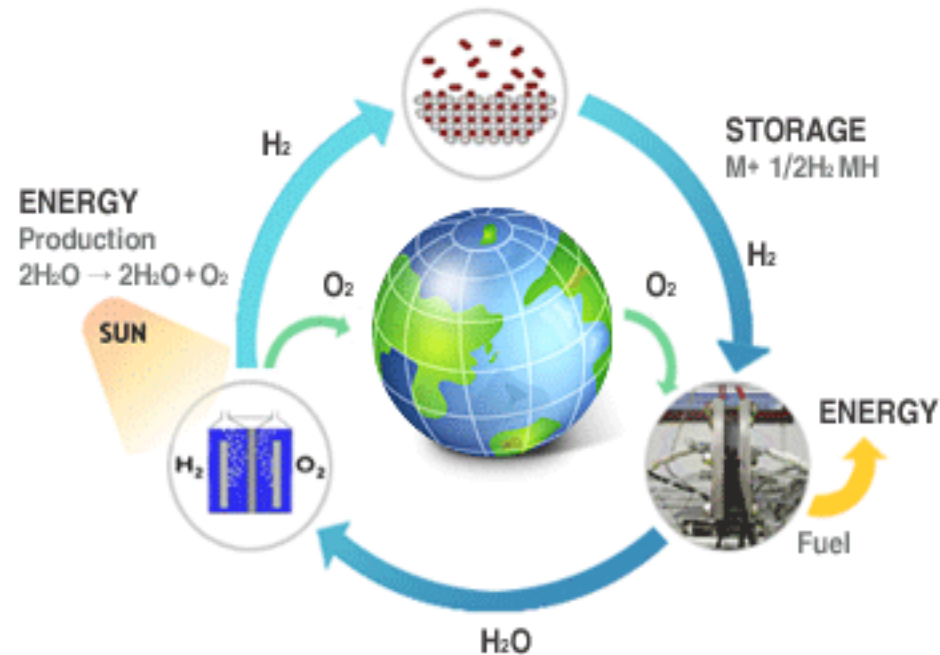




Dr. Sofoklis Makridis
Associate Professor
Department of Environmental Engineering
University of Patras

