

Public policy paper

Steel industry co-products

Legislation should encourage the sustainable use of steel industry co-products.

Introduction

Over the past 20 years, use of the steel industry's co-products has increased significantly.

Innovative technology developments and synergies with other industries have brought the steel industry ever closer to its goal of zero waste to landfill.

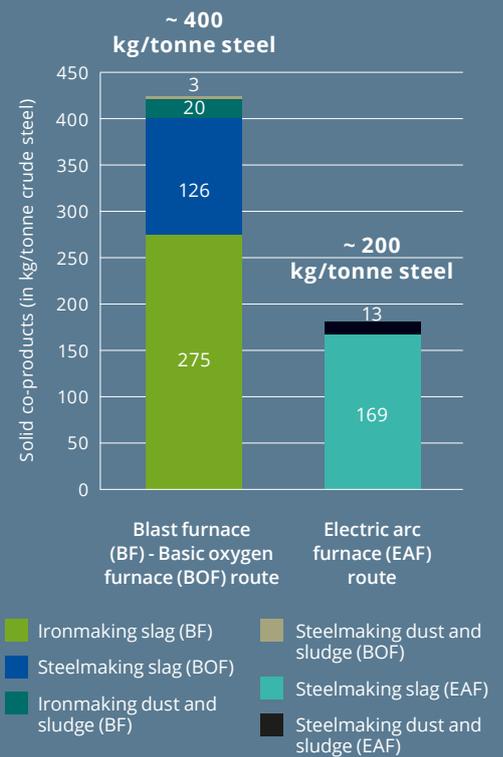
In this paper, co-products refer to materials that are produced in parallel to or, as a consequence of, the production of a primary product and which have a potential value.

The main solid co-products produced during iron and crude steel production are slags (90% by mass), dust and sludge.

On average, the production of one tonne of steel results in around 200 kg of co-products for the electric arc furnace (EAF) route and 400 kg for the blast furnace - basic oxygen furnace (BF-BOF) route.

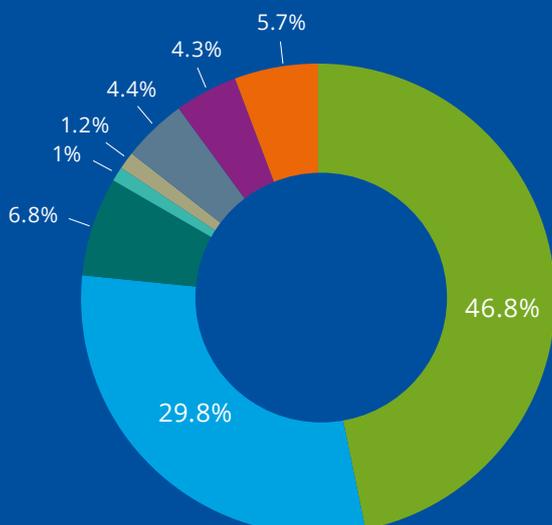
Alongside solid co-products, process gases from coke ovens, BFs or BOFs are also important steelmaking co-products.

Main solid co-products per steelmaking route¹ (average outputs in kg/tonne crude steel)



¹ Steel Industry By-products report, worldsteel 2010

Use of iron and steelmaking slags in Europe*² in 2016 - total 41 Mt



- Cement, concrete additive, etc.
- Road construction
- Metallurgical use
- Hydraulic engineering
- Fertiliser
- Other
- Interim storage
- Landfill

