



# Financing & Insuring Green Hydrogen Risks and the Role of Risk Transfer

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# Munich Re Green Tech Solutions

For OEMs, Projects & Investors



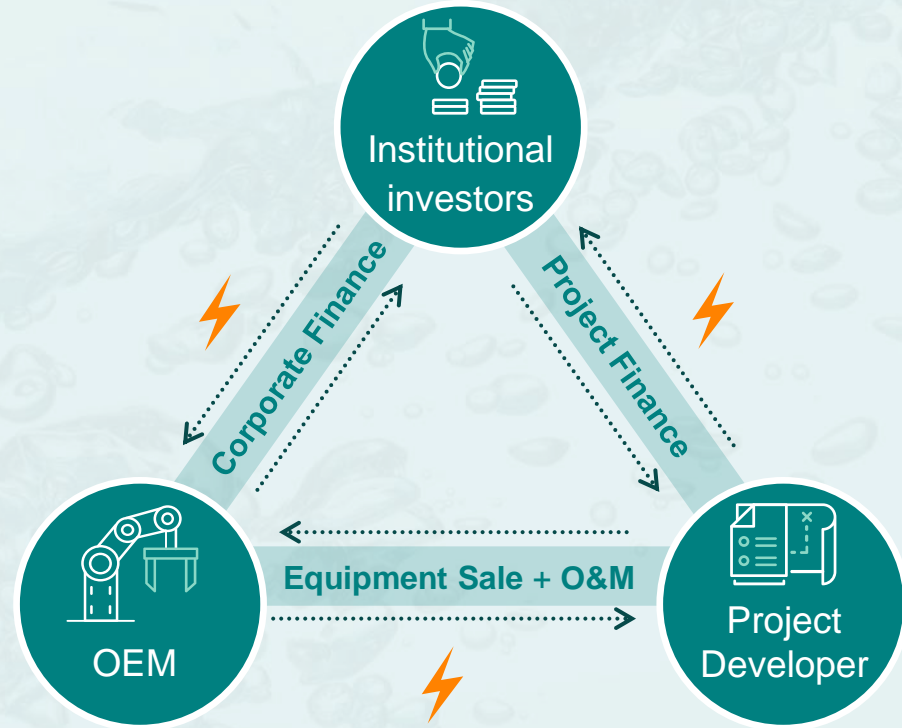
Within Green Tech  
with a nameplate capacity of  
in  
> 850 projects  
~ 51 GW  
~ 80 countries.

