



SOLUTIONS FOR HYDROGEN PRODUCTION & PURIFICATION

Sumaré – SP – Brazil - 2022 - Version 1

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Hytron

Company's History



- Technology company founded in 2003
 - Spin-off from Hydrogen Laboratory (DAP - IFGW), Unicamp
 - Strong R&D activities, focused on innovative applied solutions
- Expertise in Hydrogen Production and Alternative Energy Systems
 - Multidisciplinary team of specialists, inc. PhD's and MSc's
 - Technology development
 - System design, integration and supervision
- 2015: New Headquarters (Sumare, SP - Brazil)
 - Facility dedicated to R&D (current and future portfolio), fabrication and testing
- 2020: NEA GROUP acquires Hytron and integrates H₂ generation into its portfolio

BUSINESS UNITS



COMPRESSOR SOLUTIONS	SEALING SOLUTIONS	PROCESS SOLUTIONS	DIGITAL SOLUTIONS	ENERGY SOLUTIONS
				
Compressor Systems	Recip Compressors	Pendulum Roller Mills	Business Applications	Green Gases
Service	Rotating Systems	Impact Classifier Mills	Digital Operations	Green Mobility
Revamps	Sealing Materials	Classifiers	Asset Performance	Sustainability
 				

The NEA GROUP Portfolio for the H₂ Value Chain



Biomass
CH₄ + H₂ up to 8000 Nm³/h
1-10 to 70-80 bar

Refinery & Processing and Liquefaction Plants
Hydrocracking
Desulphurization
Synfuels

Gas Storage

H₂ Transportation, LH₂ Regasification, LOHC

800-5000 Nm³/h
30-200 to 500-900 bar

Natural Gas Grid
H₂ feed in 100-200 kNm³/h
1-30 to 70-80 bar (10-20%)

Transportation

Wind, Solar, Hydro

H₂ Generation Electrolyzers, SMR+CCS, Pyrolysis, ...

40-100 kNm³/h
1-30 to 70-80 bar

H₂ Pipeline Grid
200-2000 kNm³/h
30 to 70-80 bar

Service & Commercial
Industry, e.g. Steel, Glass, ...

