Green Steel: Utilizing Municipal Solid Waste and Biomass for Primary Production

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The steel sector has historically been recognised as a hard-to-abate sector. At least 70% of steel is produced using blast furnaces. While the blast furnace is the most mature and economical technology, it is also extremely emissive; for every ton of steel, 2 tons of CO_2 are emitted into the atmosphere. At present, in fact, the steel sector contributes to the 7% global greenhouse gas emissions.
A viable alternative to the blast furnace for reducing emissions is the use of Direct Reduced Iron (DRI) technology, where iron ore is reduced to metallic iron using a mixture of hydrogen and carbon monoxide as the reducing agent. Most DRI plants use natural gas as an energy source and as a source for the reducing gas. This allows greenhouse gas emissions to be halved. it is only with the use of renewable energy sources and green reducing gases that CO_2 emissions for steel production can be reduced almost completely. One solution that has been much studied is the use of green hydrogen from electrolysis as a reducing agent. The big limitation of hydrogen from electrolysis is the high cost of electrolysers and the scale-up from pilot to industrial scale.
It is therefore of great interest to find mixtures of green reducing gases that are not derived from electrolysis. In this, the use of municipal solid waste and biomass can be an excellent solution. The aim of this work is to investigate the coupling, by means of appropriate process simulations, between waste and biomass gasification plants and the DRI steel production plant. It is of crucial importance to understand whether the use of syngas from waste and/or biomass results in a change in the quality of the DRI product. Furthermore, once the technical feasibility is established, estimate the energy efficiency, the actual reduction in CO_2 emissions and the profitability of the plant.