# Uncertain and unproven technologies contribute to hesitance when it comes to investments

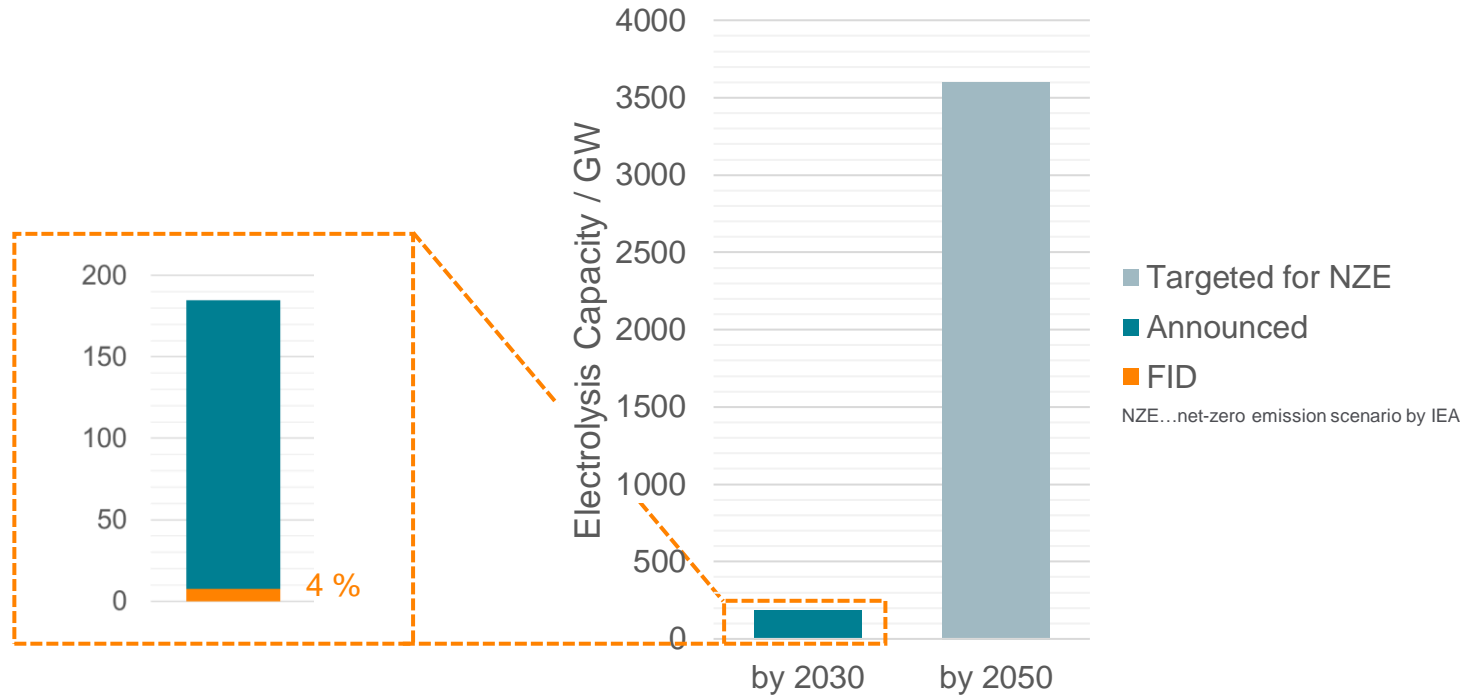
“

We are not bankable!

- ✗ Lack of long-term experience data on technology performance
- ✗ Lack of offtake agreements
- ✗ Lack of standards / certificates
- ➔ Scale-up risks



# Green Hydrogen Scale in a Net Zero Emission Scenario



Data Source: [IEA, Global Hydrogen Review, 2023], recalculated from a 2030 annual hydrogen production of 27Mt via electrolysis assuming 7000h/a and average operating hours and 48kWh/kg, early stage announcements included

# Hydrogen's properties differ vastly from carbon-based fuels

New opportunities, new challenges, new risks

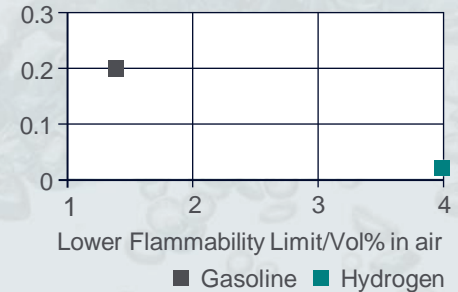


## Flammability

A relatively high hydrogen concentration, but low ignition energy is needed for hydrogen to burn

→ hot, high and fast burning flame, which is invisible in daylight

Ignition Energy/mJ



## Volatility

H<sub>2</sub> is the lightest molecule; 1L of gaseous hydrogen at standard conditions ~ 0.09 g

