



PH₂OS Solar Technologies

INNOVATION in the PRODUCTION of GREEN
HYDROGEN

Company Information

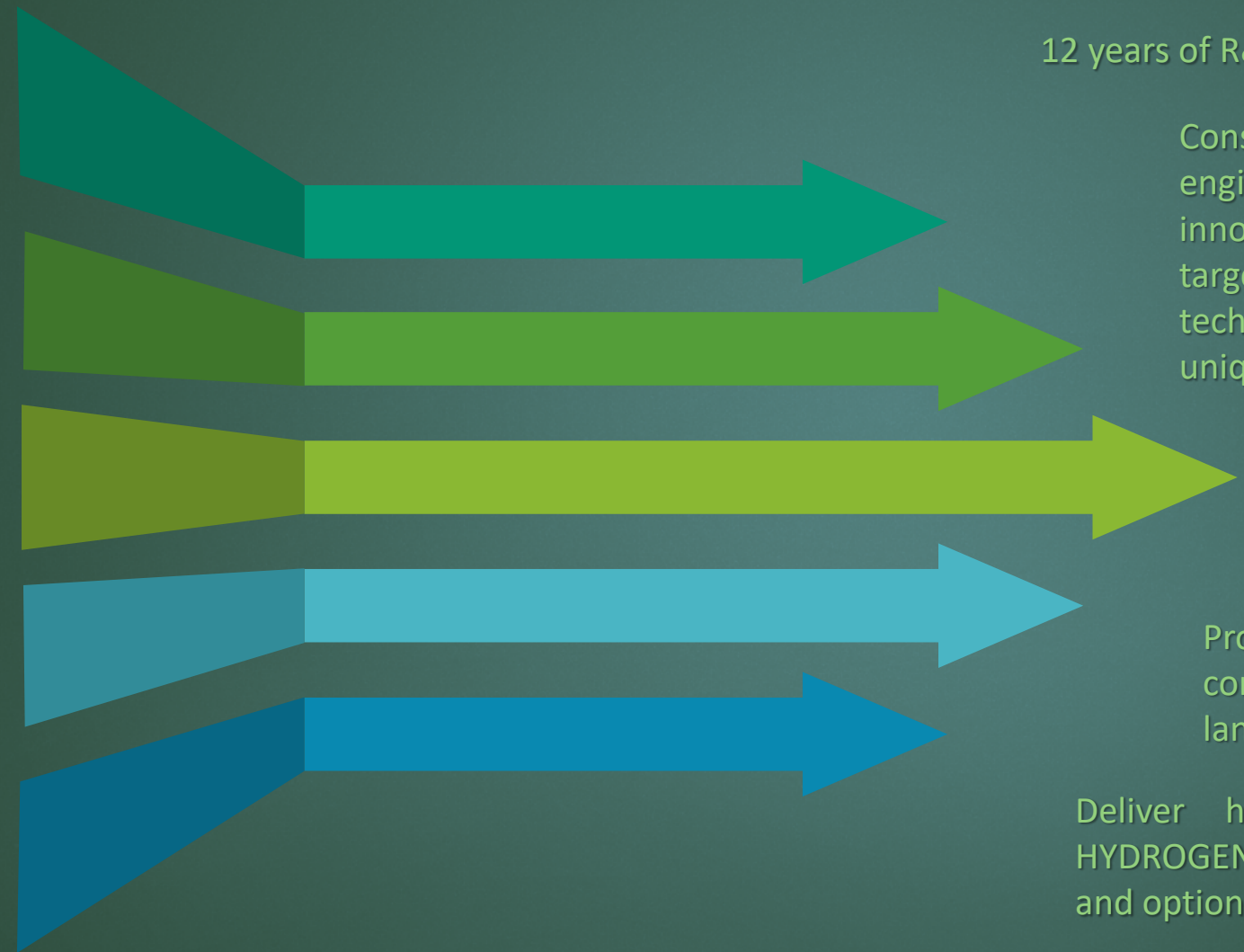
PHOS Solar Technologies Ltd. (UK)