Surplus Power from Conventional Power Plant

200-5000 Nm³/h
1-30 to 500 bar

Salt Cavern H₂ Storage

H₂ Turbine Power Plant

Fuel Cell Power Plant
Residential



Primary Energy

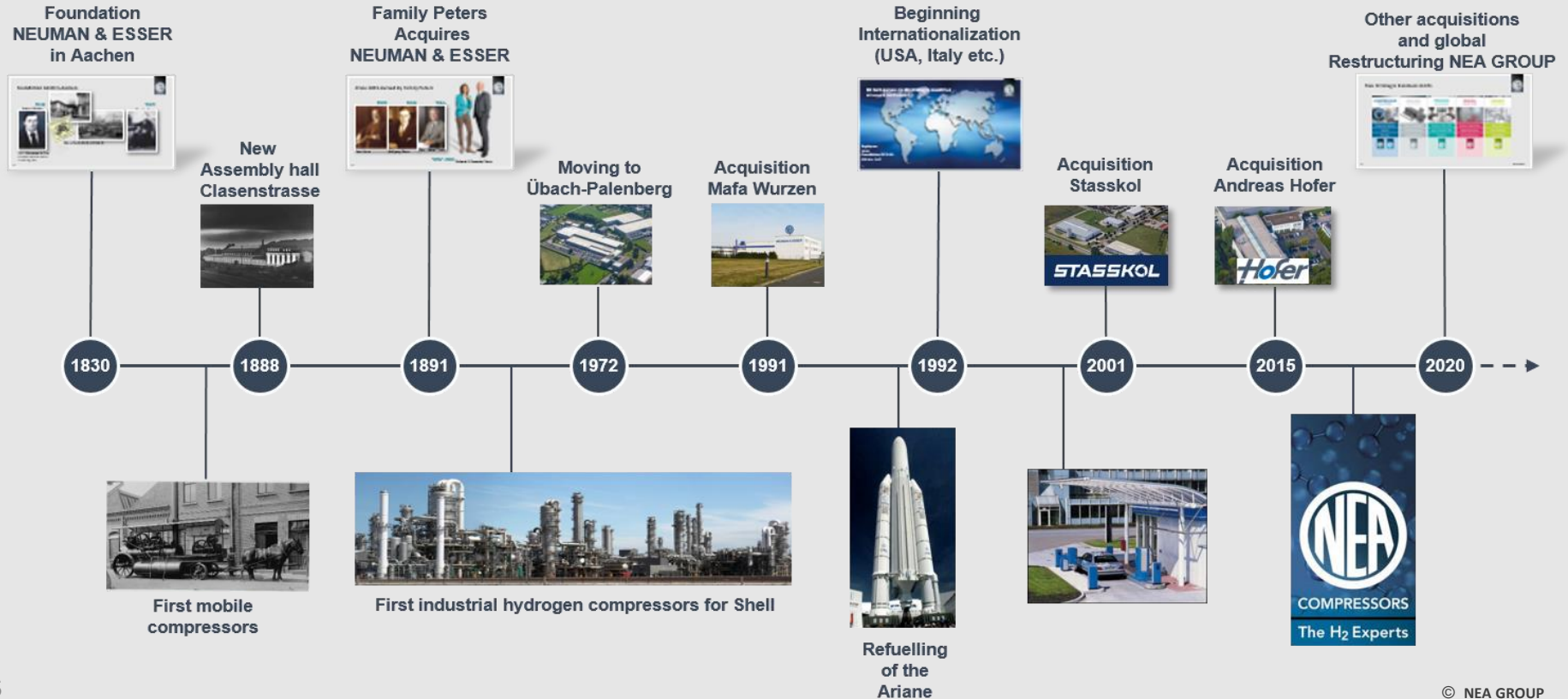
Conversion & Processing

Storage

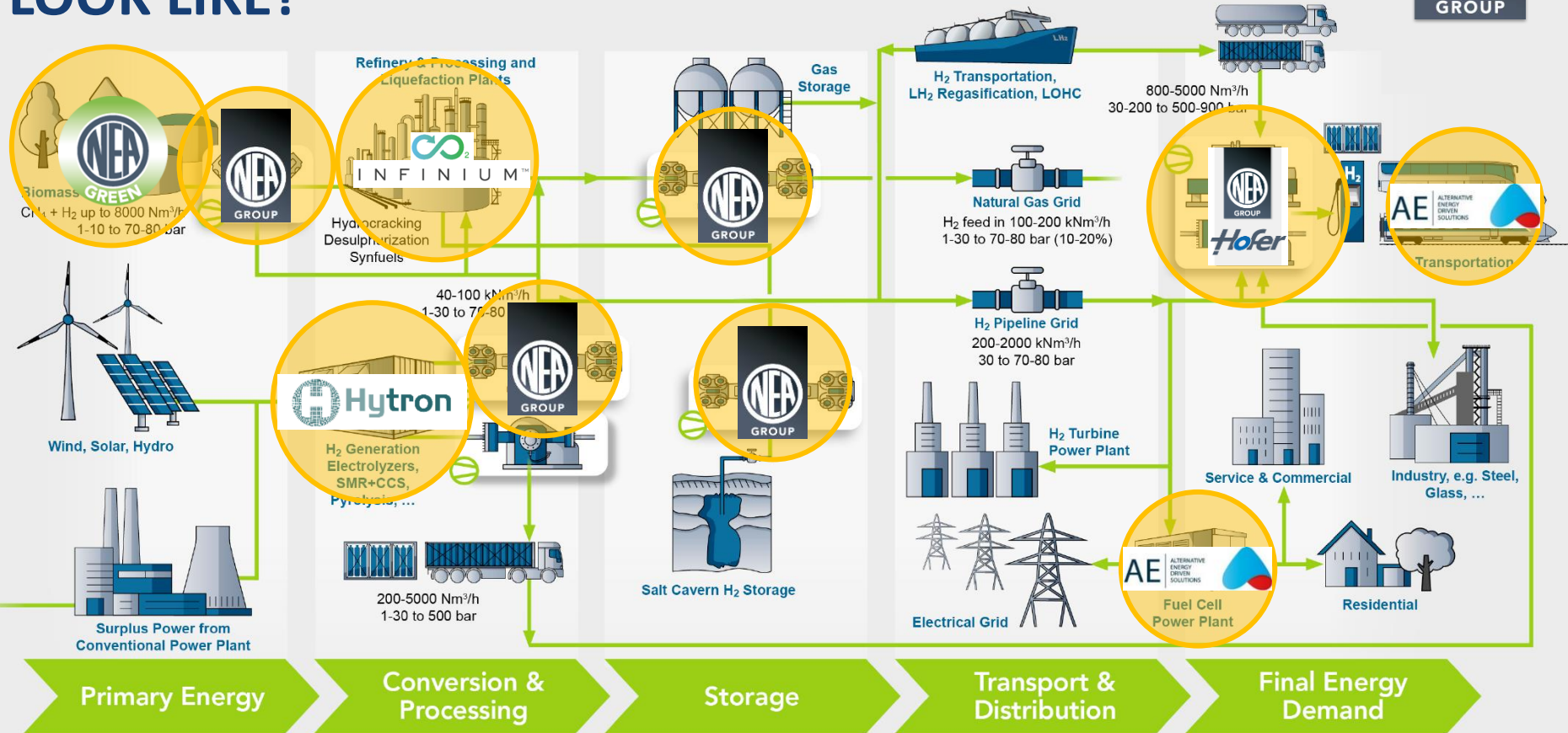
Transport & Distribution

Final Energy Demand

Decades of Experience in Compressing Hydrogen



HOW DOES THE H2 SUPPLY CHAIN LOOK LIKE?



WHICH APPLICATIONS FOR HYDROGEN ARISE?



HYDROGEN IN THE NATURAL GAS GRID

- In the future, parts of the natural gas grid will be converted into a hydrogen network.
- During the conversion, turbo compressors should be replaced by piston compressors.



SYNTHETIC FUELS

- Synthetic fuels are produced from CO₂ and hydrogen.
- Infinium develops a process for the production of synthetic fuels, NEA contributes compressors.



BIO-LNG FOR LONG-DISTANCE TRANSPORT

- Long-distance transport might partly use hydrogen and partly use bio-LNG.
- In the field of LNG, NEA has experience in compression, while Arcanum develops and builds biogas plants.



HYDROGEN MOBILITY

- WE see a small market for FCEVs but expect a huge market for commercial vehicles.
- Through AEDS, we will enter the markets HOFER is represented in >100 hydrogen filling stations and is currently facing a very high demand.



ELECTROLYSERS FOR HYDROGEN PRODUCTION

- Industry needs green hydrogen. With Hytron, we produce electrolyzers.
- Nearly every electrolyser comes with a compressor (so-called electrolysis compressor systems), since hydrogen is usually always needed at higher pressure.





