Hytron
Company’s History

• **2003:** Technology company founded
  • 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 (Sumaré, SP - Brazil)
  • Facility dedicated to R&D (current and future portfolio), fabrication and testing („cold“ and „hot“ runs);
• **2018:** Supply of commercial equipment
• **2020:** Part of the **NEA GROUP**
Press Release

NEA GROUP acquired HYTRON Energy & Gas

Machinery and Plant Manufacturer strengthens leading position in hydrogen solutions

The NEUMAN & ESSER (NEA) GROUP from Ubach-Palenberg acquired HYTRON Energy & Gas (HYTRON)

Nov 19, 2020
Decades of Experience in Compressing Hydrogen

- **Foundation NEUMAN & ESSER in Aachen**
- **New Assembly hall Clausenstrasse**
- **Family Peters Acquires NEUMAN & ESSER**
- **Moving to Übach-Palenberg**
- **Acquisition Mafa Wurzen**
- **Beginning Internationalization (USA, Italy etc.)**
- **Acquisition Stasskol**
- **Acquisition Andreas Hofer**
- **Other acquisitions and global Restructuring NEA GROUP**

- **1830**: First mobile compressors
- **1888**: First industrial hydrogen compressors for Shell
- **1972**: Refuelling of the Ariane
- **1991**: Acquisition of Mafa Wurzen
- **1992**: Beginning Internationalization (USA, Italy etc.)
- **2001**: Acquisition of Stasskol
- **2015**: Acquisition of Andreas Hofer
- **2020**: Other acquisitions and global Restructuring NEA GROUP
The NEA GROUP Portfolio for the H₂ Value Chain

**Primary Energy**
- Biomass: CH₄ + H₂ up to 8000 Nm³/h 1-10 to 70-80 bar
- Wind, Solar, Hydro
- Surplus Power from Conventional Power Plant

**Conversion & Processing**
- Refinery & Processing and Liquefaction Plants
- Hydrocracking Desulphurization Synfuels
- H₂ Generation Electrolyzers, SMR+CCS, Pyrolysis, ...
- 200-5000 Nm³/h 1-30 to 500 bar

**Storage**
- Gas Storage
- Salt Cavern H₂ Storage

**Transport & Distribution**
- H₂ Transportation, LH₂ Regasification, LOHC
- Natural Gas Grid
  - H₂ feed in 100-200 kNm³/h 1-30 to 70-80 bar (10-20%)
- H₂ Pipeline Grid
  - 200-2000 kNm³/h 30 to 70-80 bar
- 800-5000 Nm³/h 30-200 to 500-900 bar
- Electrical Grid

**Final Energy Demand**
- Service & Commercial
  - Industry, e.g. Steel, Glass, ...
- Residential
- Fuel Cell Power Plant

**Utilization**
- Transportation
Solutions Portfolio

FUEL REFORMING
Fuel Reformers
System Attributes

- Rated productions up to 350 Nm³ H₂/h (per module)
- Integrated and autonomous solutions (“Turn-Key”):
  - Feed treatment, Reforming & Shift conversion
  - PSA gas purification & Purity supervision
  - Thermal management & Utilities:
    - Heat recovery, Instrument air provision, Process water production
    - Controls & Cabinet (outdoor installation)
- Proprietary control software & Supervisory platform (SCADA)
- Hydrogen purity up to 99.9999% (6.0)
- Operating pressure: 10 bar
Fuel Reformers
Product Structure

Stacked HRSG
Centralized Multifuel Burner
Economizer
Steam-Reformer
Shift #1 + Shift #2

Fuel and Blanketing Control
Process Water Dosing

© NEA GROUP
Fuel Reformers
Product Performance – Biomethane

- **Biomethane / NG**: 4.85 Nm³ / kg H₂
- **Water**: 35 L / kg H₂
- **Electricity**: 4.71 kWh / kg H₂
- **Hydrogen**: up to 750 kg/day

**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 (typical)
## Fuel Reformers
### Biomethane Reforming – 20 kg H₂/h Case

