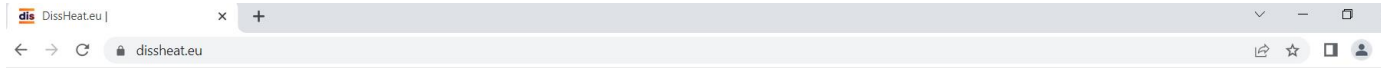


Internal summary and wrap up

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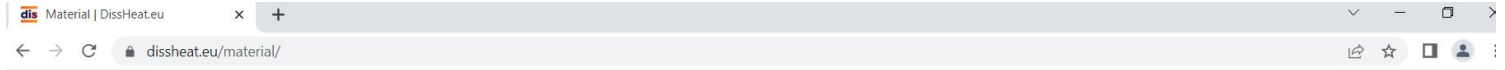


Improve technology and product quality to save resources for a fossil free production

Innovative technologies enable to produce products at Intelligent high quality and efficiency on the pathway to green steel and to completely avoid fossil CO₂ emissions in industry. European steel industry as continuously improved heating processes as a key component in production by research and piloting to increase product quality and save resources. In this project we evaluate and analyse previous research work and extract a roadmap for future industrial heating research, to support and deliver a pathway how to reach the European Green Deal and an approach for product improvement by heating processes.

We would like to thank the Research Fund for Coal and Steel of the European Union for the funding of this project, Grant Agreement No. 101057930, which is relevant for the future research in the steel industry.





Project ▾

Results ▾

Events&Material ▾

Contact&Imprint ▾

Dissemination Material

Presentations and videos of previous events as well as flyers of current and planned events can be downloaded here.

Webinar series

State of the art and BAT in industrial heating – open online seminar series organized by the dissHEAT project, May to June 2023



Introduction to the Dissheat project and webinar series
Andreas Johnsson – For presentation as PDF click [here](#).

Heating and burner technology, seminar form May 2, 2023

For Video of webinar click [here](#).





Heating and burner technology, seminar form May 2, 2023

For **Video** of webinar click [here](#).



Research findings and technical development over the last 20 years

Oliver Hatzfeld – For presentation as PDF click [here](#).



New concepts for industrial heating and burner technology

Oliver Hatzfeld – For presentation as PDF click [here](#).

Modelling and control of entire furnaces (level 2), May 9, 2023

For **Video** of webinar click [here](#).



Alternative combustion techniques using organic fuel: case studies with CFD

Davide Ressebotti – For presentation as PDF click [here](#).



Research developments during the last 20 years and today's BAT and State of Art

Filippo Avellino – For presentation as PDF click [here](#).

Materials in the furnace and product quality, May 23, 2023

For **Video** of webinar click [here](#).

