Fuelling Industrial Decarbonisation – Hydrogen and Alternative

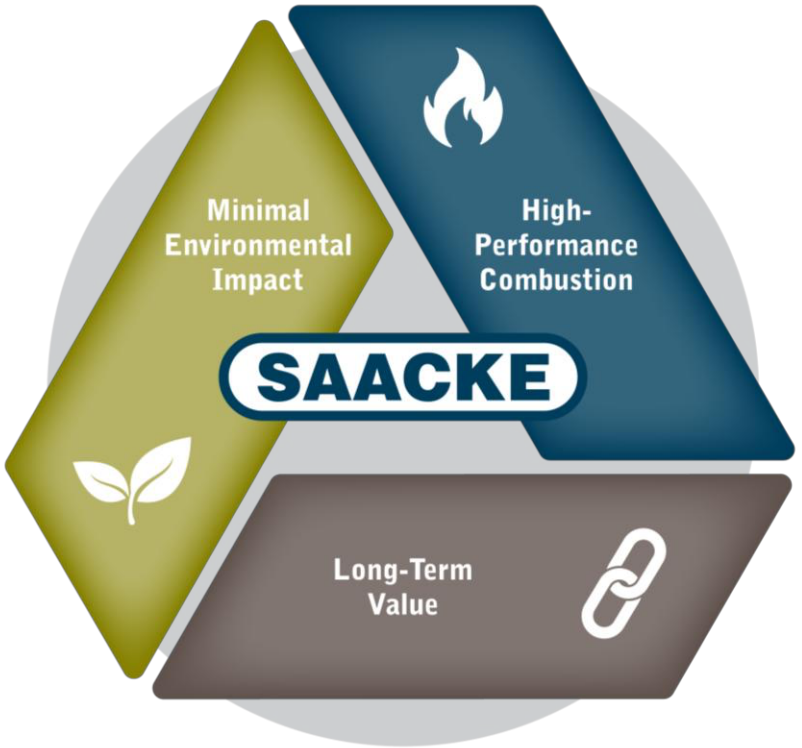
Philipp Schönberger
- SAACKE GmbH

FERF
FUEL AND ENERGY RESEARCH FORUM

SAACKE – sustainable combustion technology for industry and marine applications.

SAACKE is the **world's leading provider of industrial combustion technology**.

We develop and produce innovative solutions capable of utilizing all types of fuels exceptionally efficiently, thus helping our customers to reduce their ecological footprints and minimize CO_2 emissions.



In use all over the world for maximum efficiency in challenging settings.

