
Emisije nepremičnih virov - Določevanje emisij toplogrednih plinov (TGP) v energetsko intenzivnih industrijah - 2. del: Proizvodnja železa in jekla

Stationary source emissions - Greenhouse Gas (GHG) emissions in energy-intensive industries - Part 2: Iron and steel industry

Emissionen aus stationären Quellen - Bestimmung von Treibhausgasen (THG) aus energieintensiven Industrien - Teil 2: Stahl- und Eisenindustrie

Émissions de sources fixes - Détermination des émissions des gaz à effet de serre dans les industries à forte intensité énergétique - Partie 2: Industrie sidérurgique

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Stationary source emissions - Greenhouse Gas (GHG) emissions in energy-intensive industries - Part 2: Iron and steel industry

Émissions de sources fixes - Détermination des
émissions de gaz à effet de serre (GES) dans les
industries énérgo-intensives - Partie 2: Industrie
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Emissionen aus stationären Quellen - Bestimmung von
Treibhausgasen (THG) aus energieintensiven
Industrien - Teil 2: Stahl- und Eisenindustrie

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EN 19694-2:2016 (E)**European foreword**

This document (EN 19694-2:2016) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by January 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate M/478 given to CEN by the European Commission and the European Free Trade Association.

This European Standard deals with sector-specific aspects for the determination of greenhouse gas (GHG) emissions from steel production. This standard can be used to measure, report and compare the GHG emissions of a steel facility. It can also be used to assess the GHG performance of a steel facility or parts of it.

EN 19694, *Stationary source emissions — Determination of greenhouse gas (GHG) emissions in energy-intensive industries* consists of the following parts:

- *Part 1: General aspects*
- *Part 2: Iron and steel industry*
- *Part 3: Cement industry*
- *Part 4: Aluminium industry*
- *Part 5: Lime industry*
- *Part 6: Ferroalloy industry*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The steel industry recognizes the urgent need to take action to combat climate change. Slowing and halting global warming will require substantial reductions in greenhouse gas emission on a global scale. To play a part in achieving these reductions, steel production sites, recognized as major emitters of GHG, should as a first step assess their CO₂ emission performance relating to the production of steel products in order to identify and quantify emission reduction opportunities.

Steel production involves complex chemical reactions, successive heating cycles, and the recycling of various by-products. A variety of inputs, including raw materials, reactive agents, fuel and heat sources are transformed into a wide range of steel products, by-products, waste materials and waste energy.

Steel sites manufacture a wide range of products including, among others, sheet products, plate products, long products, pipe and tubes. In addition, some steel sites produce unique high-performance specialty steel products, which are created by employing various sub-processes including micro-alloying and surface treatment, thus requiring additional heat treatments. Therefore, there are no two steel sites in the world which are the same. As a consequence, a sound assessment of performance should be made independent of the production structure.

Regulations related to climate change require steel companies to devise methods to reduce CO₂ emissions from steel sites while continuing to produce steel products from these diverse and complex steelmaking processes. To accomplish this, it is desirable to have universally common indicators for determining the CO₂ emission performance of a site.

It has been the usual practice to determine CO₂ emissions at facility level, from which a CO₂ intensity per unit of reference product, usually "crude steel", can be derived. ISO TC 17/SC /WG 21 has proposed and issued a standard for the determination of CO₂ intensity derived from the method developed by worldsteel (the world steel association) as ISO 14404-1 and ISO 14404-2.

Although giving a valuable insight on CO₂ emission performance, the "CO₂ intensity" approach suggested by the ISO 14404 standards series has some limitations as it provides only one single CO₂ value for any specific facility, regardless of the complexity of its structure.

With a view to better evaluating the CO₂ performance of a facility along the steel value chain, the European Steel Industry has, since 2005, worked to set up CO₂ accounting rules aimed at carrying out the CO₂ emission performance assessment of steel production facilities while taking into account and properly addressing potential distortions due to differing facility structure. To this end, this standard goes beyond the mere "CO₂ intensity" approach to determine the performance of each process and unit that is part of the facility in order to identify the strengths and weaknesses in the value chain and, at a later stage, consolidate the performance at facility level.

As stressed in Part 1 of this standard series, this standard does not prejudice the content or application of any other standard or legal provision.

