Why consider biomass in steelmaking?

Under the right circumstances, biomass can be considered a carbon-free resource; therefore, it can be an attractive option to reduce emissions from iron and steel production.

The International Energy Agency (IEA)'s bioenergy programme notes that “within the biospheric carbon cycle, bioenergy can be carbon neutral because the carbon that is released during combustion has previously been sequestered from the atmosphere and will be sequestered again as the plants regrow, i.e. if sustainably produced. However, the full supply chain must be considered, and all emissions associated with the production, processing, transport and use of bioenergy need to be included. Particularly harvesting, transport and processing generally involve fossil energy use. Nevertheless, analysis shows that the fossil energy used in the supply chain is generally a small fraction of the energy content of the bioenergy product, even for woody biomass transported over long distance, e.g. between North America and Europe.”

Biomass is already used to a significant degree in the power sector. For example, the former Drax coal-fired power plant in North Yorkshire, England, converted four of the power station’s six generating units to use sustainable biomass instead of coal. This has transformed Drax, which supplies 5% of the country’s electricity, into the UK’s largest renewable power generator and the biggest decarbonisation project in Europe.

Biomass in iron and steelmaking

While some blast furnaces do currently operate entirely using biomass, the relative strength of charcoal compared to coke means that these are smaller furnaces. Charcoal is currently used commercially to substitute for a proportion of the coal used in blast furnaces, primarily in Brazil.
Biochar can potentially be substituted for pulverised coal currently injected directly into blast furnaces. Work was undertaken to this end under the Australian CO₂ breakthrough programme, which focussed on substituting coal used in pulverised coal injection (PCI) in the blast furnace with sustainable biochar. Some development continues to further optimise charcoal production to improve its product specifications for steel production.

The Torero partnership project is testing the use of biocoal (torrefied waste wood) to partially substitute coal in ArcelorMittal’s plant in Ghent, Belgium. Construction of the project started in 2018; reactor #1 is expected to start production in 2022 and reactor #2 in 2024. The two reactors will each produce 40,000 tonnes of bio-coal annually.

**Opportunities and challenges**

**Sustainable biomass**

Biomass can be cultivated sustainably by steel companies, or acquired from third party growers. In either case, a number of stewardship initiatives to support users of biomass exist; these have been developed by global bodies such as the Forest Stewardship Council and Sustainable Biomass Program (certification scheme designed for woody biomass).

Regional schemes include the European Programme for the Endorsement of Forest Certification, the American Sustainable Forestry Initiative and the Brazilian CERFLOR programme. Legislative frameworks and regulations can also ensure forests are managed responsibly.

**Challenges**

Increasing demand for bioenergy feedstock is leading to conflicts, with differing demands on land use. Competition for arable lands required for food and fibre production is the major issue concerning biomass production. Soil disturbance, nutrient depletion and impaired water quality are also potential environmental effects from biomass feedstock production and utilisation of agricultural and forest residues for energy.