Established: 2010

Key Shareholders: Konstantinos Arvanitis, Dr. Evangelos Arkas

Key Inventor: Dr. Evangelos Arkas, PHD of Physics; ex NASA scientist

PH₂OS Technologies - Milestones



12 years of R&D Investment

Consisted of highly skilled scientists and engineers, who have worked in the field of innovation and disruptive patented technologies, targeting the optimization of pioneering technologies merged, to deliver a sophisticated, unique, beyond any competitive product

Achieved certified results in the production of GREEN HYDROGEN, that no other technology can deliver

Production of GREEN HYDROGEN at an extremely competitive cost (below 2€/kgH₂) with minimum landmass usage

Deliver higher quantities of GREEN HYDROGEN than any other technology and optionally operate on a 24/7 basis

OBJECTIVES

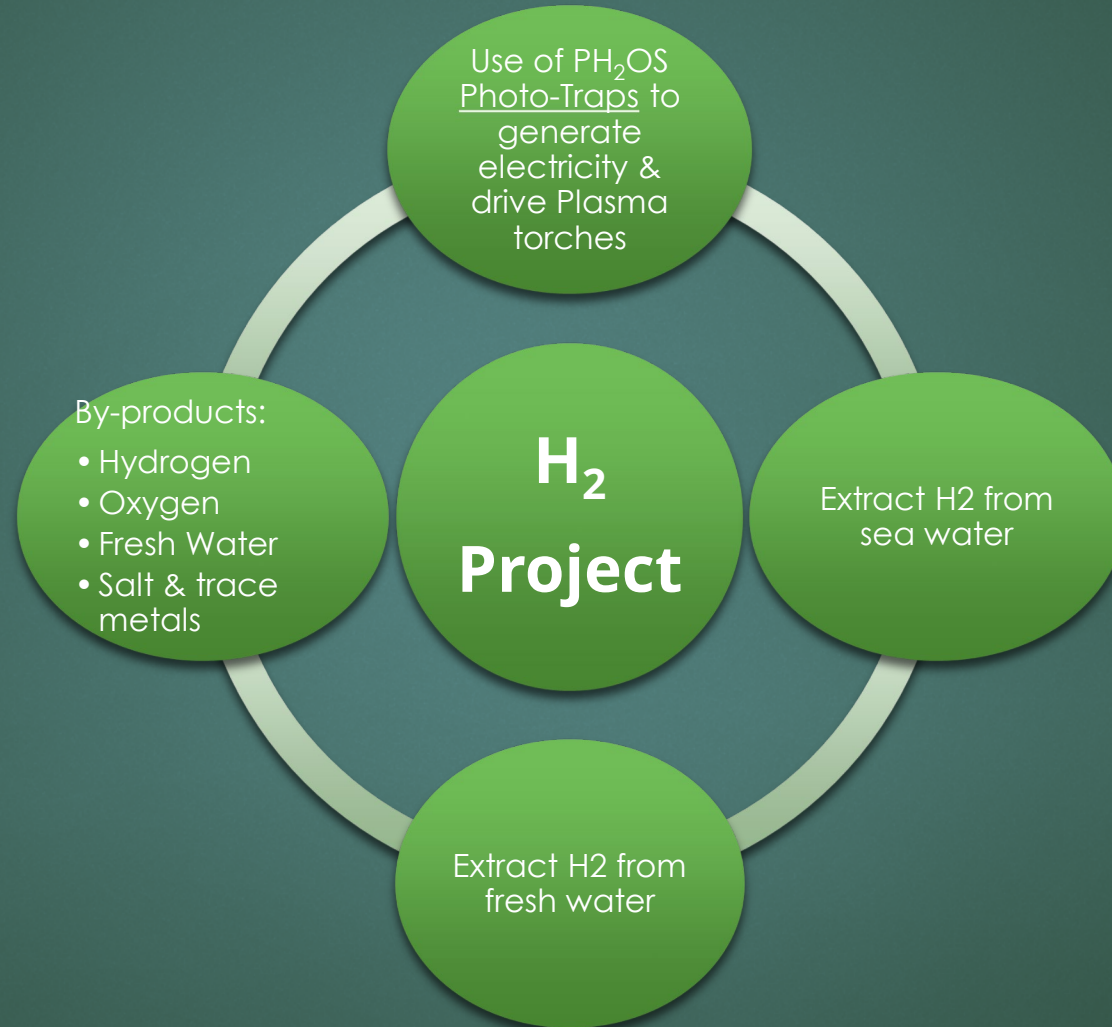
Purpose

- Minimize the pollution that derives from the production of brown, grey and blue hydrogen(s) extracted from fossil fuels
- Produce Real Green Hydrogen by applying the novel PH₂OS method

Results

- The current predictions are that “low carbon Hydrogen” will become competitive by 2040, which is **not** Green.
- We have been successful in our endeavours and we are ready to deliver Real Green, carbon-free Hydrogen to the World.
- Note: All references to “low carbon” can translate to the use of fossil fuels

H₂ Project Basics



H₂ Technology Overview

PHOS Solar Trap Unit

- Highly efficient absorber of solar irradiation
- Use of standard solar PV cells
- Landmass usage is 1/4th of conventional PV plant of the same kWp
- Nearly impossible to sustain damage due to elements because the PV cells are enclosed
- Do not contribute to reflections into the atmosphere because 100% absorption of the solar irradiation is established
- Energy output approximately **3.5 times** vs. conventional plant
- First prototype successfully in operation
- Patented technology

