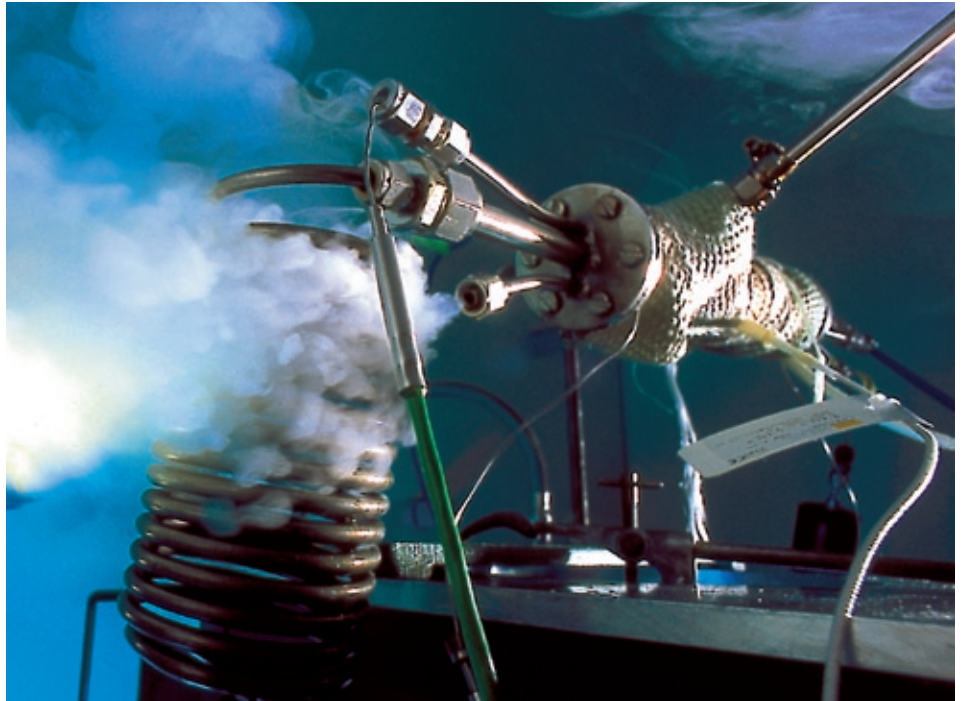




## Diesel Vaporization – residue-free, reliable and efficient



Demonstration of the residue-free diesel vaporization. One observes the diesel vapour as it is ejected through the opened outlet.

### Feel free to ask!

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Diesel is a conventional fuel used worldwide. It is required for mobile drive-trains in combustion motors or for diesel aggregates in grid-independent power supplies. In combination with a reformer for generating hydrogen, diesel is the ideal fuel for many fuel cell applications. For optimal dosage and reaction control, it is advantageous if the feed-in fuel is in a gaseous form. Diesel, unlike other liquid hydrocarbons, forms residues if evaporated in direct contact with hot heat exchanger surfaces.

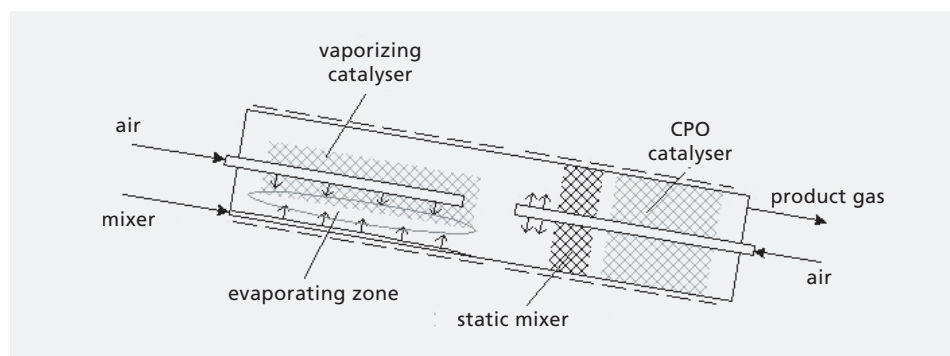
**Fraunhofer ISE, together with a Swiss engineering company, developed a patented procedure whereby diesel is transformed into a gas without creating residues or soot.**

**Do you have specific performance requirements?** We will scale the vaporizer conforming to your specifications.

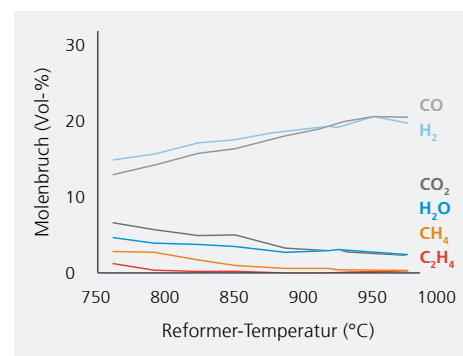
**Does your application have to meet special boundary conditions?** You can use the diesel vaporizer with combustion motors, burners or fuel cells. We will gladly adapt the process to fit your specifications and will develop a reliable operating strategy.

**Do you need a system solution?** We combine our diesel vaporizer with a reformer for hydrogen generation for a fuel cell system. You receive a completely automated system for grid-independent electric power generation.

**Are you interested in a production and marketing of this procedure?** We would be glad to inform you about the exploitation rights associated with our patented process.



Schematic of the diesel vaporizer



Composition of the product gases from the vaporizer

### Vaporizer

The liquid diesel flows along the floor of the reactor. On a catalyst coated grid, the more volatile components of the diesel are partially oxidated upon addition of air/oxygen. The generated heat resulting from this process leads to the vaporization of the diesel film.

At present, the vaporizer is investigated in an assembly with a power of 5 kW, as based on the lower calorific value of diesel fuel. By the combustion with air, the catalyst reaches temperatures between 450°C and 600°C. In this process neither the diesel nor the air requires preheating.

The residue-free vaporization was verified during operation for the duration of over 100 hours.

### Hydrogen Generation

For the hydrogen generation, a reactor for catalytic partial oxidation (CPOX) is connected in line behind the diesel vaporizer. The CPOX has a compact design, requires no water and enables dynamic load switching. Similarly, no residues are formed in the CPOX.

Using gas chromatography, we determine the composition of the product gases after vaporization and reforming. The gas composition at 900°C is equivalent, in principle, to the thermodynamic equilibrium: The nitrogen concentration is 55 %, the hydrogen and CO concentrations are each ca. 18 %, the CO<sub>2</sub> and the water content are both approximately 4 %. The concentration of ethylene, which is of particular interest, because ethylen is a precursor of soot, is below 0.2 %.

As an alternative to CPOX, an autothermal reformer can be implemented.

### Competence

Since the 1990s, Fraunhofer ISE has carried out research and development on fuel cells and hydrogen generation. We are continuously active in international research networks, and we cooperate closely with industry partners. Fraunhofer ISE is certified according to DIN EN ISO 9001:2000.

Our experience and know-how include:

- Completely automated systems for hydrogen generation
- Control and safety technology
- Steam reforming
- Partial oxidation
- Autothermal reforming
- Shift reactors
- Selective methanation
- Selective oxidation
- Pyrolysis
- Development and long-time characterization of catalyses

What can we do for you?