

Hydrogen - A Competitive Energy Storage Medium To Enable the Large Scale Integration of Renewable Energies

Seville, 15-16 November 2012

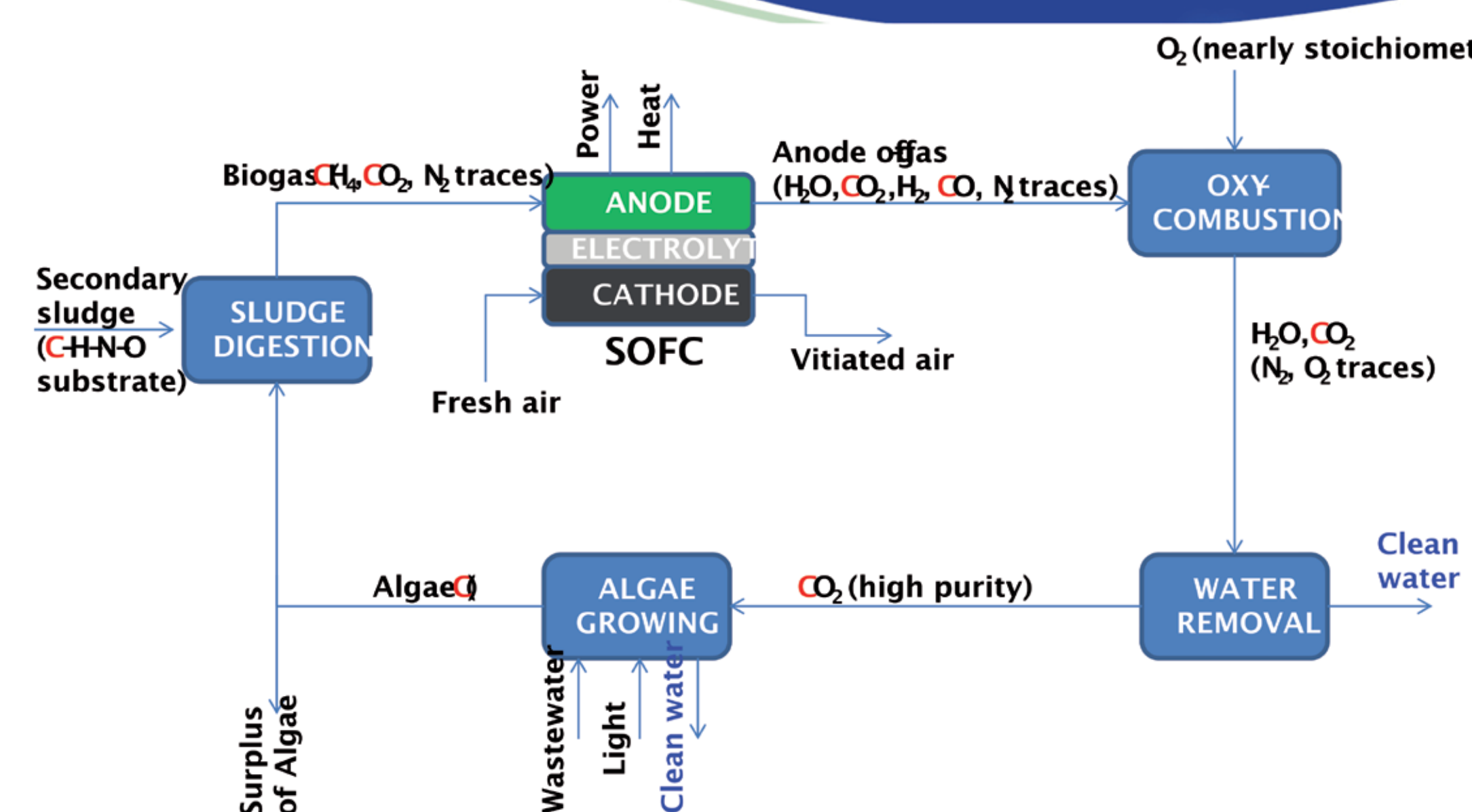
SOFC CCHP with poly-fuel: operation and management (SOFCOM)

Overall Objectives and Budget

Applied research project devoted to demonstrate the technical feasibility, the efficiency and environmental advantages of CCHP plants based on SOFC fed by different typologies of biogenous primary fuels (locally produced), integrated by a process for the CO₂ recovery. Several issues will be addressed:

- high efficiency integration designs
- impact of fuel contaminants
- carbon sequestration and management
- maintenance strategies, pre-normative issues and scale-up analysis

Total Budget: 6,219,613 € - FCH contribution: 2,937,753 €



Carbon cycle in the SOFCOM process

SOFC systems can be one key-point element of a C and H recirculation economy

Technical Barriers and Targets

Target 1. Fuel issues: detailed poisoning mechanisms, advancing in cleaning and processing technologies

Target 2. Define and operate proof-of-concept fuel cell systems fully integrated with biomass processing units and carbon re-use technologies

Target 3. Maintenance, safety, repair and de-commissioning of fuel cell systems on a demonstration scale

Technical accomplishments / progress / results

LAB TESTS: biogenous fuel production section; fuel cleaning section; fuel processing section; SOFC CCHP section; anode exhaust

oxy-combustion; CO₂/H₂O separation; carbon re-use module (photo-bio-reactor for algae growing).

SYSTEM ANALYSIS: analysis of the best structure and operating conditions of the demonstration plants; design of single components, and P&ID of the complete plant

Future Work

LAB TESTS: (1) deep analysis of contaminants (cleaning bed, fuel processing unit, SOFC anode); (2) anode exhaust oxy-combustion; (3) CO₂/H₂O separation; (4) algae growing in photo-bio-reactor using CO₂-recovered stream.