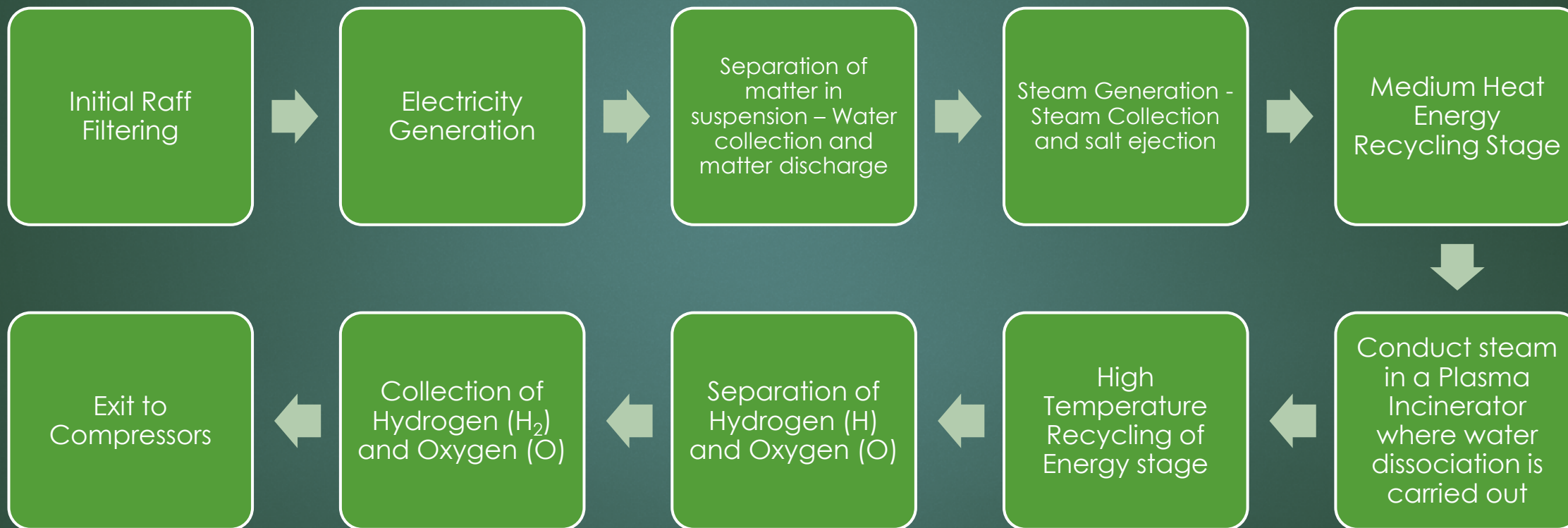
H₂ Technology Overview

H₂ Production Unit

- Highly innovative production method
- Use of steam generation via cavitation – very fast & efficient process
- Based on commercially available plasma systems
- Water separation into Hydrogen and Oxygen – patented technology
- Several Patents received

H₂ Technology Overview

The sequential stages for Fresh & Sea Water



PH₂OS Solar Trap

Main Technical data

- 25 kWp output per Solar trap Unit
- 30 sq.m area coverage per unit
- Absorber consists of highly reflective aluminum mirrors
- Use of conventional monocrystalline PV cells
- Wind resistance up to 150 km/h
- Approx. energy output 3.5 times vs. a conventional plant
- Can work during cloudy periods

Main Advantages

- High Efficiency – approx. 4 times that of market monocrystalline solar PV cells
- Low cost material – easy assembly
- Lifetime time comparable to conventional cells
- Able to be used with conventional electrolyzers
- Robust integrated cleaning system
- Less surface erosion
- Able to work with tracking system

PH₂OS H₂ Production Unit

Main Technical data

- Bespoke patented plasma torch design
- 3D printing of key mechanical parts
- No moving parts
- Can use salt water – patented desalination technology
- No moving parts
- Highly innovative patented H₂ separation process

