



The 23<sup>rd</sup> International Asset Facility and Maintenance Management Conference

# THE H2 EDUCATOR

Building Confidence Through Hands-On Hydrogen Training



12-14 January 2026

Riyadh, KSA

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Organized by



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# AGENDA



## H2 Educator

System Walkthrough  
AEM Electrolyzer Technology  
Hydrogen Production Process  
Water Circuit - Instrumentation



## Safety System

Hydrogen the Ninja Element  
Safety Implications  
Fire Triangle Approach  
H2 Educator Safety Systems



## Economics

Modular Scaling Demonstration  
Business Case Development.



## Applications

Examples  
Brainstorming Session

# Easy Energy Companies & Consulting



EasyEnergy is a **Swiss Engineering & Consulting company** with worldwide references.

Combining knowledge and experience in the field of **power, heat, gas**, hydrogen and **special fluids**, we support customers in their hydrogen projects as **system integrator**.

Thanks to our cooperation with leading partners we design and manufacture customized products such as **hydrogen production systems, auxiliaries for turbines**, gas and liquid filtration unit, **compressor skid**.



**Davide Hanselmann**  
Easy Energy Companies & Consulting SA  
*CEO*

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# H2 Educator – How it works

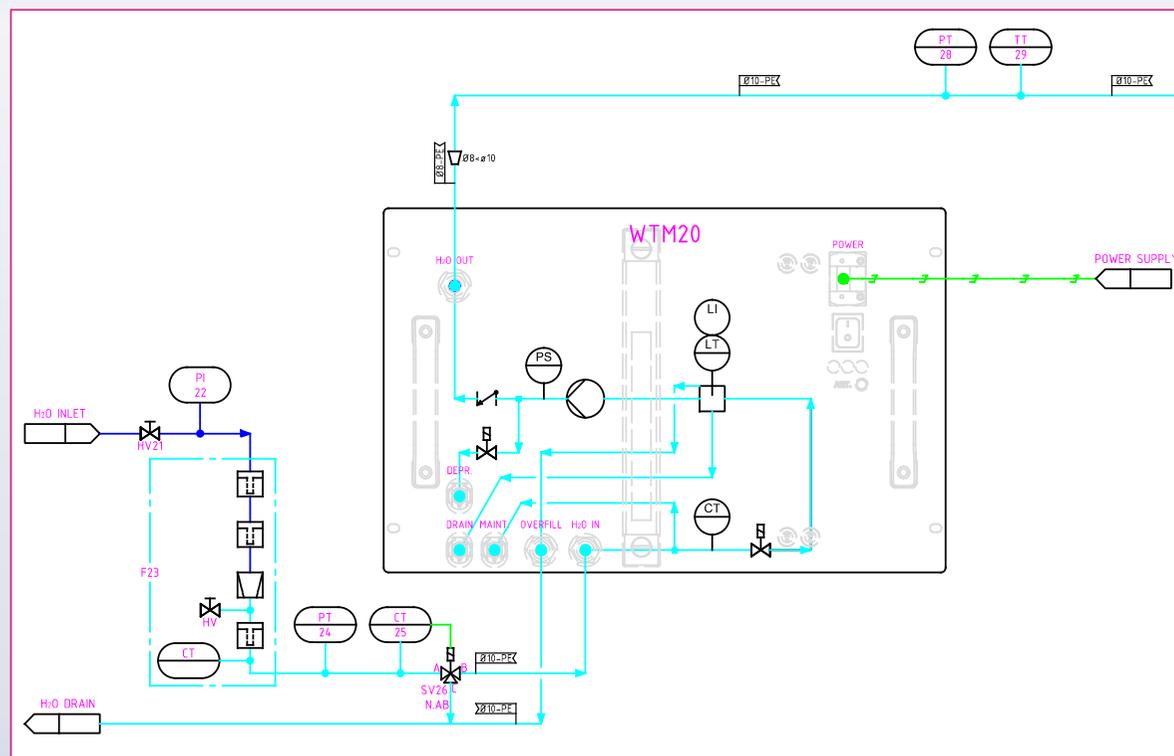
We realized and operate a H<sub>2</sub> EDUCATOR to **test**, **verify** and **validate performance** of production system under different loads with **Enapter AEM electrolyser**.



## H2 Educator – How it works

### WATER CIRCUIT

- Tap water
- Water treatment system with osmosis filter
- Water conductivity check
- Demi Water tank
- Demi Water supply to electrolyzers