SYSTEM ANALYSIS: best solutions of the plant in terms of energy, environmental and economic balances; analysis of the strategic applications and scale-up of the plants.

DEMONSTRATION: installation and test of the Demonstration in Torino (WWTU biogas) and Demonstration in Helsinki (bio-syngas from wood gasification).

Conclusions and major findings

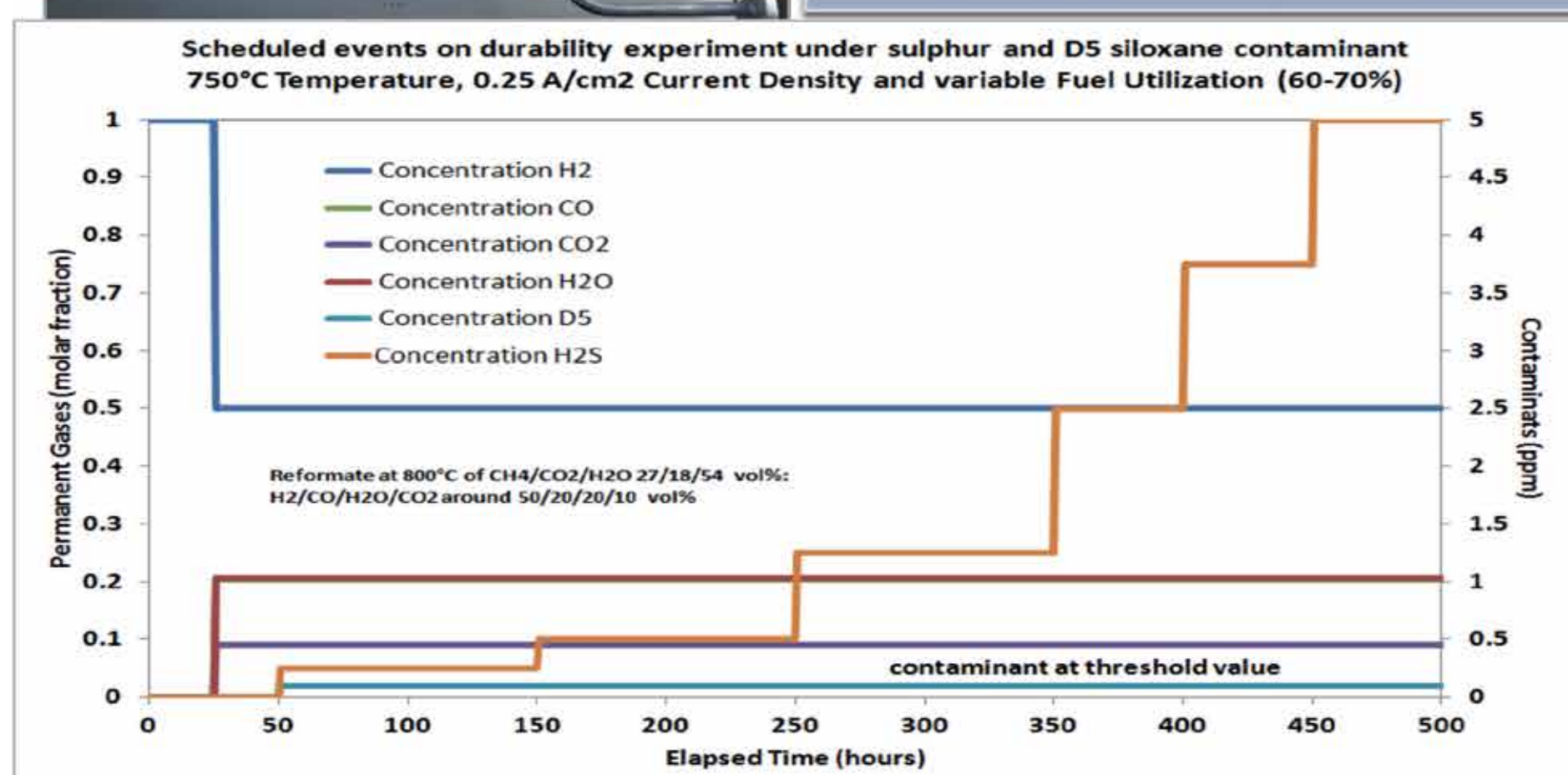
SOFCOM foresees the demonstration of complete biofuel-fed SOFC systems achieving electrical efficiencies 50%+, overall efficiencies 80%+, complete use of H and C atoms (algae growing): exergy efficiency of 90%+. The plant concept can be integrated in plants linked to the use of recovered CO₂ and H₂ for synthetic fuels production.

Project Overview

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- **Companies:** Topsoe Fuel Cells A/S (DK), Società Metropolitana Acque Torino spa (IT), Matgas 2000 A.I.E. (SP)
- **Research Centers:** Teknologian Tutkimuskeskus VTT (FL), Consiglio Nazionale delle Ricerche (IT), Instytut Energetyki (PL)
- **Universities:** Politecnico di Torino (IT), Ecole Polytechnique Fédérale de Lausanne (CH), Technische Universitaet Muenchen (DE), Università di Torino (IT)
- From 11/2011 to 10/2014
- www.sofcom.eu



Contaminant	Model Compound	Low Value	High Value
Hydrocarbons	C ₂ H ₄	0	100 ppm
Halocarbons	C ₂ Cl ₄	0	1 ppm
Siloxanes	D5	0	1 ppm



SOFCOM biogas contaminant tests