→ rises rapidly in air



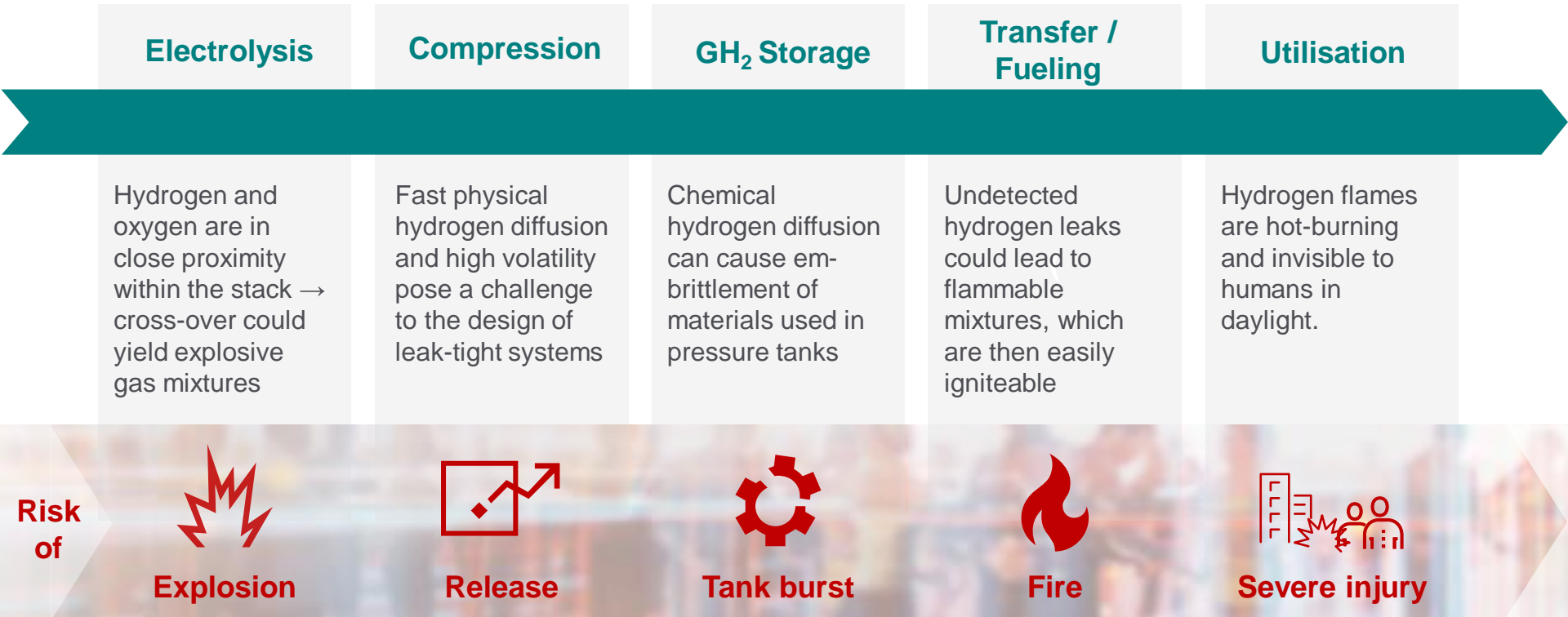
## Diffusivity

Hydrogen can diffuse physically and chemically

→ escapes fast and can even pass through most materials incl. metals

→ can cause brittleness in most solids

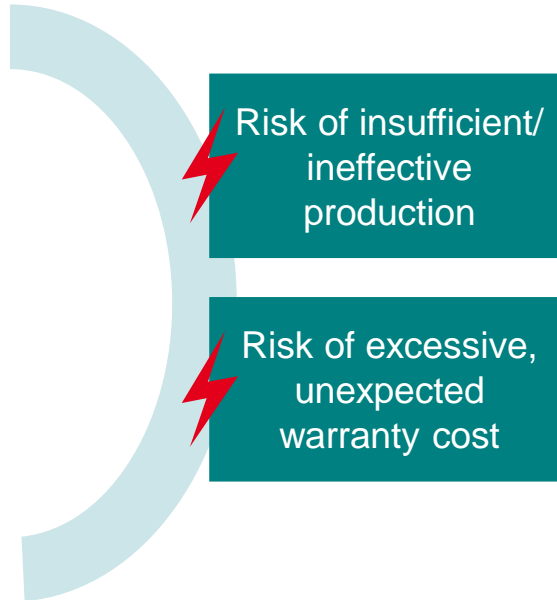
# Examples of technical risks along the GH<sub>2</sub> value chain associated with hydrogen as a “new” energy carrier



