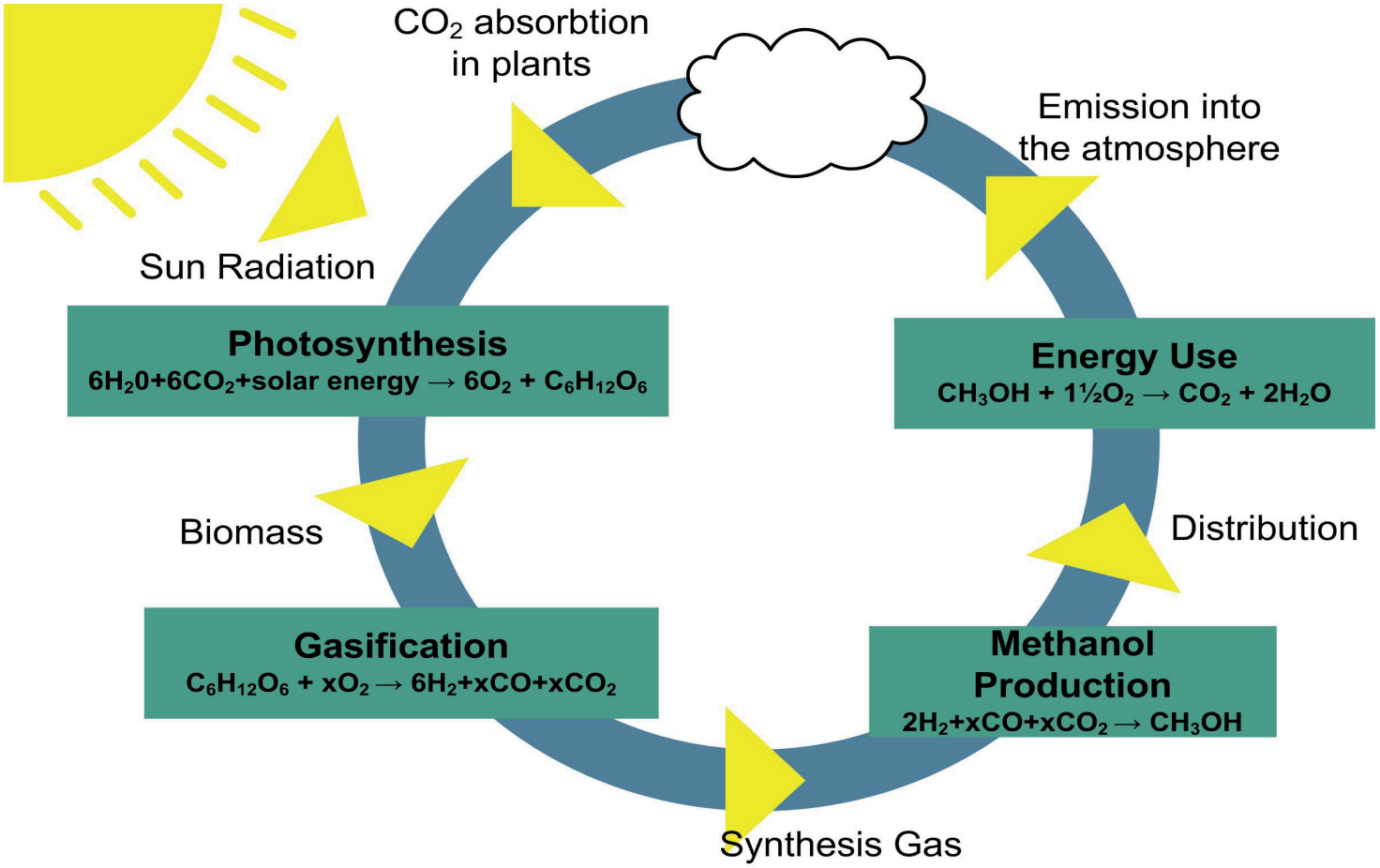
DANISH TECHNOLOGICAL INSTITUTE

Methanol and hydrogen

Methanol – the ideal material for storing hydrogen for fuel cell stacks



Hydrogen and fuel cell stacks
Hydrogen is the preferred fuel for fuel cell stacks, but it is difficult to handle and store. It is therefore very attractive to use a material which can ”absorb” the hydrogen and act as hydrogen-carrier.

