Energy efficiency in European industry

# Iron & Steel sector

## Introduction to the iron and steel sector

The iron and steel industry covers most of NACE sector code C24 ("*Manufacture of basic metals*"). The EU is the world's second-largest steel producer, after China. The key subsector is C24.1 ("*Manufacture of basic iron and steel and of ferro-alloys n.e.c.*"). The about 2,400 enterprises in this subsector employ more than 300,000 persons, and are responsible for 73% of the total final energy consumption of the sector.

In contrast to most other industrial sectors, the energy consumption in the iron and steel sector is expected to keep growing in the coming decades. Energy intensity is expected to improve only marginally, while steel production is projected to increase.

## GP **High-speed burner for ladle heating**

**44%**
**energy savings**

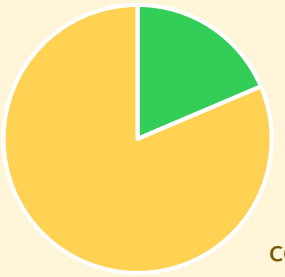
Pre-heating burners are used to keep the empty ladles warm before filling the ladles with molten metal. This process is carried out in order to avoid thermal shock when molten metal is poured. The high- speed burners allow the use of kinetic energy of high-speed gas to produce heat and thus drastically reduce fuel consumption while maintaining the same temperature of the ladle. The new burner guarantees the uniformity of the ladle temperature, also reducing the pollutant emissions produced.

This practice is an easy and cheap option, with implementation costs of €40,000 and payback time of 6 months. In the case in Italy where the good practice was implemented, 195 *toe* per year were saved, compared to a baseline energy consumption of 439 *toe* (44% energy savings). *more info*

## GP **New type of nozzle for water descaling**

The replacement of nozzles that deliver water for descaling can lead to energy savings. The change of the nozzles allowed to reduce the load on the pumps and to switch-off a second pump. In an example situation in the finishing process of basic iron and steel manufacturing, there were three pumps for water transportation. In the ex-ante situation one pump was used as backup and the other two were working in the standard conditions. In the ex-post situation it was able to switch off one of the working pumps leaving two of them as a backup and only one working in the standard conditions. This cheap measure (€10,000) immediately led to energy consumption improvement of 45%, which meant that the payback time was a matter of only a few days. *more info*

## Statistics EU iron and steel sector



Iron and steel*:
**18.6%**
of EU industry energy consumption

- **9,300 enterprises**
- **620,000 people employed**
- **Gross added value € 34 billion**
- **Final energy consumption: 50.8 Mtoe per year* (18.6% of total EU industry energy consumption)**

In terms of turnover, the iron and steel sector is dominated by a small number of large companies, with in all analysed countries more than 60% of turnover being recorded in large enterprises (with almost 90% in Poland).

Based on analysing sector in Austria, Italy, Poland, and the UK, most energy saving measures/interventions have been implemented in the basic iron and steel manufacturing subsector.

The most widely implemented interventions in the sector are related to process design and optimisation, covering about 36% of all interventions and resulting in 76% of energy savings. Hence, energy savings are usually large strictly process-related measures, rather than simple standard measures.

* The energy consumption statistics cover the downstream steel making processes, and therefore exclude upstream processes such as iron making from iron ore.

## Recommendations: international competition

The steel industry is highly exposed to international competition, and energy-efficient production can be a competitive advantage. However, stringent energy efficiency targets can result in high costs, which may be disadvantageous for European enterprises as compared to their international competitors. In setting targets and regulations for energy efficiency in the iron and steel sector, therefore, policy-makers have to consider issues of international competition and possible carbon leakage (move of production, energy use, and greenhouse gas emissions to countries with more lenient regulations). Voluntary agreements have proven to be suitable instruments to improve energy efficiency, while maintaining European industry competitiveness.

## GP **Surface combustion furnace revamping**

To improve the annealing furnace it is possible to either replace it, add a new part to the process working in parallel, or revamp the existing furnace. Furnaces can be optimized by for example changing refractory materials, burners, control systems or cooling systems, by altering the type of fuel, or by modifying the way of material transport and charging.