# Business Case: “To Have and Have Not” (1/2)

Spotlight on Performance and Durability Risks

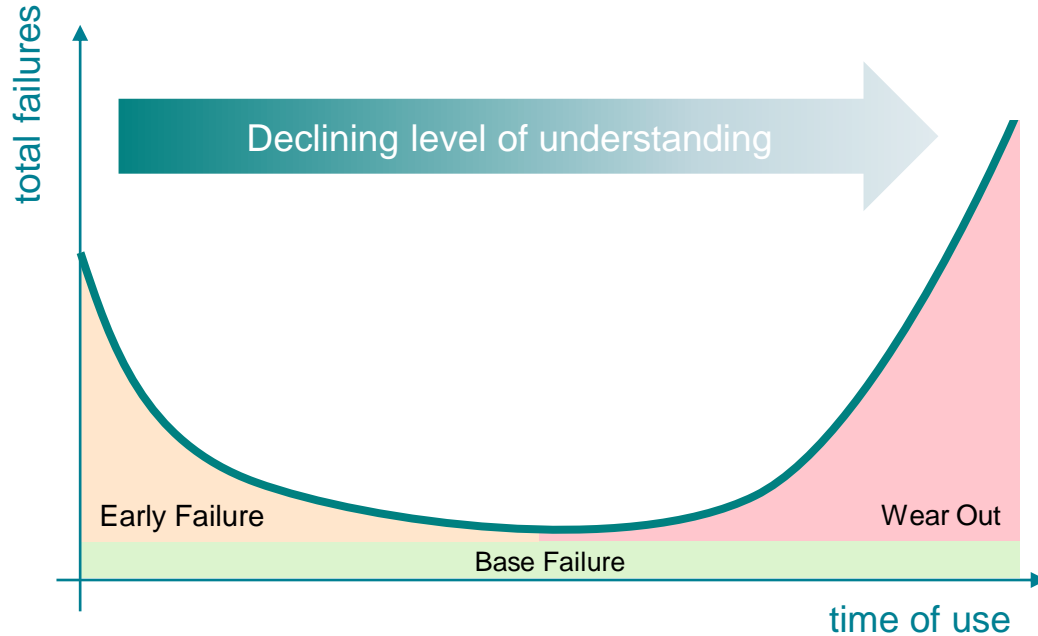
- Limited technological maturity
  - considerable uncertainties in scaling, performance and durability aspects
  - impairs bankability of hydrogen projects
- Complex, non-linear aging behavior
  - multi-component systems
  - interrelated and often mutually reinforcing degradation mechanisms
  - influenced by multiple factors (ambient conditions, use case, materials, feed purity etc.)




- × Business case is built on performance and durability assumptions
- × Accelerated degradation, progressing wear-out, serial losses etc. not accounted for
- × Reserves only consider “the expected”

