SALZGITTER MANNESMANN FORSCHUNG

Ein Unternehmen der Salzgitter Gruppe

GrInHy – Grüner Wasserstoff in der Stahlherstellung

Salzgitter, 07.06.2017

Simon Kroop

Konzernstruktur und Eckdaten GJ 2016

Salzgitter AG Konzern

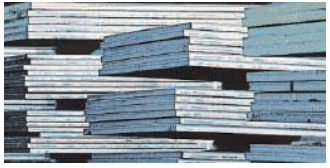
Außenumsatz kons.: 7,9 Mrd. €
EBT: 53 Mio. €
Mitarbeiter: 23.152

Flachstahl

- **Außenumsatz:** 1,8 Mrd. €
- **EBT:** -2 Mio. €
- **Mitarbeiter:** 6.062

Grobblech / Profilstahl

- **Außenumsatz:** 0,7 Mrd. €
- **EBT** -32 Mio. €
- **Mitarbeiter:** 2.585



Mannesmann

- **Außenumsatz:** 1,0 Mrd. €
- **EBT:** -22 Mio. €
- **Mitarbeiter:** 4.731

Handel

- **Außenumsatz:** 2,9 Mrd. €
- **EBT:** 45 Mio. €
- **Mitarbeiter:** 1.914

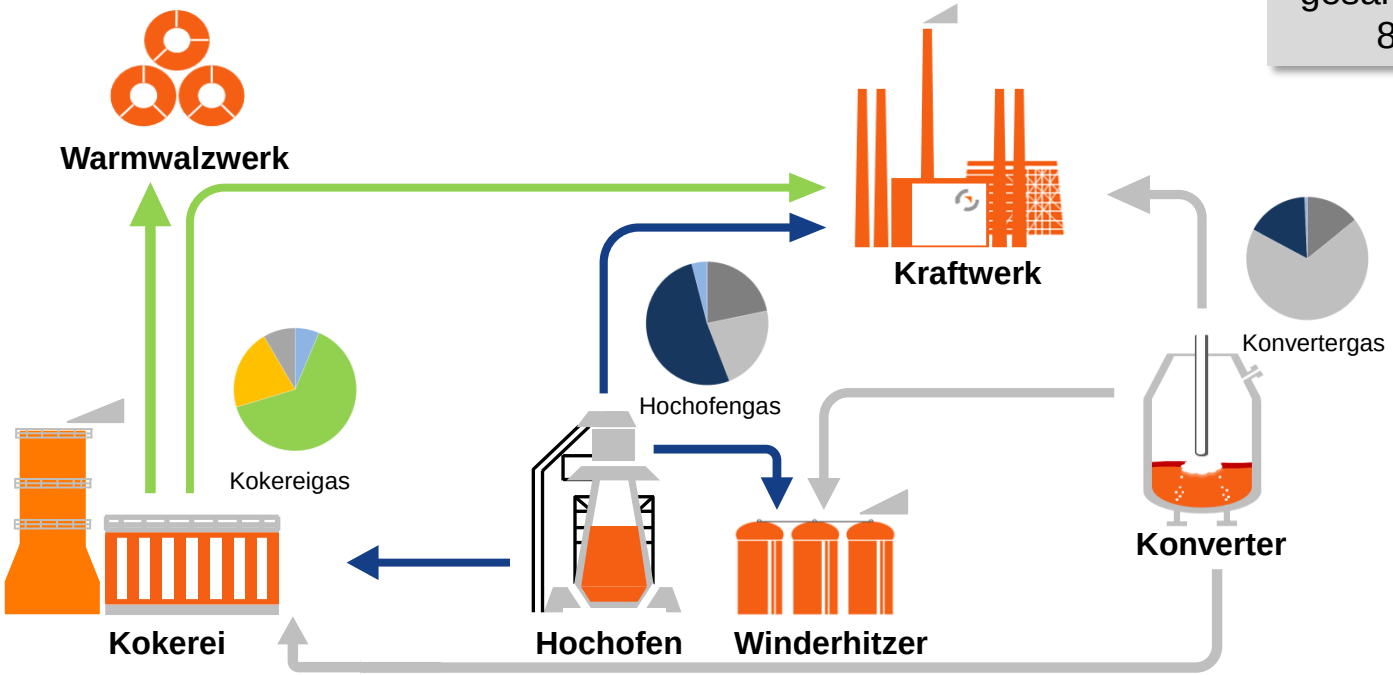
Technologie

- **Außenumsatz:** 1,3 Mrd. €
- **EBT:** 28 Mio. €
- **Mitarbeiter:** 5.301

Alle Angaben zu Mitarbeitern per 31.12.

