Nemesys

INNOVATIVE HYDROGEN TECHNOLOGIES

Nemesys

NEMESYS è una società di ricerca Codice ATECO 72.19.09 “Ricerca e sviluppo sperimentale nel campo delle altre scienze naturali e dell’ingegneria” che lavora sulla frontiera dell’innovazione tecnologica lungo tutta la catena del valore dell’idrogeno, sviluppando soluzioni tecnologiche atte a superare le criticità che ne hanno impedito fino ad oggi la diffusione in ambito civile.

Recentemente NEMESYS è stata partecipata dal Gruppo multinazionale Baker Hughes che ha acquisito circa il 30% tramite la controllata italiana NUOVO PIGNONE HOLDING S.P.A.

NEMESYS is a research company ATECO code 72.19.09 "Research and experimental development in the field of other natural sciences and engineering" working on technological innovation alongside theentire hydrogen value chain, developing technological solutions to overcome those critical issues that have been an obstacle to its spreading in the civil sphere so far.

Recently NEMESYS has become an investee company of the multinational Baker Hughes that acquired about the 30% through the Italian subsidiary NUOVO PIGNONE HOLDING S.P.A.

www.nemesysenergy.com info@nemesysenergy.com

Nemesys is an IP company

Our Activities

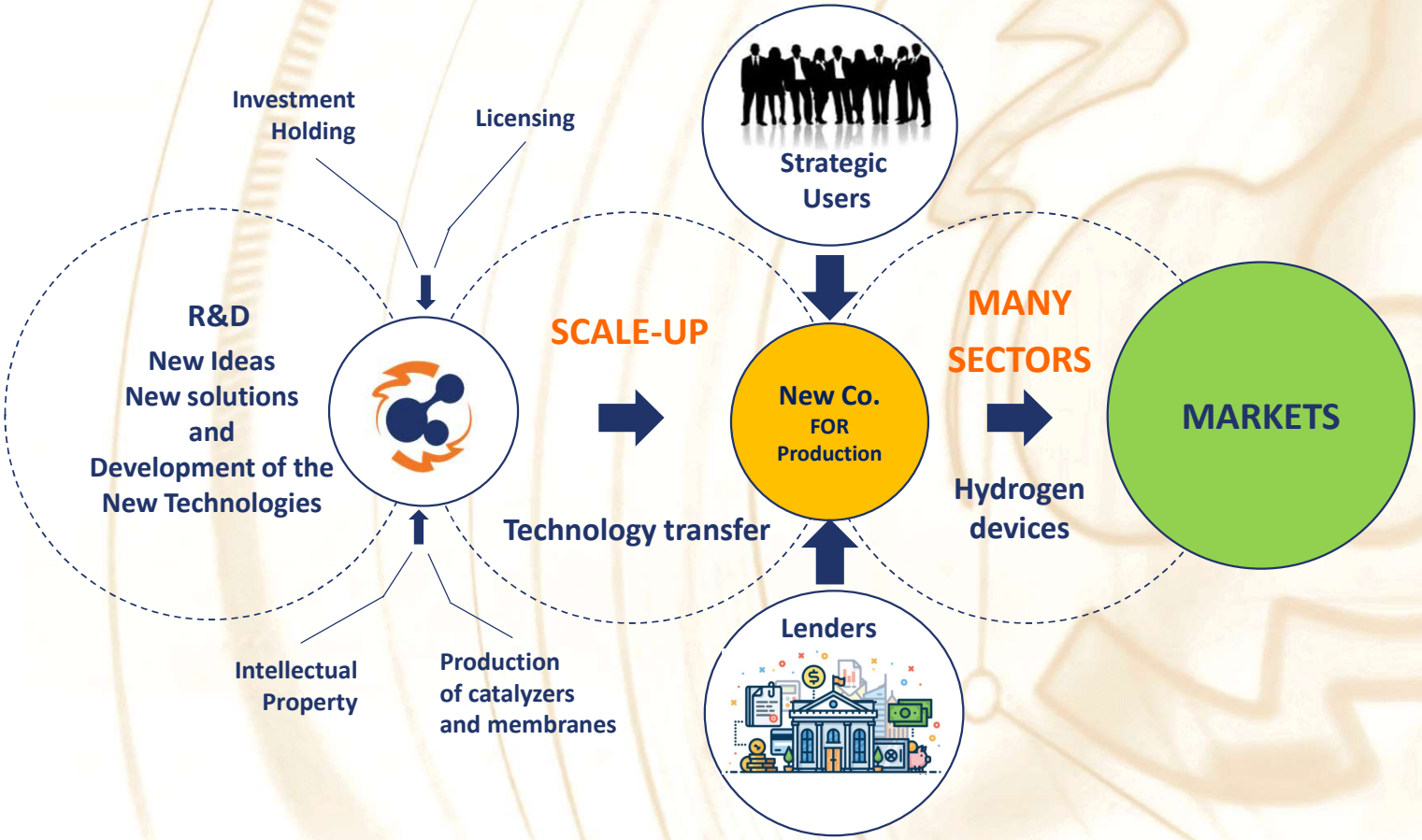
- R&D
- Intellectual Property
- Technology transfer
- Licensing
- Production and sell of catalyzers and membranes
- SPV - Holding Company

