Research Topics

Arianna Baldinelli, PhD

Hydrogen Production

- Experimental and numerical investigation of high-efficiency hydrogen production through Solid Oxide Electrolyzers.
- Green H_2 energy system techno-economic analysis (TEA)

Green ammonia

- TEA of Energy-driven green ammonia production systems with multiple renewable sources supply
- Analysis of green ammonia supply chain in remote energy hub systems, against competing hydrogen carriers

Bioenergy Systems

- Intensification of biomass gasification processes with other renewable energy sources (RES)
- Coupling of bioenergy technologies with other RES in BtX/PtX systems and local energy communities.

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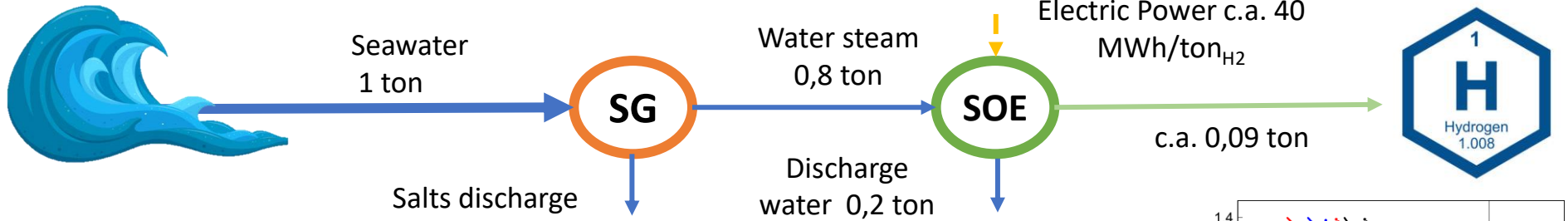
Hydrogen Production – ongoing research

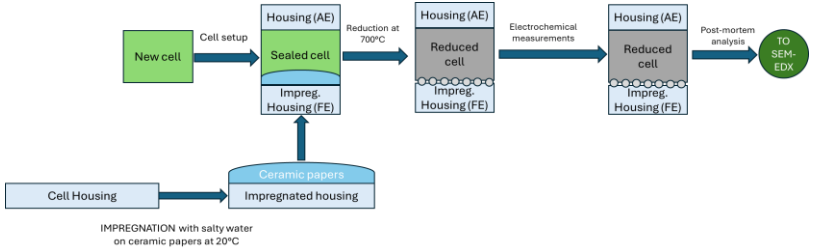
PRIN 2022 POSEIDON (role: Principal Investigator)

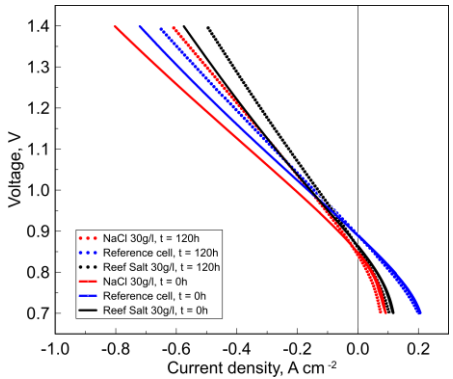
Photo-driven Optimal Seawater Electrolysis for energy-IslanDs OperatioN



Main research goal:

Develop and implement an **experimental methodology** to address **seawater effects** on **solid oxide cells (SOE)** and on **stack materials** during electrolysis operation.





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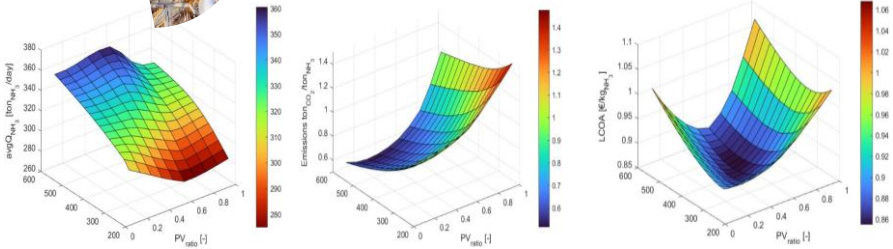
Green Ammonia: production and logistics

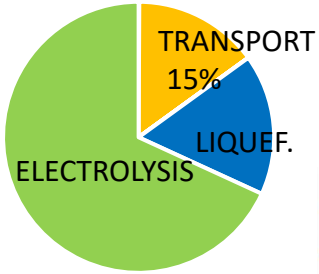
Techno-economic analysis of Energy-driven Green ammonia production systems

CONTEXT: Electrolysis is the coupling Power-to-X block. Conventional Ammonia production is not flexible to match electric Variable RES: limited capability for quick shut down, start-up and ramp-up/down. Multiple energy storage solution are investigated to decouple the problems.

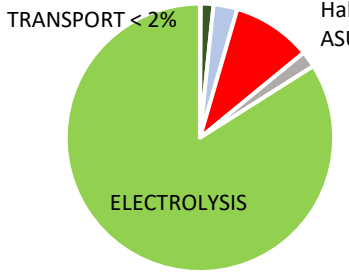
METHOD: Timestep simulation of integrated Power-to-X systems in order to improve energy, environment and economic feasibility



Analysis of green ammonia and LH2 supply chain in remote energy hub systems



Energy carrier: Green LH2
Supply Chain Energy Efficiency: 44%



Energy carrier: Green NH3
Supply Chain Energy Efficiency: 49%

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Bioenergy Systems – NEST Spoke 3

Investigate advanced biomass gasification systems to increase hydrogen yield and efficiency

Scope of the research activity

- Design and model an integrated system for enhanced hydrogen-rich syngas production, combining: gasification agent pre-heating by bi-axial solar concentrator system (CSP), allothermal biomass gasification, dry rock thermal energy storage
- Define and implement a control logic
- Perform an energy analysis under real solar irradiance/ambient temperature profiles
- Evaluate the potential gain obtained through CSP and the adaptable system management due to DRTES