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SOLAR- UPGRADING OF FUELS FOR GENERATION OF ELECTRICITY

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ABSTRACT

This paper presents a novel process comprising solar upgrading of hydrocarbons by steam reforming in solar specific receiver reactors and utilizing the upgraded, hydrogen-rich fuel, in high efficiency conversion systems, such as gas turbines or fuel cells. In comparison to conventionally heated processes, about 30 % of fuel can be saved with respect to the same specific output. Such processes can be used in small scale as a stand-alone system for off-grid markets, as well as in large scale to be operated in connection with conventional combined-cycle plants. The solar reforming process has an intrinsic potential for solar/fossil hybrid operation, as well as a capability of solar energy storage to increase the capacity factor.

The complete reforming process will be demonstrated in the SOLASYS project, supported by the European Commission in the JOULE/THERMIE framework. The project has been started in June 1998. The SOLASYS plant is designed for 300 kWel output, it consists of the solar field, the solar reformer and a gas turbine, modified to enable operation both on fossil fuel as well as on the product gas from the solar reformer. The SOLASYS plant will be operated at the experimental solar test facility of the Weizmann Institute of Science, Israel. Start-up of the pilot plant is scheduled for the end of the year 2000.

The midterm goal is to replace fossil fuel feedstock by renewable or non conventional feedstocks in order to increase the share of renewable energy and to establish processes with only minor or no CO2 emissions. Examples are given for solar upgrading of bio-gas from municipal solid waste as well as for upgrading of weak gas resources. With some feedstock pretreatment (removal of sulfur components, adjustment of composition) the product gases after solar reforming can be used for further processing to methanol or other chemical compounds.