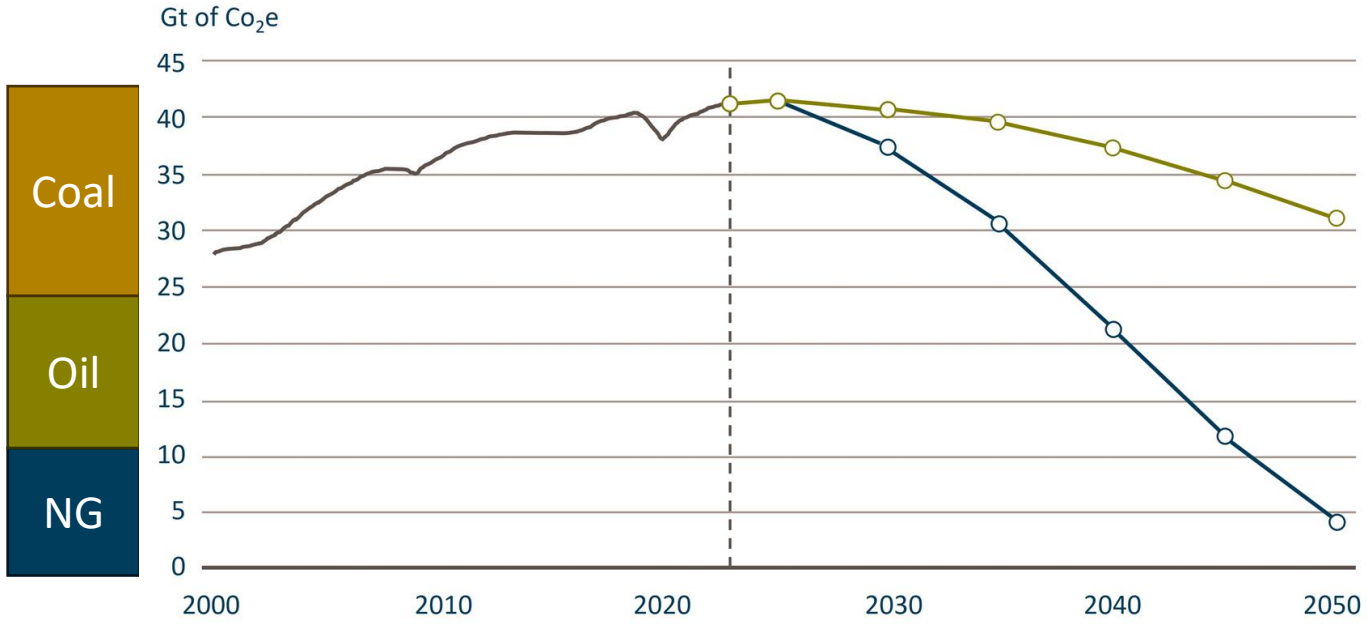
About the Person

Philipp Schönberger

- Dipl.-Ing. Process Engineer & Author
- Since 2009 with SAACKE
- Since 2023 Managing Partner- Consulting and Engineering

