Forging a greener future

How the INITIATE technology can help decarbonise the steel and fertilizer industry

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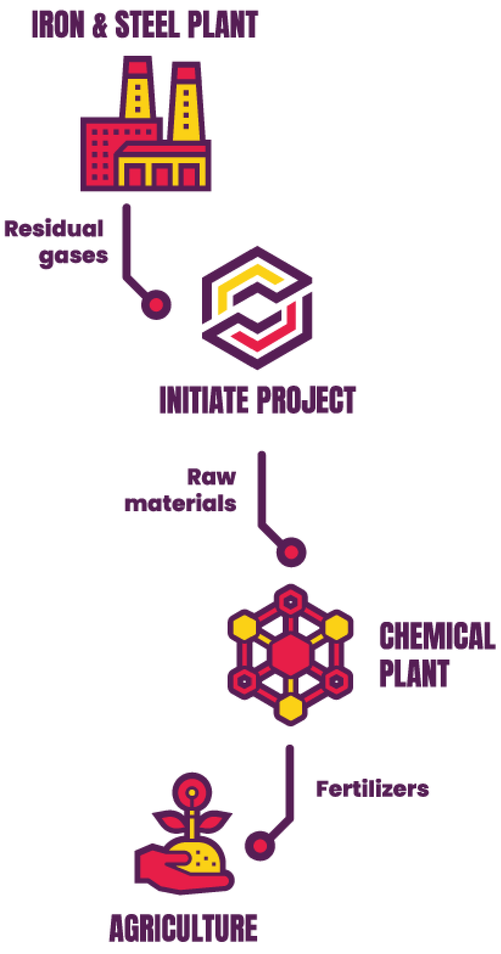
MOTIVATION

Steel production is responsible for 15% of the GHG emissions. The INITIATE technology captures CO_2, H_2 and N_2 from residual steel gasses, which can be used as chemical feedstocks for fertilizer (i.e., ammonia or urea) production. The remaining CO_2 can be sequestered.



The goal of the study is to evaluate the prospective environmental impact of the INITIATE technology on industrial scale and identify environmental hotspots for design optimisation.

APPROACH

- The environmental impact of large scale urea production with the INITIATE technology is assessed using prospective LCA[1]:
  - Foreground changes from TRL 7 to TRL 9 are modelled based techno-economic assessment and expert input.
  - Prospective modifications to the background are included, by considering three prospective scenarios using premise[2].

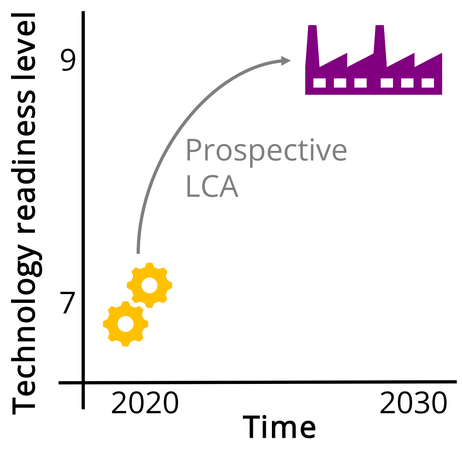


Figure 1: Prospective framework

- The iron and steel plant itself is outside the scope.
- Residual steel gasses are commonly used for electricity and heat and are replaced by grid electricity and natural gas based heat.
- Counterfactual approach for urea production.

