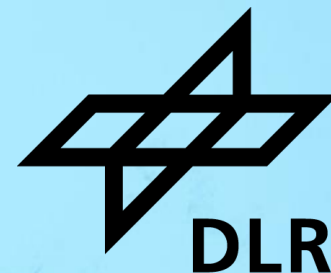
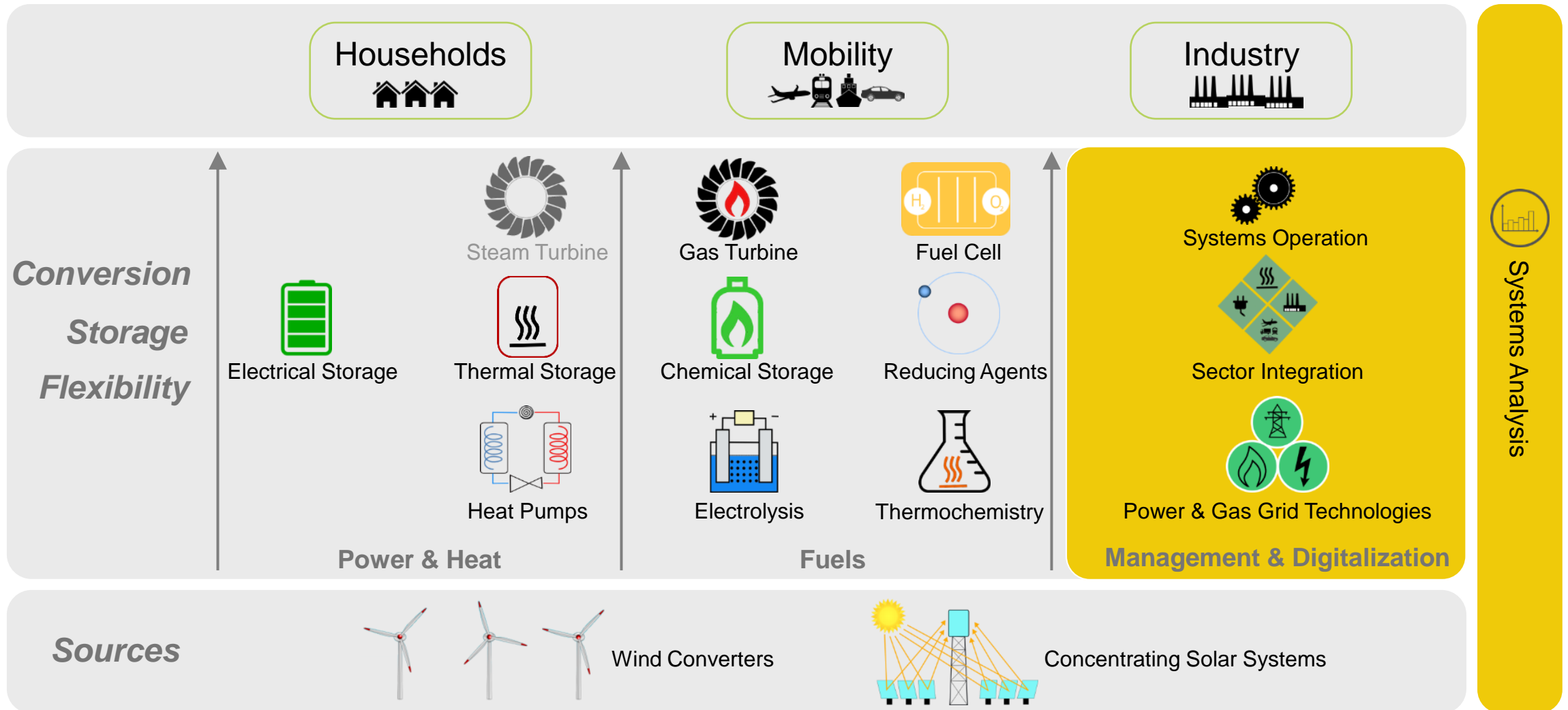