*At a global level, percentages vary from region to region

² EUROSLAG – The European Slag Association, 2017

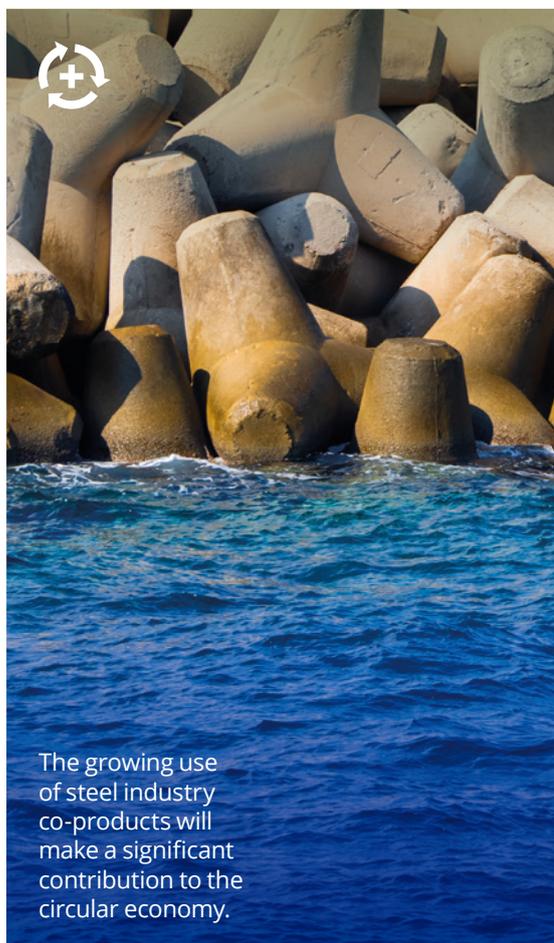
Key points from this report



Legislation should clearly differentiate co-products from waste to facilitate their use and improve their perception.



Governments should support research into new applications of co-products, such as the development of Carbon Capture and Use (CCU) technology applied to process gases.



The steel industry can be a reliable partner, providing heat and electricity to local communities.



Legislation should not apply stricter regulations on the use of co-products; on the contrary they should be given preferential treatment.



Legislators should take a holistic approach when assessing the sustainability of steel industry co-products.

The growing use of steel industry co-products will make a significant contribution to the circular economy.

The use of steel industry co-products

Co-products from the steel industry have many uses within the industry itself, in other industries and in wider society. In some cases, it is the physical properties that determine the use, such as steelmaking slag used as aggregates in road construction; and sometimes it is the chemical composition e.g. process gases used as fuel to produce heat and/or electricity. Valuable non-ferrous metals can also be recovered from slags, dust and sludge when the concentrations are sufficient.

Some examples of common uses of steel industry co-products:

- Blast furnace slag – substitute for clinker in cement-making
- Steelmaking slag – aggregates in road construction, soil improvement
- Process gases – heat and electricity production
- Dust and sludge – internal and external use of iron oxides and alloying elements
- Petrochemicals from cokemaking – tar, ammonia, phenol, sulphuric acid and naphthalene for the chemical industry

- Emulsions from mills and used oil – reducing agent in blast furnaces or used in coke plants.

In all cases, using a steel industry co-product as a substitute for an equivalent product will improve resource efficiency and contribute to the circular economy.

Ongoing technological development

Technological development in the production and processing phases, with the aim of producing co-products with uniform and improved properties, is a continuous effort. New technologies will further increase co-product usage rates and, more importantly, expand their use by improving the quality of the materials recovered.

Recent developments include demand management and refocusing the production process to better control the properties of the co-products.

Public and political perception

Today, there is no uniform legal definition of co-products; it varies from country to country and sometimes even between different pieces of legislation. When co-products are not clearly differentiated from waste, it creates unnecessary hurdles for their use and transport as well as issues around public and political perception.

It is necessary to clearly differentiate co-products from waste in legislation to improve the perception of co-products and to encourage their use.

Regulatory framework

Beneficial use of steelmaking co-products will reduce the energy and emissions required to make equivalent products. Their use should therefore be given preferential treatment, or at least be encouraged.

worldsteel believes it should be possible to substitute equivalent products for co-products within the same legal framework. This should include the application of identical quality and environmental testing requirements and limits for primary and secondary materials. For example, leachate levels for slags used in road construction should also be applicable to natural aggregates of diverse geological origin.

Furthermore, the development of international/regional quality standards for applications of co-products would improve their public and political perception.

Legislation should in the best case give precedence to the use of co-products or should at least avoid stricter requirements for their use.

Circular economy, resource efficiency and zero waste

The use of co-products has contributed to a material efficiency rate in the steel industry of 96.3% worldwide¹ (average of all steel industry efficiency rates). Our goal is the 100% efficient use of raw materials and zero waste.