Hydrogen & Fuel Cells: Materials and Processes



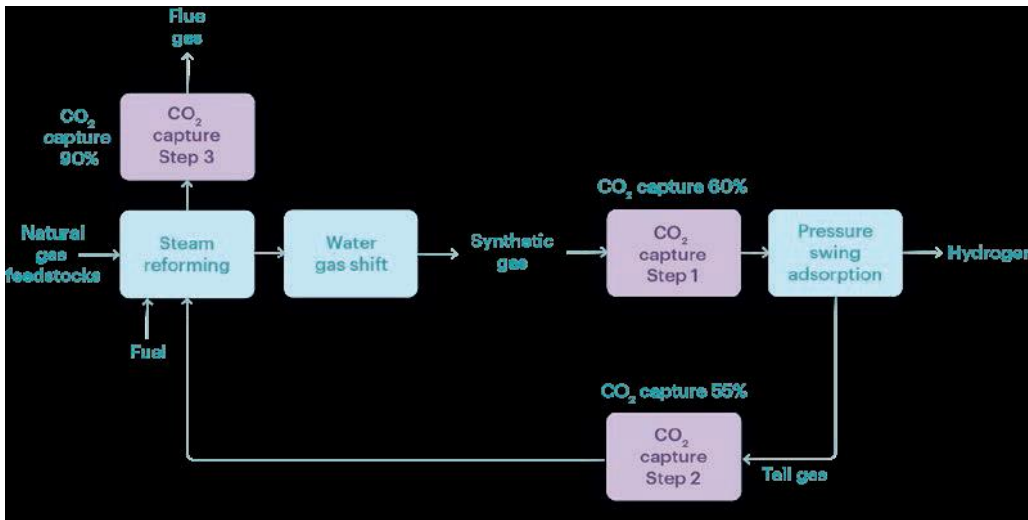
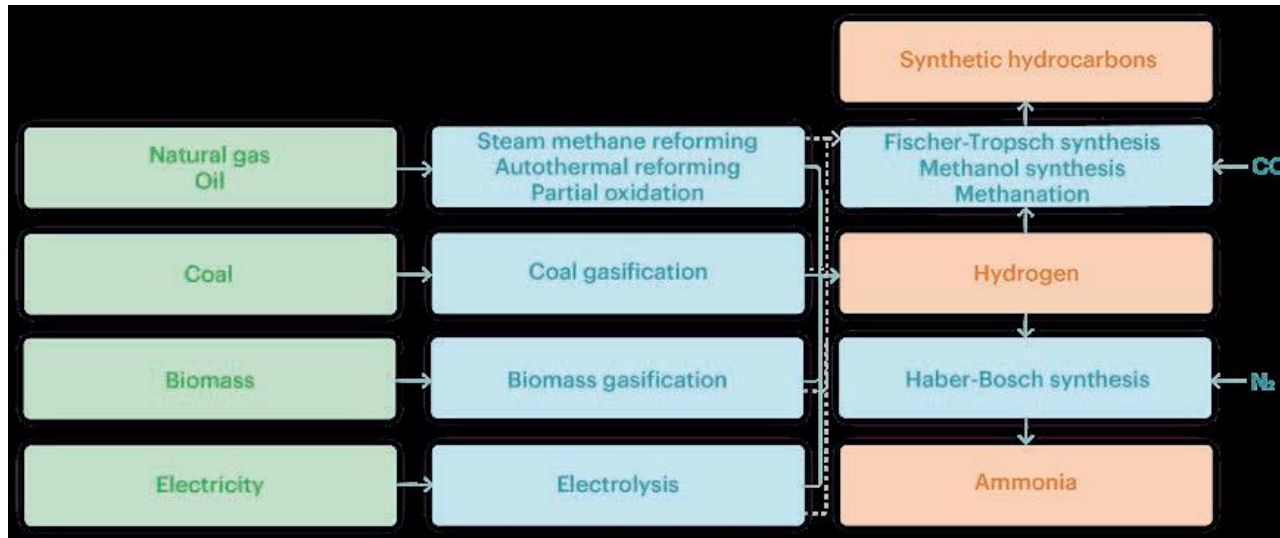


From “Green” to “Blue” Development

In recent years, colors have been used to refer to different sources of hydrogen production.

- “Black”, “grey” or “brown” refer to the production of hydrogen from coal, natural gas and lignite, respectively.
- “Blue” is commonly used for the production of hydrogen from fossil fuels with CO₂ emissions reduced by the use of carbon capture, use and Storage (CCUS).
- “Green” is a term applied to production of hydrogen from renewable electricity. In general, there are no established colors for hydrogen from biomass, nuclear or different varieties of grid electricity. As the environmental impacts of each of these production routes can vary considerably by energy source, region and type of CCUS applied.
- **Around 70 Mt of dedicated hydrogen are produced today, 76% from natural gas and almost all the rest (23%) from coal.**
- **Electrolysis currently accounts for 2% of global hydrogen production, but there is significant scope for electrolysis to provide more low-carbon hydrogen.**

Production of Hydrogen



Japan: The very compact "Ene-farm Mini" makes hydrogen from home

How about DEI (PPC)?

Construction for a world-first project to turn coal into [#hydrogen](#) has commenced. The pilot project is the first step in creating a commercial hydrogen [#energy](#) supply chain requiring the use of carbon capture and storage. This project is supported by the Australian Government, Japanese Government and [Victorian Government](#), alongside a consortium of Japanese companies.

