



REGIONE DEL VENETO



InnovatiVE
SMART SPECIALISATION STRATEGY
VENETO

ENPHOS

HYDROGEN & BATTERIES SOLUTIONS

Dialoghi per l'innovazione • 3
#TRANSIZIONE ENERGETICA

Luigi Migliorini – ENPHOS



Venezia Heritage Tower – 9 aprile 2024





ENPHOS

HYDROGEN TRUE POWER

PURE CLEAN ENERGY

PHOTOSYNTHESIS





THE COMPANY



ENPHOS: VISION & MISSION



VISION: Pure Energy: ἐνέργεια/enérgeia/energy and φῶς/phōs/light

**MISSION: Development of a Sustainable & Circular Economy through Solutions
Green Hydrogen Generation - Energy Storage - Photosynthetic Solar Fuels**

**ENPHOS: Competence Center with Experienced & Innovative People & Partners
developing Products and Solutions for a Sustainable & Circular Energy World**

**LOCATIONS: Office and Manufacturing in Verona (Italy)
Laboratory for Materials Developments in Padova (Italy)**

**R&D PARTNERS: Universities Padova & Trieste and Politecnico Milano (Italy)
Sponsoring 8 PhD and Researchers (hiring plan 2024-2025)**

Luigi Migliorini (Verona, 1970)

MSc Economic Sciences at University of Padova (Italy)

Executive Courses in Nanjing University (P.R.China)

Passionate of Green Energy & Renewable Hydrogen

- | | |
|------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1998-2000 | China Chief Representative Assistant - Teksid (Fiat)
Nanjing (P.R.China) |
| 2000-2010 | AsiaPacific Ceo – Fiamm Asia (Fiamm Group)
Singapore and Wuhan (P.R.China) |
| 2011-2018 | Great China Ceo - Prysmian & Draka (Prysmian Group)
Shanghai (P.R.China) and Singapore |
| 2018-2023 | Founder & Ceo – SeedForces (www.seedforces.com)
Verona (Italy) |
| 2020-now | Founder & Ceo – Enphos (www.enphos.com)
Verona (Italy) |

ENPHOS: FUNDED IN DECEMBER 2020

STATUS: INNOVATIVE START-UP SINCE 2021

SHAREHOLDERS: 100% LUIGI MIGLIORINI

REGISTERED CAPITAL: 96,000 EURO

OWN CAPITAL INVESTED (2021-23): MORE THAN 2 MILLION EURO

BANK FINANCING: 300K EURO FROM BANCO BPM

GRANTS (EUROPEAN & ITALIAN): MORE THAN 6 MILLION EURO

MAIN INVESTMENTS: PEOPLE, R&D ACTIVITIES, KNOW-HOW TRANSFERS

REVENUES: 700K Euro in 2022 (Electrolyser and Various Projects)

800k Euro in 2023 (Electrolyser and Various Projects)

> 1 millions in 2024 (European and Italian Projects)

ENPHOS: KEY PEOPLE



Luigi Migliorini
MSc Economic Sciences
Founder & Ceo



Matteo Miola
Postdoc Materials & Chemistry
R&D & Innovation



Damiano Perusi
MSc Eng Mechanic & Energy
Operations & Project



Luca Montini
BSc Engineering
Application & Service



Giulia Di Gregorio
PhD Nano Technology
Materials' Laboratory

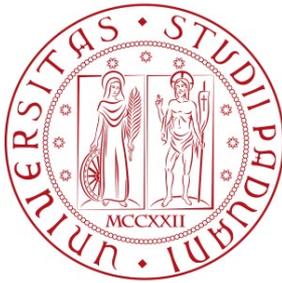


Enrico Picotti
PhD Information Technology
Automation Strategies

Note: more highly qualified people are completing their PhD/MSc through specific Partnerships with few Universities and will join Enphos during 2024 and 2025

Intellectual Property Strategy: know how & materials protection

- a) Agreements signed with University of Padova
- b) Agreements signed with University of Trieste
- c) Agreements signed with Politecnico of Milano



Intellectual Property Strategy: processes and products protection

- a) Patent for Modular high efficiency Electrolysers and more
- b) Patent for Zinc Iron Redox Flow Batteries Additives and more
- c) Patent for Artificial Photosynthesis Solution production and more