Main Advantages vs. PEM

- Continuous production process
- Works with sea water
- Partnered with an RES storage system or continuous green power generation (e.g hydro power, geothermal etc.), can work on a 24/7 basis
- Efficiency approx. 7 times better than PEM electrolyser – **6.5 kWh/kg H₂**
- Lower Hydrogen production cost

Production of H₂ and Energy needed

The PH₂OS Method

- DOES NOT use electrolysis
- Energy consumption 6.5kWh / 1 kg H₂ produced - more than 8 times lower than that of electrolysis

The in-use fossil fuels consumption per kilogram of H₂ is:

- By Coal, Petrol or Methane, approximately 61 kWh
- By electrolysis, 55 kWh via power provided by PVs, Solar-thermal & Wind turbines

PH₂OS Hydrogen Plant

Demonstration Project:

Location: Greece

Installation Capacity: 25 kWp

Option #1: Daytime Operation

- LCOE calculation considers a discount rate of 5%.
- LCOE calculation considers a 0.3%/year efficiency drop.
- No cost for land lease.

PH₂OS Solar Trap

Direct Comparison @ 25kWp & 1200 kWh/kWp

PH2OS Solar Trap	Criteria	PV Plant
30 m ² area	Land Usage	118 m ² area
Monocrystalline Si	PV technology	Monocrystalline Si
Stationary Bases	Mounting	Stationary Bases
17500 €	Equipment Cost	10000 €
700 €/kWp	Total Cost	400 €/kWp
116960 kWh/a	Energy Production	34400 kWh/a
25.50	LCOE (€/MWh)	66.25

