

## FACT SHEET

### Climate change mitigation



Steel producers around the world are researching and piloting low-carbon technologies, which have the potential to radically reduce the climate change impact of steelmaking. They are also involved in initiatives aiming at improving their performance with existing technologies and bringing all steel makers to the same efficiency levels as the industry's leading performers.

The steel industry has made significant improvements in energy efficiency over the last decades and thus in the related CO<sub>2</sub> emissions intensity.

The steel industry and its products are part of the climate change solution, however new breakthrough technologies will be required to reduce CO<sub>2</sub> emissions to the level that will meet commitments in the Paris agreement.

The CO<sub>2</sub> generated in the steel industry results from the chemical reaction between coke and coal (carbon) and iron ore in a blast furnace. This process is called iron ore reduction and produces hot metal (near pure iron), which is subsequently converted into steel.

Integrated iron and steel plants recirculate all the generated process gases back into the production processes to recover energy from heat and produce electricity, thus increasing efficiency and reducing the need for external energy and effectively reducing greenhouse gas emissions.

Modern steel plants are extremely energy efficient and operate close to the limits of thermodynamics. Employing leading practices and technologies maximises the energy efficiency and minimises emissions of CO<sub>2</sub>. At present there is no alternative production process available to replace the use of carbon in iron and steelmaking.

#### Technology and leading practice transfer

worldsteel member companies see technology and leading practice transfer as part of the solution - bringing all the major steelmaking companies up to the best in class as quickly as possible.

The objective is to disseminate leading practices without compromising competitiveness. worldsteel members exchange information in projects, workshops and conferences as well as expert group and committee meetings on innovation, technology, environment, raw materials quality improvement, product sustainability and safety and health.

There are online benchmarking tools available for worldsteel members to enable optimisation of energy intensity, CO<sub>2</sub> emission intensity, reliability performance, process yields, safety and health and sustainability performance. These systems can be used by members for internal benchmarking or to compare themselves with peer companies or sites. These are powerful internal processes to determine where the leading practices are and ensure these are transferred within the company to reach the best operational level.<sup>1</sup>

The data can also be used to see how a site's performance measures with the rest of the industry. This enables the companies to transfer knowledge and practice by agreement.

#### The CO<sub>2</sub> breakthrough programme

Modern steel plants operate near the limits of practical thermodynamic efficiency using existing technologies. With most major energy savings already achieved, further large reductions in CO<sub>2</sub> emissions are not possible with the existing technologies. The goals of the Paris Agreement require breakthrough technologies to be developed via innovation and exploration of new production processes.

To drastically reduce the overall CO<sub>2</sub> emissions from the production of steel, the development of breakthrough technologies is crucial. Today, many promising projects are being developed in different parts of the world. Some projects are in the early research stage while others are in pilot or demonstration phase. Although their goals are similar, approaches differ and can be categorised as follows:

- **Hydrogen as a reducing agent** - Avoids carbon and uses hydrogen to reduce iron ore thereby averting the creation of CO<sub>2</sub> while producing H<sub>2</sub>O (water) instead.

- **Carbon Capture and Storage (CCS)** - Generates a clean and concentrated CO<sub>2</sub> stream that can be captured and stored.
- **Carbon Capture and Utilisation (CCU)** - Uses the components of the co-product gases from existing processes to produce fuels or input material for the chemical industry.
- **Biomass as a reducing agent** - Can partially substitute coal for biomass such as charcoal.
- **Electrolysis** – Reduces iron ore using electricity

Every one of these technologies will have a role to play in cutting CO<sub>2</sub> emissions and will be essential enablers of a low-carbon society. Their implementation at a larger scale, however, will require large quantities of affordable carbon-free hydrogen, biomass and electricity as well as access to CO<sub>2</sub> transportation networks and storage to be readily available, which implies a fundamental transformation of the global energy system.