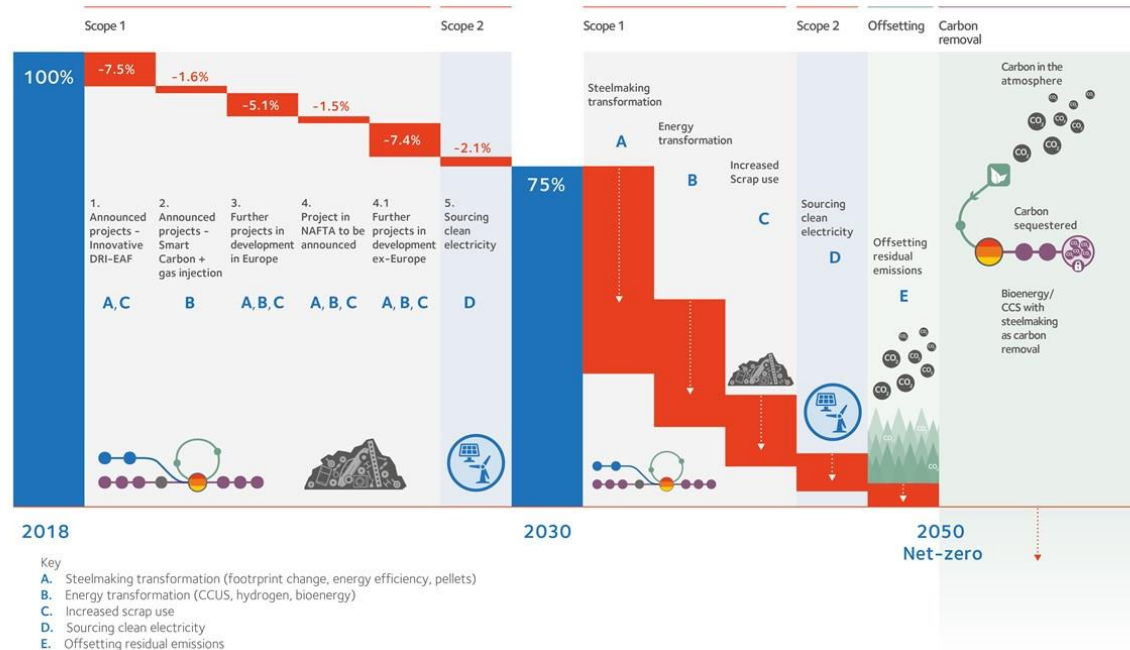


- In this work shop we have tried to give you an overview on reheating by:
 - Findings, annalysis and outlook in the different fields of reheating
 - A draft roadmap for future research
 - 3 guest presentations related to industrial heating and outlook
 - Panel discussion
- In this last part of the work shop we would like to give you, the addience the possibility to address direct questions, guidance, corrections, ... to us, the consortium.



Global focus of research

- Global focus of the roadmap for future research is reducing CO2 emissions by 35 per cent by 2030, and of achieving carbon-neutral steelmaking by 2050.



Technology impact and integration research:

- **Heating** with new fuels, hybrid and combinations:
Hydrogen, biofuels, oxy-fuel, electrical heating (Topic 5)
=> Flameless or ultra LowNO_x combustion
- **Efficiency** with new technologies and heat recovery if applicable
Dark zone / heating with off gas
from new fuels, hybrid and combinations

Oxidizer	Preheating oxidizer	Dark zone
Air		
Oxygen enhanced combustion (OEC)		
Oxy-fuel (100 % Oxygen)		



Technology impact and integration research:

Impact on **product and plant**

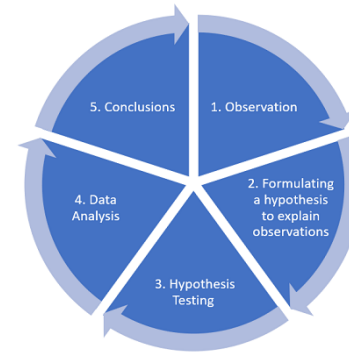
- Hydrogen combustion, electrical heating and combinations:
 - Influence on product-material, temperature uniformity, scaling
 - Influence on furnace and heating equipment when technologies are combined: i.e. high H₂O content in exhaust gas
=> influence on resistance heaters
=> influence on refractory and insulation
- Security when handling H₂



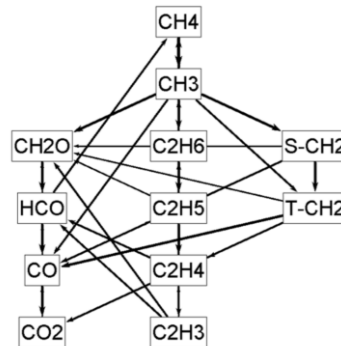
Future research need Modelling and control (level 2)