[Marubeni Corporation](#) [K](#)
[awasaki Heavy Industries, Ltd.](#)
[J-POWER](#)
[Sumitomo Corporation](#)
[Iwatani Corporation](#)



3 tonnes of hydrogen during the trial phase

The pilot plant the amount of CO₂ is expected to be the equivalent to the annual output of approximately 20 cars.

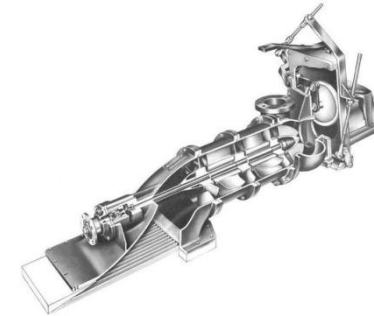
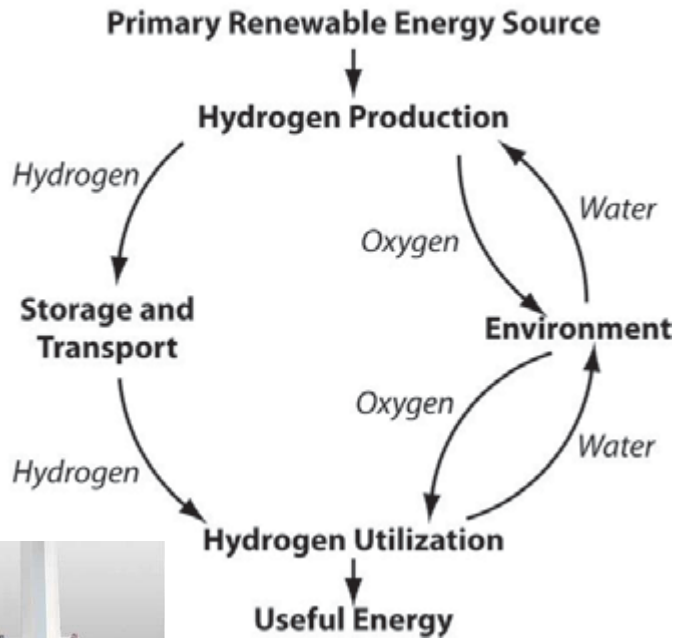
German-Greek Hydrogen Boats



United Nations
Framework Convention on
Climate Change

Hydra e-25 H2 FC Waterbus 25 Passengers

Hydrogen Life Cycle



Hydrogen – Fuel Cells Boat

- **Fuel Cell System:** Fuel cell type: AFC, Alkaline Fuel Cell Fuel: hydrogen Oxidant: aerial Oxygen Electrolyte: 30 % potassium hydroxide (KOH) Performance 16 KW
- **Hydrogen storage:** A Metal-hydride hydrogen storage (MHS) of 70 m³ will be installed with an operating pressure of 5 bar

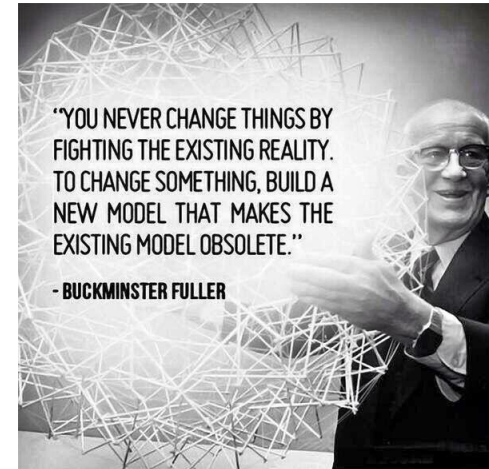


Oil and Gas (C-H & H₂)

- Building an environment of a ~100 % Greek self-assembly in energy and geopolitics
- Environmental Impact of hydrogen of producing natural gas with Carbon Capture
- Transforming hybrid systems in green & blue economy
- Leveling up our Country's impact
- ...
- ...

*Thank you very much for your attention
Sofoklis*

Any
Questions??



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