

## Energy issues for global closed ecosystem and space closed ecosystem

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The solar methanol or DME, which can be produced from these syn-gases are up-graded fuels with solar energy, and we can transport the solar energy globally by tanker.

The water decomposition reactions using solar energy can be introduced into the eqs. 1 and 2. In this case, the solar thermochemical process (two-step water splitting process using metal oxides) is the thermochemical process using concentrated solar energy, and this process can omit the electrolyzer, and has economical advantage for the production cost. The two-step water splitting process is being developed in EU and USA using the practical solar concentrating system and solar furnace in 50-500kW size, and the rotary reactor for the two-step water splitting process with 2kW size has been developed in Tokyo Institute of Technology in Japan. This process uses the solar concentration system, and the beam-down solar concentration system is the most promising one technically and economically. And based on the technology concerning the beam-down system which has been developed by TIT, feasibility study was carried out and the power generation cost was evaluated for the beam-down solar concentration system. The rotary solar reactor which has been developed by TIT is composed of the dual reaction cells for oxygen releasing and hydrogen production, which makes two-step water splitting process continually by rotating the ceramics through each reaction cell (Fig1). When the two-step water splitting reactions was carried out using the rotary solar reactors with Ni,Mn-ferrite, a clear oxygen gas evolution was observed by the water decomposition and oxidation state of the Ni,Mn-ferrite was regenerated at 800C of the hydrogen evolution cell temperature. With this type of the continues reactor can obtain both oxygen and hydrogen gases at the same tiem, and hydrogen gas can be continually produced using a small amount of the reactive ceramics. We can highly expect the practical solar hydrogen production technology using the concentrated solar thermal energy.