Das integrierte Hüttenwerk mit Kuppelgaswirtschaft

Heutige Stahlherstellung auf Basis von Kohlenstoff

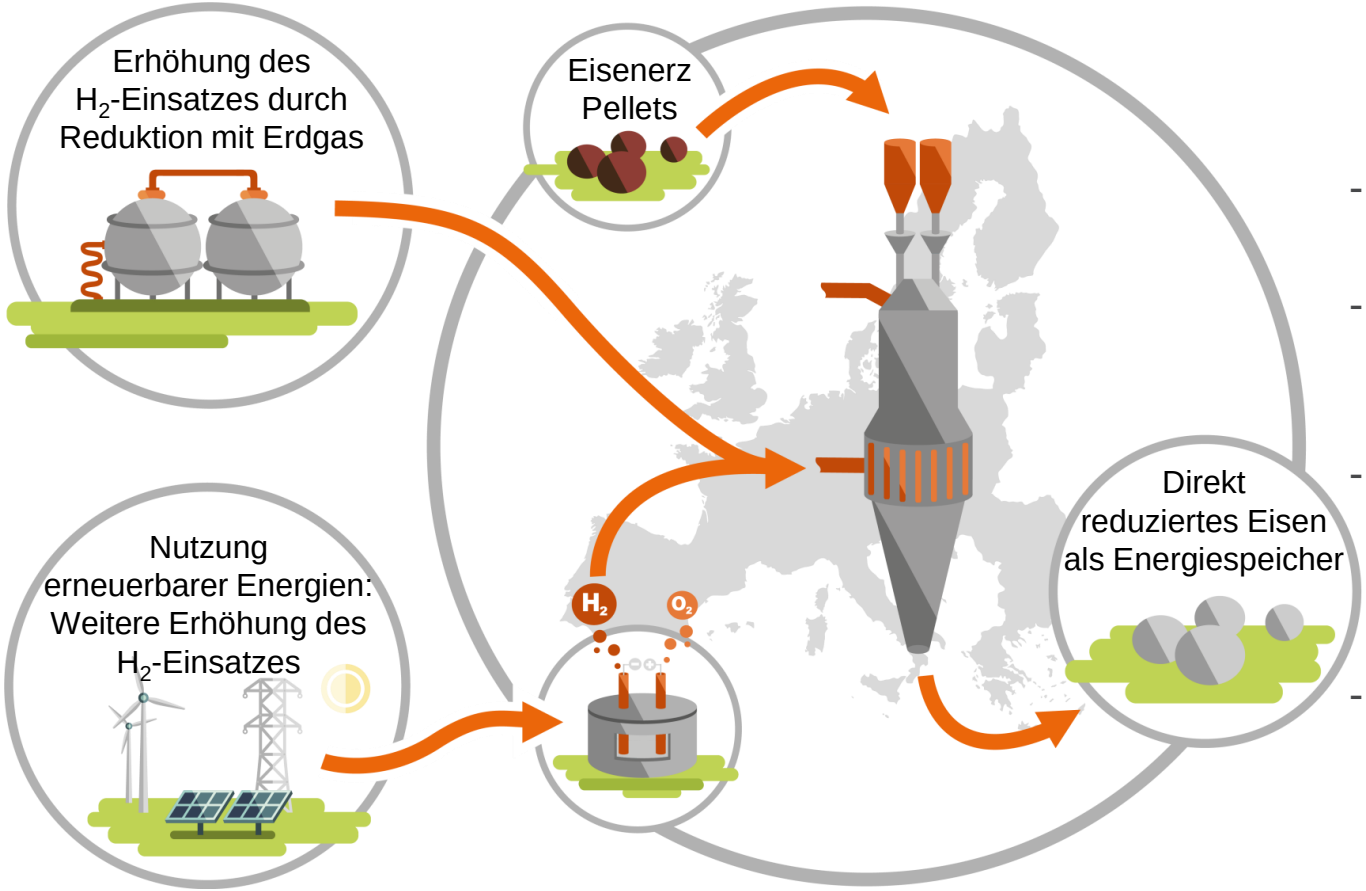


gesamte CO_2-Emissionen:
8 Mio. t CO_2/Jahr

Fackelverluste
nur ~0,1 %

H_2
CH_4
CO
CO_2
N_2
H_2O
Rest

SALCOS: SAlzgitter Low CO_2 Steelmaking



CO_2-Vermeidung im integrierten Hüttenwerk

- H_2 statt C zur Eisenerzreduktion
- Weiterentwicklung bereits etablierter Technologien (Erdgas-Direktreduktion)
- Stufenweiser Umbau der Verfahrensroute: zwischen **10 – 80 %** CO_2-Einsparung
- BMBF-geförderte Machbarkeitsstudie **MACOR** (2017 – 2020)

Green Industrial Hydrogen via reversible high-temperature electrolysis

Simon Kroop, Salzgitter Mannesmann Forschung GmbH

Salzgitter, 2017-06-07

This project has received funding under grant agreement No 700300.