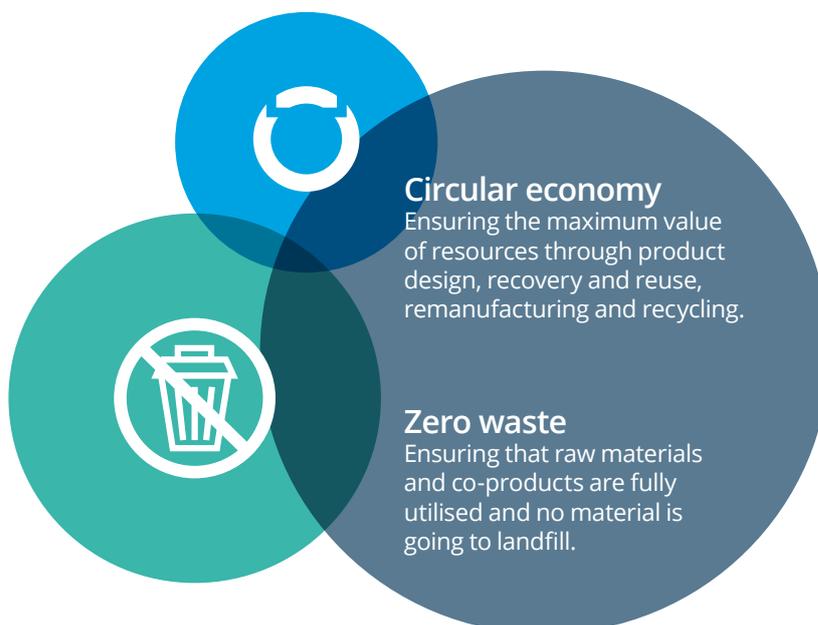
Co-products can be used during the steelmaking process or sold for use by other industries. This increases resource efficiency, prevents landfill waste and reduces CO₂ emissions. The sale of these co-products is also economically sustainable. It generates revenues for steel producers and forms the base of a viable industry worldwide.

Minimising waste and ensuring resources remain in use for as long as possible are key to achieving a sustainable circular economy.

For example, replacing Portland cement with slag cement in concrete can save up to 59% of the embodied CO₂ emissions and 42% of the embodied energy required to manufacture concrete and its constituent materials².

There is a need for a holistic approach in the use of co-products where all environmental, energy and resource aspects are considered.

The use of co-products should be encouraged, thereby saving natural resources and energy.



¹ Sustainable Steel - Indicators 2019 and the steel supply chain, worldsteel

² Slag Cement Association

Research

In order to use more of the steel industry's co-products and achieve the maximum benefit from this use, research into processes, processing and applications is continuously being conducted.

For example, research is ongoing in the field of Carbon Capture and Use (CCU), which focuses on the transformation of process gases and their subsequent use, for example, in the chemical industry.

To make further progress, however, the steel industry would benefit greatly from partnerships with other industry sectors as well as government support.

This would also increase knowledge among policy makers and hopefully initiate discussions on the necessary legal frameworks.

Research into new applications of co-products would greatly benefit from increased government support.

There should be strong support for the use of co-products in legislation and the development of new applications should be promoted.

Once cleaned, process gases from iron and steelmaking are used as fuel in power plants to produce electricity either on or off site.

Value for the community > use of process gases

Process gases (from the coke oven, BF and BOF) once cleaned are used internally to produce steam and to fuel reheating furnaces or they can be used as reducing agents in the BF. They are also used as fuel in power plants to produce electricity either on or off site. Typically, part of this electricity is then fed back into the steel plant while part is used by local communities or neighbouring industries.

When gases are fully utilised, they can provide between 60 to 100% of the plant's electricity requirements³ depending on the configuration of the plant. The gases are flared only if no other option is available.

Legislative frameworks that promote the use of process gases would save fossil fuels and reduce CO₂ emissions from gases that are still flared.

Partnerships with local communities should be encouraged as the steel industry can be a reliable partner, providing process gases, steam or excess heat to the local community.

³ Energy use in the steel industry, worldsteel, 2014



Industry application › Recycling of iron bearing materials



A number of co-products with a high iron content are generated throughout the steelmaking process. These include dust and sludge from the wet and dry abatement equipment, mill scale from the hot rolling mill and iron ore and sinter fines.