EN 19694-2:2016 (E)**1 Scope**

This European Standard provides a harmonized methodology for calculating GHG emissions and GHG performance in the steel industry.

This European Standard applies to facilities producing any of the multiple products of the steel value chain. It is supported by a set of worksheets [1].

This European Standard deals with the specific aspects for the determination of GHG emissions from steel production and the assessment of emission performance. This standard is to be used in conjunction with EN 19694-1, which contains overall requirements, definitions and rules applicable to the determination of GHG emissions for energy-intensive sectors, thereby providing a common methodological approach.

EN 19694-1 and EN 19694-2 provide a harmonized method for:

- a) measuring, testing and quantifying methods for the determination of greenhouse gas (GHG) emissions;
- b) assessing the level of GHG emissions performance of production processes over time, at production sites;
- c) the establishment and provision of reliable and accurate information of proper quality for reporting and verification purposes.

In addition, this standard provides a stepwise approach for the determination of CO₂ emissions and the assessment of CO₂ performance of steel facilities, providing a set of methodologies allowing for a fair and reliable assessment of the CO₂ performance of each individual process along the steel production value chain.

It can be seen as a toolbox which enables the determination of CO₂ emissions and the assessment of CO₂ performance of steel production facilities at various levels of disaggregation, establishing a sound system for:

- the evaluation of the global CO₂ performance of a steel production facility taking its production structure into account;
- setting a reliable basis for evaluation of the CO₂ reduction potential in a facility and the contributing processes;
- setting a basis for accurate evaluation of new technologies.

Next to the determination of the direct and indirect CO₂ emissions of a steel facility, this standard has a strong focus on performance assessment which it strives to address through the following aspects:

- assessment of CO₂ impact, including process emissions: this methodology evaluates the total CO₂ emission of a steel facility, with the carbon content of the waste gases burdened as CO₂ to the processes giving rise to them;
- assessment of the actual CO₂ impact: this methodology evaluates the total CO₂ emissions released by a steel facility, but considers waste gases exported or used in a power plant as equal to natural gas in terms of CO₂ emissions;
- carbon input CO₂ performance at facility level: this methodology delivers an indicator comparing the facility performance with best practice, on the basis of the carbon input to the system;

- CO₂ performance assessment at process level: this methodology delivers a set of indicators comparing process performance with best practice at unit level. These indicators are then combined as a consolidated figure for the whole facility. This methodology also provides a theoretical assessment of the CO₂ saving potential up to best practice.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 19694-1, *Stationary source emissions — Determination of greenhouse gas (GHG) emissions in energy intensive industries — Part 1: General aspects*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

boundaries

organizational or technical limits of a facility or plant

Note 1 to entry: The wording of “battery limits” can also be utilized.

3.2

Electric Arc Furnace facility

steel production facility based entirely or partially on the use of recycled scrap melted in an electric arc furnace

Note 1 to entry: By extension, this type of facility can incorporate a direct reduction production unit.

3.3

integrated facility

steel production facility based on use of virgin iron ores applying the blast furnace route

3.4

net use

net use of a source stream is the amount of fuel, material or energy which is used at the reporting boundaries during the reporting period.

Note 1 to entry: It can be calculated for the total facility from procurements, deliveries and stock variations or at process level from external use and net generation excluding internal recycling.

3.5

processing CO₂ emissions

CO₂ emissions related to the transformation of upstream to downstream products incorporating direct emissions and indirect emissions resulting from procurements

Note 1 to entry: The processing emissions do not include the indirect emissions of upstream products.

EN 19694-2:2016 (E)**3.6****reference CO₂ saving potential**

saving potential calculated by taking the difference between the emissions of a plant or facility and the emissions of the corresponding reference plant or facility

Note 1 to entry: This concept is a theoretical one and does not necessarily represent the actual CO₂ saving potential that is technically and economically achievable.

