

Fact Sheet:

The facts about steelmaking Steelmakers seeking Green steel



Traditionally, steel has mostly been made using fossil fuels - including coal, gas and electricity powered by fossil fuels.

7% of the global energy sector's carbon dioxide emissions comes from steelmaking (including all process emissions).



Steelmakers have a growing interest in developing 'green' or 'zero carbon steel'.

Main Steel Production Pathways





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There are three ways to make steel:

- 1.** The primary **blast furnace and basic oxygen furnace (BF-BOF)** process uses coal. Iron oxide is reduced to iron inside a blast furnace using coke (derived from coking / coal) as the reducing agent. The resulting molten, carbon-rich 'pig iron' is processed into steel in a basic oxygen furnace, where oxygen is blown through it to reduce its carbon content.
- 2.** The primary **direct reduced iron and electric arc furnace (DRI-EAF)** process uses syngas which is made from natural gas or gasified coal and also electricity to power the electric arc furnace. Iron ore is converted to metallic iron using the syngas. The direct reduced iron is then further processed into steel in an electric arc furnace.
- 3.** The secondary **scrap steel and electric arc furnace (scrap-EAF)** process uses electricity. Recycled scrap steel is heated and melted in an electric arc furnace to form new steel.

Steelmaking Processes: Carbon Emissions and Energy Consumption

Technology process	Direct CO ₂ (t)/ Crude steel (t)	Direct and Indirect* CO ₂ / ton of crude steel	Energy Consumption (GJ/t)		Share of global steel production (%)
			International Energy Agency	Worldsteel**	
BF-BOF	1.2	2.2	21.4	22.7	73.2
DRI-EAF	1.0	1.4	17.1	21.8	4.8
Scrap-EAF	0.04	0.3	2.1	5.2	21.5

Source: IEA, World Steel Association, IEEFA calculation

*Indirect emission emissions are indirect GHG emissions from the generation of purchased energy consumed by a company.

**The IEA states all energy intensities in final energy terms, whereas Worldsteel accounts for electricity consumption in primary energy terms, using a conversion factor of 9.8 GJ of fuel per MWh of electricity (equivalent to a 37% conversion efficiency). This means that processes that consume electricity will appear more energy intensive when quoted using the Worldsteel analytical boundary, relative to the one used by the IEA.

- In 2020, **73% of global crude steel production** totalling 1.88 billion tonnes used the blast furnace and basic oxygen furnace (BF-BOF) process.
- In 2020, 26% of total global crude steel production came from electric arc furnaces powered by electricity. The majority came from scrap steel, and the lesser from the direct reduced iron and electric arc furnace (DRI-EAF) process.
- The blast furnace and basic oxygen furnace (BF-BOF) process releases the highest carbon emissions: 2.2 tons of CO₂ emission per ton of crude steel. Because it uses coal, this process is becoming obsolete in an emissions-challenged world.
- The direct reduced iron and electric arc furnace (DRI-EAF) process releases lower emissions: 1.4 tons of CO₂ emission per ton of crude steel.
- The scrap steel and electric arc furnace (scrap-EAF) process releases the least carbon emissions.
- The direct reduced iron and electric arc furnace (DRI-EAF) process could be zero emissions if green hydrogen (produced using renewable energy-powered electrolysis) and electric arc furnaces powered by renewable energy were used.
- The scrap steel and electric arc furnace (scrap-EAF) process has the potential to be zero emissions where powered by renewables.

About IEEFA

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