THE PRODUCTS





➤ SUSTAINABLE MOBILITY: RENEWABLE HYDROGEN

- Green Hydrogen for Bus/Trucks
- Electrolysers Needs: > 4 bill Euro
- Green Hydrogen Market: > 15 bill Euro



➤ SUSTAINABLE ENERGY: LONG DURATION STORAGE SYSTEMS

- Long duration Energy Storage (> 8 hours)
- Energy Storage Needs: > 6 bill Euro
- Long Duration Storage: > 6 bill Euro



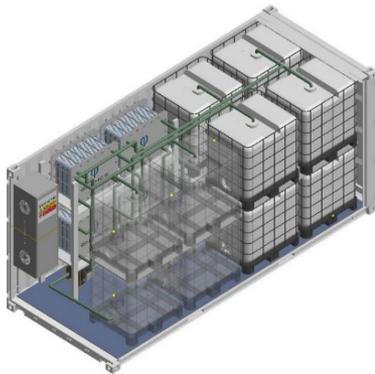
➤ SUSTAINABLE INDUSTRY: PHOTOSYNTHETIC SOLAR FUELS

- Solar fuels through Photons
- Grey Hydrogen Market: > 230 bill Euro
- Natural Gas Market: > 900 bill Euro



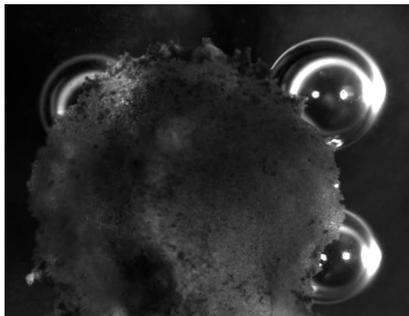
HYDROGEN

- **HYTHESIS: Green Hydrogen Electrolysers**
 - PEM (Proton Exchange Membrane) efficient & pure H₂
 - Power Range: 10 kW to > 1 MW
 - GEMS: Gas and Energy Management System



BATTERY

- **SEEDS: Energy Storage System for Long Duration**
 - Redox Flow Batteries (Safe & Secure)
 - Methydor: metal hydrides H₂ storage (P < 40 bar)
 - PCS: Power Conversion Systems (efficient, bidirectional)



PHOTOSYNTHESIS

- **METAPHOS: Solutions Inspired by Nature**
 - Artificial Photosynthesis Materials and Modules
 - White Hydrogen Generation from Photons and Water
 - Nano-Materials, Inter-disciplinary projects





HYTHESIS: GREEN H₂ PEM ELECTROLYSERS

HYTHESIS: ELECTROLYSERS PEM (PROTON EXCHANGE MEMBRANE)

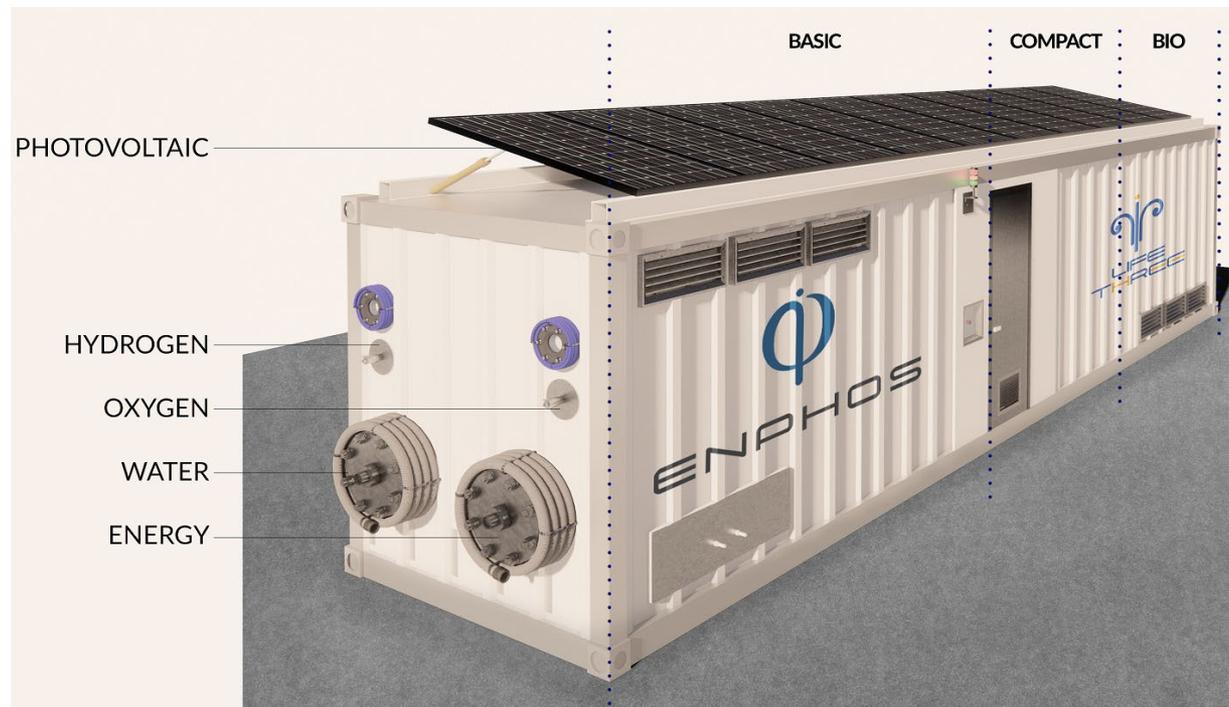
- Electrolysis Systems:**
- Modular Stacks (different size cells)
 - Power Conversion (high efficiency)
 - Water & Gas Purification Systems
 - Gas & Energy Management System (GEMS)