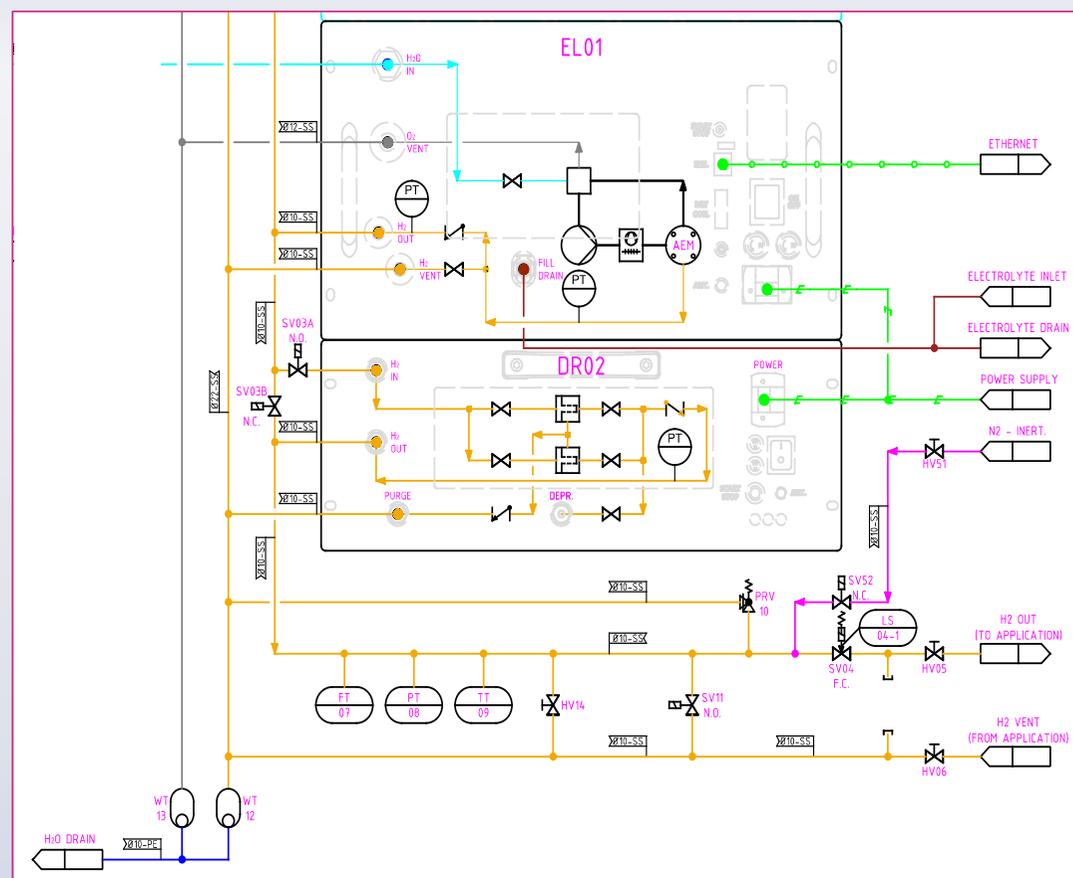


# H2 Educator – How it works

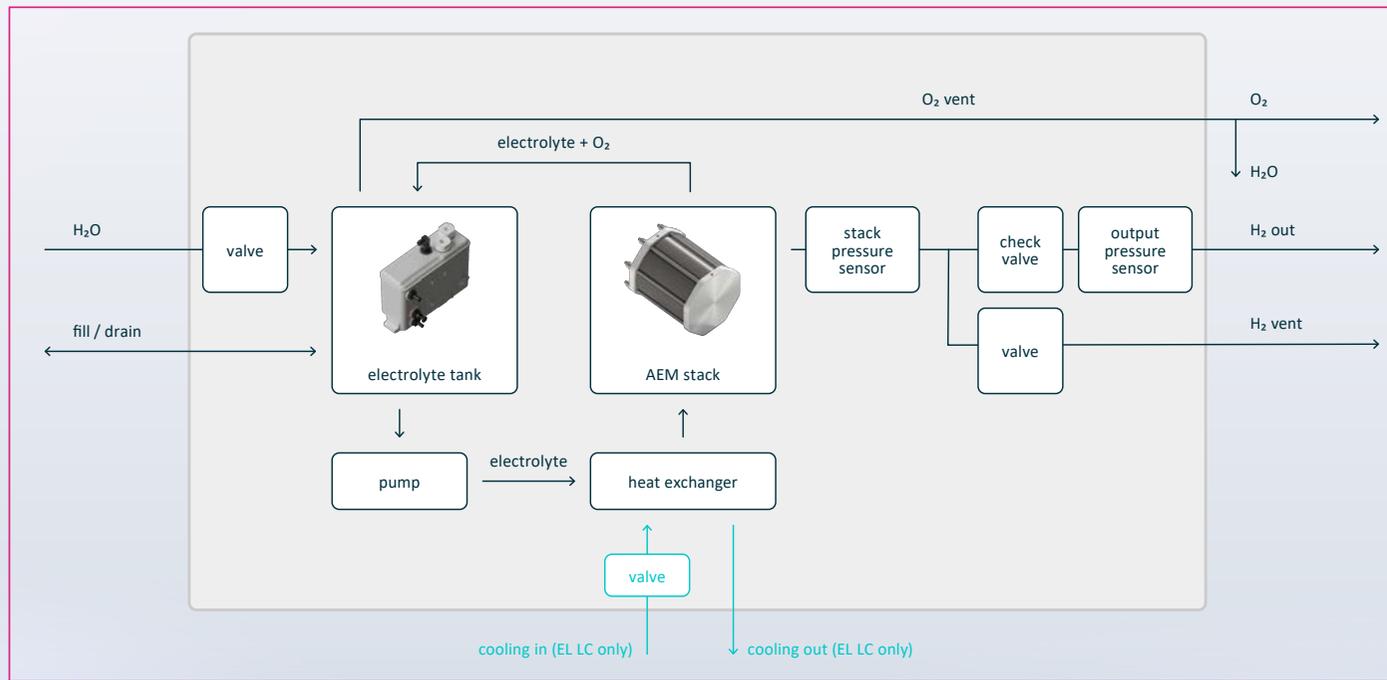
## HYDROGEN CIRCUIT

- ❑ Demi water from tank
- ❑ Hydrogen out to dryer module 99.999% purity
- ❑ Hydrogen from dryer to application
- ❑ Hydrogen could be vented if needed
- ❑ Oxygen vented outside, need to be separate from Hydrogen
- ❑ Water trap for draining condensate