3.7**equipment or unit**

technical unit for achieving a specific operation

3.8**total CO₂ emissions**

sum of direct and indirect CO₂ emissions

3.9**upstream energy**

energy used for the production of one unit of a source stream

4 Abbreviations

ARP achievable reference performance

ASU air separation unit

BF blast furnace

BFG blast furnace gas <https://standards.iteh.ai/catalog/standards/sist/effe3ad6-07ae-4623-84b0-efcf8e170e2d/sist-en-19694-2-2017>

BOF basic oxygen furnace

BOFG basic oxygen furnace gas

CDQ coke dry quenching

COG coke oven gas

DRI direct reduced iron

EAF electric arc furnace

EF emission factor of a source stream

GHG greenhouse gases

HBI hot briquetted iron

HM hot metal

HP high pressure

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IEeq	indirect emission equivalent factor of a source stream
IPCC	Intergovernmental Panel on Climate Change
LP	low pressure
LPG	liquefied petroleum gas
SRG	smelting reduction gas

5 Scope of reporting for the iron and steel industry

5.1 Plants, processes and boundaries

5.1.1 General

The steel production route involves a number of different processes, which can be operated on site or externalized. Also in each process, some operations can be externalized or may simply not exist so that particular care has to be taken when defining the system boundaries. A list of the processes that can take place in a steel production facility is given hereafter. Their technical boundaries (list of processes or units to be included in the reporting when existing) are given in Annex A.

5.1.2 Integrated steel making

The related plants and processes are:

- a) coke plant – coke making;
- b) sinter plant – sintering;
- c) pellet plant – pelletization;
- d) blast furnace plant – blast furnace iron making;
- e) BOF plant – BOF steel making including BOF converter, secondary metallurgy and casting.

5.1.3 EAF steel making

EAF steel making is a short production route since in most case, it only implements an EAF plant including the electric arc furnace, secondary metallurgy and casting.

5.1.4 Other primary processes

Beside the blast furnace, some alternative processes have been developed to produce primary iron for use in steel making processes:

- a) gas based direct reduction plant – DRI/HBI making;
- b) coal based direct reduction plant – DRI/HBI making;
- c) smelting reduction plant – iron making.

5.1.5 Rolling mills

A variety of rolling mills are used to transform crude steel into commercial products and the types of rolling mills considered in this standard are:

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- a) cogging mill for primary rolling of ingots;
- b) billet mills;
- c) hot strip mill and compact strip mills for production of flat steel;
- d) plate mills;
- e) bar and rod mills;
- f) section mills for production of medium and heavy profiles;
- g) wire rod mills;
- h) seamless tube mills.

5.1.6 Downstream processes

Downstream treatments apply only to flat rolled products which are transformed into various final products by a succession of operations. Due to the large range of product quality that can be produced by these processes, the operation results vary widely between different sites and, therefore, these processes are excluded from the scope of process performance assessment. Should any operator want to enlarge the scope of assessment, the list of processes to include is given below:

- a) pickling;
- b) cold rolling;
- c) annealing which can be batch or continuous;
- d) hot dip metallization;
- e) electrolytic metallization including electro-galvanizing, tin plating, tin free plating and other metal coating;
- f) organic coating.

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5.1.7 Other processes

Additional processes, which can be implemented in a steel production facility, are among others:

- a) forging;
- b) heat treatment (for plates, sections, tubes, forged pieces);
- c) dust treatment;
- d) lime production (calcining);
- e) steam raising and power generation;
- f) air separation;
- g) flaring of excess gas;

- h) other plants including facility offices, general maintenance shops, on-site transport, central water treatment and water networks.

5.2 Products and by-products

5.2.1 General

A product is the intended output of an activity; it can be a final product delivered to external customers or an input for a downstream plant or process. It is the reference output of a plant or process and can be accompanied by associated by-products or wastes. Only by-products having a noticeable impact on GHG emissions are considered in this standard. Products can be produced on site or procured from other operators. The full list of products and possible by-products is given in Annex B and the classification of products is indicated below.

5.2.2 Upstream products

Upstream products include all products starting from raw materials to hot rolled products which are the first level delivered to customers. They are:

- a) coke;
- b) sinter;
- c) pellets;
- d) direct reduced iron (DRI/HBI);
- e) hot metal;
- f) crude steel;
- g) roughing mill semis;
- h) hot rolled products.