Electrolysers Range: Input: 40 kW - 2.4 MW
Output H₂: 8 - 480 Nm³/h



HYTHESIS: INNOVATIVE STACKS & ELECTROLYSERS FOR GREEN HYDROGEN

- Modular Multi-MW Containers Solutions (1.2 – 2.4 MW)
- New design for innovative Stacks and Catalysts (> 100 kW)



ENPHOS: SEEDS BATTERIES

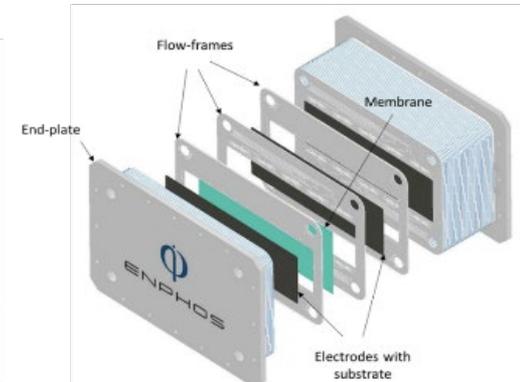
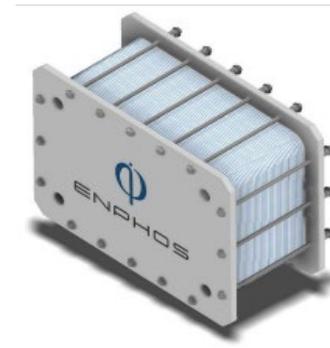
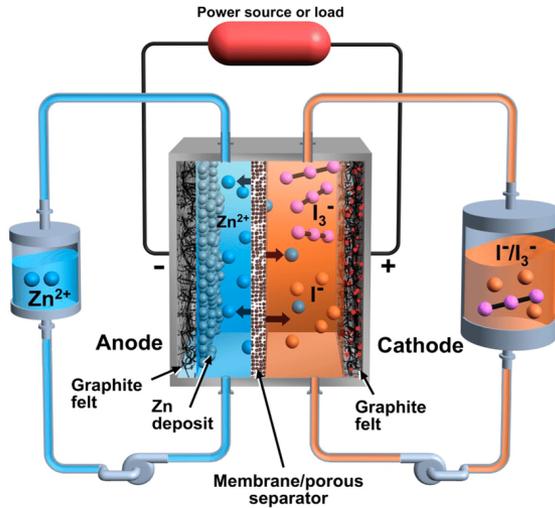


SEEDS: ZINC IRON FLOW BATTERY ENERGY STORAGE



SEEDS: SUSTAINABLE & EFFICIENT ENERGY DYNAMIC SOLUTIONS

- Advanced flow battery for LDES (Long Duration Energy Storage)
- Zinc/Iron: based on non-critical materials (no Lithium)
- Long life cycle (> 10,000 cycles)
- EMS & BMS: control management with bidirectional power conversion
- Matching the typical Renewable Power Energy Curves (6-12 hours)
- EIC Accelerator (EU) grant approved

