GrInHy2.0
Green Industrial Hydrogen

Energy-efficient hydrogen production for today’s and future steelmaking

Best Practice Steel Industry
Hydrogen @ Mining: Best Practice Examples of Hydrogen Applications in Germany

Simon Kroop, Salzgitter Mannesmann Forschung GmbH

This project has received funding under grant agreement No 826350.
Salzgitter Flachstahl GmbH – Integrated Steel Production Amidst the EU

Salzgitter Flachstahl GmbH … „Heart of the Salzgitter AG group“

- Integrated steel works operating 3 blast furnaces
  - Concentrated at one location in Salzgitter/ Lower Saxony on an area of 7 square kilometers (~980 soccer fields)
  - ~5 mt yearly crude steel capacity

- Top modern production plants
  - High-tech downstream facilities
  - Very energy-efficient processes
  - Compliant with all EU ecological standards

- High-quality steel grades for sophisticated applications
  - Hot-rolled and cold-rolled coil
  - Electrogalvanized, hot dip galvanized and organic coated sheet
  - Fabricated products for automobile and construction industry

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<tr>
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<th>2017</th>
<th>2018</th>
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<tr>
<td>Crude steel production</td>
<td>4,492</td>
<td>4,645</td>
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<tr>
<td>Sales</td>
<td>€2,652</td>
<td>€2,887</td>
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<td>Total workforce</td>
<td>31/12/</td>
<td>5,761</td>
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Process energy is supplied via solid carbon:
~ 2.5 Mio. tons/a of coal and coke

Total CO₂ emissions by SZFG:
~ 8 million t CO₂/a
SALCOS – SAlzgitter Low CO₂ Steelmaking

Direct Reduction Process – Central Element of SALCOS

SALCOS is...

- pairing already established technologies with hydrogen technologies and an innovative operational concept
- a step-wise transformation of the integrated steelmaking route supporting the transition of the energy system
- reducing today’s CO₂ emissions by more than 95%
- a sustainable "Carbon Direct Avoidance" approach: Reducing instead of recycling!

Natural gas in times of less renewable electricity

Volatile renewable electricity for green hydrogen

Iron ore pellets (Fe₂O₃)

Direct reduced iron (Fe)
First GrInHy Project –
Proof of energy-efficient hydrogen production

- World’s biggest steam electrolyser producing \(40 \text{Nm}^3_{\text{H}_2}/\text{h}\) (150 kW\(_{\text{AC}}\))
- Integration into infrastructure of Salzgitter’s iron-and-steel works
- Hydrogen production with steam from waste heat and electricity
- Electrolyser electrical efficiency of \(78\%_{\text{LHV}}\) sets new standards
- Operational experience from 12/2017 – 08/2019
- Meeting hydrogen quality for today’s steel annealing processes
- In total, the system was operated for approx. 10,000 hours during project duration

GrInHy: 03/2016 – 02/2019.

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.
GrInHy2.0 – Next milestone towards green steel

- First Steam Electrolyser (StE) demonstration in megawatt class in an industrial environment
- Green hydrogen production using green electricity and industrial steam from waste heat
- Optimal control & integration into existing infrastructure and energy management system
- Investigation of regulatory frameworks for Green Hydrogen
- Assessment of CO₂ avoidance potential of a European hydrogen-based steel industry
- Validation of stack technology
Role of Partners

Overall project coordination and environmental studies

Integration of electrolyser system and operation with steam from waste heat

Technical coordinator and manufacturing of steam electrolyser

Engineering and assembling of hydrogen processing unit for compression and drying

Implemention study of a hydrogen-based, low CO₂ steelmaking route in Europe

Intensive long-term stack testing of steam electrolyser cells
Set-up of the 720 kWel steam electrolyser
How does it look like today?
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Simon Kroop
Project Coordinator

Contact us: www.green-industrial-hydrogen.com/contact