Who we are

The GrInHy consortium consists of eight partners from five different EU countries and is characterized by its interdisciplinary expertise.

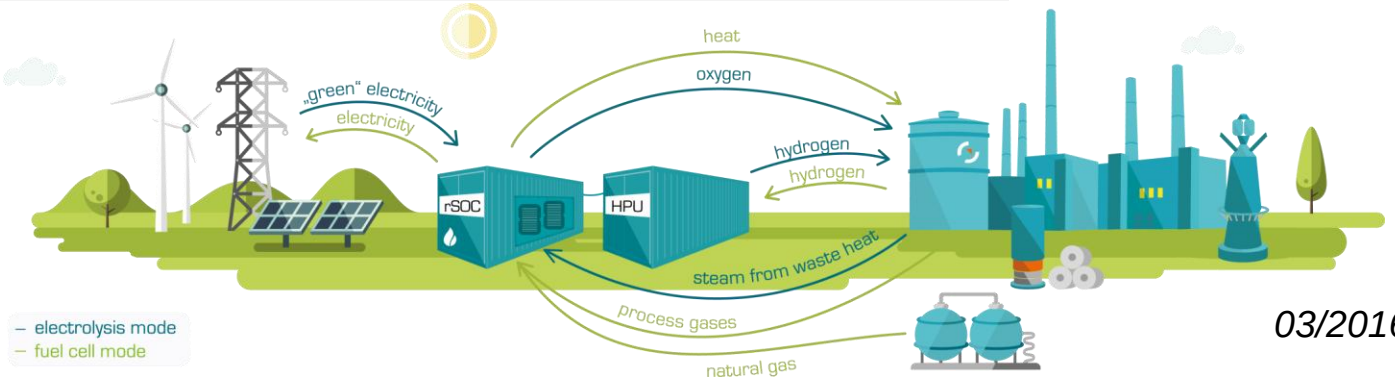
These include a technology specialized SME, large industries, university and non-university research organizations.

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 700300.

This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Hydrogen Europe and N.ERGHY.

www.green-industrial-hydrogen.com

Mission



03/2016 – 02/2019

- **Manufacturing** of the most powerful **reversible high-temperature electrolyzer** (HTE)
- **First-time implementation** of a reversible HTE at an **integrated iron-and-steel works**
- Usage of **stream from (waste) heat** of on-site processes
- Meeting the **high-quality standards** for steel annealing processes
- Running the system in a **reversible operation**
- **Assessment** of further **business cases** to generate additional economical benefits
- Theoretical **proof of concept of green hydrogen production** from renewable energy sources

Energy balances

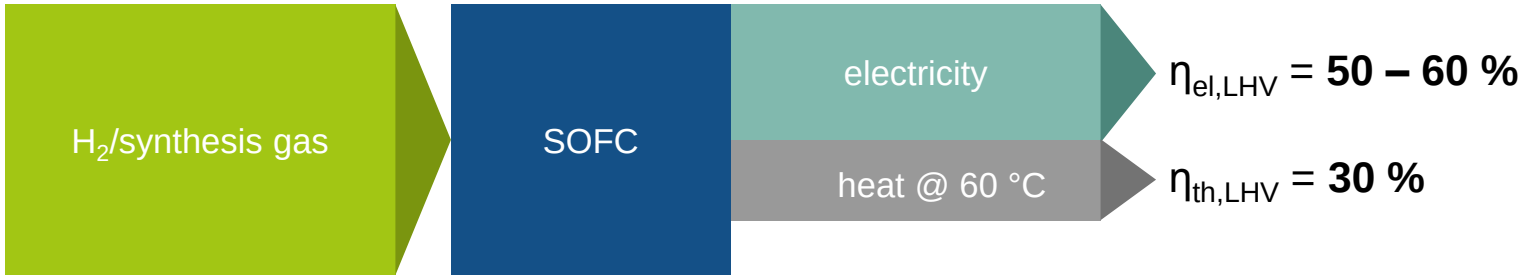
GrInHy
Green Industrial Hydrogen

Potential

Electrolysis (SOEC mode)

Due to the integration of waste heat RSOCs are highly energy efficient in terms of electrical energy input

Fuel Cell (SOFC mode)



Objectives

GrInHy
Green Industrial Hydrogen

Efficiency	proof of reaching an overall electrical efficiency of at least 80 $\%_{LHV}$
Upscaling	SOEC unit to a power input of 150 kW_{AC} and production of 40 Nm^3_{H2}/h
Operation	at least 7,000 h of operating the system
Lifetime	greater than 10,000 h with a degradation rate below 1 %/1,000 h
Reversible Operation	higher capacity utilization for stronger business cases
Costs	development of dependable data on system costs and cost reductions
Exploitation Roadmap	reversible high-temperature electrolyzer as a marketable product

The GrInHy System

GrInHy

Green Industrial Hydrogen

visit us at www.green-industrial-hydrogen.com

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