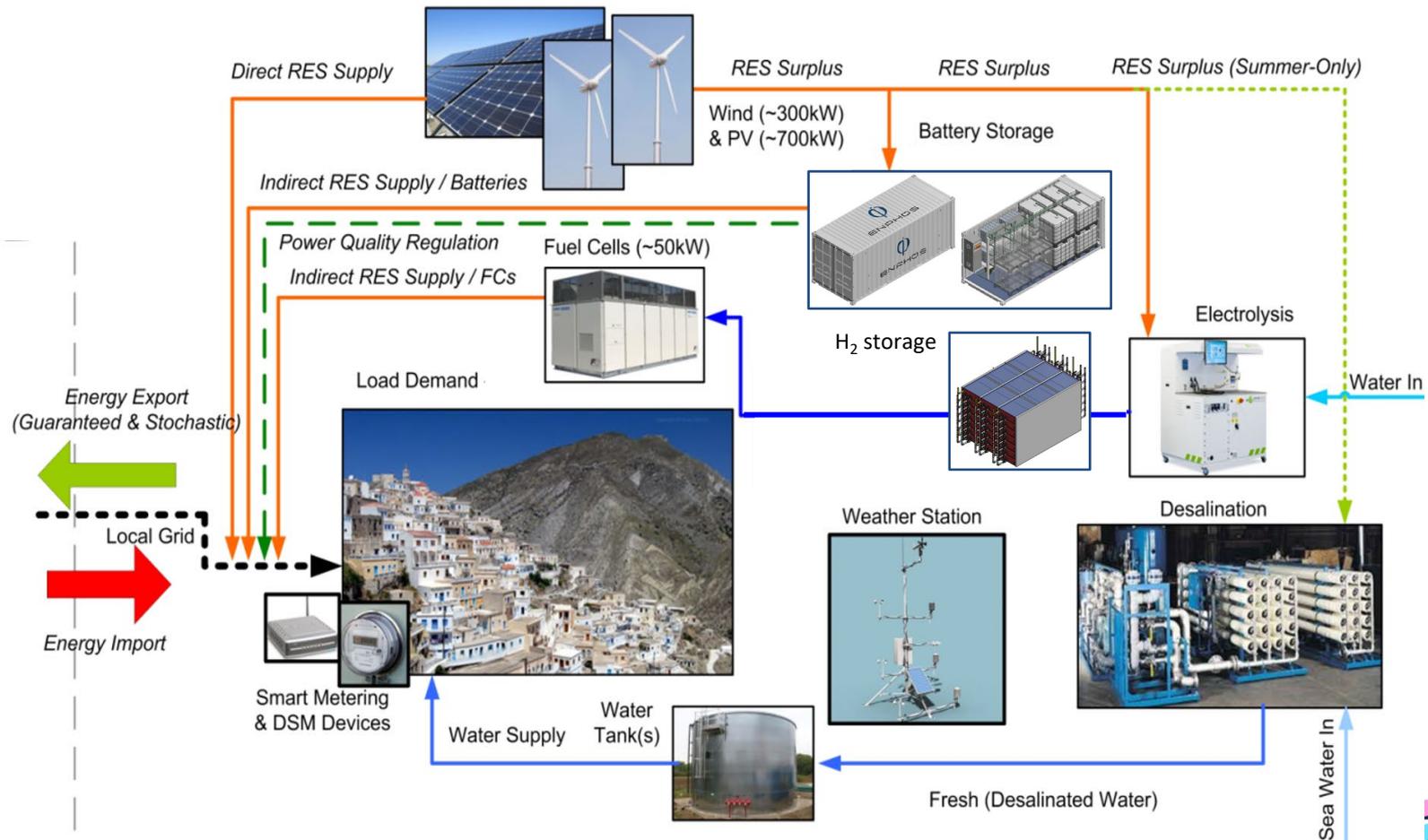


SEEDS: HYBRID LONG DURATION ENERGY STORAGE



SEEDS: OFF-GRID & ISLANDS TYPICAL PROJECT

- Hybrid System: -Low pressure Hydrogen Storage
-Advanced battery for LDES (Long Duration Energy Storage)
- Key Aspects: Long Service Life, Temperature Immune, Safe & Recyclable