Methanol as hydrogen-carrier
Methanol is an excellent hydrogen-carrier and can therefore be used as a hydrogen store for fuel cells. Methanol is easily turned into hydrogen through a catalytic process, using a fuel reformer. This is done at a temperature of 200-300 °C.

Many other liquid fuels can be reformed into hydrogen, but the process requires a considerably higher temperature and greater energy consumption than when using methanol.

Methanol and the transport sector
Today, methanol is used extensively in the chemical industry, which therefore has considerable experience of handling and storing methanol.Experience suggests that it will be relatively easy to integrate methanol in the current infrastructure for supplying fuel to the transport sector.

Production methods
One of the great advantages of methanol is, that it can be produced in many ways. Currently, most of the methanol for industrial use is produced though by steam reforming of natural gas.

Sustainable energy
To be a sustainable fuel, methanol must, however, be produced on the basis of sustainable energy sources. Fortunately, there are many ways of producing methanol on the basis of sustainable energy and the methods are familiar.

Cost
Hydrogen produced on the basis of reformed methanol is already very competitive. One m³ of hydrogen bought as industrial gas is approx. 5-8 times as expensive as hydrogen produced on the basis of methanol.

Technical specifications

Safety and environment

Methanol is poisonous to the human organism and must be handled with the same precautions as petrol and diesel. 25 ml of methanol constitutes a fatal quantity and methanol can be absorbed in the body through breathing, the skin or ingestion. Of course, safeguards must be taken against this when constructing methanol-based systems. However, smaller quantities are not harmful to the body, as they occur naturally and methanol is broken down in the body.

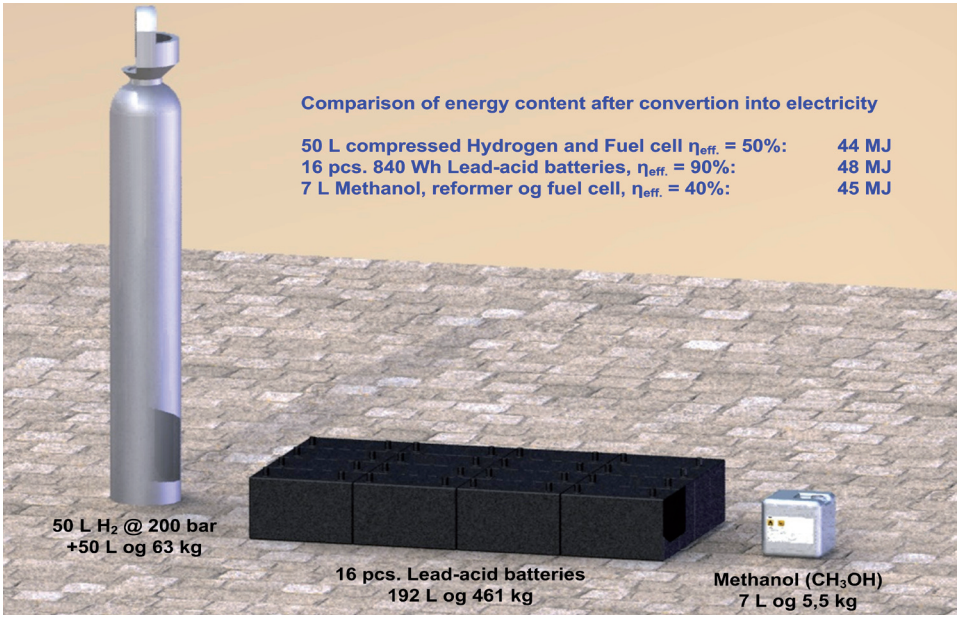
From a combustion point of view, methanol is regarded as a safer fuel than petrol, as it burns more slowly and develops less heat. Methanol is broken down naturally if discharged into nature and can be diluted with water in the case of major discharges.

Production

Methanol can be produced on the basis of sustainable energy sources in many ways. Some of the main methods are:

- Gasification of biomass
- Steam-reforming of biogas
- Electrolysis using electricity from wind or solar energy combined with CO_2 from power plants
- Fermentation of biomass

Comparison with other energy storage technologies



Facts about methanol

Methanol has the following characteristics:

- Synonyms: Methyl alcohol, wood alcohol
- Chemical formula: CH3OH
- Boiling point: 64.6 ˚C
- Density: 791 kg/m3
- Energy density: 19.9 MJ/kg

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