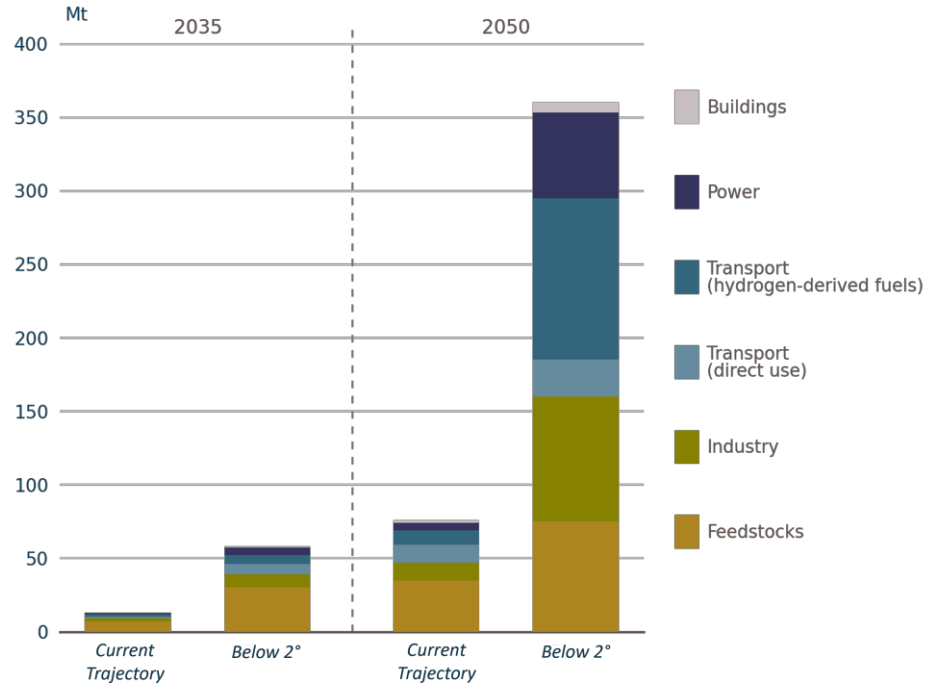
Motivation

Carbon Emissions



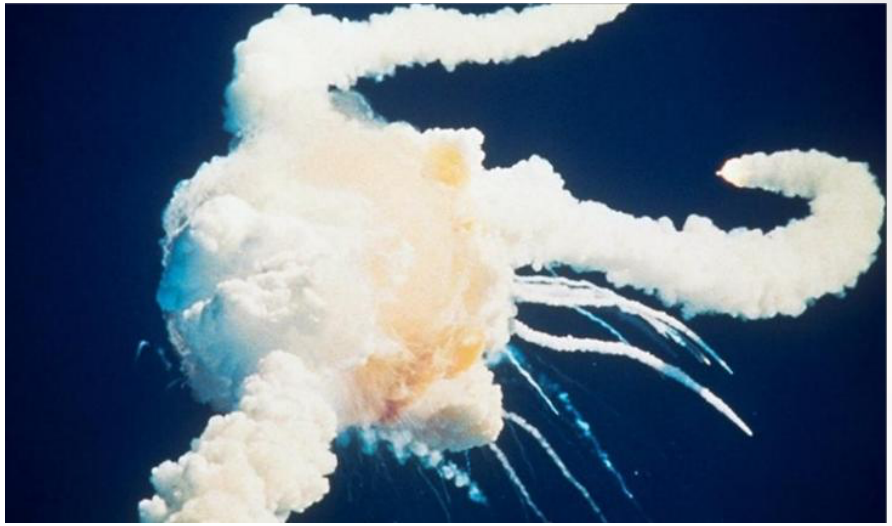
Carbon emissions include CO_2 emissions from energy use, industrial processes, natural gas flaring, methane emissions from energy production and the incomplete combustion of traditional bioenergy

Low carbon hydrogen demand By sector

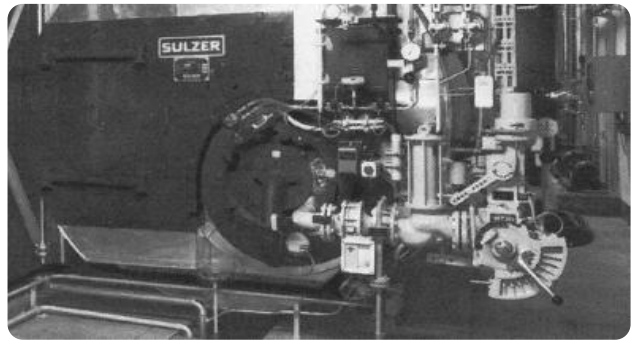


Transport (hydrogen-derived fuels) includes hydrogen used to produce methanol, amonia, and synthetic fuels consumed in the transport sector.