We set up Special Purpose Vehicles with selected players

First SPVs for electrolyzers planned in 2024

Business Model

we aim at building partnerships with leaders in the energy and mobility sectors



Energy transition is ongoing

The new challenge

Fossil fuels are hard to abate in:

Smartburners

Flights

Trains

Trucks

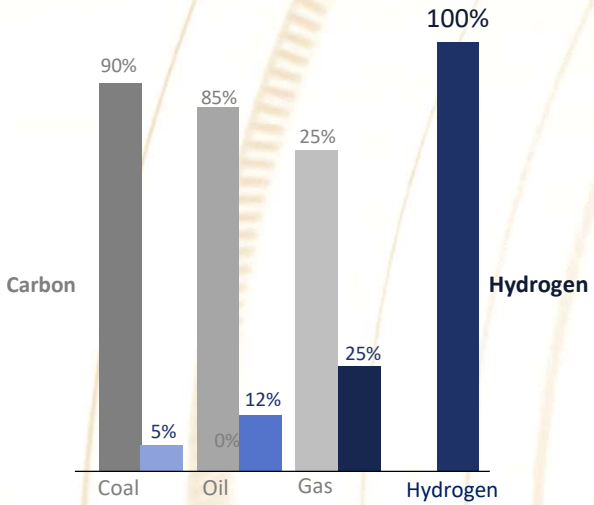
Ships

Hydrogen is the main clean possible solution

Hydrogen is…

+ CLEAN

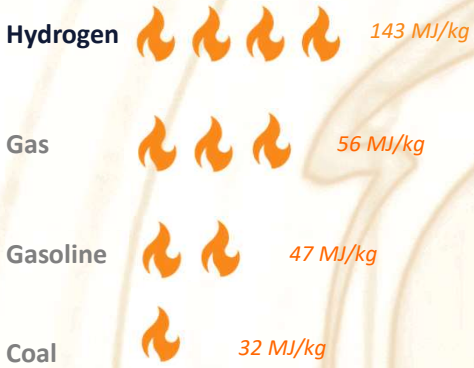
kg CO2 per produced MWh



+ Pulito

+ ENERGY

per unit of mass



+ Energia

+ WIDESPREAD

1 kg H2 every 9 liters of water

+ Abbondante

…The ideal clean energy vector

Nemesys has made hydrogen safe and efficient with its technologies and products

	PRODUCTION	STORAGE&TRANSPORT	UTILIZATION
Technologies Licensing and technology transfer	**ALKALINE ELECTROLIZER** VERY HIGH EFFICIENCY > EU objectives 2030 PATENTED	**HYDROGEN CARRIER BOOSTER** FOR UAV, SHIPS TRADE SECRET	**HYDROGEN BATTERY** LOW PRESSURE RECHARGEABLE (0-8 bar) WITH METAL HYDRIDES PATENTED
	DBD CWR (DIELECTRIC BARREER DISCHARGING CATALYTIC WATER REFORMING) NEW CONCEPT – VERY HIGH EFFICIENCY TRADE SECRET	**AMMONIA AND OTHES HYDROGEN CARRIERS** TRADE SECRET	**DBD CO_2 METANATION** VERY HIGH EFFICIENCY TRADE SECRET
Products Manufacturing and sale	**LOW COST MEMBRANES FOR ALKALINE ELECTROLYZERS** TRADE SECRET	**CATALYZERS FOR HYDROGEN CARRIERS** TRADE SECRET	**CO_2 RESISTANT MEMBRANE FOR FUEL CELLS** TRADE SECRET