ENPHOS: METAPHOS PHOTOSYNTHESIS





METAPHOS: PLANKT-ON & WHITE HYDROGEN



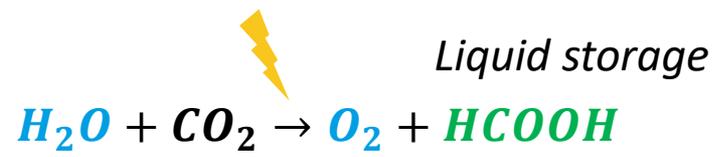
PLANKT-ON & WHITE HYDROGEN

- A disruptive **net-zero** emissions technology to address the global energy demand
- **Bioinspired** strategy for the production of Hydrogen & **Solar Fuels**
- The **plankton-like** protocells will be shaped as containers of two synergic subdomains of light harvesting and **CO₂ conversion**

Inspired by Nature, PLANKT-ON is the first synthetic plankton-like protocells that autonomously utilises light, water, and CO₂ to produce O₂, H₂ & Solar Fuels



Wireless and photo-catalytic formic acid production (H₂ carrier)



H₂

Local controlled delivery





METAPHOS: PLANKT-ON & METAPLANKTON

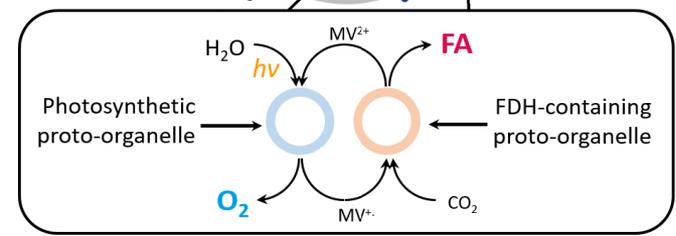
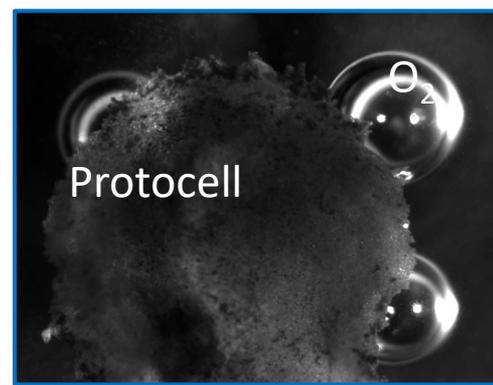
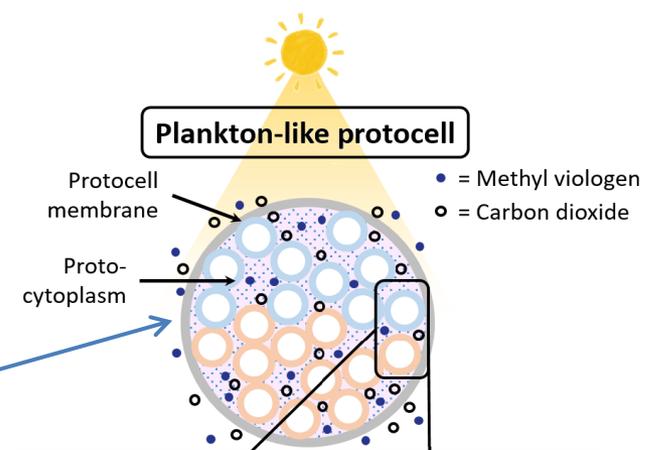
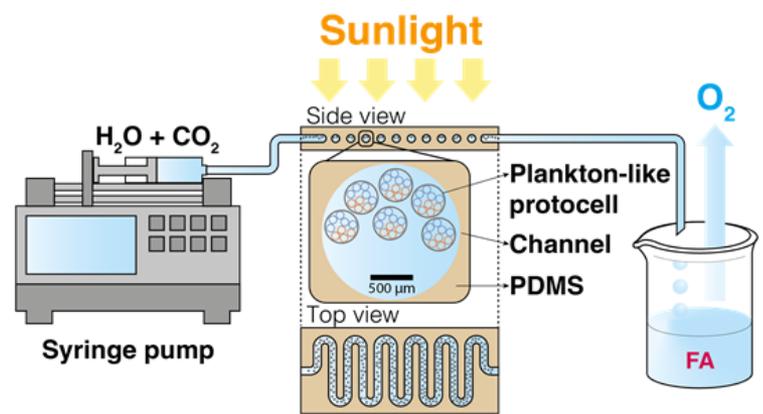


EIC INNOVATION PATHFINDER: PLANKT-ON (6 Universities & Enphos)