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H₂ COMO VETOR ENERGÉTICO

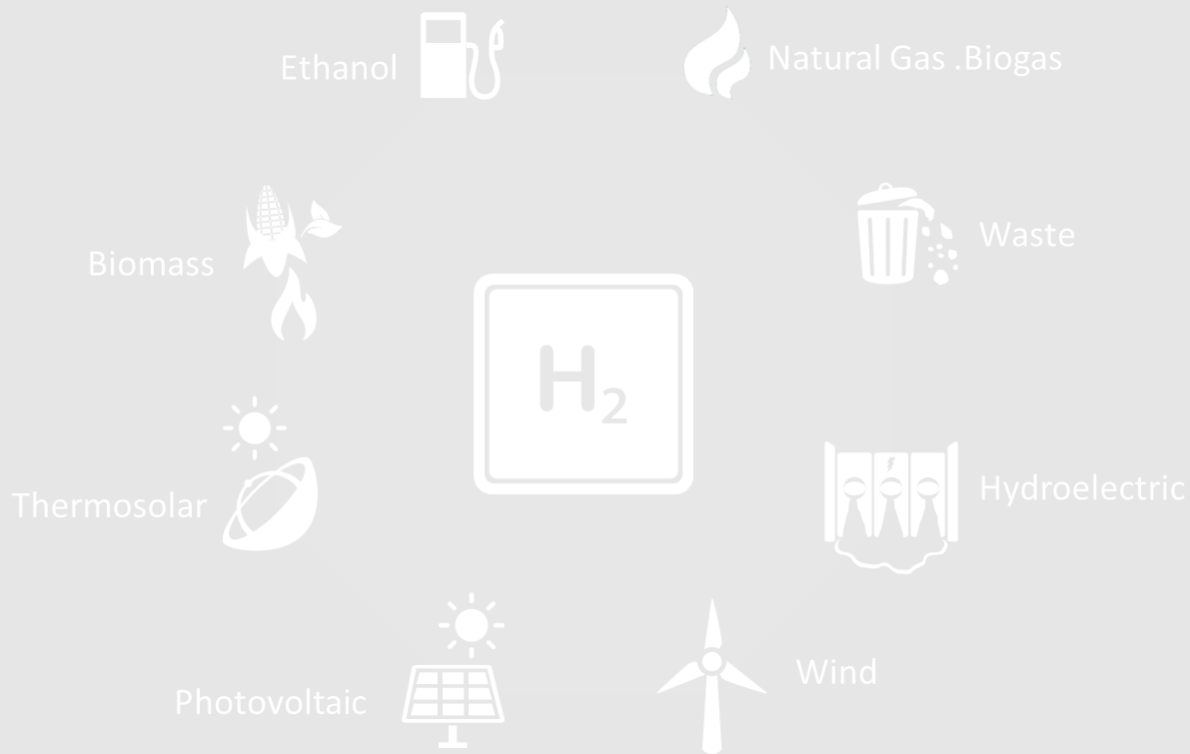
FONTES PARA A PRODUÇÃO DE H₂



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HIDROGÊNIO – H₂

Tipos de consumidores



	REFINARIAS EXPORTAÇÃO	INDUSTRIAL	LABORATÓRIAL
Atualmente	<ul style="list-style-type: none">• Demanda atendida por grandes plantas para a produção de H₂• Fonte: Gás Natural	<ul style="list-style-type: none">• Demanda atendida atualmente por carretas• Fonte: Excedente das refinarias	<ul style="list-style-type: none">• Demanda atendida por Cilindros• Fonte: Excedente das refinarias e indústrias
Futuro	<ul style="list-style-type: none">• Demanda atendida por grandes plantas para a produção de H₂• Fonte: Eletrólise, Reforma de Biocombustíveis	<ul style="list-style-type: none">• Tendência para geração <i>on-site</i>, com produção de H₂ renovável• Fonte: Insumos disponíveis localmente	<ul style="list-style-type: none">• Demanda atendida por Cilindros• Fonte: Excedente das refinarias e indústrias

HIDROGÊNIO – H₂

Consumos e Portes



EXPORTAÇÃO OU REFINARIAS



Consumo médio de H₂ nas
Refinarias
5 ton de H₂/h

ELETRÓLISE

HyPEM
ELECTROLYSER

HyALK
ELECTROLYSER



250 MWh → 5 ton de H₂/h
100 MWh → 2 ton de H₂/h
50 MWh → 1 ton de H₂/h

UHE SÃO SIMÃO



1.710 MW → 34 ton de H₂/h
~7 Refinarias

HYTRON'S PRODUCTS



HyPEM
ELECTROLYSER

HyALK
ELECTROLYSER

Electrolyser

Use of renewable sources
H₂ and O₂ production
Green H₂ applications
Higher electrical consumption compared to reformers
Higher global demand for modular applications

HyREF
NG REFORMER

HyREF
EtOH REFORMER

Steam Reforming

Use of local feedstocks
Pure H₂ or H₂ + CO production
Continuous production (no intermittence)
Interest of the NG industry
Green Solutions:
(Biomethane end ethanol)

HyPSA
Gas Purification System

Pressure Swing Adsorption

H₂ Purification
Methane Purification (others)
It may be included in our equipment, or sold separately

HyPEM

ELECTROLYSER

HyALK

ELECTROLYSER



<https://agilesolutionexperts.com/>

- Tailor-made solutions
- Different Sizes
- Production in Brazil
 - 2023: 70 MW per year
- Production in Germany
 - 2024: 300 MW
- Providing complete solutions