Associations with hydrogen

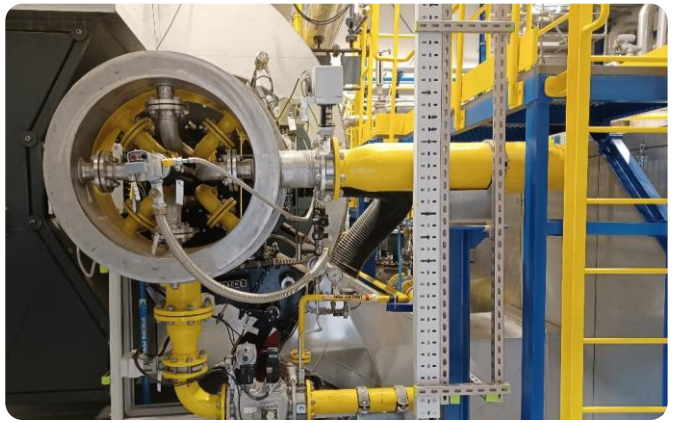


H2 combustion: long term experience



1981

2019



2024

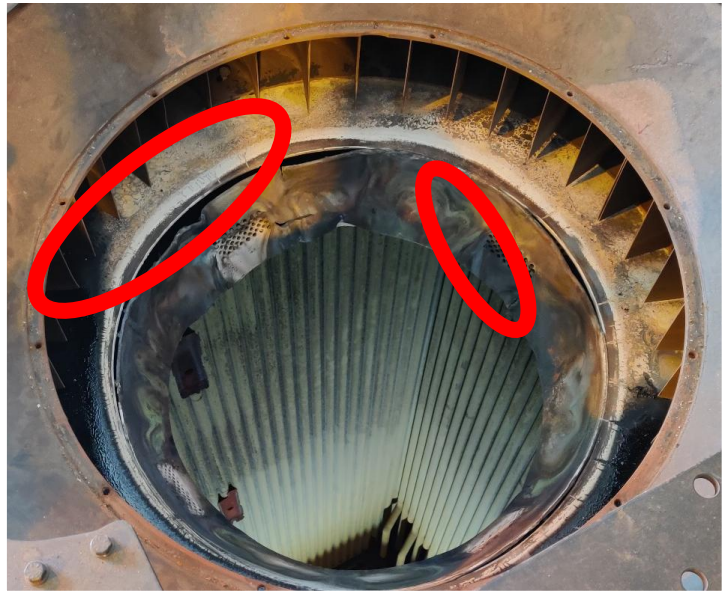
A comparison of hydrogen and natural gas
Hydrogen as a fuel

Feature	Natural gas H	Hydrogen
Calorific value	35.82 MJ/m³	10.82 MJ/m³
Standard density	0.78 kg/m³	0.09 kg/m³
Wobbe Index	46.1 MJ/m³ Natural gas L: 39.5 MJ/m³	40.98 MJ/m³
Adiabatic combustion temperature	2044 °C	2252 °C
Laminar flame speed	0.39 m/s	2.81 m/s
Air requirement	9.55 m^3 /m^3_{LuftBS} 959.8 m^3 /h/MW_{Luft}	2.38 m^3 /m^3_{LuftBS} 791.9 m^3 /h/MW_{Luft}

Technical challenge 1: Wear

Wear due to high temperature load

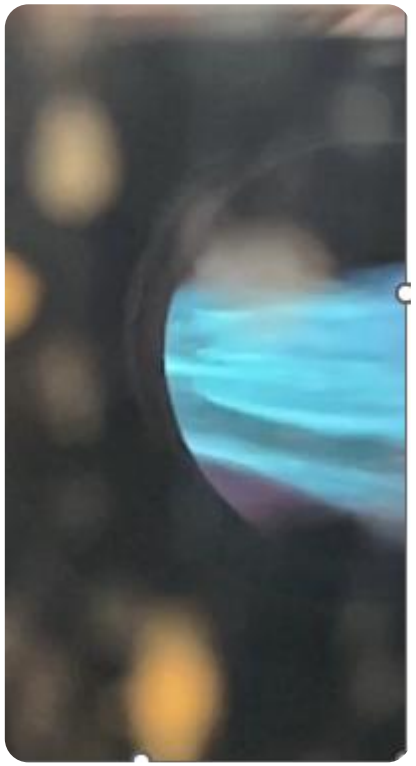
- Minimize thermal load through special burner design
- Parts in contact with the flame made of heat-resistant steel
- External exhaust gas recirculation → Also reduces NOx emissions