**H<sub>2</sub> up to 35 bar**  
**99.999% pure**  
**2 kg/day**



# H2 Educator – Electrolyzer



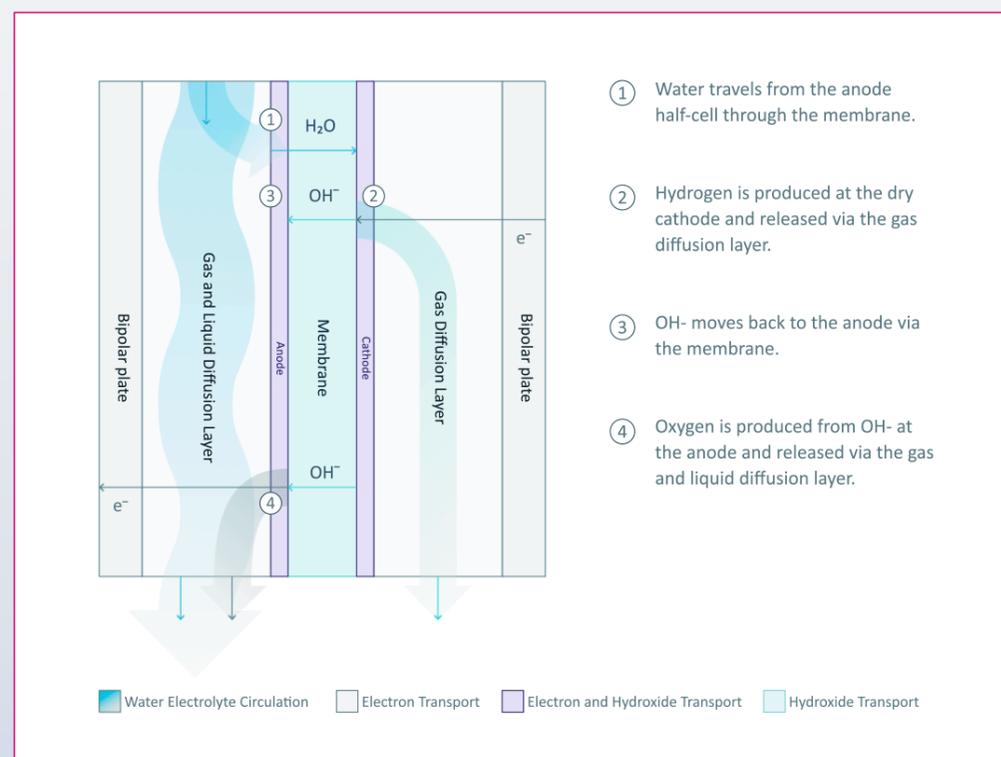
# H2 Educator – Electrolyzer – Stack Working Principle

## ANION EXCHANGE MEMBRANE ELECTROLYZER

Anion Exchange Membrane (AEM) Electrolysers unlock on-site hydrogen production **for any use, at any scale.**

Electrolysis with anion exchange membranes has **clear benefits** compared with other electrolytic processes such as conventional alkaline electrolysis using diaphragms (AEL) or the more recent method of proton exchange membrane electrolysis (PEM) which is highly dependent on raw materials such as precious metals.

The innovative AEM concept **reduces investment costs** because the cells used for electrolysis in alkaline conditions do not require precious metals. Therefore, far less expensive materials can be used. Other attributes of this AEM electrolysis platform are **high current density, very good efficiency, and high flexibility.**



## H2 Educator – Instrumentation

**Emerson reliability, precision, complete range of product (more focused on bigger projects)**

### MEASUREMENT & FLOW



### LIQUID & GAS ANALYTICAL



### FLOW CONTROL VALVES



# H2 Educator - DEMO



DEMO VIDEO

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# H2 Educator – Control & Monitoring – Safety



## Safety – Fire Triangle For Hydrogen



### AVOID

#### **Unintentional mixing:**

Use only hydrogen compatible materials and consider design and safety factors to prevent leaks



### ANTICIPATE

#### **Ignition mechanisms:**

Control mechanisms that can ignite hydrogen-oxidizer mixtures

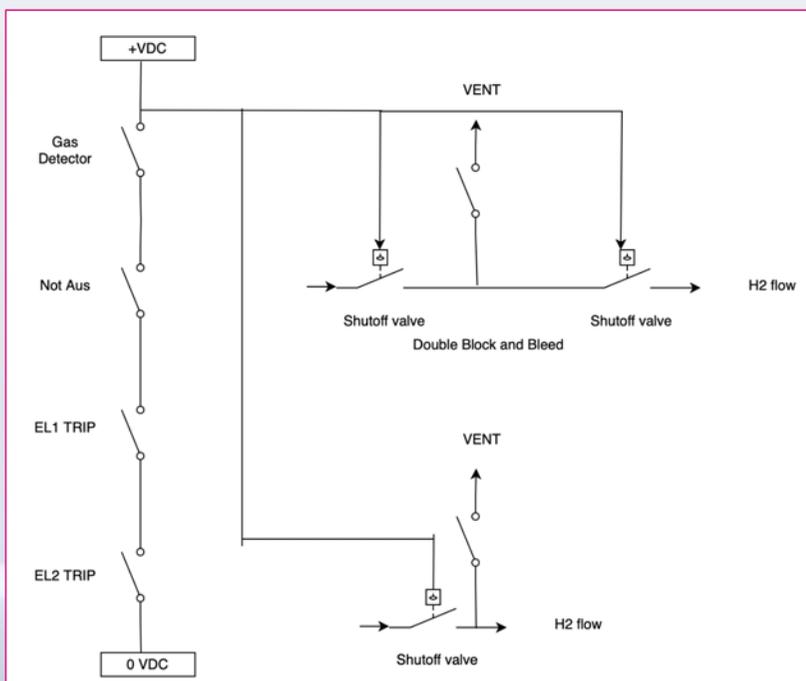


### ADOPT

**Best practices:** Implement safe practices with inspection, assembly, operation, maintenance and safety systems

# H2 Educator - Safety Concept

- ❑ N2 injection line to purge all piping
- ❑ Safety system with spring return, limit switch for close position, manual venting