Our technologies and markets of reference

Electrolyzers

MAIN ADVANTAGES

High Efficiency: <40 kWh/kg H_2
Two vessel design: higher pressure
No precious metals: target CapEx<300€/kW
Target H_2 cost: < 2€/kg

MARKETS OF REFERENCE (TAM)

Electrolyzers market
>50GW installed in 2030[1]
>80Mt H_2 from electrolysis in 2030[1]
>180M$ alkaline by 2028 growing 6,4% CAGR[2]

Storage / Transportation

Low pressure: 0-8 bar vs. 700
Safety: allowed in ATEX environments
Low weight: 1 kWh/kg metal hydrides
4 kWh/kg liquid boosters carriers NH3 NaBH4

H_2 storage market
14,7Bn$ in 2021 (40% material based)[3]
4,4% CAGR[3]

Battery / Fuel cell

Low pressure: 0-8 bar vs. 700
Dual charge: power and faster[4] H_2 recharge
No precious metals: lower CapEx
Higher voltage: >1V / cell (vs. 0,6 other acid)

Fuel cells market
4 Bn$ in 2021[3]
23,2% CAGR[3] especially for stationary

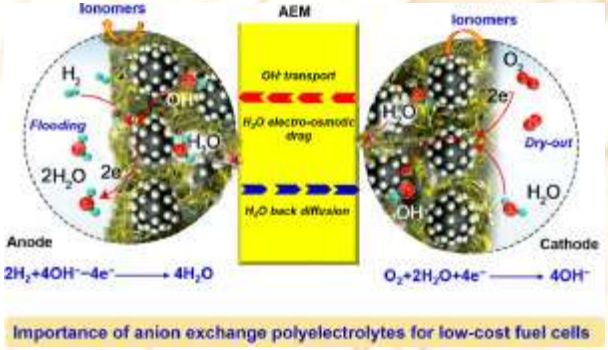
[1] IEA [2] Researchandmarkets [3] Grand View Research [4] 5min for 100kWh

Membranes and catalists

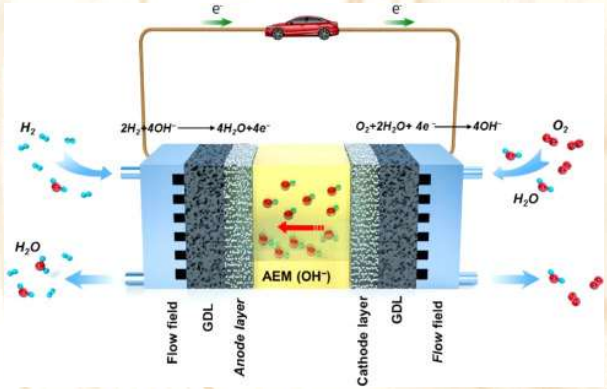
Our Products:
5 membranes types
13 catalyzers
depending on application

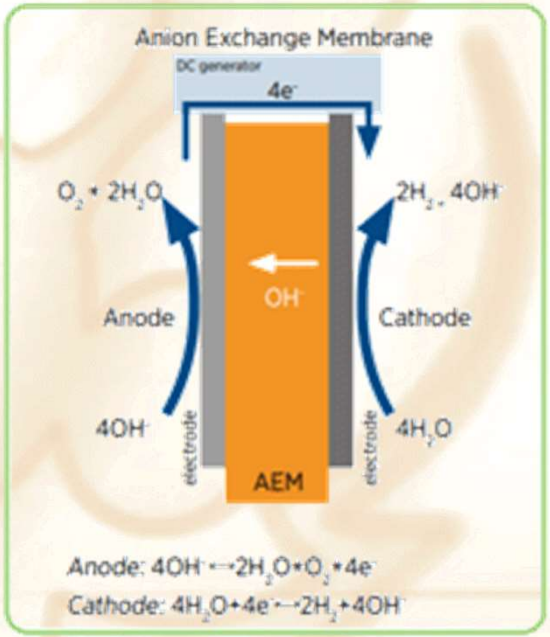
- **Anion Exchange Membranes**
- **No precious metal, no gamma rays for activation**
- **Innovative stack design**
- **Allows CapEx reduction down to 300 €/kW**