Technical challenge 2: Flame monitoring

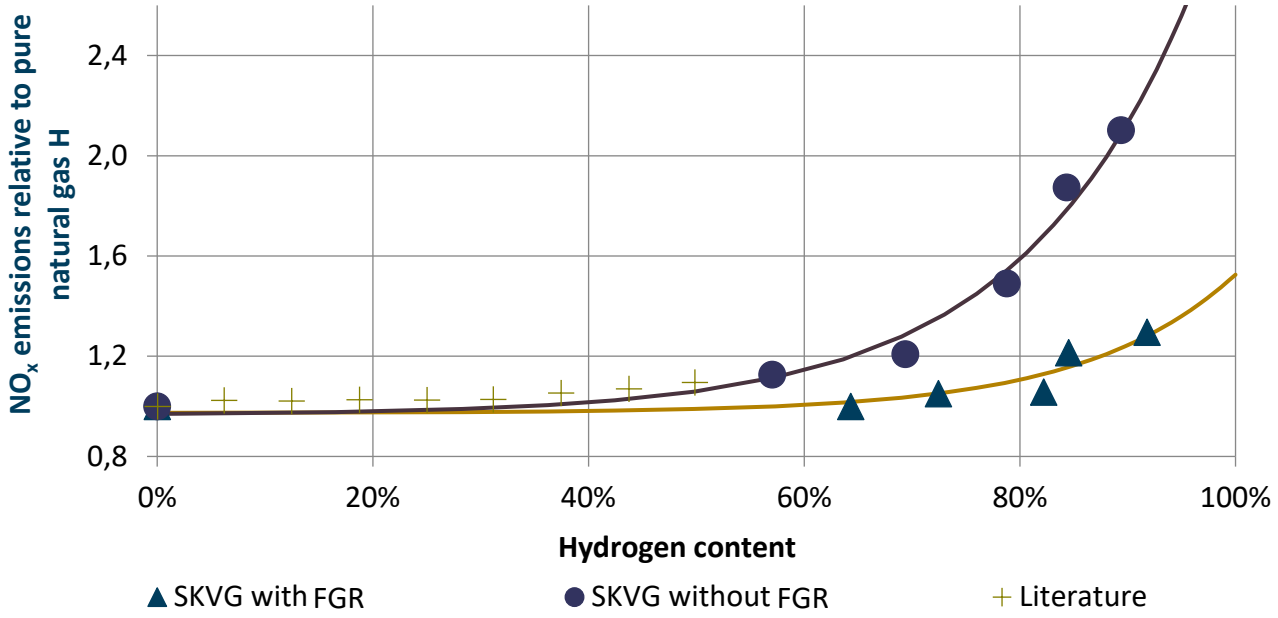
Flame monitoring

- UV flame scanners are tried and tested
- OH- radicals



Technical challenge 3: NOx emissions

Hydrogen and Natural Gas



Source: iGF final report - Investigation of the effect of hydrogen admixture into the natural gas grid on industrial firing processes in thermoprocessing plants, 2017

Combustion plant 1
Natural gas + Hydrogen on steam boiler

Task

- Steam generation with natural gas or hydrogen fuel + mixed firing
- 30 t/h flame tube boiler
- Burner type SSBGG 200.02
- Fuels: Hydrogen / natural Gas

Technical data

Firing capacity:	20,7 MW
Control range:	H2: 1:5
	NG: 1:7
Emissions:	H2: NOx <80 mg/Nm³@3%
	NG: NOx <75 mg/Nm³@3%

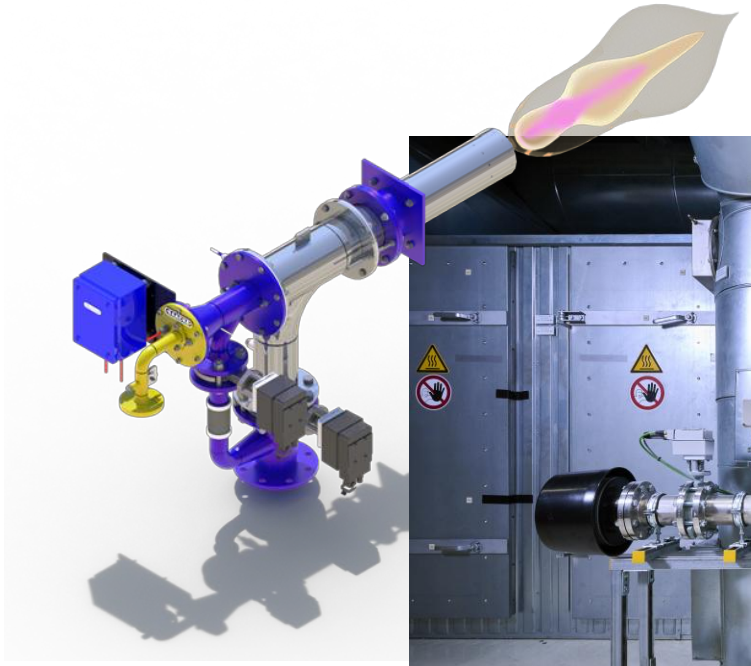
Combustion plant 2
Hydrogen on paint dryer