H₂ SOME BRAZILIAN PROJECTS

FIRST MW ELECTROLYSER IN BRAZIL

1,3 MW Plant Structure EDP Pecém – Ceará - Brazil



FIRST MW PEM ELECTROLYSER IN BRAZIL

1,3 MW Plant Structure EDP Pecém – Ceará - Brazil



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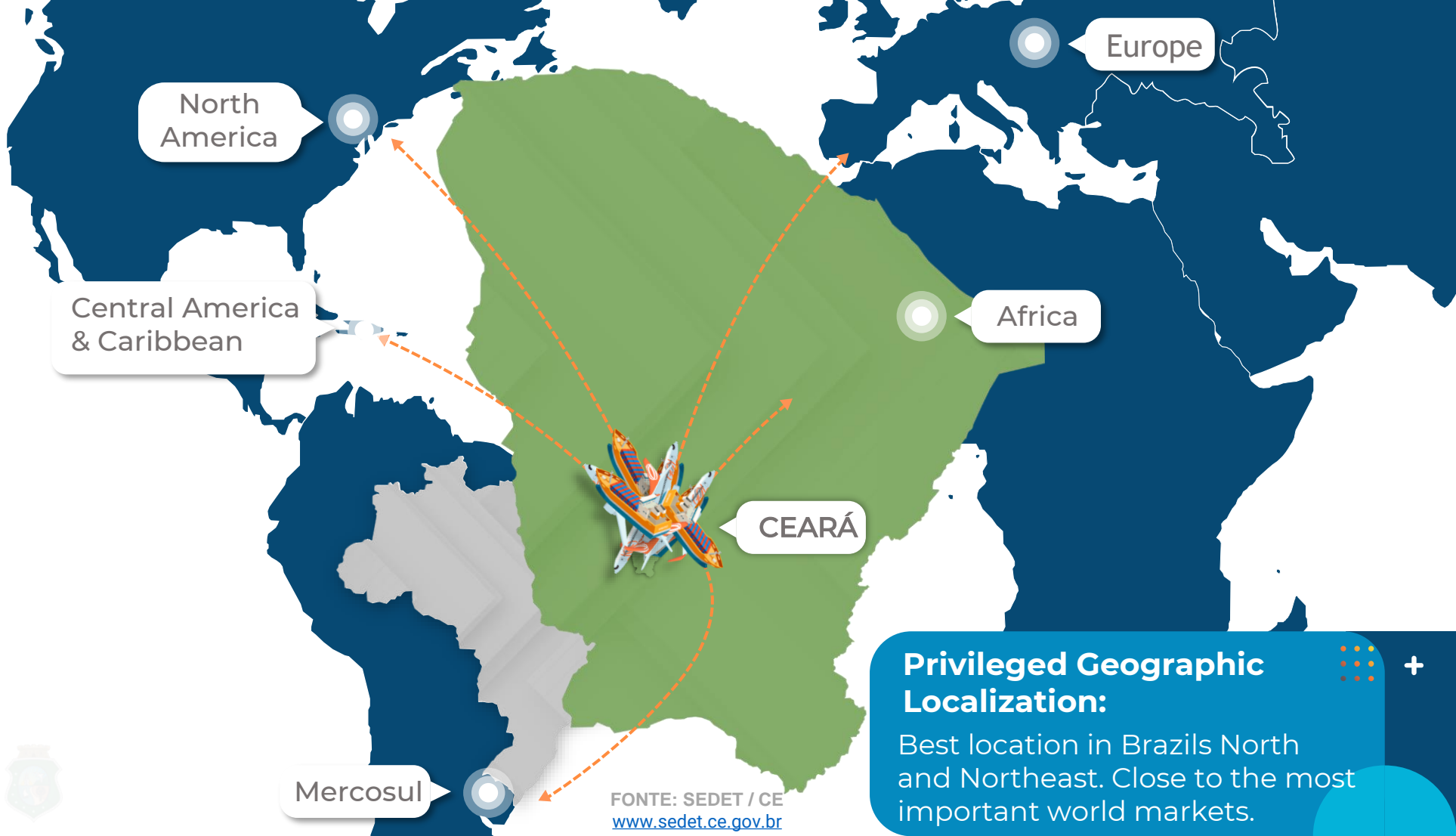


First MW-sized electrolyser to be installed in Brazil's green hydrogen hub in Ceará state.

The customer “EDP Brasil”, part of the Group “Energias de Portugal”, awarded the order to HYTRON based on the technological expertise it has been shown them since the beginning which gave them confidence to speed up to a very swift Purchase Order.

