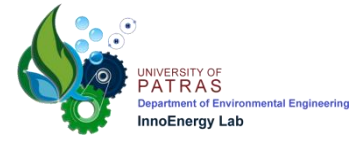




# Hydrogen Energy Autarky

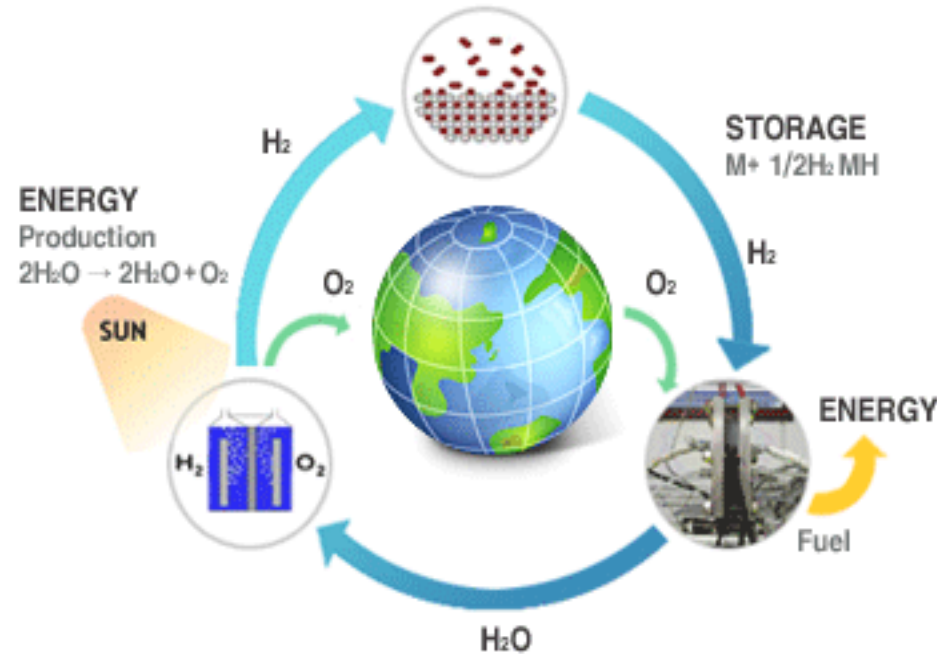


**Dr. Sofoklis Makridis, Associate Professor**

Department of Environmental Engineering, University of Patras

Honorary Visiting Research Fellow at Dept. Chemical Eng., University of Bradford

## 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 CO<sub>2</sub> 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.**

# Hydrogen Energy Autarky



1

## Hydrogen-Based Energy Autarky Smart Cities

Startup Project Proposal  
Business Plan

“A New Hydrogen Energy Storage System”  
For



1

## Hydrogen-Based Energy Autarky Smart Islands

Startup Project Proposal  
Business Plan

“A New Hydrogen Energy Storage System”  
For

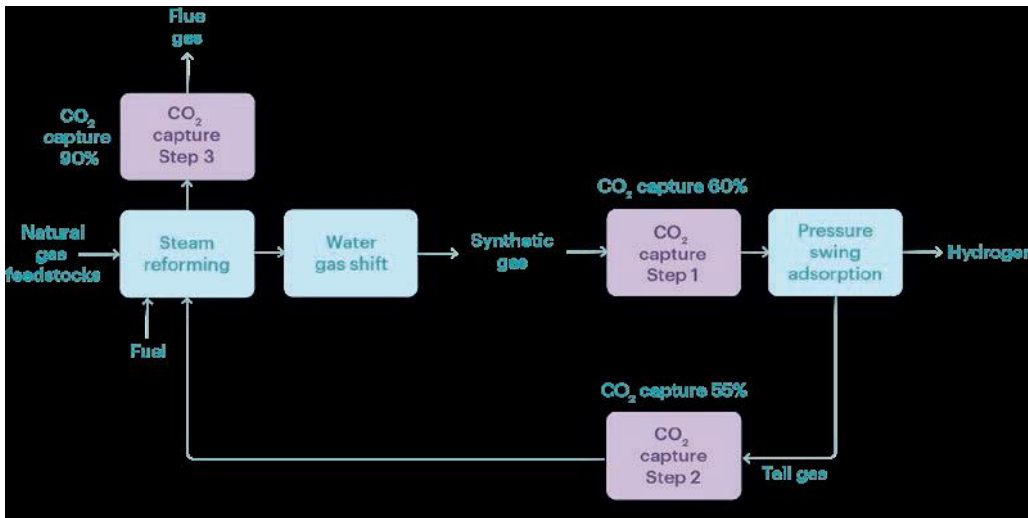
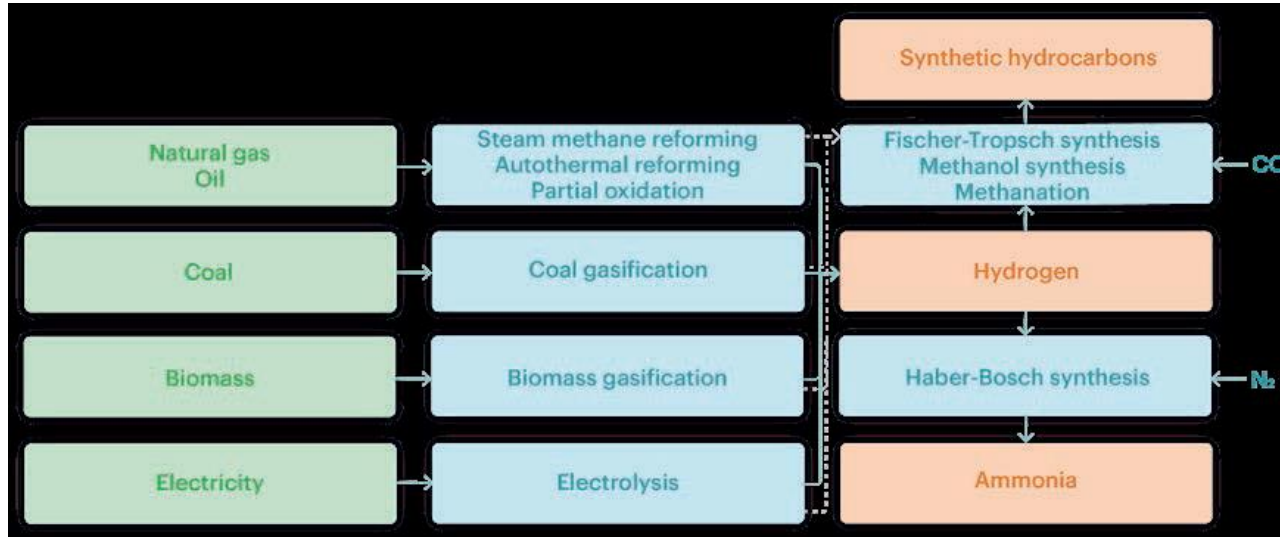
# Hydrogen Port – Patras???