# Keynote to Fuel Cell Systems

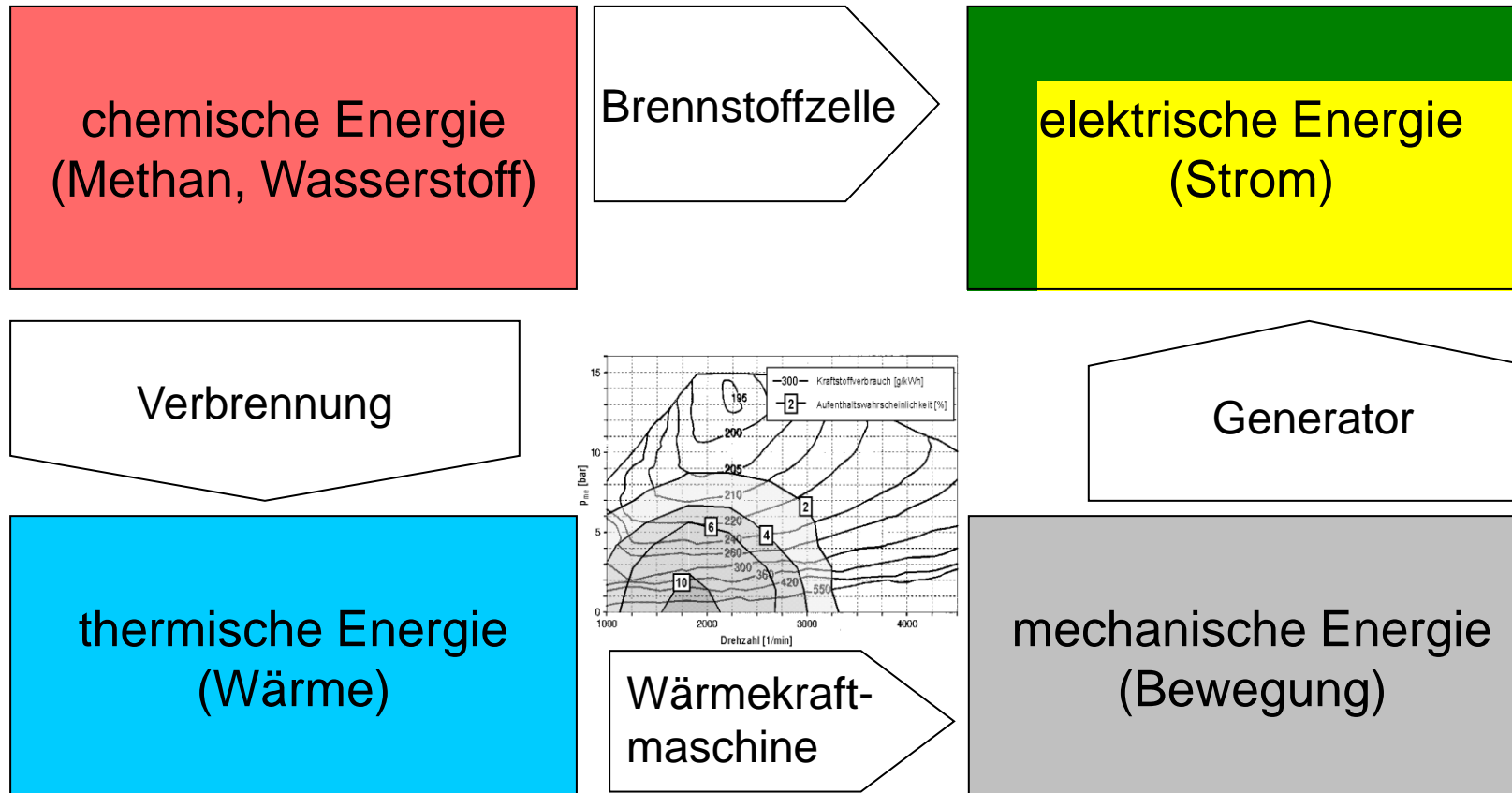
**Dr. Alexander Dyck**  
**Hydrogen Hydrogen Cross Border Conference 2024; Session Technology & Innovation**  
**on 28. February 2024 in Aurich**



