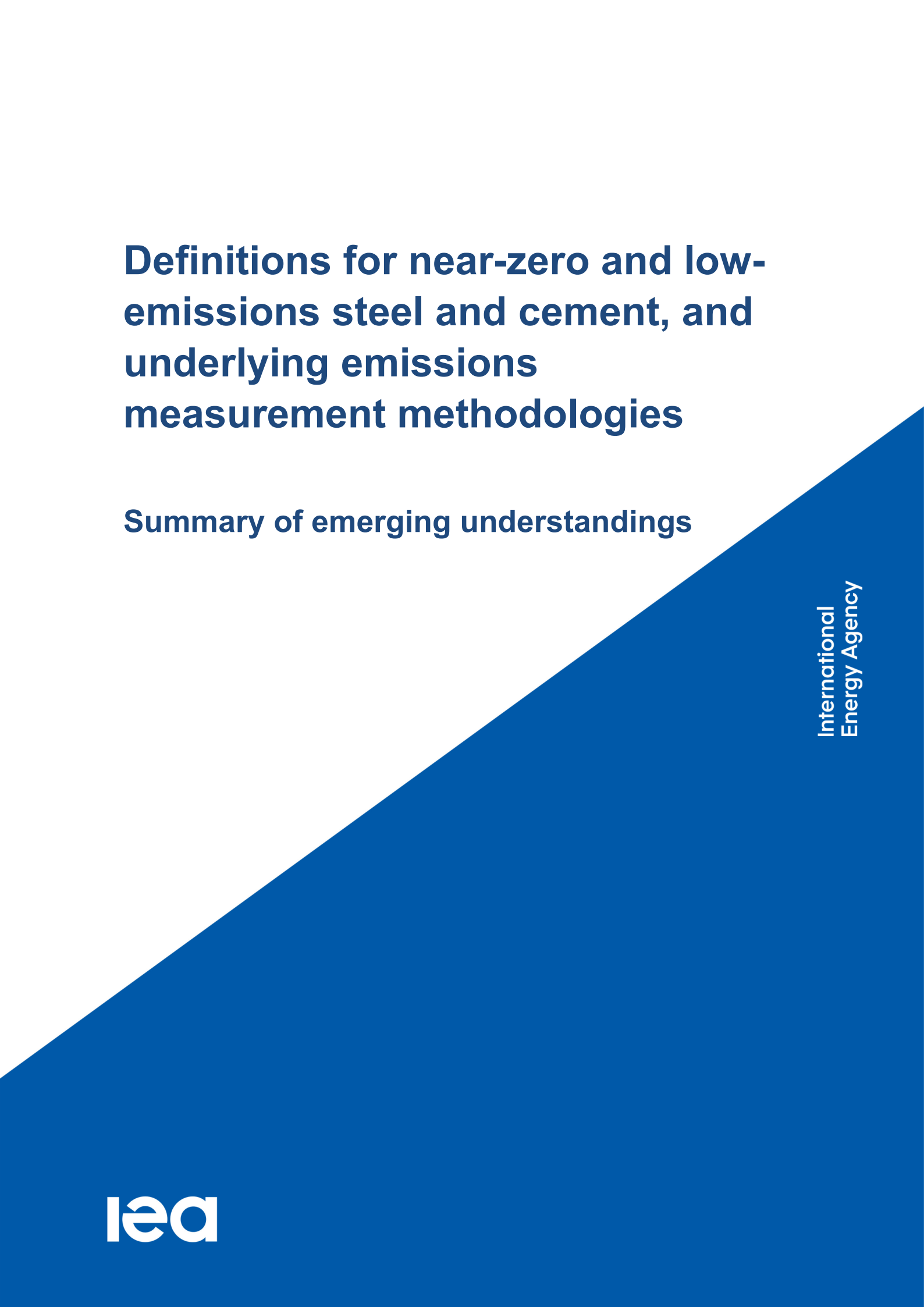
Definitions for near-zero and low-emissions steel and cement, and underlying emissions measurement methodologies

Summary of emerging understandings

International Energy Agency



INTERNATIONAL ENERGY AGENCY

The IEA examines the full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, demand side management and much more. Through its work, the IEA advocates policies that will enhance the reliability, affordability and sustainability of energy in its 31 member countries, 13 association countries and beyond.