Consequence of failure (rank)	Consequence of failure ranges				MTTF rank		
	Personal health and safety (S)	Environmental (E) degradation	Impact on production (P) and operation	Cost (Economy) (C)	1	2	3
					25 < MTTFF < 250 (years)	5 < MTTFF < 25 (years)	MTTF < 5 (years)
1	Minor injuries. No potential for fire. No effect on safety systems.	A small spill has been detected. Volume < 0.01 m <sup>3</sup> (10 liters) to sea or spilled on installation.	Brief stop of production less than 3 hours. Failure of subsea equipment with negligible impact on production.	Repairs can be performed while being on topside.	N	L	M
2	Personal injuries requiring medical treatment. Potential for fire, but not in classified area (e.g. possible failure to isolate section from the platform). Limited effect on safety systems.	Moderate spill to sea. Any oil > 0.01 m <sup>3</sup> (10 liters) Any red chemicals > 0.01 m <sup>3</sup> (10 liters) Any yellow chemicals > 0.1 m <sup>3</sup> (100 liters) Any green chemicals > 10 m <sup>3</sup> (1000 liters)	Shutdown or reduced rate of production between 3 to 12 hrs. Failure of subsea equipment with limited impact on production (e.g. retrievable modules or components forming part of the water injection system).	Subsea intervention with need of a small to medium sized vessel.			
3	Serious personnel injuries. Potential for fire in classified area (e.g. possible failure to isolate the section from platform). Hender safety systems inoperable.	Major spill to sea. Any oil > 16 m <sup>3</sup> (100 bbl) Any quantity of black chemicals.	Shutdown or significant reduced rate of production for more than 12 hours.	Major subsea interventions with the necessity of rig or large vessel.			

## RISK ANALYSIS

Degree of seriousness	Injury	Work related illness (WRI)		Uncontrolled discharges/emissions		Oil/gas/flammable liquids leakages		Fire/explosion		Failure in safety/security functions and barriers		Reputation	
		Actual	Potential	Actual	Potential	Actual	Potential	Actual	Potential	Actual	Potential	Actual	Potential
1	Fatality	Work related illness that result in death	Single spill with long term effect on the environment.	Release to air > yearly expected emission of component	>10 kg/s or brief leak/sight >100 kg	Whole facility/area exposed	Threaten whole facility/area	Great international negative exposure in mass media and among organizations					
2	Serious lost time injury/serious injury	Work related illness	Single spill with short term effect on the environment.	Release to air > weekly expected emission of component	1-10 kg/s or brief leak/sight >10 kg	Large part of facility/area exposed	Threaten large part of facility/area	Medium international negative exposure in mass media and among organizations					
3	Other lost time injury or injury involving substitute work	Work related illness that results in short term absence or restricted/alternative work	Single spill with minor effect on the environment.	Release to air > weekly expected emission of component	0.1-1 kg/s or brief leak/sight >1 kg	Parts of facility/area exposed	Threaten parts of facility/area	National negative exposure in mass media, from authorities on national level					
4	Medical treatment injury	Work related illness that results in treatment from authorized health care personnel	Single spill with minor effect on the environment.	Release to air > weekly expected emission of component	<0.1 kg/s	Local area of facility/area exposed	Threaten local area	Local/regional negative exposure in mass media, from authorities and customers					
5	First aid injury	Other work related illnesses	Single spill or release to air with negligible effect on the environment	Significantly less than 0.1 kg/s	<<0.1 kg/s	Negligible risk for facility/area	Negligible risk for facility/area	Limited to a few persons or a single customer					

## H2 Educator - Training

Due to high interest in the scaling hydrogen economy more and more companies and therefore employees need to be trained in all parts of the hydrogen value chain, but **training** outside the companies' offices result in additional travel costs, likely leading to limited or no real training related to hydrogen topics.

In addition to that, hydrogen trainings from official notified bodies or training centres are very expensive. Safety topics, correct handling of hydrogen assets and the automation of hydrogen production processes need to be trained by service personnel, engineers, and new hires.

**Our H2 Educator** helps to **increase the knowledge regarding hydrogen production**, measurement, and control in a simple, small and mobile Device.

It allows us to train our own team, and stakeholders teams effectively and on-site. It is ever evolving and dynamic.