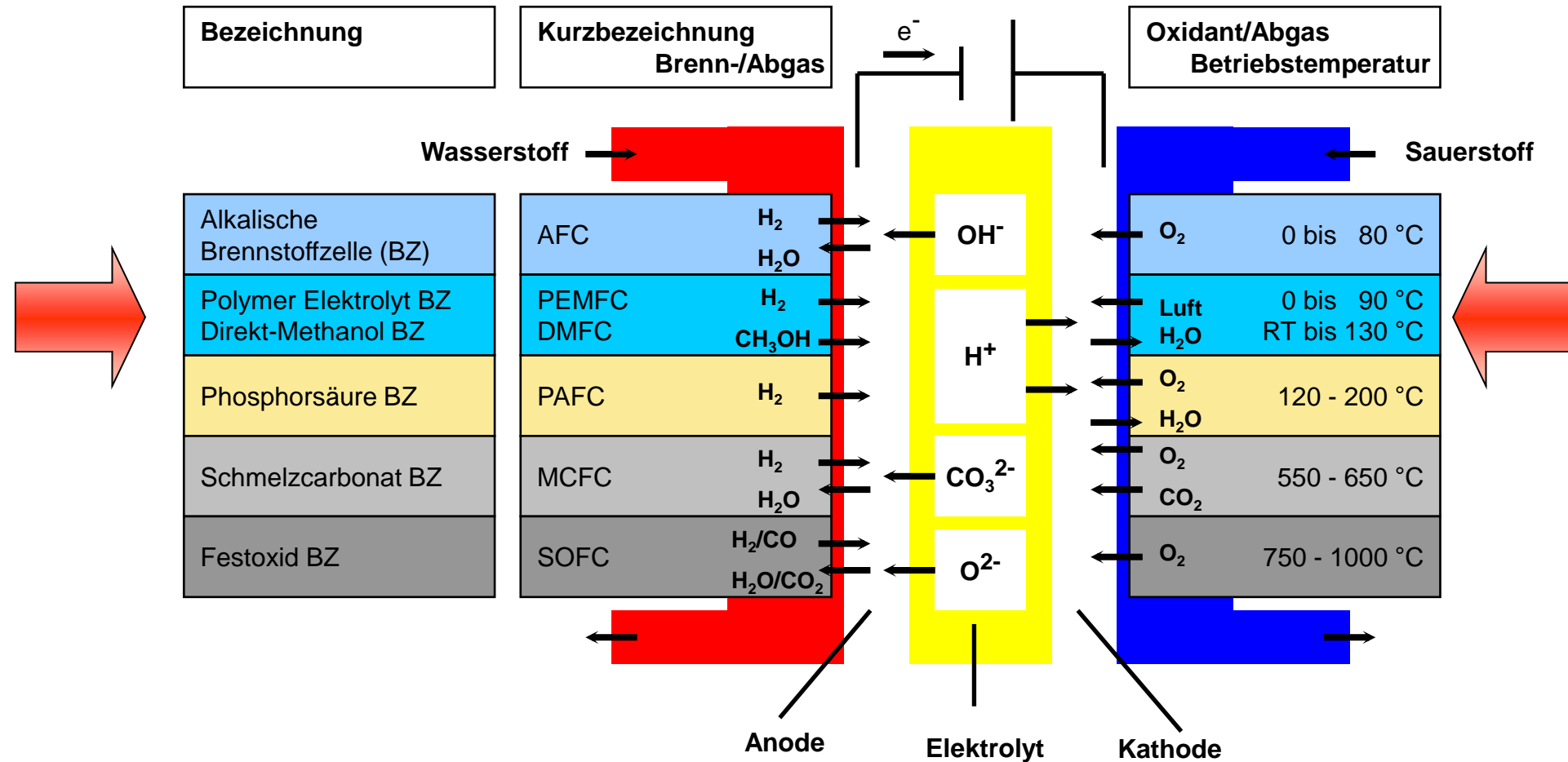
# Energy research at DLR – Research at DLR in general, Shares from the Institute in Oldenburg (VE)