IEA member countries:

Australia
Austria
Belgium
Canada
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Japan
Korea
Lithuania
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Spain
Sweden
Switzerland
Republic of Türkiye
United Kingdom
United States

The European Commission also participates in the work of the IEA

IEA association countries:

Argentina
Brazil
China
Egypt
India
Indonesia
Kenya
Morocco
Senegal
Singapore
South Africa
Thailand
Ukraine

Source: IEA.
International Energy Agency
Website: www.iea.org

Acknowledgements

Definitions for near-zero and low-emissions steel and cement, and underlying emissions measurement methodologies: Summary of emerging understandings was prepared by the Energy Technology Policy (ETP) Division of the Directorate of Sustainability, Technology and Outlooks (STO) of the International Energy Agency (IEA). The project was designed and directed by Timur Gül, IEA Chief Energy Technology Officer. Araceli Fernandez Pales, Head of the Technology and Innovation Unit provided guidance throughout the development of the report. The lead author was Tiffany Vass.

The development of this paper benefitted from contributions provided by the following IEA colleagues: Peter Levi, Isabel Geppert, Antonella Pasetto, and Andrew Ruttinger.

Per Anders Widell provided essential support. Lizzie Sayer edited the manuscript. Thanks also to Astrid Dumond of the Communications and Digital Office.

This paper has been prepared as a follow-up to the 2022 IEA report, Achieving Net Zero Heavy Industry Sectors in G7 Members and the 2023 IEA report Emissions Measurement and Data Collection for a Net Zero Steel Industry, and as part of discussions over the course of 2024 in the IEA's Working Party on Industrial Decarbonisation (WPID) and the Climate Club. The paper benefited from insights and views shared by government and non-governmental stakeholders in several WPID and Climate Club meetings held throughout the year. Additionally, governments submitted input via a questionnaire conducted between May and August, and through direct written feedback.

Industry and other non-governmental reviewers provided essential written feedback to improve the quality of the paper. They include: Helén Axelsson (Jernkontoret), Nia Bell and Jen Carson (Climate Group), Daniel Boero Vargas (World Economic Forum), Agnes Borg and Jesper Kansbod (SSAB), Clare Broadbent (World Steel Association), Alli Devlin and Annie Heaton (ResponsibleSteel), Samuel Flückiger (thyssenkrupp Steel), Peter Hemingway and Fiona Skinner (UNIDO), Yannick Hemmerlé, Mauro Pisu and Jonas Teusch (OECD), Fragkoulis Kanavaris (Arup), Malgorzata Kasprzak and Roland Kupers (UNEP), Yinghao Liu and Xiang Meng (China Baowu), Andrew Minson (Global Cement and Concrete Association), Christoph Müller (German Cement Producers Association [VDZ]), Adina Renee Adler (Global Steel Climate Council), Markus Steinhäusler (voestalpine), Yoshio Takagi (Japan Iron and Steel Federation), and Hiroyuki Tezuka (JFE Steel Corporation).

The individuals and organisations that contributed to this study are not responsible for any opinions or judgements it contains. The work reflects the views of the International Energy Agency Secretariat but does not necessarily reflect those of individual IEA member countries, WPID members, Climate Club members, or of any particular funder or collaborator. All errors and omissions are solely the responsibility of the IEA.

Table of contents

Executive Summary

Definitions can provide a common language to help accelerate the net zero transition in industry

A common global understanding on definitions for near-zero emissions and low-emissions materials is a crucial enabler of the industry transition to net zero. These definitions can underpin multiple enabling policy mechanisms to stimulate demand and accelerate deployment of the technologies needed for steel and cement decarbonisation. Clarity on definitions is needed to provide a higher degree of certainty, which would enable the private sector to move forward with the required investments for the transition.

Globally interoperable definitions can be used by countries in policies in accordance with their own circumstances. A common international understanding on definitions is important given the global nature of industrial markets, in order to reduce reporting burden on the private sector and send a clear market signal on the direction of travel. Definitions are a common language or tool, that can then be employed in policies by different countries in line with their own starting points and targeted paces of transition.