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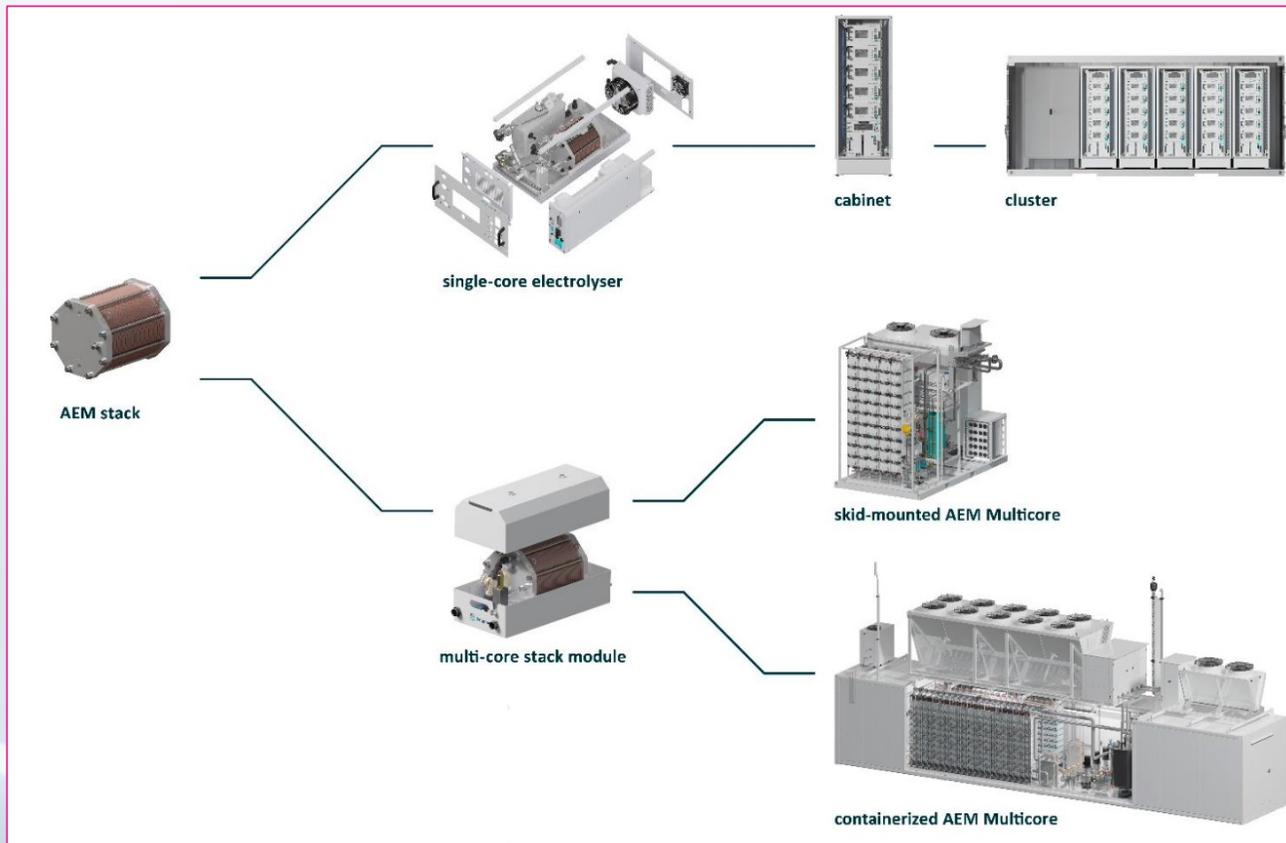
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## H2 Educator – AEM Technology – Benefits



COMPARISON OF THE ELECTROLYZERS			
Technical Differences	AEL Electrolysers	PEM Electrolysers	AEM Electrolysers
Electrolyte	Potassium hydroxide solution	Polymer membrane	Anion or cation exchange membrane
Operating temperature	50 – 90°C	< 100°C	< 60°C
Efficiency	70 – 80%	70%	80%
Maximum current density	0.5 – 1 A/cm <sup>2</sup>	1 – 2 A/cm <sup>2</sup>	2 – 4 A/cm <sup>2</sup>
Catalyst material	Nickel or Raney nickel	Platinum	Non-noble metals
Maintenance	Requires frequent maintenance	Requires regular maintenance	Requires less maintenance than PEM

# H2 Educator – Modular Approach



Flexible H<sub>2</sub> production / Electricity consumption to follow renewable intermittent energy.

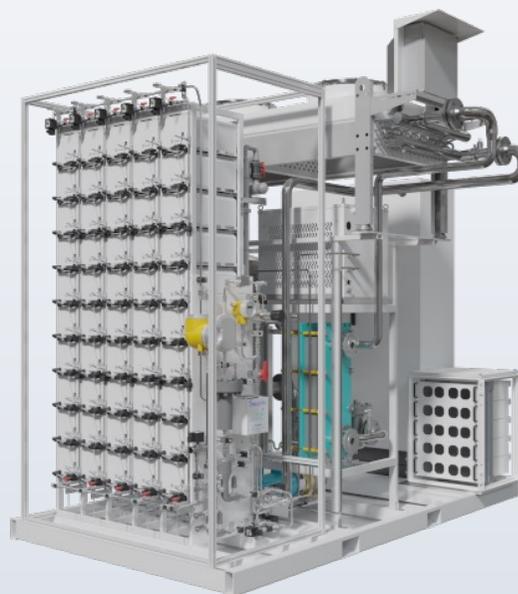
From small to bigger project, **same concept.**