# Use Cases For Chemical Energy Carriers – Fuel Cells vs. ICE

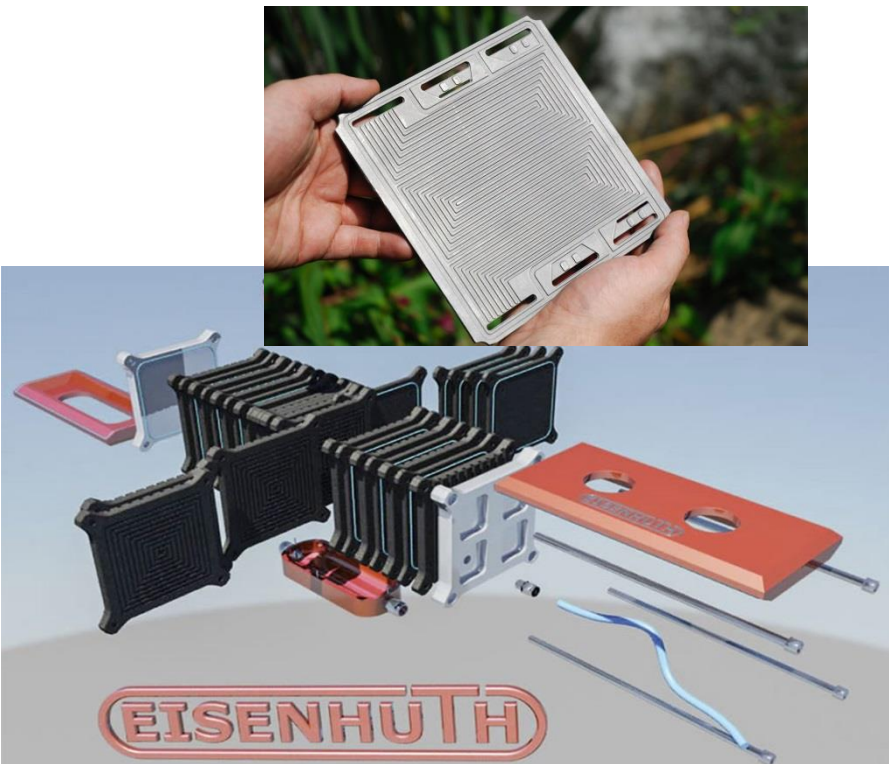


# Fuel Cell Technology – Overview





# Fuel Cell -Components, -Stack, -Module



Source: [www.eisenhuth.de](http://www.eisenhuth.de)



Source: [www.proton-motor.de/](http://www.proton-motor.de/)



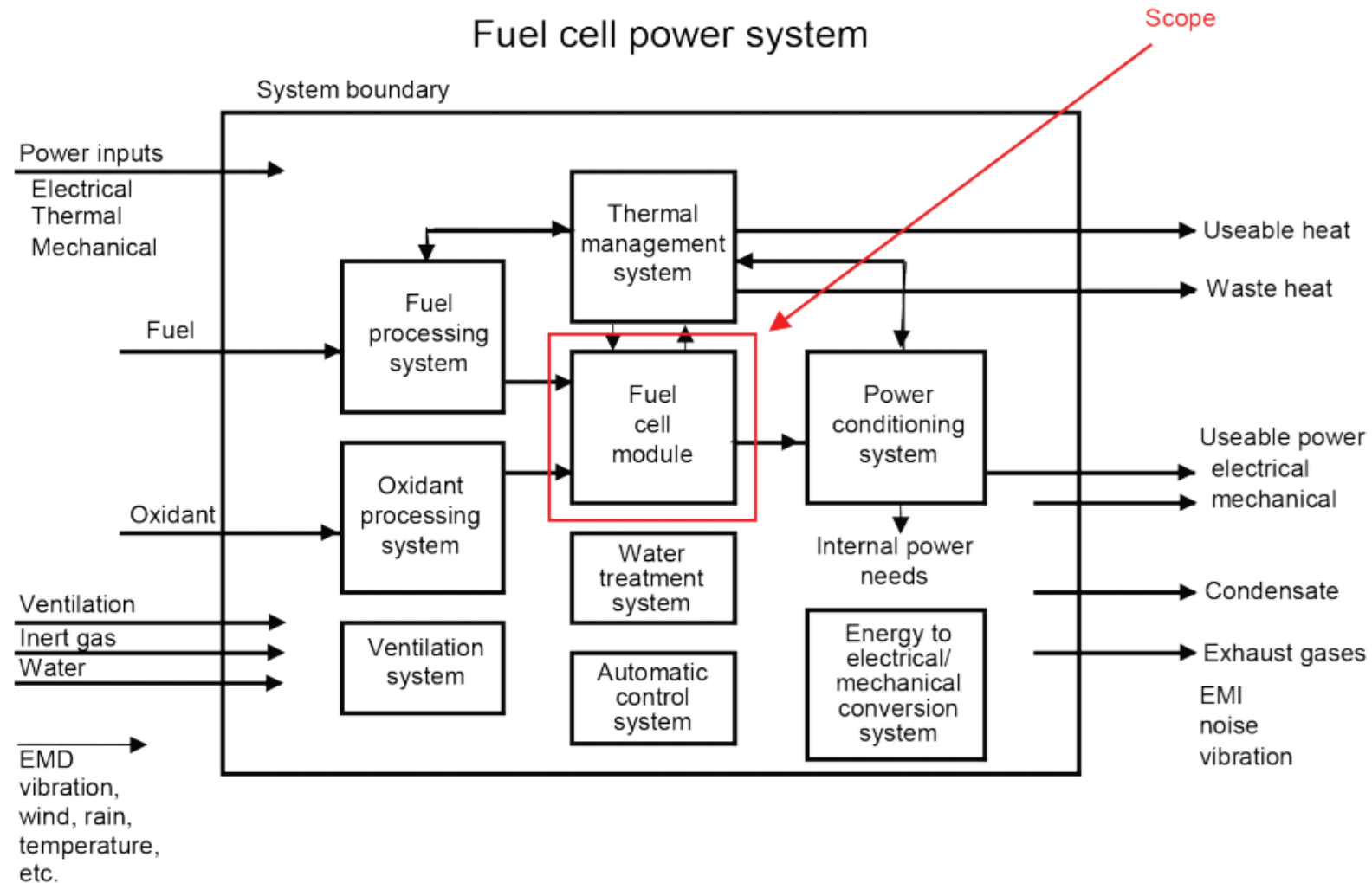
Source: [www.powercell.se/en/products/powercell-s3/](http://www.powercell.se/en/products/powercell-s3/)