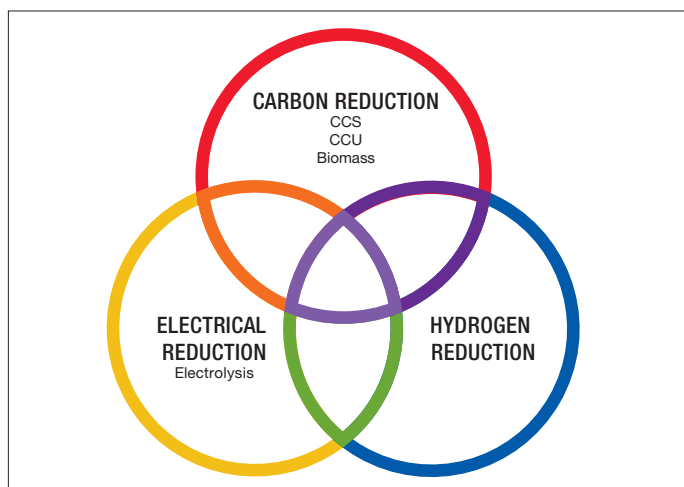


Diagramme 1: Three directions for steelmaking decarbonisation

## Global technology innovation forum

worldsteel facilitates a global technology innovation forum for its members, established in the early 2000s. Several national and regional programmes on breakthrough technologies exchange information on their projects, shared improvements and identified gaps or overlaps in research. The various regional programmes call on a range of industrial expertise from steel producers, energy generators, plant designers and equipment manufacturers. They also leverage scientific expertise of research laboratories, universities and academic research institutions across the globe.

## step up programme: Improving operational efficiency

While breakthrough technologies are being developed the membership of worldsteel, which represents more than 80% of global steel production, continues to find ways to drive efficiency in energy use and product design. To further that effort worldsteel launched, in 2019, a new programme called “step up” to encourage and assist all member companies to reach the highest level of efficiency.

The programme focuses on four key areas which have the potential to bring a steel plant’s operational efficiency to the highest level.

This multistep process covering raw materials, energy input, yield and maintenance can bring a mill operation up to the same efficiency levels as the steel industry top performers.

A 4-stage efficiency review process has been devised, based on leading practice, for all mill operators to follow, covering the following areas:

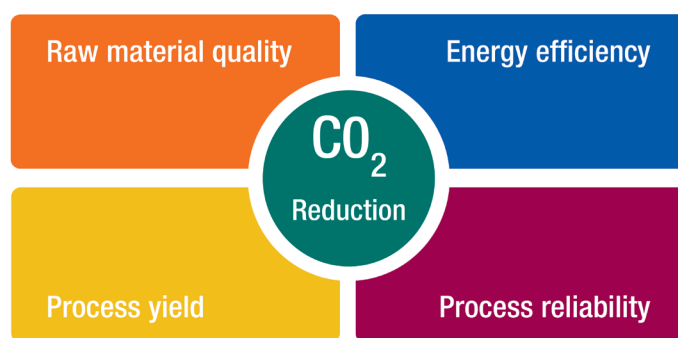


Diagramme 2: Four-stage efficiency review process

1. **Optimal raw materials selection and use:** The quality of iron ore and coking coal has a direct impact on energy intensity and CO<sub>2</sub> emissions. Measures, such as beneficiation of ore and coal at the source, switching to carbon-lean or hydrogen containing fuels, and increasing scrap use in the basic oxygen furnace are just a few of the measures that can significantly improve operational performance.
2. **Energy efficiency and minimising waste:** Energy efficiency is a crucial component of resource efficiency and there are several tested and proven improvement measures available: heat or energy recovery from solid and gas streams, coke dry-quenching, cogeneration units, electricity savings (aiming toward self-sufficiency), and many more.
3. **Improving yield:** Improving yield leads to increased output from the steelmaking processes. It is directly linked to a reduction in energy intensity and raw material use.
4. **Process reliability:** Improving a steelmaking plant’s maintenance ensures process reliability, which reduces losses in quality and process time, thereby reducing energy use per tonne of steel.

The efficiency review process based on leading practise is open to worldsteel’s membership. The programme will be tested across 9 sites in 2019 and then rolled out much more widely through 2020-2025.

1. worldsteel.org, Steel by topic section, Technology category, worldsteel.org/steel-by-topic/technology.html.