## H2 Educator – Cost / Performance

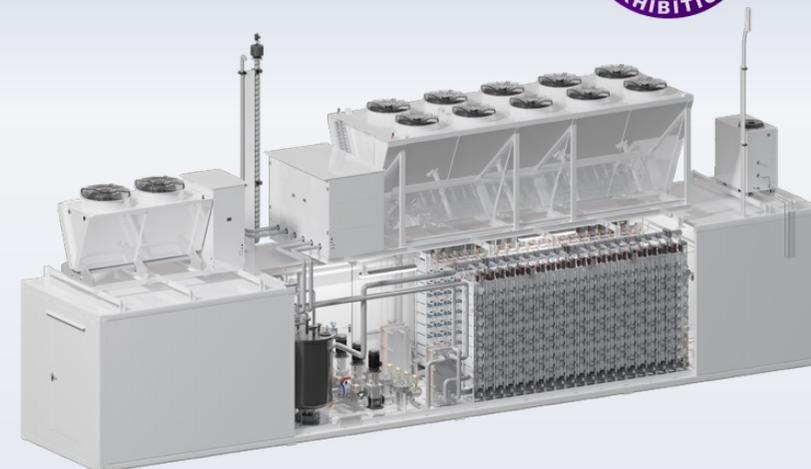
Expected life : 30'000 h



**CAPEX** - 40'000 € - 20'000€/kg/d  
**PERFORMANCE** - 5 kW = 2 kg/day  
**H<sub>2</sub> COST** - 20 €/kg



**CAPEX** - 400'000 € - 7'550€/kg/d  
**PERFORMANCE** - 120 kW = 53 kg/day  
**H<sub>2</sub> COST** - 6 €/kg



**CAPEX** - 1'500'000 € - 3'370€/kg/d  
**PERFORMANCE** - 1 MW = 445 kg/day  
**H<sub>2</sub> COST** - 2.7 €/kg

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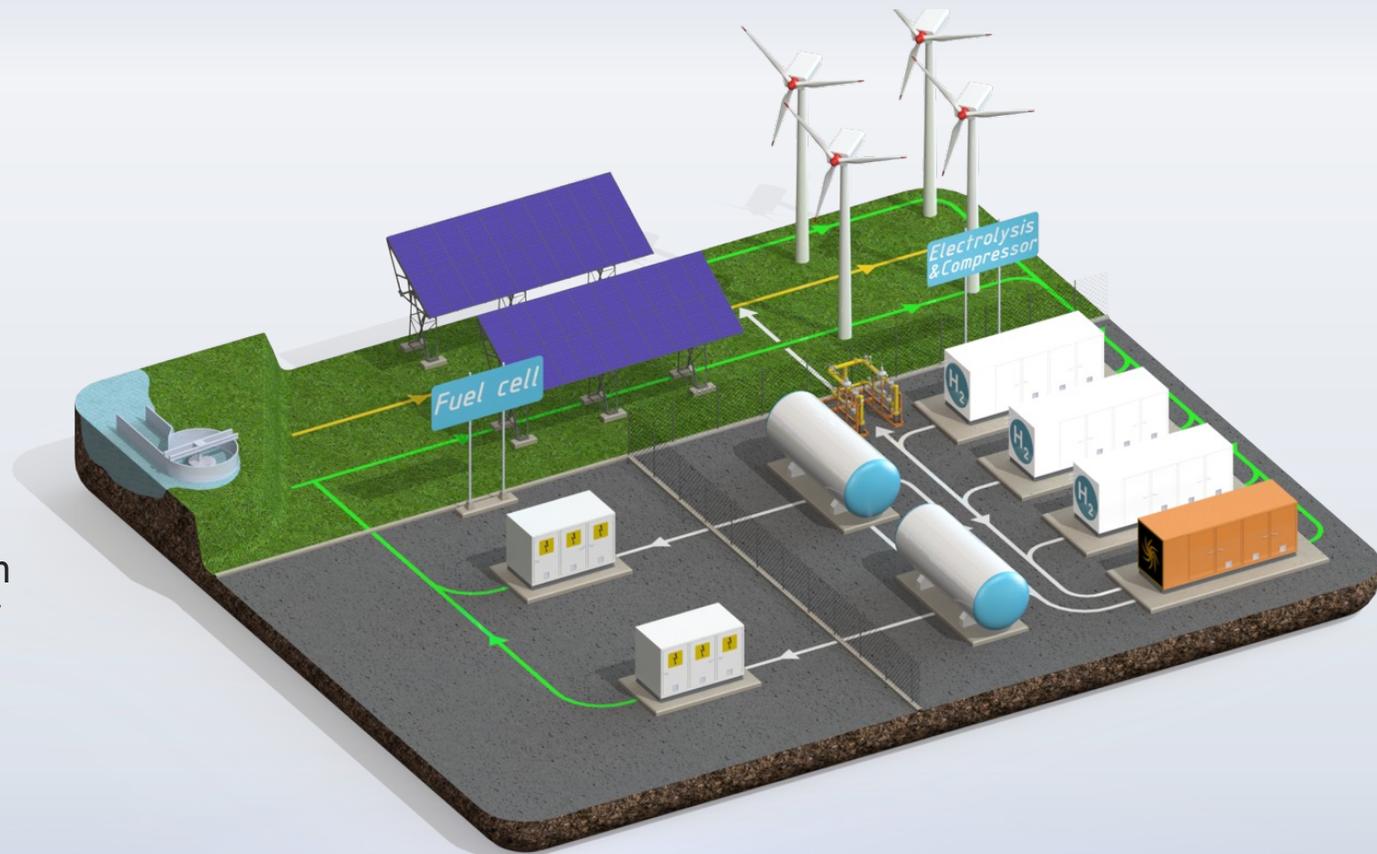
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# HYDROGEN – Backup Power



**Hydrogen backup power system** is the cleanest way to provide uninterrupted and decentralized supply of electricity.

Thanks to high **energy density**, **long lifetime**, **fast response time for start-up** and **power modulation**, fuel cell system can offer reliable and efficient source of electricity for critical loads such data center, antenna's, hospitals, banks, and other critical infrastructure.



