



Butter Bridge produces first Green Iron in the Netherlands from lower grade ore using biomass gasification and electricity

Butter Bridge has successfully demonstrated a method to process lower grade iron ore into pig iron by integrating biowaste gasification and electric smelting technology. The company now aims to build a small facility in the Netherlands to provide smelting services supporting the transition to green steel. Focus points include prereduction, ore behaviour, electrical smelting technology, related waste streams, and integration with the cement industry.

Most of the steel in the world is produced by smelting lower grade iron ore in blast furnaces. This process is carbon intensive as large amounts of metallurgical (fossil) coal are consumed in these furnaces, producing significant quantities of CO₂. In the Netherlands the production of ~7 million tonnes of steel represents emissions of 11.6 million tonnes CO₂ making it the largest industrial CO₂ emitter nationally (>7% of total Dutch emissions). Globally, steel production via the blast furnace route accounts for over 2 billion tonnes of CO₂.

To achieve net zero by 2050 it will be necessary to deploy clean steel production processes with low CO₂ emissions: green steel. The at present commercially and technically proven production route for green steel from ore requires high-grade iron ore. This ore is first processed into Direct Reduced Iron (DRI) which will mostly be melted in Electric Arc Furnaces to produce high-quality steel. However, high grade ore is not widely available and comprises only a fraction of globally traded iron ore.

To truly decarbonize the global steel industry and avoid dependence on scarce high-grade ores, new large-scale processes are required to pre-reduce and smelt the more typical lower grade ores.

Butter Bridge is a consultancy based in the Netherlands, specialised in metallurgy and notably the continuous smelting of ores using electric smelting technology. During a recent test Butter Bridge reduced commercially available low-grade ore with biobased syngas (CO-H₂ mixture), producing DRI and a biochar product (concentrated carbon residue). The syngas was produced from woody biomass in a DOPS Recycling Technologies lab-scale reactor. Various degrees of prereduction were achieved and the produced biochar was collected for use in the smelting step.

The DRI was subsequently mixed with the biochar and slagformers in predefined proportions based on calculations. This mix was placed in an electrically heated furnace made available by Ascem, the research and knowledge institute of the BTE Group.

The final products – metal pucks and slags – were assessed for quality and quantity. Both quality and quantity matched the calculations done in preparation to the tests. The

results also demonstrated that the slag and metal composition could be controlled using calculated amounts of biochar and slag forming additions. This is important to ensure a sustainable outlet for this slag as low-CO₂ raw material for the cement industry.

About Butter Bridge

Butter Bridge, a technology consultancy with significant experience in extractive metallurgical processes, was established in 2022 and is based in Groningen, the Netherlands. Butter Bridges' mission is to accelerate circular and resilient metal production in Europe. This is done by offering consultancy services alongside providing smelting facilities for the green steel transition, for training, education and R&D, and for small scale processing of residues containing critical and strategic raw materials like copper, zinc, cobalt, nickel, and vanadium.

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DOPS-RT test facility where syngas was made from biomass electrically.



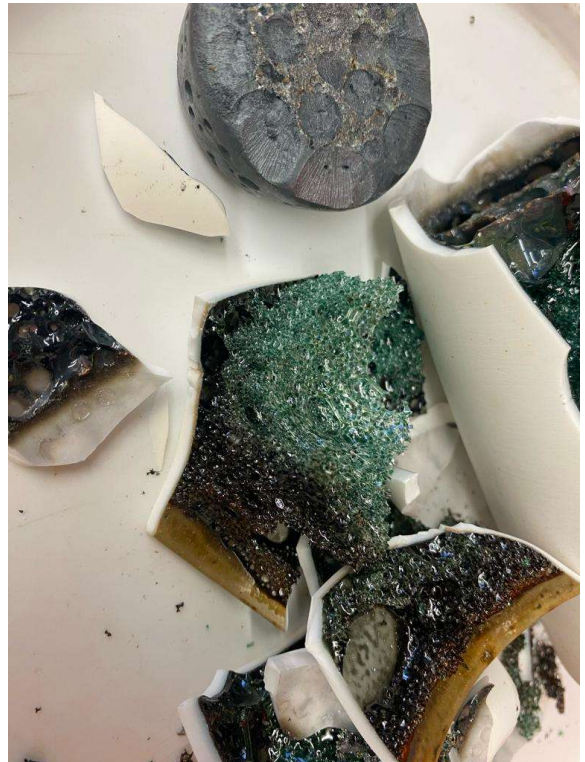
Direct Reduced Iron (DRI), which is magnetic, made by syngas from biomass.



Taking the sample from the “electric melter” at Ascem.



Iron made from low-grade ore, biomass, and electricity.



Iron and slag, made in Holland.