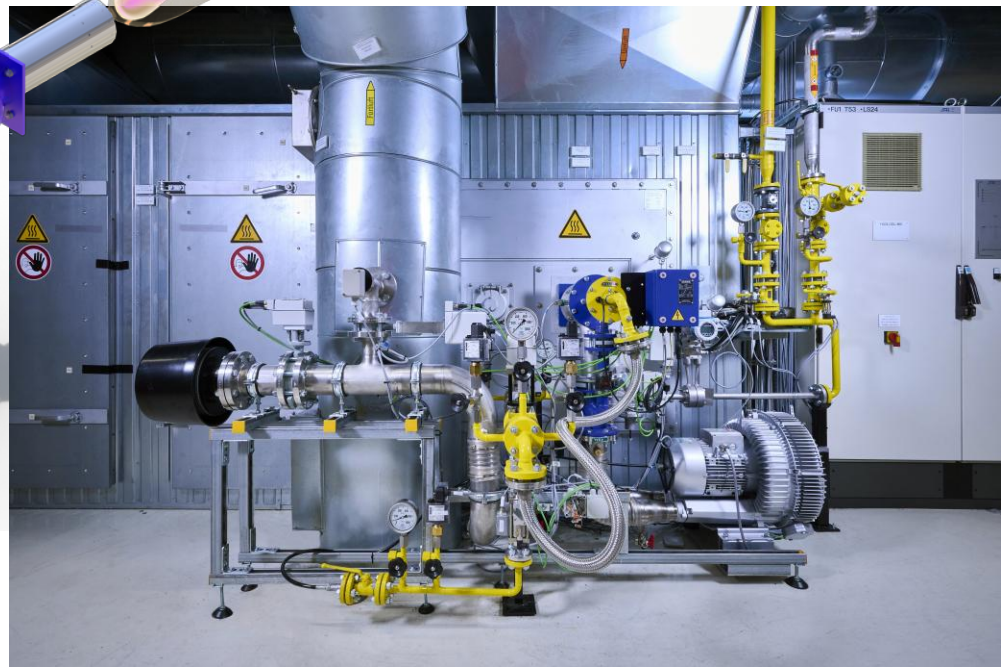
Task

- Heat generation for Paint dryer
- Burner type SSBGG micro
- Fuels: Hydrogen / Natural Gas

Technical data

Firing capacity:	*250-500 kW*
Customer:	BMW Leipzig





Alternatives to fossil fuels

Dusty

Wood dust

Coating powder dust

Coffee dust

Grain husk dust

Synthetic dusts

Gaseous

Hydrogen

Solvent fumes

Reffinery Gas

LPG

Alcohols

Pyrolysis Gas

C2-C4

Tailgas

Formalin-Gas

Process waste gases

Bio-Gas

Liquid

Solvents

Waste water

Naphta

Bio-fuels

Pyrolysis oils

Vinasse/Molasse

Liquid wastes

Animal fat

Synthetic fuels

Process wastes

Combustion plant 3
Natural gas + waste gas + liquid waste fuel + hydrogen

Task

- Utilization of production waste gases
- Utilization of liquid production residues that would otherwise be expensive to dispose of
- Compliance with emission regulations when incinerating these production residues with a high nitrogen and dust content
- Expansion of steam capacity at the site with flexible fuel utilization

Technical data

Boiler output:	14 t/h
Mass flow of liquid residue:	1.200 kg/h
Process gas volume flow:	600 Nm^3/h
Emissions:	<200 mg/Nm^3 @11%

Engineering Expertise

Large-scale thermal utilization of hydrogen and alternative fuels is proven and safe.

The decarbonisation of production processes has begun.

THANK YOU FOR YOUR ATTENTION.

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