- Bioinspired and synthetic plankton-like protocells (nanomaterials & quantasome)
- From Photons, Water (and CO₂) to produce O₂ and H₂ or formate (H₂ vector)

METAPLANTON PROJECT

- Innovative Photo-Synthetic Platform for Industrial Solar Fuel



THE PATH



ENPHOS: MILESTONES



PLANNING

 2020-21

Defined objectives and deliverables:

- Innovations
- People
- Funding
- Stakeholders

DEVELOPMENT

 2022-26

Developing teams and solutions:

- Mobility
- Energy
- Industry
- Software



EXECUTION

 2022-28

Executing pilots and projects:

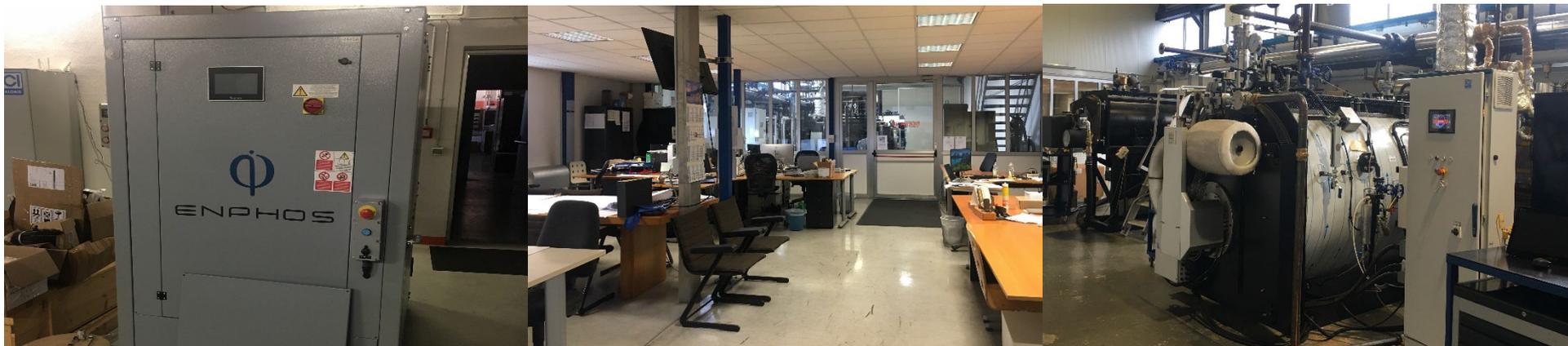
- Electrolyser
- Battery
- Photosynthesis
- Automation

EXPANSION

 2024-30

Expanding products in the markets:

- Europe
- USA
- Asia
- ROW



ENPHOS: KEY PROJECTS (co-investments)

HYPOTHESIS: GREEN HYDROGEN GENERATION	Project Type	Value (Euro)
Noi TechPark: first Italian Industrial PEM Electrolysers (160 kW) Integrated with Low Pressure Storage and Fuel Cell (2021-23)	EU Communities Bolzano Province	Own 300k Grant 500k
Hythesis Project: development and design of 1 MW electrolyser and first Italian PEM stack prototype (2023-2024)	Reg. Veneto FSC 2021-2027 Stralcio. Area tematica 1 ricerca e innovazione	Own 120k Grant 80k
SEEDS: ZINC IRON FLOW BATTERIES		
SEEDS: Zinc Iron Batteries for Long Duration Energy Storage (2024-2026) - Seal of Excellence	EIC European Innovation Council - Accelerator	Own 1 mln Grant 2.5 mln
Seeds Valley: European Network for Stationary Energy Storage System (ESS) (2025-2028)	EU Horizon	Own 1 mln Grant 2 mln
METAPHOS: PHOTOSYNTHETIC SOLUTIONS		
Plankton: Photosynthetic solutions to generate Hydrogen and Solar Fuels (2023-25) Total value (6 universities: 3 mln)	EIC European Innovation Council - Pathfinder	Own 200k Grant 550k
Meta-Plankton: laboratory prototype for Membranes for PhotoSynthetic Solar Fuels (2023-25)	PR Veneto FESR 2021-2027 Azione 1.1.3 "Sostegno ricerca e innovazione PMI"	Own 100k Grant 150k



ENPHOS



THANKS

www.enphos.com
luigi.migliorini@enphos.com
+39 331 4422 966