Definitions for near-zero emissions and low-emissions materials have distinct and complementary functions. "Near-zero emissions" is specifically reserved for technologies that are already compatible with an energy system at net zero emissions. Distinctive recognition of such performance already today is critical, particularly given the higher risks and costs that come with development and early deployment of innovative technologies. Incentivising these technologies now can help kick-start market uptake, paving the way to eventual widespread diffusion. Meanwhile, the "low-emissions" designation recognises substantial progress and emissions reductions towards the ultimate near-zero goal while not fully achieving it. Given that it will take time for the full market to transition to near-zero emissions technologies, policies that in parallel incentivise scale-up of increasingly lower-emission technologies are also valuable.

Common understanding is emerging on principles for definitions and near-zero emissions thresholds

To send the required market signal, near-zero emissions definitions should be ambitious and stable, among other characteristics. Common principles can provide a guide and set of guardrails for developing and assessing definitions. Based on emerging proposals and stakeholder discussions, the following

principles are proposed for near-zero emissions definitions of materials: ambitious (compatible with the net zero endpoint), stable (the same over time to send a consistent market signal), technology neutral (not excluding any technologies compatible with the net zero endpoint), globally consistent (applies regardless of where materials are produced or consumed to facilitate communication across global markets), physical (technologies are deployed that enable near-zero emissions without offsets or emissions reductions credits), transparent (emissions boundaries, accounting methods and inputs materials are made clear), and accessible (as simple as possible without compromising rigour).

A strong global common understanding is emerging around near-zero emissions threshold values for steel and cement among major proposals to date. In 2022, the IEA Secretariat derived near-zero emissions definitions based on its net zero scenario analyses. For steel, the threshold ranges from 400-50 kg CO_2 equivalent (CO_2-eq) per tonne of crude steel, depending on the scrap share. For cement, the threshold ranges from 125-40 kg CO_2-eq per tonne of cement, depending on the clinker ratio. Proposals and use by industry and multi-stakeholder processes are converging around very similar values compatible with the net zero endpoint, including from ResponsibleSteel, the Low Emission Steel Standard, the Global Steel Climate Council, the China Iron and Steel Association, the Industrial Deep Decarbonisation Initiative's pledge, and the First Movers Coalition, among others. The Global Cement and Concrete Association has translated the cement threshold to the concrete level, arriving at values for near-zero emissions concrete of 21-36 kg CO_2-eq per metre cubed, depending on the concrete strength. If the international community can continue converging towards existing proposals and using them in a transparent and interoperable manner rather than creating additional new proposals, it would greatly help bring clarity to global markets.

A wider range of approaches to low-emissions definitions has emerged, raising the importance of clear communication and transparency around their use. Since the transition pathway will differ according to regional circumstances, and implies different technology mixes and degrees of emissions reductions over time, the approach to defining low-emissions has greater variation and flexibility than defining near-zero emissions. Still, common principles can guide the development of such definitions, to ensure they support the transition and result in substantial emissions reductions leading towards the ultimate near-zero goal. The following principles are proposed for low-emissions definitions of materials: ambitious, with clear communication on the ambition level; signals need for progressive improvement over time; technology neutral; global coherence while accounting for regional starting points; clear communication on chain of custody; transparent; and accessible. The principles are in parallel to those for near-zero emissions but take into account the broader potential and the wider diversity of approaches for low-emissions definitions.

Existing emissions measurement methodologies and reporting tools can be adapted to facilitate the net zero transition

Emissions measurement methodologies underpin definitions, as well as multiple other mechanisms to enable the industrial transition. Existing emissions measurement methodologies (such as International Organization for Standardization [ISO] standards, EU Environmental Footprint Methods) and emissions reporting and labelling tools (such as Environmental Product Declarations, Digital Product Passports) already provide a robust basis for measuring steel and cement emissions, and should be used wherever possible in policies and for evaluation with respect to meeting definitions thresholds.