The total supply is about 1,3 MW Electrolyser powered by solar and wind sources that will be suitable to generate 250 Nm³/h of GREEN HYDROGEN.





HyPEM

ELECTROLYSER



Solutions Portfolio

POWER TO X

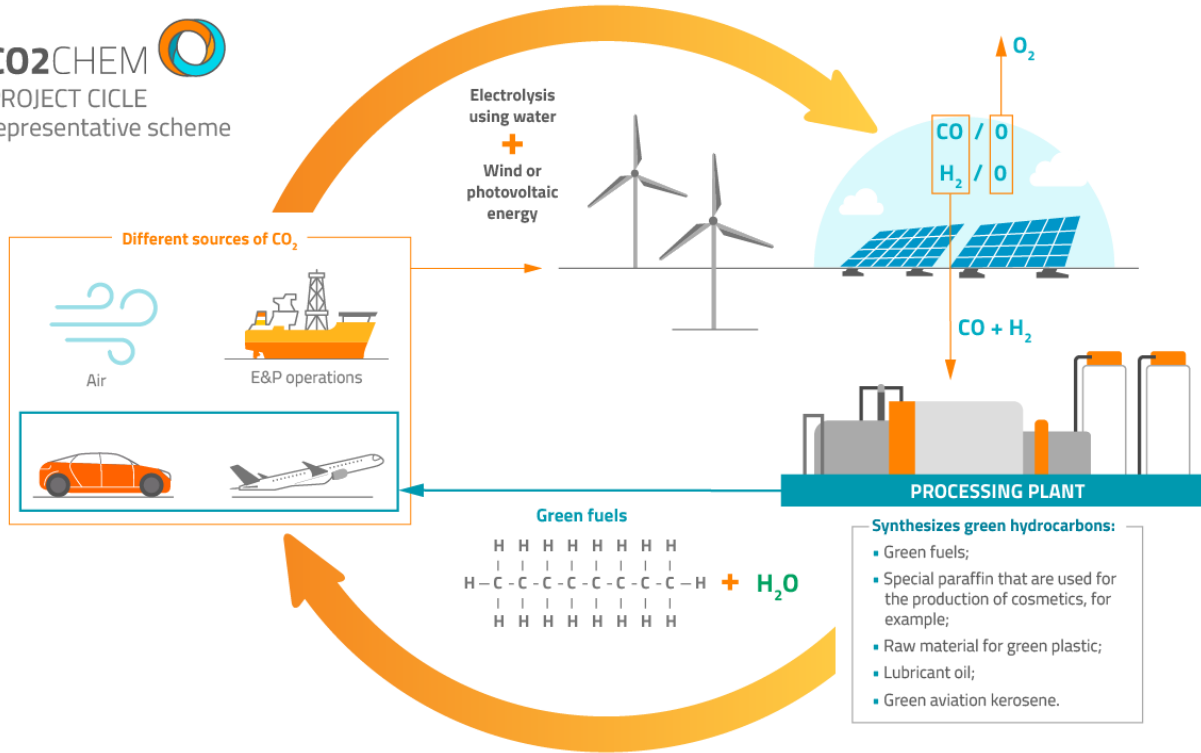
<https://www.youtube.com/watch?v=MfZpdNxxCUM>