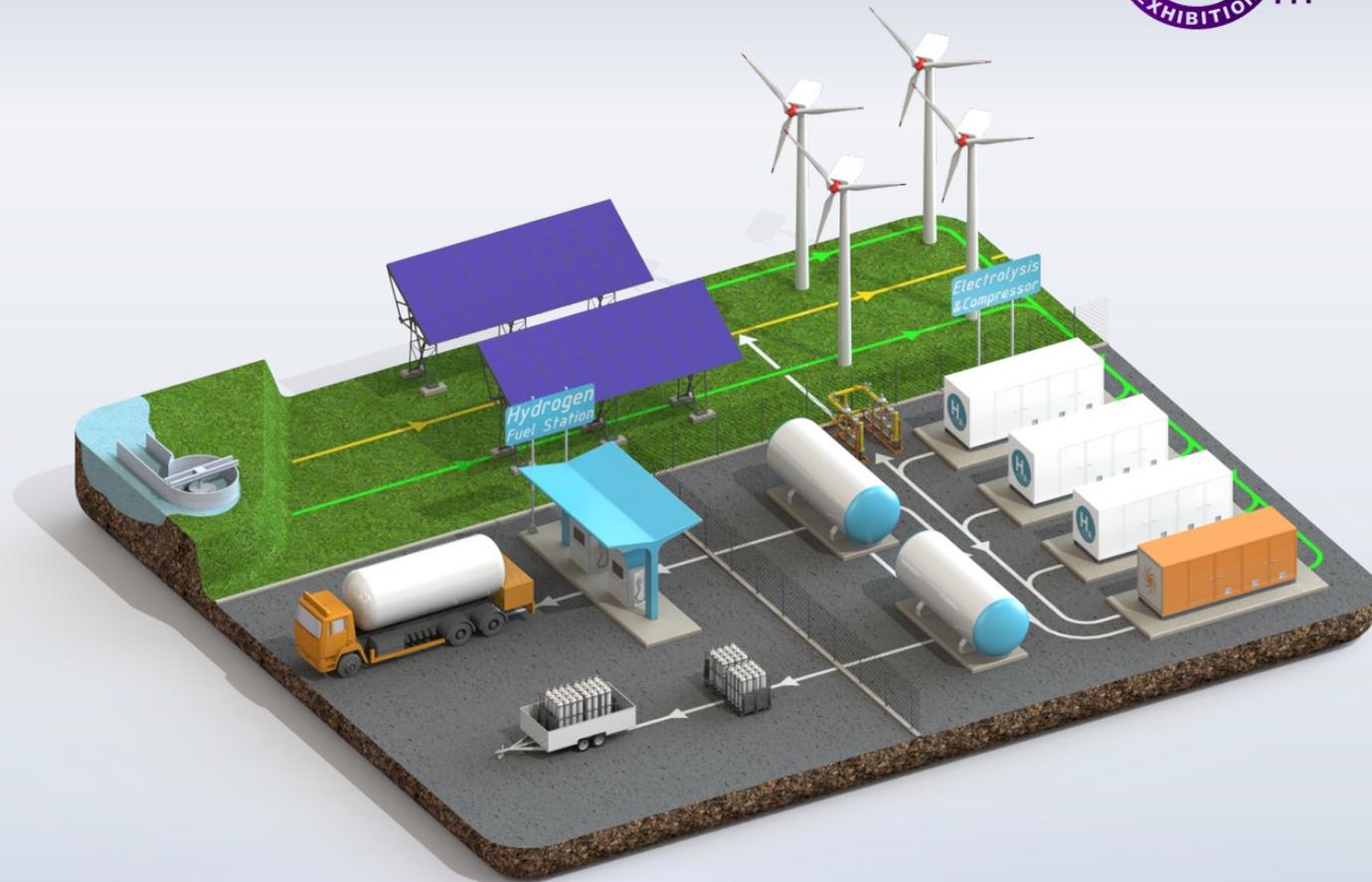
## HYDROGEN – Mobility



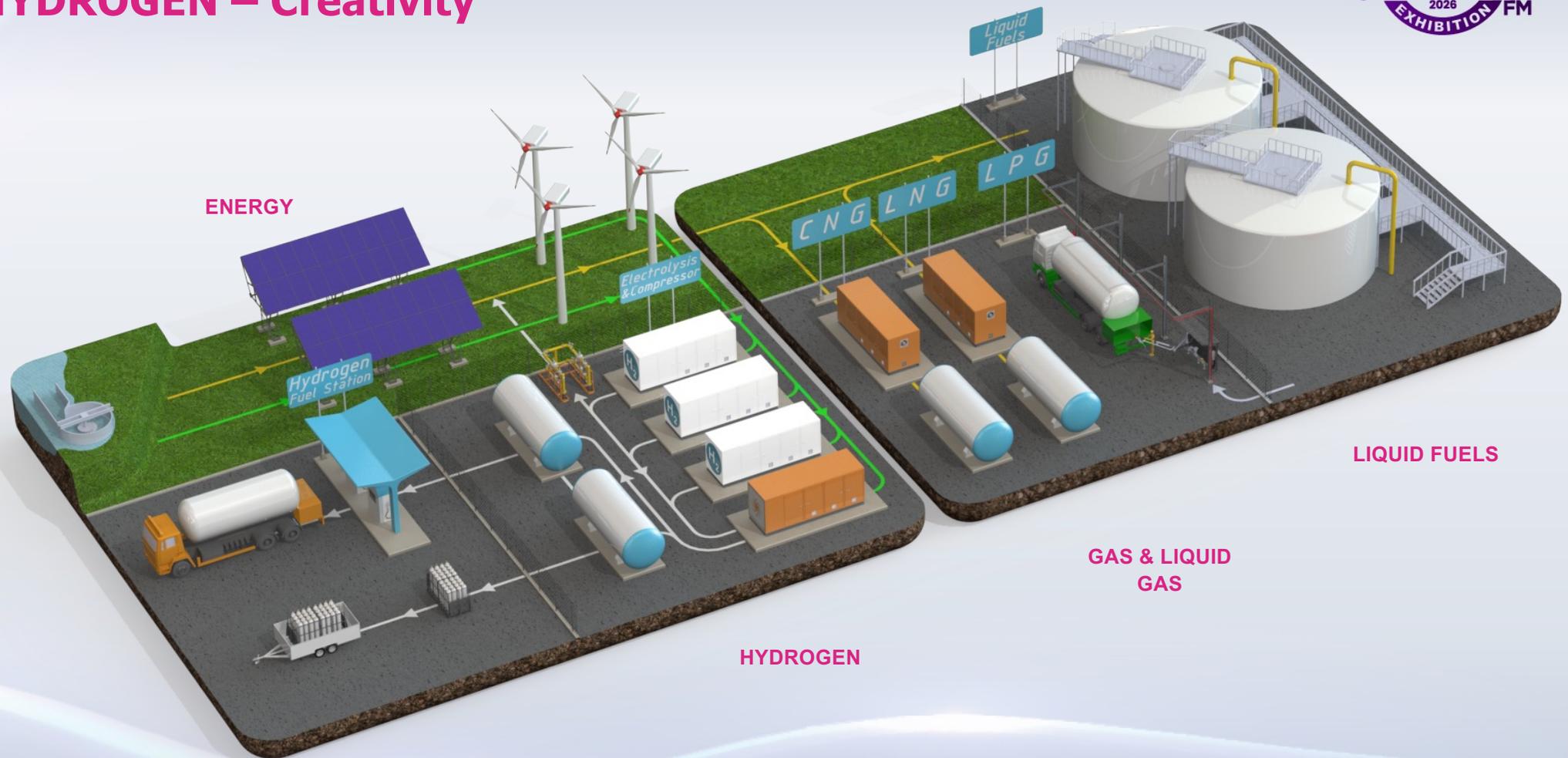
Hydrogen is one of the best solutions for **achieving carbon neutrality in the heavy mobility sector.**