RECONNECT

The port of Gävle – Aim: an energy optimized cluster



# 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](#)

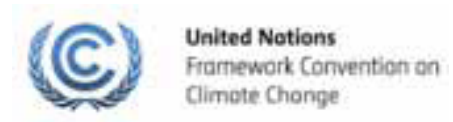


3 tonnes of hydrogen during the trial phase

The pilot plant the amount of CO<sub>2</sub> is expected to be the equivalent to the annual output of approximately 20 cars.

# Hydrogen Buildings - ZEB

**Fuel Cells and Hydrogen in Buildings:  
Integrating Electricity, Heat and Gas for  
a Decarbonised Future Energy System**



Singapore — SP Group (SP) has established the first zero-emission building in Southeast Asia that is powered by green hydrogen.

<https://www.vetoneews.gr/eletherovima/item/54449-ylika-energeia-bioklimatikh-architektonikh-gia-ena-aytonomo-systhma-twn-panagiwta-michalakakoy-sofoklh-makridh>



**CEA – rSOC Solution**

Energy transition on the move



Enabling the energy transition with first local clean energy storage system



The Smart Energy Hub makes it possible to get **100% of a building's energy** directly from local and sustainable energy production.



The Smart Energy Hub enables a **65%** decrease of primary energy consumption in buildings.



In tests, CO<sub>2</sub> emissions were reduced by **26%** for an office building in France and **70%** for residential buildings in Germany.



The global market for the new system is estimated to be **€ 10B** by 2020.



Viessmann Limited  
 Office: Hortonwood 30, Telford, Shropshire  
 TF1 7YP  
 Registered in England  
 Company Reg No. 2305071





# Hydrogen – Fuel Cells

## EFOY JUPITER 2.5

SFC's hydrogen fuel cell with up to 20 kW nominal output

### Nominal outputs from 2.5 to 20 kW

The EFOY JUPITER hydrogen fuel cell complements the extensive product portfolio of SFC Energy with energy solutions in the higher power range. Nominal outputs from 2.5 to 20 kW can be individually scaled with just one control unit. Operation and installation are very simple and there are no emissions. The EFOY JUPITER fuel cell can therefore also be used in ecologically sensitive areas. The fuel cell is very quiet and efficient.



# Oil and Gas (C-H & H<sub>2</sub>)

- 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
- ...
- ...

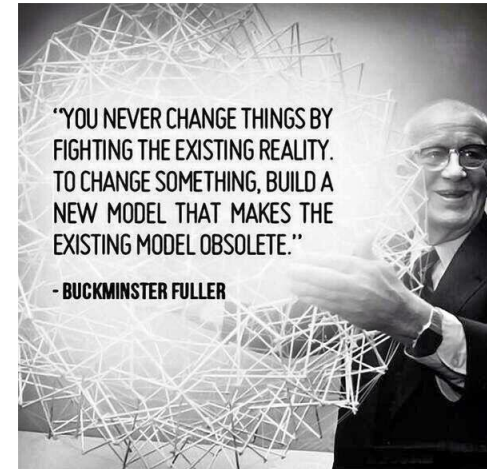
*Thank you very much for your attention  
Sofoklis*

Any  
Questions??



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