# Fuel Cell Power System – System Boundaries

IEC 62282-2-100:2020 © IEC 2020

– 7 –



Source: IEC

# Fuel Cell System Applications

- Space travel
- Airplanes / drones
- Ships (ferries, submarine, cruise ships, ...)
- Portable (army, on-board power supply, charger)
- Heavy goods vehicles (trucks, buses, refuse collection vehicles, ...)
- Cars (passenger cars, delivery vans, APU, ...)
- Buildings (stationary supply of electricity and heat)
- Reconversion (fire protection, altitude training, heat utilization)
- Work machines (e.g. forklift trucks, industrial trucks, ...)
- ...

➤ All applications need H<sub>2</sub> as infrastructure

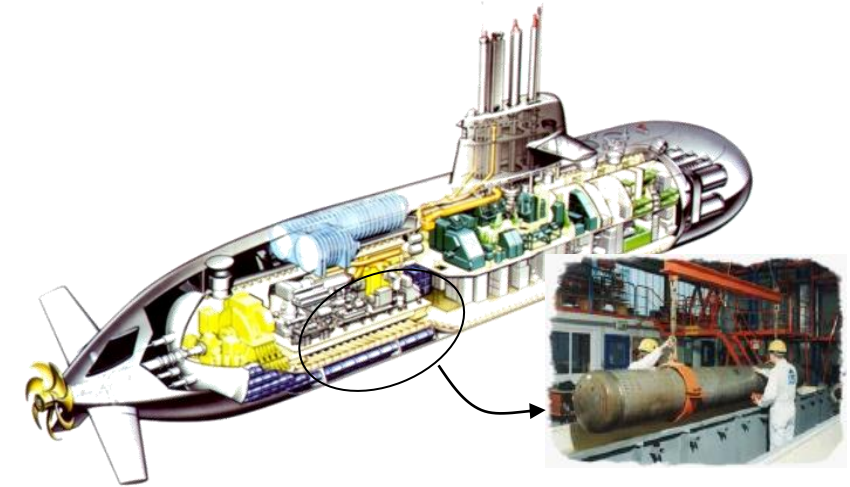




# Fuel Cell System – Market Entry

- Identification of use cases
- Added values should be reasonable
- Scalability for fuel cell systems must be proven (> MW class)
- Relevance of the price of hydrogen for operation
- Available hydrogen infrastructure needed
- ...

## U-Boot-Klasse 212 A



<http://www.diebstoffzelle.de/nachrichten/BrennstoffzellenU-BootU33beiHDWgetauft.shtml>



<https://www.electrive.net/2019/09/25/hyundai-nennt-erstedetails-zum-h2-lkw-fuer-die-schweiz/>



<https://www.faun.com/aktuelles/bluepower-entwicklung-erhaelt-offiziellen-foerderbescheid/>



Source: [www.efoy.com](http://www.efoy.com)



<https://dronelife.com/wp-content/uploads/2017/03/Screen-Shot-2017-03-28-at-7.15.14-AM.png>