Hydrogen trucks have the same **benefits** of electrical vehicles without the constraints of battery weight or recharging time.

Hydrogen enables **energy storage** from renewable sources to produce no emission fuel for transportation and logistics sectors.



# HYDROGEN – Creativity

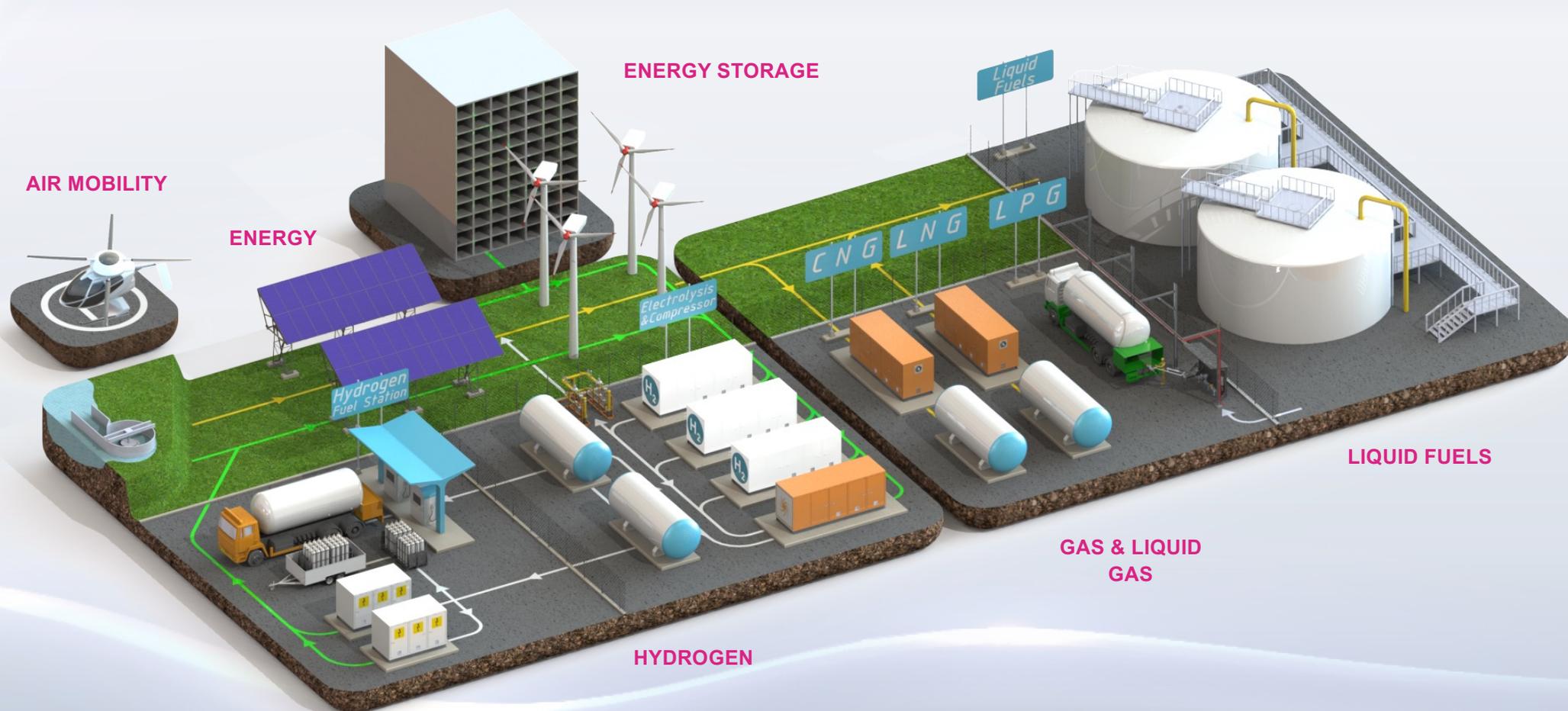


LIQUID FUELS

GAS & LIQUID GAS

HYDROGEN

# HYDROGEN – Creativity



## H2 Project – What Next?



## Summary of Learning

- RELIABLE AND WELL DESIGNED SAFETY SYSTEM
- PROPER VENTING SYSTEM SEPARATE O<sub>2</sub> AND H<sub>2</sub>
- HYDROGEN IS WET, YOU NEED TO DRAIN CONDENSATE
- INSTRUMENTATION REDUNDANT WITH LOW ERROR (CORIOLIS)
- REMOTE MONITORING AND CONTROL
- MODULAR AND FLEXIBLE PRODUCTION TO PROPERLY SIZE H<sub>2</sub> PRODUCTION UNIT AND FOLLOW INTERMITTENT RENEWABLES LOADING PROFILE
- STAFF TRAINING



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# THANK YOU!



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