PH₂OS Hydrogen Plant

Direct Comparison @ 25kWp & 1200 kWh/kWp

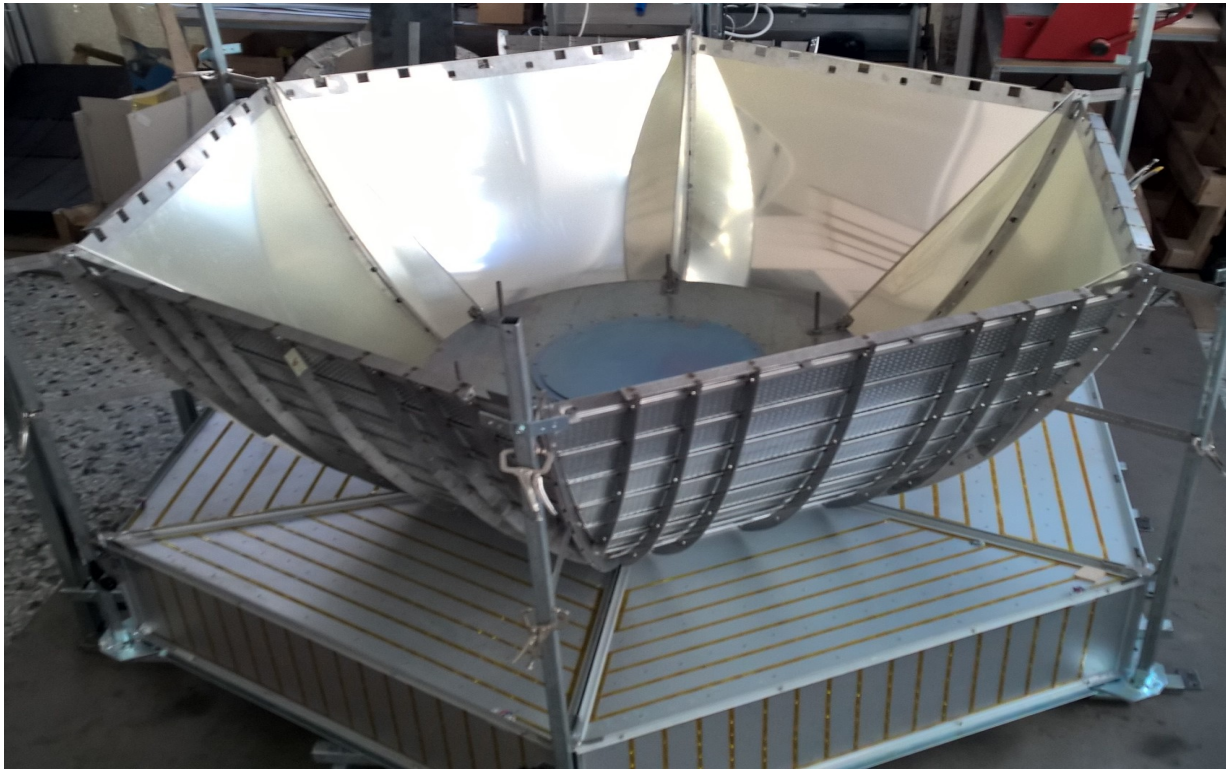
PH ₂ OS Hydrogen Unit	Criteria	PEM Electrolysers
6.5 kWh/kg H ₂	Energy Consumption	55 kWh/kg H ₂
PHOS solar trap	Energy Solar Supply	Conventional PV plant
117 MWh	Yearly Energy production	35 MWh
<u>18 tn</u>	Total H ₂ production	<u>0.637 tn</u>

PH₂OS Hydrogen Plant

Financial Analysis

PH ₂ OS Hydrogen Unit	
Energy Consumption	6.5 kWh/kg H ₂
Capital Cost	25000 €
Yearly H ₂ production	<u>18 tn</u>
Yearly Revenues (before taxes) @3.8€/kgH ₂	68400 €
*break-even point is achieved at the <u>first production year</u>	

Appendix A: Builds for Photovoltaics & Solar Thermal



A photo of a partly assembled PH₂OS Photovoltaic System. The segmented Catenary Solar Collector above, and below the segmented Proto-Traps. This PH₂OS System offers 4 times the efficiency of system installed in open fields and uses only 1/4th of the surface, and without upwards thermal drafts. Below, is a staging space saving with a PH₂OS System.



The PH₂OS Photovoltaic System. Solar Collectors above & Photo-Traps below. Design & Construction in Greece. Assembled and Tested in Kingston Canada



Thank you!

PH₂OS TECHNOLOGIES