# Business Case: “To Have and Have Not” (2/2)

Spotlight on Component Failure

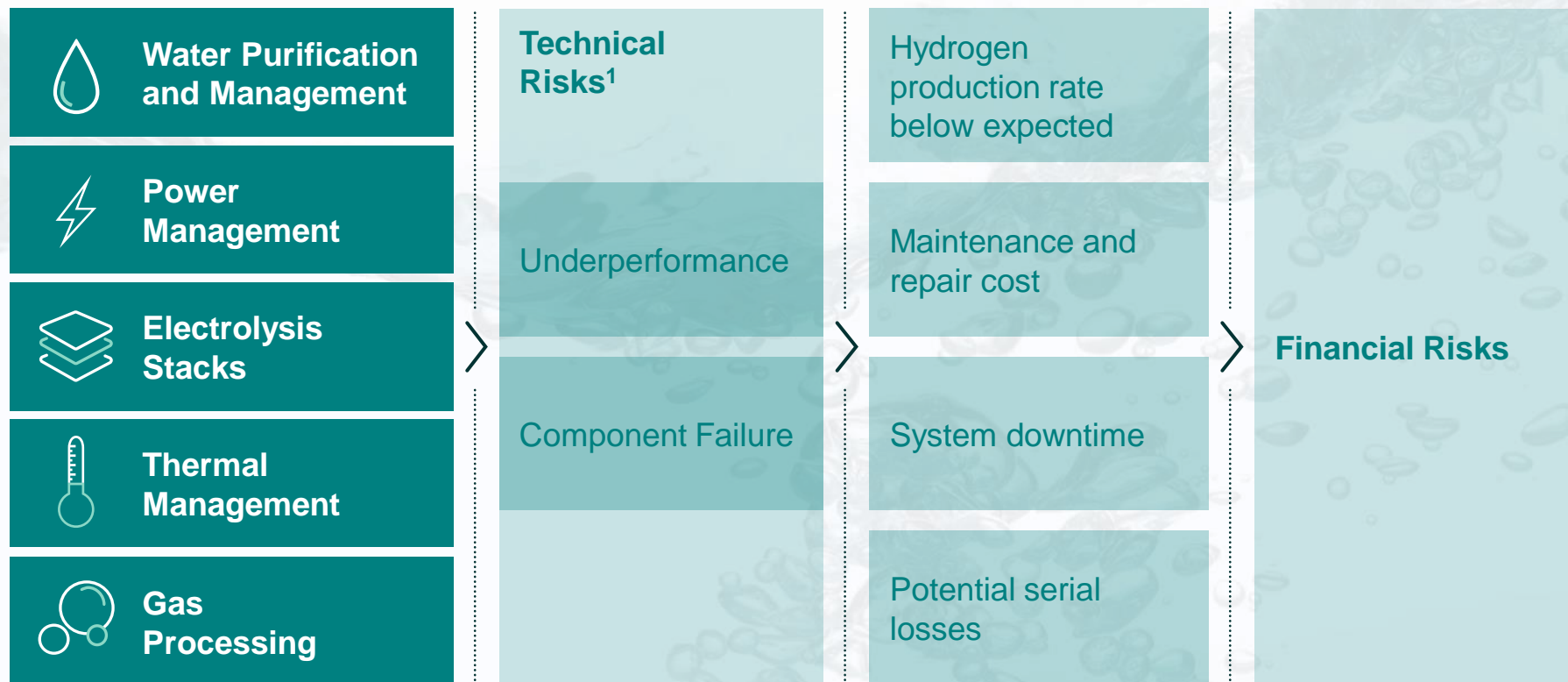


 Limited information from preliminary material and component testing

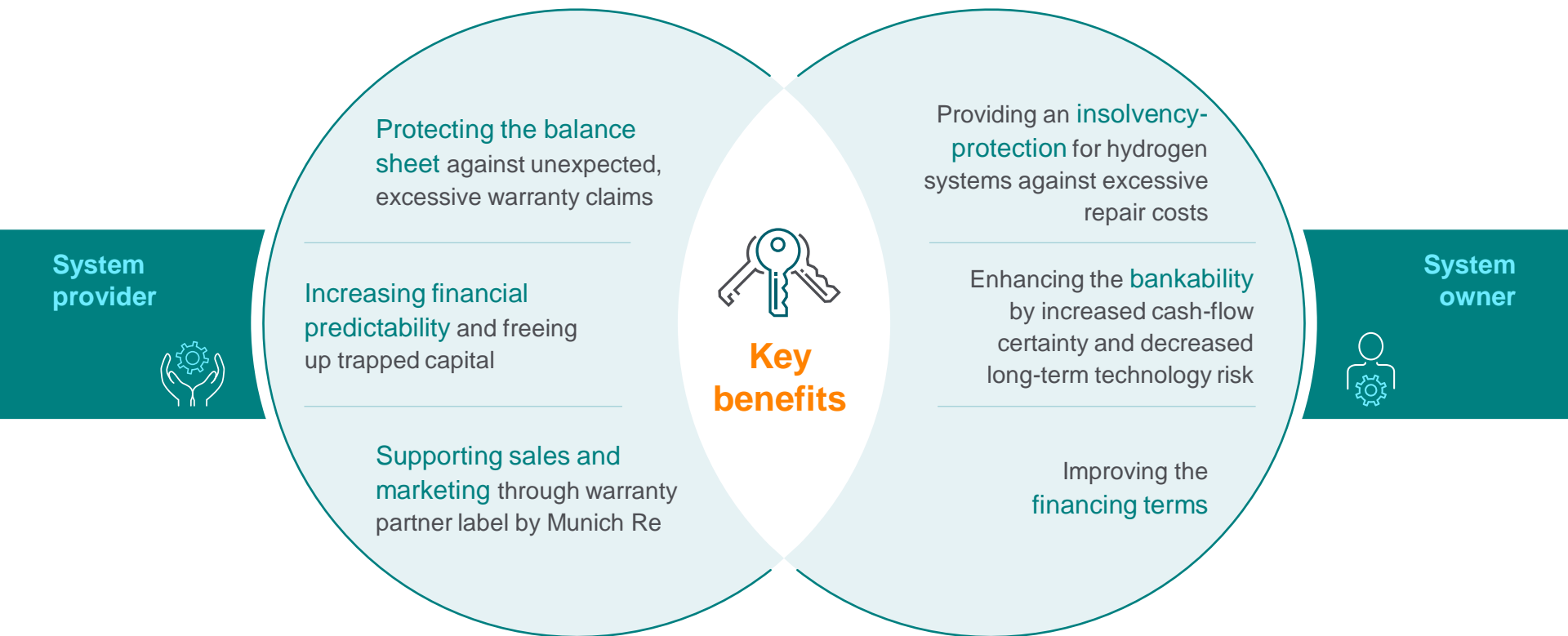
- × Uncertain component failure rates
- × Unknown wear-out times
- × Undetermined serial loss probability



# Summary of technical risks in an electrolyzer plant and their impact



# The Role of Risk Transfer: Product and Performance Warranty Backstop



Join the hydrogen adventure and stay in touch



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**Thank you!**  
Questions?



**Learn more**

Whitepapers for download on our website