<table>
<thead>
<tr>
<th>Process</th>
<th>Methane Steam-Reforming</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Installation</strong></td>
<td>40’ High Cube ISO container, including process and controls</td>
</tr>
<tr>
<td><strong>Ambient Conditions (typical)</strong></td>
<td>up to +50°C</td>
</tr>
<tr>
<td><strong>Net Production Capacity (H₂)</strong></td>
<td>20 kg/h (224 Nm³/h)</td>
</tr>
<tr>
<td><strong>Installed Power Capacity</strong></td>
<td>100 kW</td>
</tr>
<tr>
<td><strong>Methane Consumption</strong></td>
<td>97 Nm³/h</td>
</tr>
<tr>
<td><strong>Methane Feed Pressure</strong></td>
<td>15 bar₉</td>
</tr>
<tr>
<td><strong>Raw Water Consumption</strong></td>
<td>700 L/h (0.7 m³/h)</td>
</tr>
<tr>
<td><strong>H₂ Purification Process</strong></td>
<td>PSA (Pressure Swing Adsorption)</td>
</tr>
<tr>
<td><strong>Purity of H₂ (higher purities also available)</strong></td>
<td>99.999% (5.0)</td>
</tr>
<tr>
<td><strong>H₂ Delivery Pressure</strong></td>
<td>10 bar₉</td>
</tr>
<tr>
<td><strong>Operating Range</strong></td>
<td>50 to 100%</td>
</tr>
<tr>
<td><strong>Nitrogen</strong></td>
<td>5 – 7 bar₉ (99%). Only for start-up &amp; shutdowns</td>
</tr>
<tr>
<td><strong>Compressed Air</strong></td>
<td>5 – 7 bar₉ (ISO 8573.1, 2010, class 1.2.1). Only used for piloting purposes</td>
</tr>
<tr>
<td><strong>Electrical Standard (typical)</strong></td>
<td>380 Vac / 3 / 60 Hz</td>
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Fuel Reformers
Product to Come – Ethanol

Ethanol
7.65 L / kg H₂

Water
30 L / kg H₂

Electricity
2.35 kWh / kg H₂

Hydrogen
up to 750 kg/day

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 (typical)
## Fuel Reformers

### Ethanol Reforming – 20 kg H₂/h Case

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<td>Net Production Capacity (H₂)</td>
<td>20 kg/h (224 Nm³/h)</td>
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<tr>
<td>Installed Power Capacity</td>
<td>50 kW</td>
</tr>
<tr>
<td>Ethanol Consumption</td>
<td>153 L/h</td>
</tr>
<tr>
<td>Raw Water Consumption</td>
<td>600 L/h (0,6 m³/h)</td>
</tr>
<tr>
<td>H₂ Purification Process</td>
<td>PSA (Pressure Swing Adsorption)</td>
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Solutions Portfolio

PRESSURE SWING ADSORPTION
Inlets up to $7,000 \text{ Nm}^3 \text{ H}_2/\text{h}$ (per module)

Provision of any necessary accessory:
- Feed gas cooling, drying & filtration
- Purity supervision
- Utilities (Instrument air provision, Chilled water)
- Controls & Cabinet (outdoor installation)

Proprietary control software & Supervisory platform (SCADA)

Hydrogen purity up to 99.9999% (6.0)

Operating pressure: up to 40 bar$_g$ (typical)

Purified streams: H$_2$, Syngas, CH$_4$, He, N$_2$, O$_2$, among others
PSA

Product Structure – Bulk Mixtures

Hydrogen from reformate
Hydrogen from biomass
Hydrogen recovery
Methane from biogas
Higher level of CUSTOMIZATION

07-Bed Module

© NEA GROUP
PEM Water Electrolysis
Why this Technology?

• High Efficiency
• Higher Power Density
• High Operating Range
• Fast Response
• Higher H₂ Purity
• Alkali-free
• Differential Pressure
• Simpler BoP
HyPEM Water Electrolysis
System Attributes

Rated productions up to **1,000 Nm³ H₂/h** or **5 MW** (per module)

Integrated and autonomous solutions ("Turn-Key"):

- H₂ and O₂ production module
- Gas purification & Purity supervision
- Thermal management & Utilities:
  - Heat rejection, Instrument air provision, Process water production, Chilled water
- Power electronics, Controls & Cabinet (outdoor installation)

Proprietary control software & Supervisory platform (**SCADA**)  
Hydrogen purity up to 99.9999% (**6.0**)  
Maximum operating pressure: **40 bar**
HyPEM Water Electrolysis
5 MW Plant Structure – Overview

- Production & Rectification
  40’ High Cube ISO Container
  (21 Ton)

- 05 x 1 MW PEM Stack

- BoP, Utilities & Control Panel
  40’ High Cube ISO Container
  (12 Ton)

- Dry-Cooler
  (Heat Rejection)
HYDROGEN GENERATION PLANTS
Compressor Units

HOFER Diaphragm Compressors

HOFER Hydraulic Driven Compressors
HYDROGEN GENERATION PLANTS

Storage

- High pressure hydrogen storage for both stationary and mobile applications
- Storage solutions for pressures of 200 bar up to 1,000 bar
- Type II or IV pressure vessels
NEUMAN & ESSER GROUP – THE H$_2$ EXPERTS
Hytron
Experts Team

Antonio Marin  Technical Office
Technologist in Chemical Processes

Cristiano Pinto, PhD.  Administration
Physicist, MSc & PhD in Energy Planning

Daniel Lopes, PhD.  Commercial Office
Mechanical Engineer
MSc in Thermal and Fluid Engineering
PhD in Energy Planning

Diego Cambra  IoT & Automation
Physicist & Electrical Engineer

João Camargo, PhD.  Energy Systems
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THANK YOU!

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https://www.hytron.com.br