There is a wide variety of potential options for revamping the surface combustion furnace, so the costs, payback times, and potential energy savings vary widely as well. A revamping of the furnace in most cases leads to an improvement in energy consumption of about 30-40%. *more info*

## GP **Hot charging**

Charging slabs at an elevated temperature into the reheating furnace of the hot rolling mill will save energy. In addition, hot charging improves material quality, reduces material losses, enhances productivity (by up to 6%), and may reduce slab stocking. The conventional process requires a large amount of energy because the slab is temporarily cooled, inspected for flaws and defects, conditioned, and then reheated in a heating furnace. In hot charging this is avoided.

Energy savings of 0.06 GJ/t-rolled steel are estimated. In a Japanese plant, hot charging has reduced specific fuel consumption in the heating furnace by 0.21 GJ/t-product. Emissions reduction potential is estimated to be 30.2 kg $CO_2$/t-rolled steel. *more info*

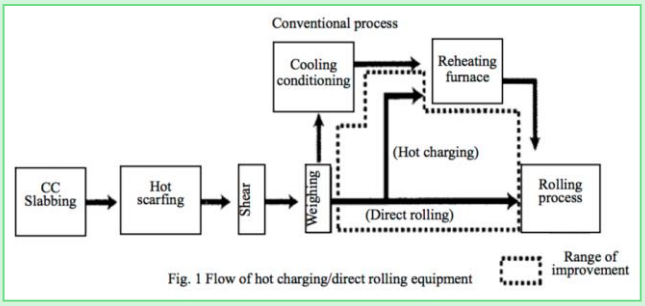


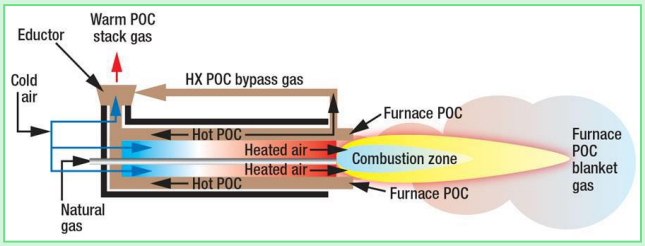
Fig. 1 Flow of hot charging/direct rolling equipment

The image shows how the cooling step is skipped in the hot charging option.

## GP **Recuperative burners**

Recuperative burners use hot flue gases to preheat the air. The flue gases are not mixed with the preheated air due to the use of heat exchanger. Replacement of old burners with new recuperative burners can be done on multiple types of furnaces.

Replacing cold air burners by recuperative burners has on average resulted in an energy consumption improvement of 23%. The payback time for the investment varies widely, but has in most cases been less than 2 years. *more info*




## Recommendations: large companies, high costs

Production in the iron and steel sector takes mostly place in large companies, and this is also where most potential is for energy savings: of energy savings recorded in the EU-MERCI database, 98% took place through interventions in large enterprises.

While in other industrial manufacturing sectors energy consumption improvements can often be achieved through standard measures on for example heating and cooling, refrigeration, and drying, in the iron and steel sector less than 10% of energy savings has been related to such relatively simple interventions. Energy savings have been mostly the result of interventions in the actual process (76%), followed by process control systems (7%), and combustion (6%). Such measures, though showing relatively large energy savings, come with high costs.

The sector therefore needs financial impulses to achieve major energy savings, for example through subsidy schemes or investment funds, especially in Member States where the financial condition does not allow for enterprises to make substantial investments.

## Policies

In many EU Member States, the iron and steel industry is covered by an energy efficiency obligation (EEO) scheme, but also many alternative measures have been implemented, including financial schemes and fiscal measures.

In various countries, voluntary agreements have been made between the government and the iron and steel sector (or all energy-intensive sectors). Such agreements have been made for example in Belgium (both Flanders and Wallonia), Finland, the Netherlands, Sweden, and the UK. In voluntary agreements, enterprises often receive tax rebates in return for energy consumption improvements. One of the objectives of such agreements is often also to cut energy use, while protecting the market position of domestic industries in the face of international competition.

## The EU-MERCI project

EU-MERCI is an EU-funded project aimed at supporting the growth of energy efficiency in industry processes. The project shares good practices of energy efficiency measures, helps industry actors to overcome expected barriers and maximise benefits, and supports policy makers. → eumerci.eu.

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