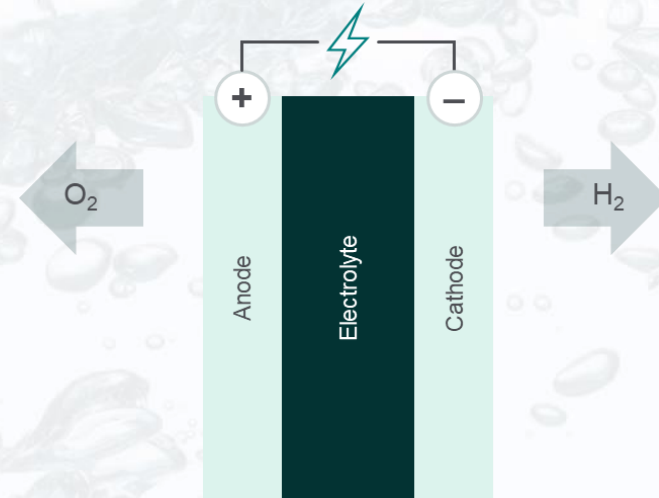
# Green Hydrogen as an Energy Carrier: Motivation & Challenges

## Large decarbonization potential

- Produced from renewables
- Inherently carbon-free
- Relatively versatile:
  - Direct use
  - Upgrading to other products
  - Re-electrification (mobile/stationary)
  - Longterm storage

## Hurdles to overcome

- Drastic scale up of production capacity would be required
- Limited familiarity with technologies and risks involved



# Simplified flow chart of an electrolysis plant

(only major streams from/to the electrolysis stacks are shown; the grey boxes indicate the system boundaries as considered herein)