RESULTS

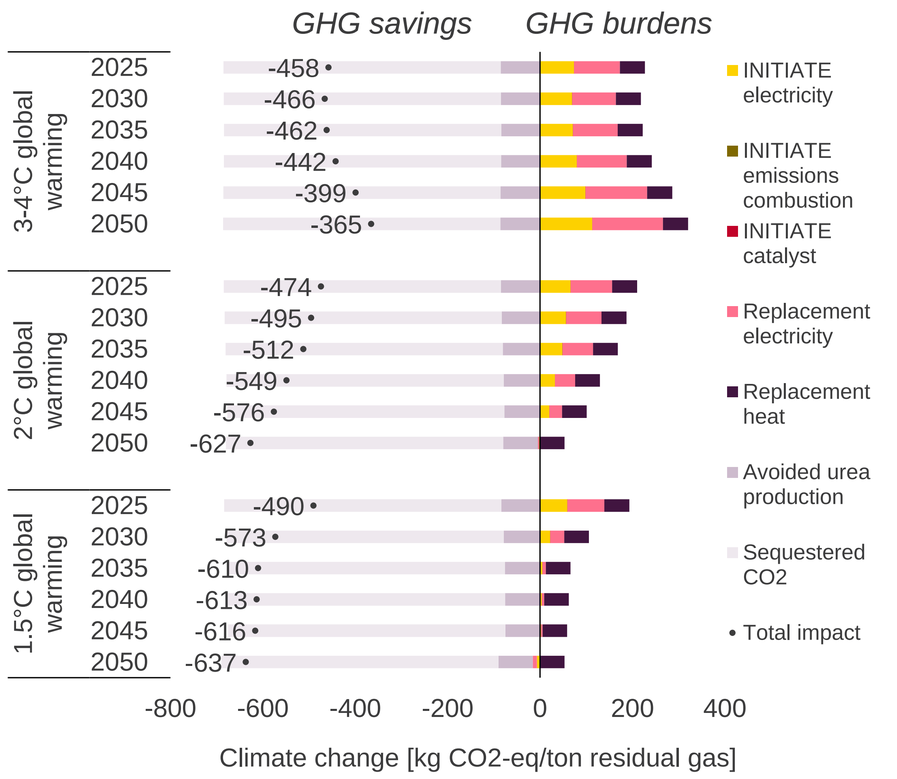


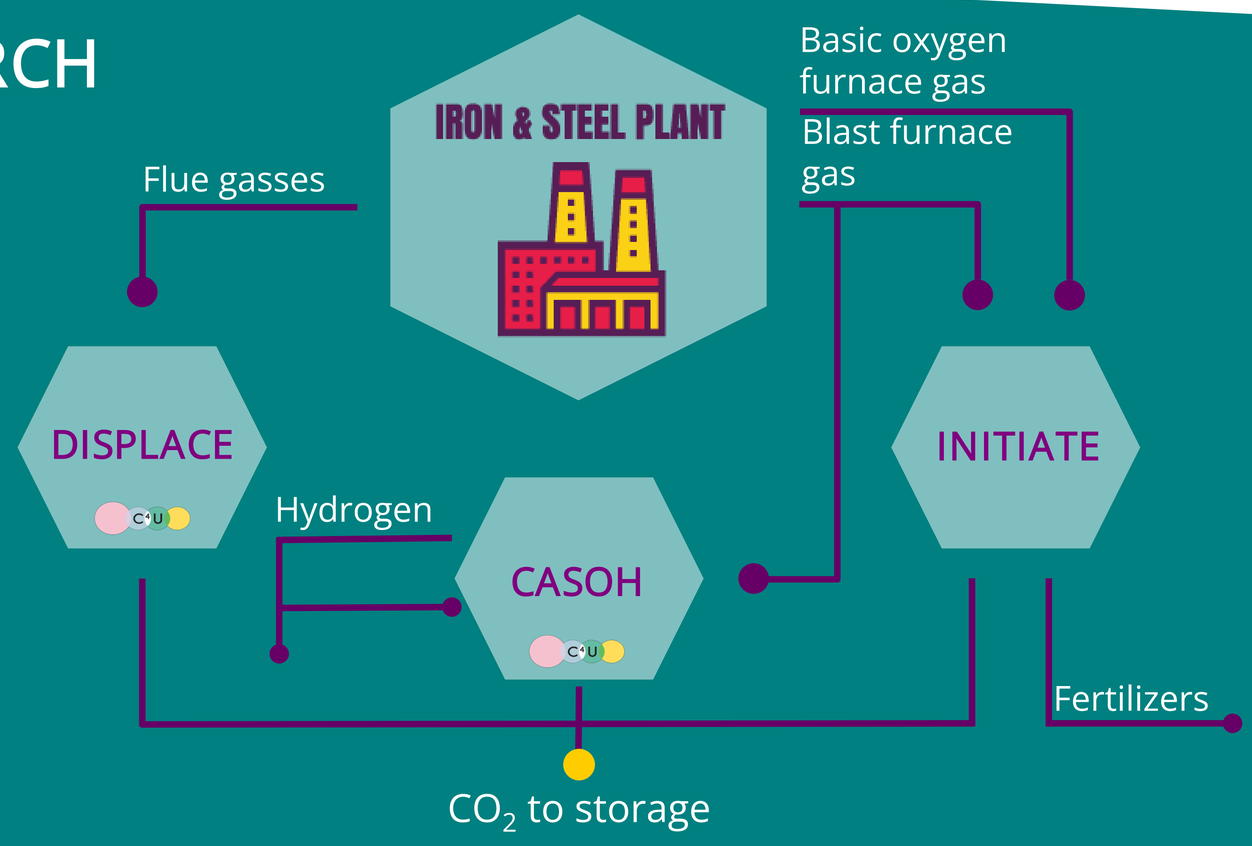
Figure 2: Prospective climate change impacts for urea production from residual steel gasses (i.e., basic oxygen furnace gas and blast furnace gas) on large scale (i.e., 1500 ton urea per day). The results are presented per ton residual steel gas, consisting of 44 kg BFG and 956 kg BOFG.

KEY MESSAGES

- Net GHG savings highly depend on the future background scenario with an increase in net GHG savings of 75% for 2050 in the 1.5°C scenario compared to the 3-4°C scenario.
- Using residual steel gasses in the INITIATE technology is favoured over using these gasses directly within the iron and steel plant for heat and electricity and results in GHG savings between 365-637 kg CO_2/ton residual gas.

FUTURE RESEARCH

Assess decarbonisation potential within the steel industry in combination with other steel carbon capturing technologies



References
1) van der Hulst, M. K. et al. *J. Ind. Ecol*. 24, 1234–1249 (2020).
2) Sacchi et al. *Renew. Sustain. Energy Rev*. 160, 112311 (2022)

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