

# **HYTHEC : AIMS AND FIRST ASSESSMENTS OF AN EC FUNDED PROJECT ON MASSIVE SCALE HYDROGEN PRODUCTION VIA THERMOCHEMICAL CYCLES**

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Thermo-chemical cycles are processes that have so far been identified as capable of producing H<sub>2</sub> without emission of CO<sub>2</sub>, using water as raw material. The HYTHEC project is funded by the European Community – 6<sup>th</sup> Framework Program Priority [6.1]. It started on April 1<sup>st</sup> 2004, and has a duration of 42 months. This project is being conducted by a research team based in five countries, and aims to compare the advantages and drawbacks of the Sulfur-Iodine (S\_I) and Westinghouse (WH) cycles. Work includes flow-sheeting, industrial scale-up, safety and cost analyses, improvement of the fundamental knowledge and efficiency of the H<sub>2</sub> production step in the S\_I cycle, and experimental application of a solar primary energy source for the H<sub>2</sub>SO<sub>4</sub> decomposition step common to both cycles.

Initial reference flow-sheets for S\_I and WH cycles have been prepared and compared. The coupling of S\_I cycle with a Very High Temperature Nuclear Reactor is therefore being studied, including energy recovery within the system. A first scale-up to industrial level (main components sizing) and cost estimation have been performed.

The knowledge of the H<sub>2</sub> production section of the S\_I cycle is being sought; vapour pressure measurements are in progress. Membrane separation techniques are under investigation too. A first database has been created. Screening criteria were developed, and a small number of membranes have been selected. Experimental work is in progress. Modelling is being carried out to evaluate the potential of membrane dewatering or iodine removal.

By using a solar furnace the splitting of sulphuric acid, a reaction common to both cycles, is being tested at process temperature up to 1200°C. Receiver-reactors act as absorbers for concentrated solar radiation and at the same time as chemical converters. Different reactor concepts have been compared and evaluated by experimental work as well as by FEM and CFD modelling. The principal feasibility to carry out the process in a direct absorbing volumetric receiver-reactor has been shown.

Different operation and plant concepts are elaborated regarding the WH process, for which thermal and electrical energy can be either provided by a nuclear reactor or by concentrated sunlight. The plant concepts are being analysed with regard to their technical feasibility and economic potential, in comparison with the S\_I process.

Updating of the models and flow-sheets will take into account the improvements found by the experiments.