CO2CHEM

Power to X



CO2CHEM 
PROJECT CICLE
representative scheme



HyREF
EtOH REFORMER

HyREF
NG REFORMER



Solutions Portfolio

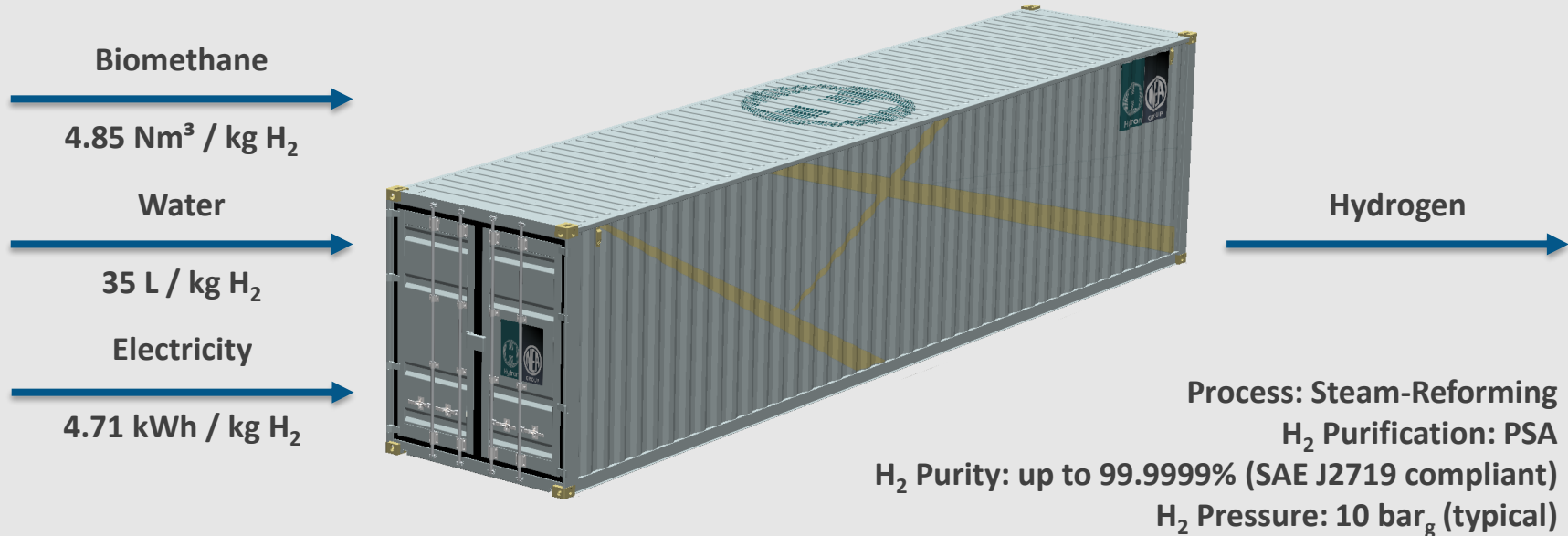
FUEL REFORMING

Fuel Reformers

PRODUCTION OF RENEWABLE H₂ FROM BIOMETHANE

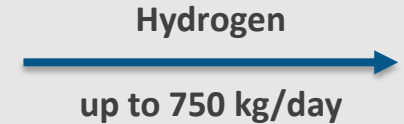
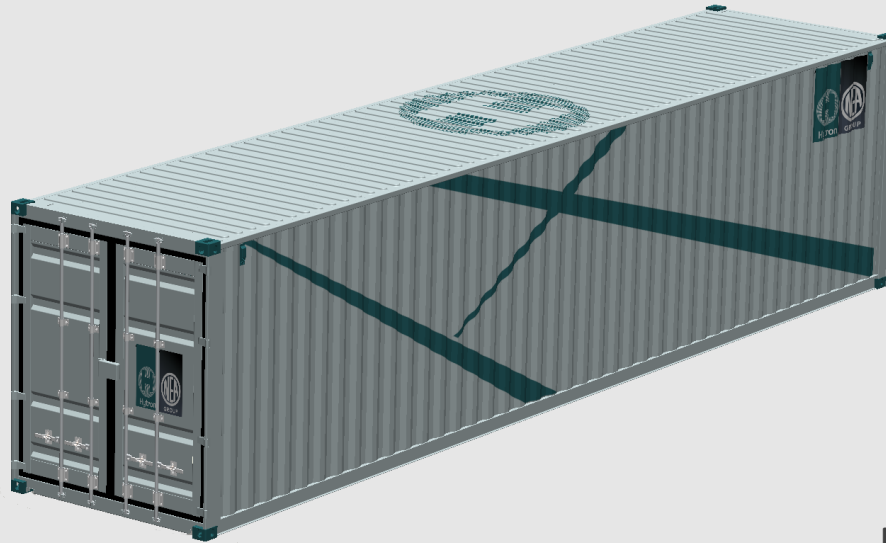
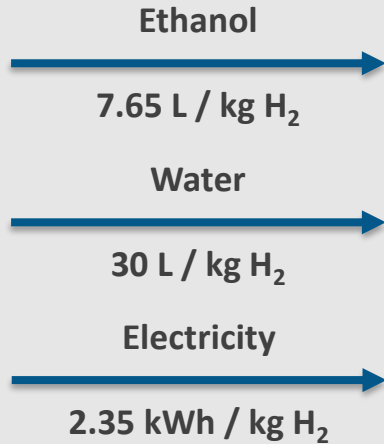