Relevant new technologies

- Extended statistical approach



- Artificial Intelligence and Machine Learning approach

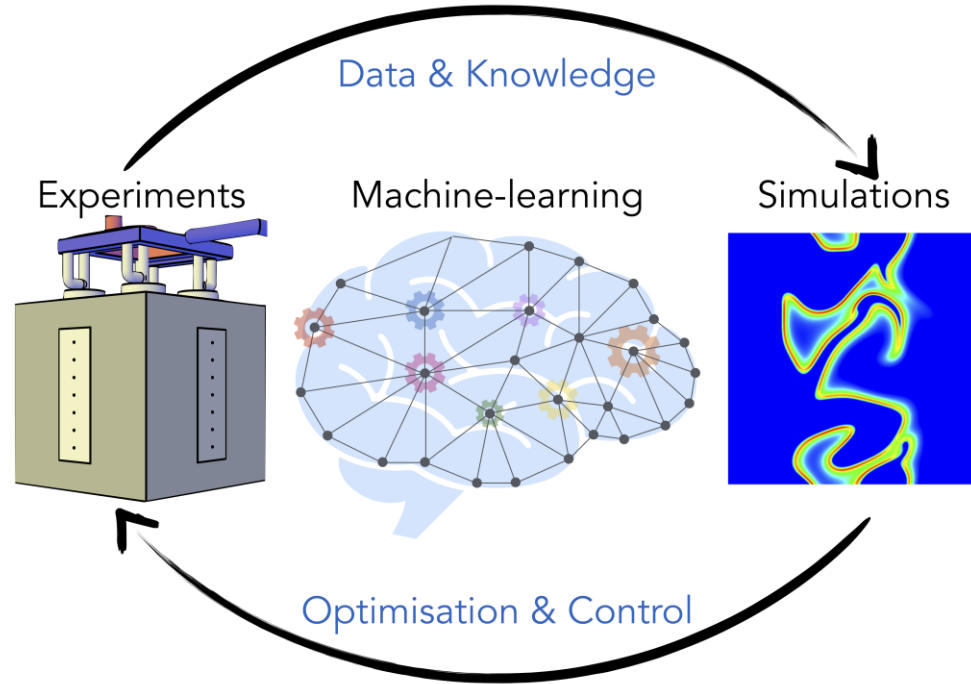


- Improved kinetic schemes

Future research need Modelling and control (level 2)

Technology impact and integration research

- Use of machine learning and/or joining of statistical models and physical models (physical-injected neural network)
- Dynamic and/or auto-adaptive modeling for process control
- Flame monitoring
- Kinetic scheme for pollutant prediction (including the formation of NO_x and particulate emissions)



1. Research gaps for alternative heating systems for sensors and control:

- Influence of fuel blends on **flow measurement**
- Influence on **fuel quality measurement**
- Optimization of **air-to-fuel ratio** for new fuels, oxidizers and fuel flexible operation
- Influence on **off-gas composition** and **pollutant emission** measurements → Development of emission measurement system
- **Temperature measurement** for process control for electrical and hybrid heating systems

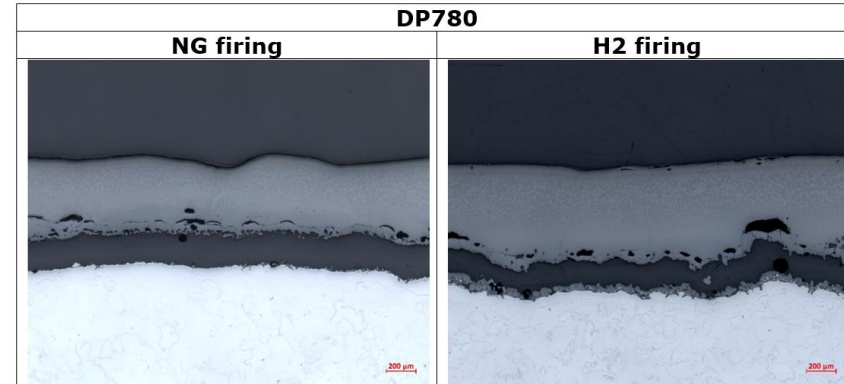
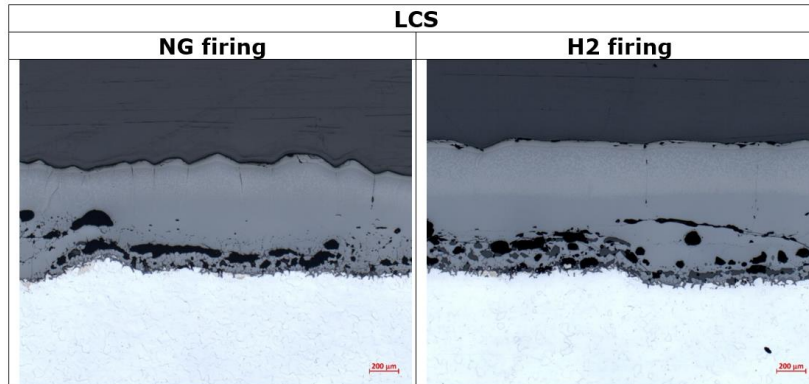


