



ISO 14404-1

Calculation method of carbon dioxide emission intensity from iron and steel production —

Part 1: Steel plant with blast furnace

Méthode de calcul de l'intensité de l'émission de dioxyde de carbone de la production de la fonte et de l'acier —

Partie 1: Usine sidérurgique avec haut fourneau

Second edition
2024-09

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This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 21, *Environment related to climate change in the iron and steel industry*.

This second edition cancels and replaces the first edition (ISO 14404-1:2013), which has been technically revised.

The main changes are as follows:

- revision of Introduction, Terms and definitions, and default emission factors;
- addition and revision of some emissions sources;
- clarification of the difference between "Boundary" and "Site boundary";
- revision of the calculation method of by-product gas;
- addition of a new informative annex, [Annex E](#) on "Decarbonization strategies and its impact in CO₂ Calculation Method" to give guidance on future relevant emission source categories as new materials and processes become widely applicable at industrial level.

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The steel industry recognizes the urgent need to take actions concerning climate change. Slowing and halting global warming requires reductions in GHG emissions on a global scale. To play a part in achieving these reductions, it is necessary for steel plants to identify the amount of CO₂ emitted during the production of steel products, in order to identify next opportunities for reduction of CO₂ on their pathway to decarbonization.

The production process of steel involves complex chemical reactions, various heating cycles, and the recycling of various by-products. This variety of imports, including raw materials, reactive agents, fuel and heat sources are transformed into a wide range of steel products, by-products, waste materials and waste heat.

Steel plants manufacture a vast range of products with various shapes and specifications including: flat items, long items, pipes, tubes and many others. In addition, they produce unique specialty-grade steel products with high-performance. These are achieved using a number of sub-processes including micro-alloying and applying surface treatments like galvanizing and coating, which require additional heat treatments. The variety of products manufactured and processes used means no two steel plants are identical.

Climate regulations in each country require steel companies to devise methods to lower CO₂ emissions from steel plants while continuing to produce steel products by these diverse and complex steelmaking processes. To accomplish this, it is desirable to have universally common indicators for determining steel plant CO₂ emissions.

Additionally, there are other aspects related to the heterogeneous nature of the steel industry around the globe other than assets characteristics, that should be taken into account (inputs availability; market and business environment, innovation) when looking for commonalities in calculation methodologies to ensure consistency and comprehensiveness.

There are many methods for calculating CO₂ emission intensity from steel plants and specific processes. Each method was created to meet the objectives of a particular country or region. In some cases, a single country can have several calculation methods in order to fulfil different objectives. Each one of these methods reflects the unique local characteristics of a particular country or region. Therefore, these methods cannot be used for comparisons of CO₂ emission intensity from steel plants located in different countries and regions.

To overcome this methodological fragmentation, the World Steel Association (worldsteel) has developed a calculation method for CO₂ emission intensity of steel plants. This calculation method was developed to facilitate steel plant CO₂ emissions. It helps members keep track of their CO₂ emissions intensity relative to the other member steel companies located in different places in the world. An agreement was reached among members, and worldsteel has issued the method as a guideline called “CO₂ Emissions Data Collection User Guide.” Actual data collection among worldsteel members based upon the guide started in 2007. Furthermore, worldsteel is encouraging even non-member steel companies to begin using the guide to calculate CO₂ emission intensity of their steel plants.

The present ISO 14404-1 revision is based on worldsteel’s CO₂ Data Collection Users Guide, version 11^[4], reviewed in 2022, and follows ISO14404-4.

This calculation method establishes clear boundaries for collection of CO₂ emissions data. The net CO₂ emissions and production from a steel plant are calculated using all parameters within the boundaries. The CO₂ emission intensity of the steel plant is calculated by the net CO₂ emission from the plant using the boundaries divided by the amount of crude steel production of the plant. With this methodology, the CO₂ emission intensity of steel plants is calculated irrespective of the variance in the type of process used, products manufactured and geographic characteristics.

This calculation method only uses basic imports and exports that are commonly measured and recorded by the plants; thus, the method requires neither the measurement of the specific efficiency of individual equipment or processes nor dedicated measurements of the complex flow and recycling of materials and waste heat. In this way, the calculation method ensures its simplicity and universal applicability without requiring steel plants to install additional dedicated measuring devices or to collect additional dedicated data other than those commonly used in the plant management. Even though, the use of measured carbon content and net calorific values are highly recommended to obtain more accurate emissions accounting for

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parties, these distinctions should be clearly stated.

With this method, a steel company can calculate a single figure for the CO₂ emissions intensity of a steel plant as a whole. By observing changes in CO₂ emissions intensity over time using this methodology, steel companies can evaluate whether their efforts to reduce CO₂ emissions are being properly implemented. As was explained earlier, most steel plants manufacture a vast range of products with various shapes and specifications. This calculation method is simple and universally applicable because it is not affected by the differences in the production processes of such diverse products, and treats a whole steel plant as one unit with one CO₂ emission intensity. Therefore, this calculation method is not applicable for calculating and determining the carbon footprint of any specific steel product.

When comparing CO₂ emission intensity between different steel plants, it should be kept in mind that each steel plant has a different composition of manufacturing products and that the energy sources and raw materials available varies among countries and regions. In addition, since the ISO 14404 series strictly defines the boundary of the target process route for each part, only steel plants using the same part of the ISO 14404 series (i.e. ISO 14404-1, ISO 14404-2, ISO 14404-3) can be compared with each other. Note that the default emission factors provided in the ISO 14404 series are global averages and is not adjusted to reflect regional differences in energy sources and raw materials. When calculating total CO₂ emissions or CO₂ emission intensity for inventory or benchmarking purposes, the emission factors applicable to the conditions of the target country or region should be selected.

In order to give guidance to users on which areas of interest will be dealt with as future sources for direct and indirect CO₂ emission factors in programmed revisions of this document, a tentative list is provided in [Annex E](#).