Updates and revisions may be needed to ensure these existing methodologies and reporting tools are fit-for-purpose. The IEA Secretariat has proposed to follow its Net Zero Measurement Principles to guide revisions of emissions measurement methodologies towards increasing interoperability and net zero compatibility; facilitate like-for-like comparison between production from all facilities; produce coherent and interoperable results for both production and products; have a comprehensive emissions boundary and scope that covers the main sources of emissions in the supply chain; apply net zero compatible accounting rules for emissions credits and co-products; and incentivise the use of site- and product-specific auditable measured data. Increasing stakeholder engagement in the processes of standards bodies, including ISO and regional and national standards bodies, could help accelerate such revisions.

1. Definitions: a critical enabler of industrial decarbonisation

A common understanding of what constitutes near-zero emissions and low-emissions materials is crucial to facilitate markets and enabling mechanisms for industrial decarbonisation and clean energy transitions. Definitions for near-zero and low-emissions materials provide a foundation for multiple targeted policies that governments may choose to use, including green public procurement, certification and labelling schemes, minimum market share regulations (quotas), product design standards, finance and funding requirements, policies to address high emissions intensity in production processes, and trade-related policies. Targeted demand and supply policies of this kind can address specific challenges of the industrial transition. They can complement and even strengthen broader policies, such as carbon pricing and measures promoting recycling, circularity and material efficiency.

Several proposals for definitions have emerged, and a common understanding and clarity are needed. In particular, private sector buyers are demanding reliability and clarity concerning goods on the market, while industrial producers need to secure buyers in order to make the business case for scaling up new lower-emissions production. The current uncertainty created by the lack of an international agreement on definitions can lead to non-action in the private sector.

Global alignment on definitions has multiple advantages, including coherence and reduced burden for producers and buyers operating across multiple jurisdictions, facilitating trade of near-zero and low-emissions materials and products, providing a common language for tracking progress (e.g. tracking global deployment of near-zero emissions steel over time in the same way that global deployment of zero-emissions vehicles is tracked), and sending a clear signal to global markets on direction of travel for reaching net zero.

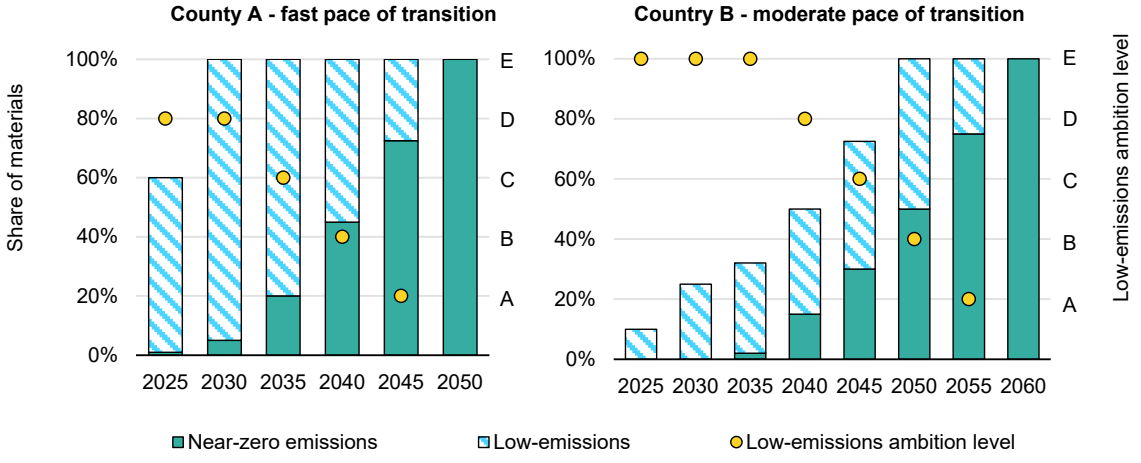
Common global definitions are a tool that can be used by countries according to their own climate targets and circumstances, including the country's starting point (e.g. current portfolio of technologies and the resulting emissions intensity) and the country's targeted pace of transition.[1] It is important not to confuse product- and plant-level definitions and thresholds (which recognise performance of individual products or plants, and often recognise performance by "first movers"

[1] Agreeing on common definitions does not bind any country to any particular application within policies, nor to any particular timeline for transitioning. While international discussions on increasing alignment in ambition and pace for industrial decarbonisation among countries are needed, such discussions are separate from discussions on alignment on definitions.

or those otherwise ahead of the average, in particular) with economy-wide and sector-level targets or standards (which may set objectives for total sectoral emissions, or requirements that must be achieved by all products and plants either individually [e.g. maximum emissions performance requirements] or collectively [e.g. sectoral average emissions performance requirements]). While they can be used together in policies, and in some cases a policy could apply a product- or plant-level definition to the whole sector, they are not the same in many instances and should not be automatically taken as such.