# Activities on hydrogen by the DLR-VE as a basic building block of sector coupling



## RingWaBe & HyQuality Europe - H<sub>2</sub> Purity



Gefördert durch:  
Bundesministerium  
für Verkehr und  
digitale Infrastruktur

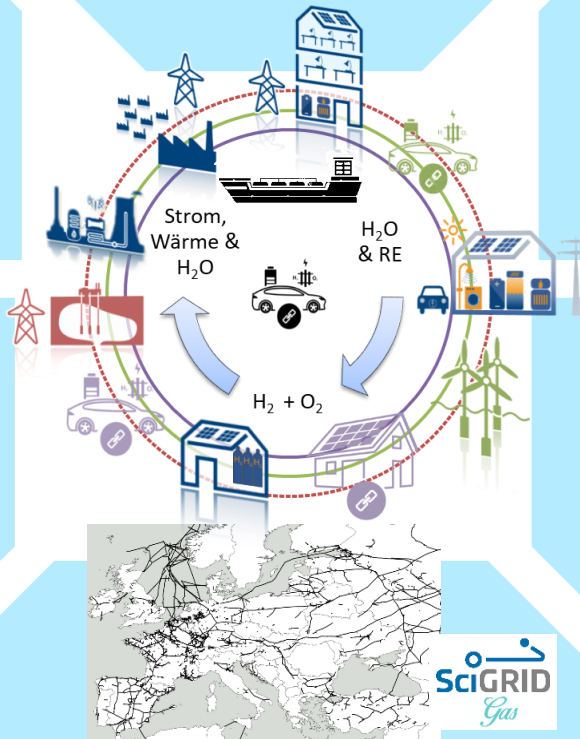
Koordiniert durch:  
NOW  
NOW-GMBH.DE



Funded by  
the European Union

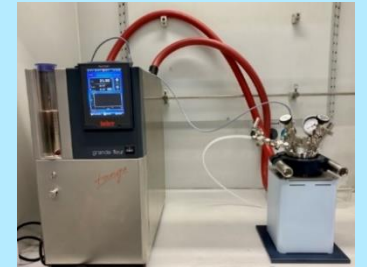
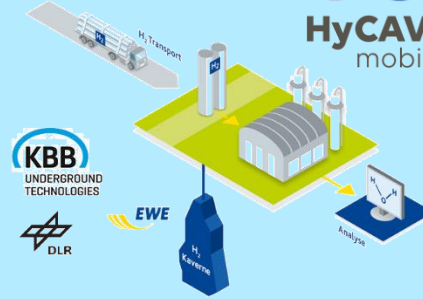
## HyResponder - H<sub>2</sub> Safety

Hy Responder



SciGRID<sub>gas</sub> - H<sub>2</sub> Infrastructure

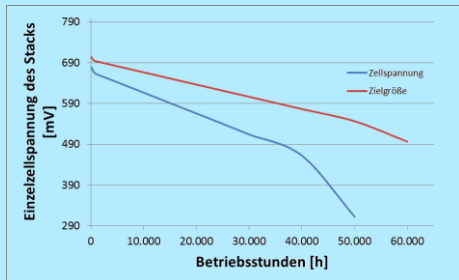
## HyCAVmobil - Storage



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NOW-GMBH.DE

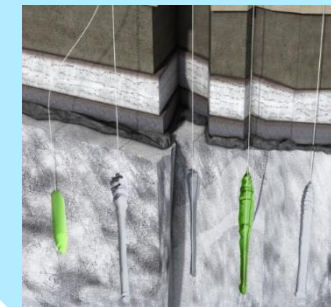
## Sorglos CHP – H<sub>2</sub> /CH<sub>4</sub> ratio (carefree)



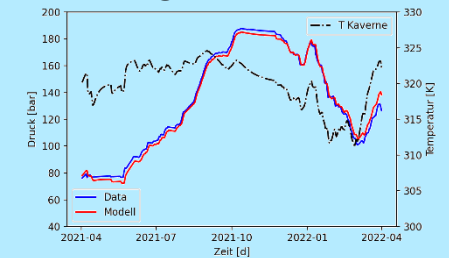
Supported by:  
Federal Ministry  
for Economic Affairs  
and Climate Action

on the basis of a decision  
by the German Bundestag

## H2CAST - Operating parameters



(c) DEEP.KBB GmbH



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Niedersächsisches Ministerium  
für Umwelt, Energie und Klimaschutz

Supported by:  
Federal Ministry  
for Economic Affairs  
and Climate Action

on the basis of a decision  
by the German Bundestag

# Hydrogen drives us!

H<sub>2</sub> as a fuel including fuel cells use



Source: <https://www.spiegel.de/fotostrecke/space-shuttle-erstflug-fotostrecke-107039.html>

# Thank you for your attention! Questions?



## DLR - Institute of Networked Energy Systems



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