- Hytron, COMGAS & SENAI Biosynthetic Project
- Agency: ARSESP
- June 2022



Fuel Reformers

Product to Come – Ethanol



Process: Steam-Reforming
H₂ Purification: PSA (Pressure Swing Adsorption)
H₂ Purity: up to 99.9999% (SAE J2719 / DIN EN 17124 compliant)
H₂ Pressure: 10 bar_g (typical)

Advantages of Using Ethanol for H₂ Production

Ethanol as Green Hydrogen Carrier



- Fact of being a renewable fuel
- Ease of transportation (usual for the Brazilian case)
- Brazil's potential as an important global player
- There is already an entire value chain established
- It is not a toxic fuel
- Enables the flat production of Green H₂ (without intermitence)
- Easy to store
- Enables local production of H₂ close to consumption

Ethanol for H₂ Production

Project



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raízen



USP

INSTITUTO SENAI
DE INOVAÇÃO BIOSYNTHETIC AND FIBERS

ESTAÇÃO DE ABASTECIMENTO (HRV)

Cidade Universitária / USP (2023)



PASSO 1

Sol no campo e cana-de-açúcar sendo processada, fermentada e destilada até produzir o etanol. O processo é realizado nos parques de bioenergia da Raízen

PASSO 2

O etanol sai dos parques de bioenergia da Raízen e segue para a estação de abastecimento da USP, onde é armazenado em um tanque

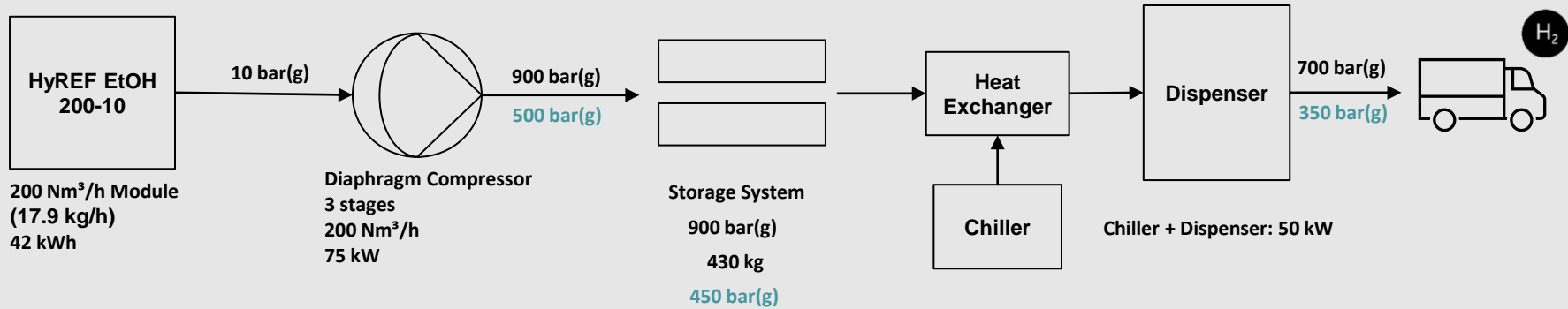
PASSO 3

O processo de produção do hidrogênio renovável a partir do etanol é iniciado nessa fase: o etanol sai do tanque e passa pelo reformador de etanol, onde vai reagir com água para produzir o hidrogênio renovável

PASSO 4

Saindo do reformador, o hidrogênio é comprimido, armazenado e disponibilizado nas estações de carregamento, com capacidade para abastecer 4 ônibus da USP

Hydrogen Refueling Station Diagram



Storage Fueling Time:	24 h → ~ 430 kg/day
Truck Hydrogen Storage:	120 kg → ~ 4 trucks/day
Bus Hydrogen Storage:	35 kg → ~ 14 buses/day
Mirai Hydrogen Storage:	5 kg → ~ 86 cars/day



NEUMAN & ESSER



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THANK YOU!