Two countries may choose to follow two different timelines in their policies for increasing the market share of near-zero and low-emissions material production, as illustrated in the figure below. Despite their transitions occurring at different paces, the policies can use the same set of definitions – comprised of thresholds for near-zero emissions and for different levels of low-emissions (ambition levels A through E, with level E allowing higher emissions and level A requiring the lowest emissions). Using the same set of definitions means that producers and buyers operating in both countries can use the same "language" to communicate. This illustrative example of only two countries can be extrapolated to the global situation, where common definitions would facilitate common communication across international markets, even as different countries have their own decarbonisation goals and paces. In particular, emerging markets and developing economies may, in some instances, require more time and potentially technical assistance to adopt definitions and related policies.

Hypothetical example of policy targets following two different decarbonisation timelines to scale up near-zero and low-emissions materials using common definitions



Notes: In this illustrative example, the left axis represents possible policy targets for a share of near-zero and low-emissions materials in a country's public procurement or material production regulation. The right axis shows possible low-emissions targets for thresholds (ambition levels), assuming a system that has low-emissions ambition levels A through E, where E is the least ambitious and A is the most ambitious; the axis represents the highest-emitting ambition level that is allowable.

Definitions for both near-zero and low-emissions materials are useful because they help achieve different policy objectives. Near-zero emissions definitions are needed to incentivise the development and progressive deployment of technologies compatible with an energy system at net zero emissions. Low-emissions definitions incentivise substantial incremental progress and emissions reductions towards the ultimate near-zero goal while not fully achieving it. These two types of definitions are complementary and should be clearly distinguished from each other.

To facilitate continued international alignment on definitions and provide guidance for governments and other stakeholders to build upon, this document suggests key common principles for the definition of near-zero and low-emissions materials (Section 2), elaborates emerging approaches to thresholds (Sections 3 and 4), highlights key principles for the emissions measurement methodologies that underpin definitions (Section 5) and summarises current suggestions and potential next steps for measurement methodologies (Section 6).

The document draws on a common understanding that is emerging among major definitions proposals for steel and cement made to date by international organisations, initiatives and industry associations. It should be noted that various governments are at different stages in determining views on definitions and some are currently undertaking national consultations and policy development processes on the topic. The topic is also under discussions in several international fora, including the Climate Club, the IEA's Working Party on Industrial Decarbonisation (WPID), and the Clean Energy Ministerial's Industrial Deep Decarbonisation Initiative.

The usefulness of both near-zero and low-emissions definitions

Policy makers should have a clear picture of what they are aiming to achieve, and how this helps the transition to net zero. The chosen policy objective will have an impact on the definitions chosen and their application in the policy. Policy objectives linked to definitions can be broadly grouped into those that aim to incentivise the following:

1. Scaling up and creating markets for innovative technologies that are compatible with the net zero endpoint. This policy objective is most closely associated with definitions for "near-zero emissions" materials. Technologies such as direct reduced iron (DRI) steel production with 100% hydrogen from low-emissions sources or a cement plant with full carbon capture and storage require innovation and often have high risk and cost for initial deployment. Policies that aim to support early scale-up of these technologies in the near term are critical to

enable learning, reduce costs and increase acceptance, in order to support more widespread deployment in the medium to long term. Furthermore, since investments in industrial plants are large and the lifetimes of plants are long, there is value in already today incentivising technologies compatible with net zero for new plants and major retrofits – the overall transition is likely to consist of step changes in emissions for individual plants successively, rather than a gradual reduction in emissions at similar speeds across all plants.

