DEU\\_TZ\\_hydrogen\\_engine\\_ready\\_for\\_the\\_market.pdf](https://www.deutz.com/fileadmin/contents/com/media/press_relaeses/EN/2021/20210812_DEUTZ_PR_DEU_TZ_hydrogen_engine_ready_for_the_market.pdf)



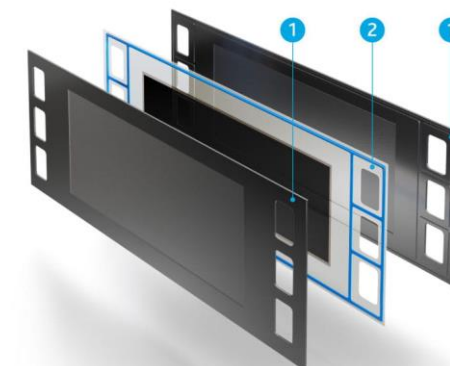
<https://www.sacmi.it/it-it/ceramics/Sanitari/Cottura>

<https://sacmi.com/it-IT/ceramics/Piastrelle/Preparazion-e-polveri-ceramiche>



Toyota forklift truck, © Toyota

Single Cell of a Heavy Duty Fuel Cell Stack



- 1 Heavy Duty – Bipolar Plate (BPP)  
Graphite bipolar plate with advanced flow field design for homogenous temperature profile and homogenous gas distribution.
- 2 Heavy Duty – Membrane Electrode Assembly (MEA)  
Fully integrated MEA with patented sealing concept for advanced assembly characteristics.

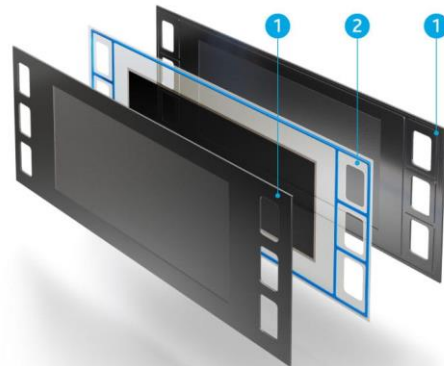
<https://www.fst.com/fuel-cell/>





## Fuel cell

Single Cell of a Heavy Duty Fuel Cell Stack



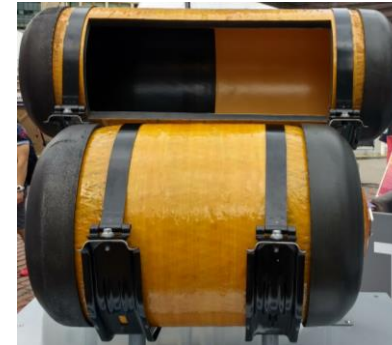
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## Hydrogen tank

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## Electrolysers



<https://cdn.offshorewind.biz/wp-content/uploads/sites/6/2022/09/13121015/Worlds-largest-electrolyser-arrives-in-Norway-to-scale-up-green-hydrogen-projects1.jpeg>



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