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5.2.3 Downstream products

Downstream products result from the primary transformation of hot rolled steel and are mainly concerning flat products. They are:

- a) pickled coils;
- b) cold rolled coils;
- c) annealed coils;
- d) hot dip galvanized coils;
- e) electro-galvanized coils;
- f) tin plated coils;
- g) tin free coils;
- h) other metal coated coils;

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- i) organic coated coils.

5.2.4 Other products

Other products are:

- a) forged pieces;
- b) heat treated products;
- c) treated dust DRI/Pig iron.

5.3 Energy, utilities and other materials

The iron and steel industry uses a large number of energy sources, utilities and other material sources. A number of these streams may have an impact on GHG emissions due to their carbon content and/or the indirect emissions they involve. Based on experience of existing production sites, a list is given in Annex B according to the following classification:

- a) solid and liquid fuels and reducing agents: coal, coke, anthracite, heavy oil, light oil, diesel oil, LPG, charcoal, used plastics and tires and others. Annex B gives a detailed list of solid and liquid fuels and reducing agents considered in this standard;
- b) gaseous fuels: other than the four gases generated by the steel production processes (COG, BFG, SRG, BOFG) and listed as by-products of the corresponding processes, the steel industry uses natural gas mainly for combustion purpose but also as a reducing agent in direct reduction furnaces or blast furnaces. In specific locations, other gases can be used such as coal mine gas or tail gas from treatment of process gas;
- c) utilities: electricity, heat and industrial gases;
- d) miscellaneous materials including iron ores, scrap, fluxes, alloys and electrodes;
- e) residues which can be by-products or wastes arising from the processes are considered only when they have an impact on GHG emissions.

5.4 Greenhouse gases in the steel industry

As demonstrated by the different field tests carried out to support this standard, CO₂ is the only relevant greenhouse gas in the steel industry.

5.5 Processes and reference products

The assessment of CO₂ emission performance of a process requires, as a first step, the determination of its CO₂ emission intensity (expressed as kg of equivalent CO₂ per tonne of reference product). The reference products of the processes included in the scope of performance analysis are given in Table 1.

Table 1 — Reference products of process

Process	Reference product
Coke making	Total dry wharf coke discharged from coke quenching excluding quenching breeze or CDQ dust
Sintering	Equivalent bell sinter calculated as merchant sinter production x screening ratio at blast furnace
Pelletizing	Equivalent bell pellets calculated as gross pellet production x screening ratio at blast furnace
Gas-based DRI	Total amount of DRI/HBI delivered by the process (including DRI screening fines)
Coal-based DRI	Total amount of DRI after separation of coal char and fluxes (including DRI fines)
Blast furnace iron making Smelting reduction iron making	Total amount of liquid hot metal at tap hole
BOF/EAF steel making & cogging mills ^a	Total amount of continuous casting semis for subsequent use+ amount of ingots not used in cogging mills + amount of cogging mill semis
Hot rolling mills	Total amount of hot rolled products for subsequent use
Other process	Total amount of product
Lime kilns	Total amount of lime + dolime produced
^a In case of ingot casting, the crude steel product is not ready for hot rolling operation and a first step of rolling (cogging) is necessary to prepare a semi-product similar to crude steel from continuous casting. Including the cogging mill in the crude steel production step clearly highlights the interest of developing continuous casting for reduction of GHG emissions.	

5.6 Units

The units used in this standard are as follows:

- a) solid materials: metric tonne (t) of dry material;
- b) liquid fuels: metric tonne (t) or cubic meter (m³), depending on local practice;
- c) gaseous fuels (or fuel gases): the flow of any gaseous fuel can be expressed either as thousand cubic meters at normal temperature and pressure (1013,25 hPa (1 atm), 273,15 K) on dry basis or as Gigajoule net calorific value (GJ ncv) with reference to H₂O as water vapour;
- d) utilities and industrial gas: the units are Megawatt.hour (MWh) for electricity, metric tonne (t) for steam and hot water and thousand cubic meters at normal temperature and pressure (1 013,25 hPa (1 atm), 273,15 K) for industrial gas;
- e) CO₂ emissions: metric tonne (t CO₂).

6 Basic principles of CO₂ emission determination

6.1 General

The determination of CO₂ emissions can be done either through calculation (carbon mass balance method) or through stack emission measurement. Given the relatively high number of stacks in a steel