Alcaline Fuel-cell and AEM Electrolizers



Importance of anion exchange polyelectrolytes for low-cost fuel cells





NEMESYS Electrolyzers AEM-Stack Technologies

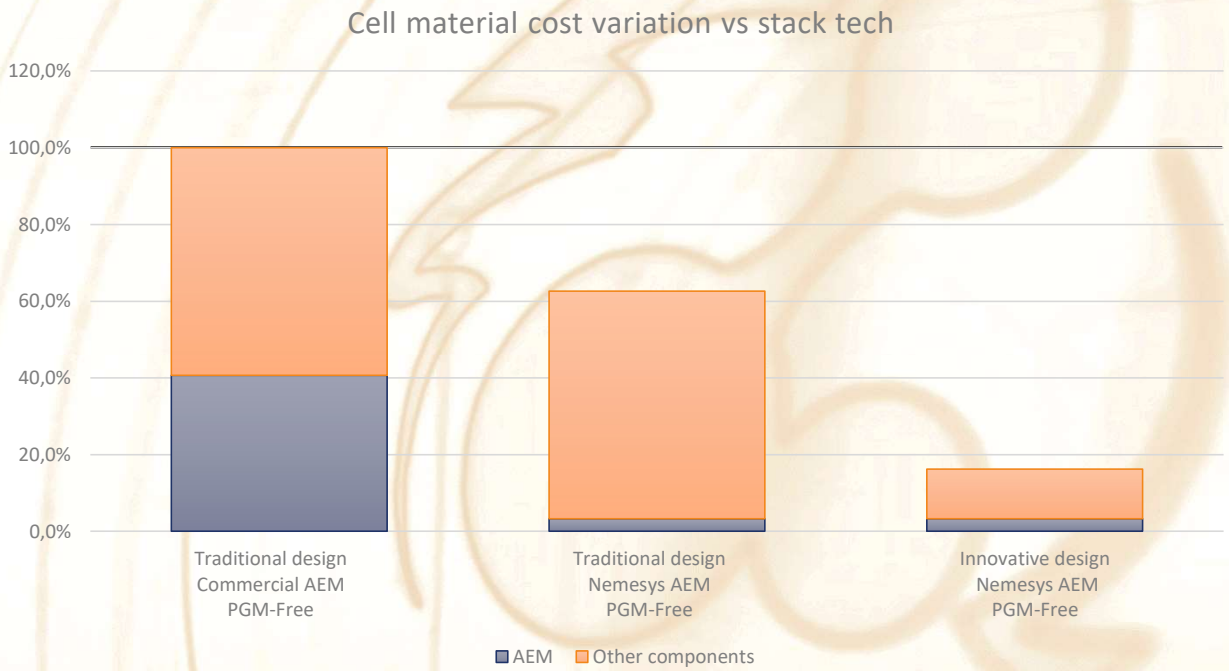
How MEAs are assembled makes the difference.

We are developing a new stack technology to ensure better performances and scalability. This also comes with a reduced overall material consumption for improved resistance to supply chain volatility.

In this project we will so test two variants:

<u>Industrial ready tech</u>
A **traditional design** with our **membranes and PGM-FREE catalysts**

<u>Scaling up tech</u>
An **innovative design with our AEM, PGM-FREE catalysts** and reduced material usage



The final electrolyzer **will be tested in significant size** to prove technology and scalability and will use the traditional, the innovative or both technologies based on ongoing performances and stress tests results.

