

Green Iron production in South Africa

Primary iron/steel production is the biggest global industrial emitter of greenhouse gasses (GHGs). Most emissions come from the production of primary iron from iron-ore.

A number of countries and steelmakers have announced net-zero commitments.

Technologies to produce zero-emissions “green iron” (GI) exist. Much progress has been made on hydrogen direct-reduced iron (HDRI). It is not yet proven at commercial scale but there are strong indications it will be in the next 5-10 years. Though it will cost more than conventional/current technologies at first, demand is anticipated in some markets and end-uses such as voluntary supply chain decarbonisation, markets regulated by end-use standards, government procurement or car-buyers prepared to pay 1-2% more for vehicles with zero embodied emissions steel.

Commercial-scale GI plants have been announced to begin operating in the EU from 2024-2030. Policy-created “Lead Markets” with decarbonisation targets, R&D support, market protection, and (public and private sector) policy-driven “market-pulls” are driving competitive innovation. These include voluntary commitments (e.g. Orsted & Volvo) and government actions such as regulations for environmental footprints of buildings and direct government green procurement mentioned in formal policy documents. Lead Markets are a core element of EU Industrial Policy.

As decarbonisation accelerates, it is likely that it will be less costly to produce GI in South Africa than in the EU. This is mainly because of the abundant, very low-cost renewable energy potential in South Africa and the predicted high demand for low-carbon electricity and hence higher electricity price in the EU, which has more limited renewable energy resources.

A commercially competitive South African GI plant would have a dedicated solar PV supply, electrolysers and hydrogen storage for a continuous feed of hydrogen. South African GI plants could feed into the ‘second phase’ of the establishment of HDRI, namely global diffusion, from around 2027--2030, when the technology has been proven at scale in the initial EU lead market.

GI could become a certified distinct commodity product as a feedstock for steelmaking.

Production of GI at a South African location, for export to the EU, could have substantial financial and economic benefits for both South Africa and Europe. Such an arrangement could reduce the overall costs of EU decarbonisation while making its steel industry more competitive.

To facilitate timely green HDRI investments, cooperation is required between South Africa, the EU and steelmakers in terms of technology accessibility and market access. This is possible within current policy frameworks but will require specific policy implementation mechanisms and efforts. It will need to navigate WTO, trade, state-aid, level playing field etc. policies and rules within the context of the SA-EU Free Trade Agreement and Strategic Partnership.

Though South African GI export plants will be feasible on purely commercial terms initially, domestic use will come later. South Africa is not in the same position as the EU when it comes to creating a domestic market to warrant the large lumpy investment involved in a GI plant. However, GI will become more competitive with conventional iron across markets over time, as economies of scale and technology learning reduces costs and climate policy induces carbon pricing worldwide. Southern African markets will then be in a position to consider it for local use.

In summary, green HDRI is an opportunity for South Africa to export renewable energy embedded in beneficiated domestic iron ore, hugely increasing the value of this iron ore and so generating export revenues at a scale. Such revenues are essential to creating the macro-economic conditions needed to support a just transition, including replacing unsustainable coal export revenues and taxes. In addition, green HDRI investments would help enlarge the base for the entire renewable energy value chain in South Africa. Ultimately, GI could be a foundational stepping stone on the path to a sustainable and profitable revitalization of South African industry.