2. Open topics concerning legislation for alternative heating systems:

- NO_x limit definitions
- Revision of BREF FMP to new limit definitions
- Emission measurement standards



1. Study the impact of residuals on product quality
 - Cu: diffuses quickly leading to segregation, roughening and intergranular oxidation
 - Mo: above 0,25% will increase scale adhesion
2. Perform a full screening of all grades related to the different reheating alternatives (e.g. 100% Hydrogen combustion)



3. Adaptations :

- Gas flow and composition (e.g. Nitrogen injection at exit)
- Coatings
- Alternative metallurgical composition

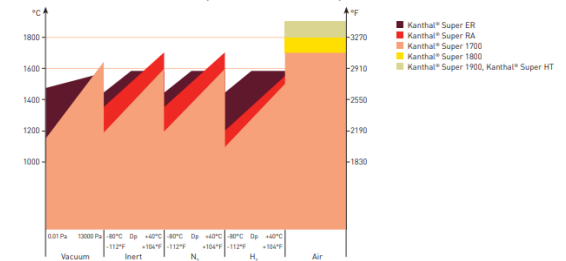


4. Wear of components :

- Burner nozzle wear by hydrogen flame
- Wear of electrical resistances
- Wear / adhesion on ceramics



Maximum recommended element temperature in different atmospheres



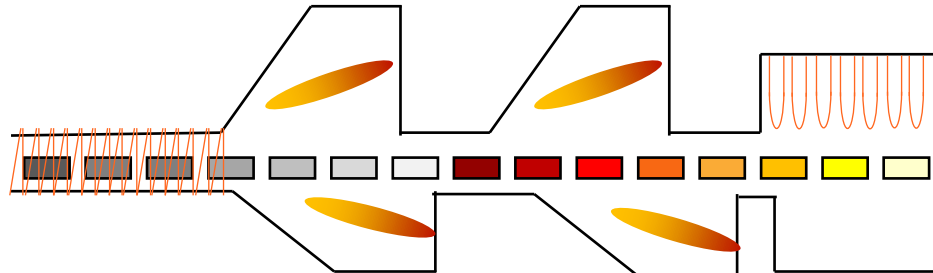
Flexifuel strategies

- Optimization of hybrid fuel usage (H₂, NG)



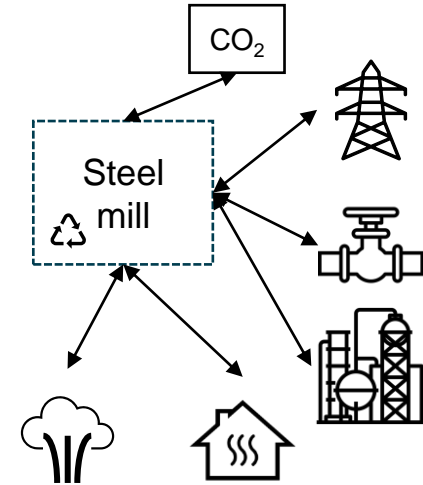
Technology integration research

- Hybrid furnace operation (induction, combustion, resistive)
 - Retrofit
 - Greenfield



System integration research

- Internal integration within steel mill
- Options for CCS/CCU
- Flexible interaction with gas and power grids
- Oxygen use
- Integration with chemical industry for synthetic fuel production
- Heat integration with steam production or hot water production





Thank you for the attention!

Stay informed
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