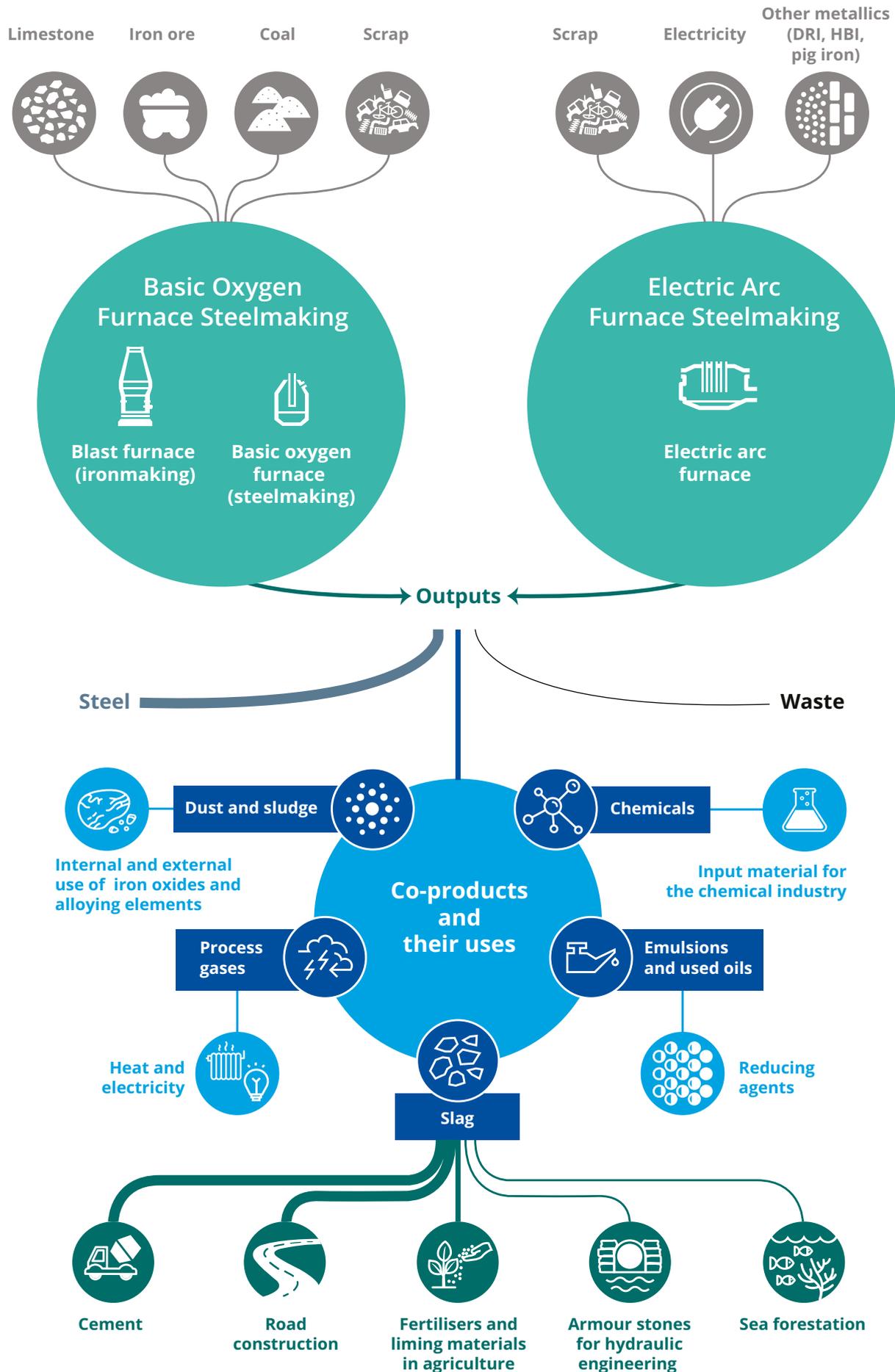
The valuable iron content from these co-products is recovered and returned to the steelmaking process, replacing virgin material and contributing to a more efficient use of resources.

Value for other industries › From construction to healthcare to agriculture



Tar is a cokemaking co-product that is used as a seal coating material in the construction sector and to produce paints and synthetic dyes. As a medication, tar can be further processed and used in applications such as soap and shampoo to treat dandruff and skin conditions (psoriasis).

Sulphur is used to vulcanise rubber and manufacture sulphuric acid but is also used in insecticides and fertilisers. These are just a few examples that demonstrate the value of co-products for many industries, presenting an environmental advantage by preserving virgin materials.



World Steel Association

Avenue de Tervueren 270
1150 Brussels
Belgium

T: +32 (0) 2 702 89 00
F: +32 (0) 2 702 88 99
E: steel@worldsteel.org

C413 Office Building
Beijing Lufthansa Center
50 Liangmaqiao Road
Chaoyang District
Beijing 100125
China

T : +86 10 6464 6733
F : +86 10 6468 0728
E : china@worldsteel.org

worldsteel.org



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