Alkaline Electrolyzer

Nemesys technological superiority

kWh/kg H2

- Competitors — 50-55
- UE objectives RD 2030 — 48
- **Nemesys (new configurations in development)** — **<40 (>82% efficiency target)**
  Less energy to produce H_2
- Minimum from thermodinamics — 33

Higher production efficiency

Direct coupling no energy storage

High working pressure

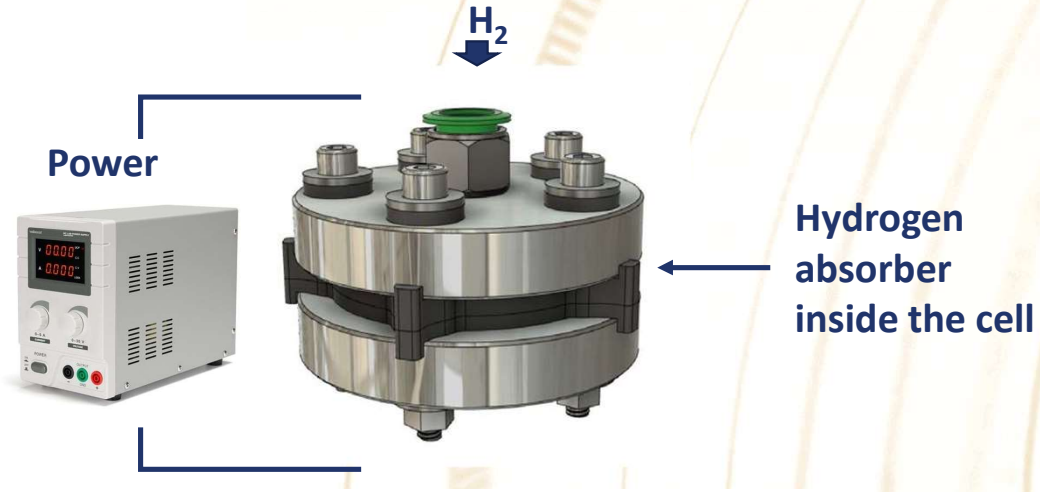
Lower OpEx to produce hydrogen

No precious metals,
No expensive membranes

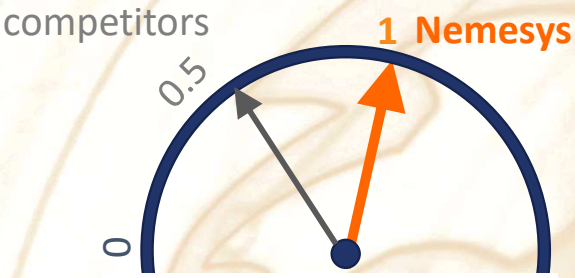
Lower CapEx => <300€/kW already today

Fuel-cell-Battery with superior performances

Double recharge: with power or low pressure H2 (faster)



Scale up version



Volt / cell

Alkaline technology
Maximum efficiency

Lower CapEx, thanks to CO2 resistant membrane

No precious metals

- **Higher efficiency**
- **Thermal equilibrium**
- **Higher voltage/cell**
- **Lower weight**
- **Lower cost**
- **Faster recharge**

Hydrogen carriers by extended autonomy

Nemesys' advanced solutions have countless applications

Hydrogen Booster

liquid or solid substances

hydrogen carrier

safety

Standard commercial formats

Ease of distribution and sale

On board hydrogen recharge

With water and a catalyzer

Awards

ACKNOWLEDGMENTS AND GRANTS

POR-CREO European regional program

Won MCE 4X4 2018 Mobility Conference Exibition (Milan)

Won INTERREG-FRISTART 2018 EU Program Italy-France;

Won NEXT ENERGY 4 Financed by TERNA'S Grant

SEAL OF EXELLENCE from EU program HORIZON 2020

BREVETTI+ 2020
BREVETTI+ 2021

Two Assignment GRANTS for tenders' INVITALIA BREVETTI+

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PMI innovativa ai sensi della Dlg. 179/2012 - Codice Attività ATECO 72.19.09 – Ricerca nel campo delle Alte Scienze naturali e ingegneristiche