2. Valuing interim steps towards the net zero objective. This policy objective is most closely associated with definitions for "low-emissions". Since it will take time for the full market to transition to near-zero emissions technologies, policies that in parallel incentivise scale-up of increasingly lower-emission technologies are also valuable. Targeted support policies are particularly useful to incentivise deployment of transformational technologies that already substantially reduce emissions and are capable of transitioning over time to achieve near-zero emissions. Examples include natural gas DRI steel production with increasing blending of hydrogen over time, or carbon capture, utilisation and storage (CCUS)-equipped cement plants capturing only process emissions initially but transitioning to zero-emissions fuels over time to eliminate combustion emissions.

3. Addressing high emissions intensity in production processes. This policy objective is most closely associated with definitions for "low-emissions", if used to require emissions reductions from production that does not fall below a low-emissions threshold. Taking into account the time needed for the transition and economic implications, policies may require industries to lower emissions intensity in their production process according to the circumstances of each country. Such policies could be used to address the reduction of emissions from unabated energy-intensive facilities.

A robust and internationally-recognised set of definitions for "near-zero emissions" and "low-emissions" materials can be used together in carefully designed policies to achieve any or all of these policy objectives, according to targeted timelines.

2. Principles for definitions

As a number of definition proposals have recently been or are currently being developed, a first and important point of agreement is on the principles that should underlie such definitions. This section elaborates principles for near-zero and low-emissions definitions that can help ensure that definitions are robust, and best aid the transition to net zero. These principles can be used as a guide in working towards common definitions.

Principles for near-zero emissions definitions

A common understanding is emerging that definitions for near-zero emissions steel and cement production should adhere to principles in line with those laid out in the 2022 report Achieving Net Zero Heavy Industry Sectors in G7 Members, prepared by the IEA Secretariat under the G7 Industrial Decarbonisation Agenda. Near-zero emissions definitions should be:

- **Ambitious.** The emissions threshold should be compatible with the end point of a net zero energy system, in line with the IEA's scenario analyses.[2] This includes only permitting limited residual industrial emissions that are very difficult and costly to abate, and at or below the level of emissions remaining for the sector when the energy system reaches net zero in IEA scenarios.[3] Setting an ambitious and achievable upper threshold for near-zero emissions is inclusive of the possibility for some production to perform even well below this threshold.
- **Stable.** The emissions threshold value stays the same over time, in order to send a clear and consistent signal to markets. It is not dependent on a single scenario context that is subject to frequent revision; rather it is compatible with the end goal of achieving net zero emissions by mid-century according to the IEA's scenario analyses.
- **Technology neutral.** The emissions threshold does not imply a specific production pathway, nor does it exclude a specific strategy. Compatibility with the net zero endpoint is key, not the type of furnace, fuel or emissions reduction technology; thus no production pathway that could be compatible with a net zero energy system is excluded. This implies sensitivity to regional cost considerations

[2] See for example IEA (2024), World Energy Outlook 2024 and IEA (2021), Net Zero by 2050: A Roadmap for the Global Energy Sector.

[3] Since it is likely to be technically and economically very challenging to entirely eliminate emissions from industrial production, "near-zero" emission materials are the likely "net zero compatible" endpoint for industrial sectors, while other sectors will reach negative emissions through direct air capture and bioenergy with carbon capture and storage, to achieve net zero emissions for the energy system as a whole. Thus, for industry, "near-zero emissions" can be compatible with "net-zero". This does not preclude the possibility to also have an additional category for actual "net-zero" or "net negative" industrial production or products, to give special recognition for investments that manage to address the last residual emissions, such as use of bioenergy with carbon capture and storage.

and other circumstances that may influence which net zero endpoint technologies are most suitable. Technology neutral does not imply emissions neutral nor input material neutral – that is, definitions should have sufficient rigour to include only technologies that are compatible with net zero. Additionally, definitions may account for the fact that the physical properties of different input materials (e.g. iron vs. scrap, clinker vs. supplementary cementitious materials) impact how difficult it is to achieve a very low emissions level, regardless of the technology used.

- **Globally consistent.** The emissions threshold applies regardless of where the steel or cement is produced or consumed. This enables clear communication and a consistent signal across global markets. Notably, this does not imply uniform global policy ambition and speed of progress towards net zero; rather the same near-zero emissions definition can be applied within policies according to national and regional circumstances (e.g. different countries might choose to procure different shares of near-zero emissions materials over time).
- **Physical.** To receive recognition for achieving near-zero emissions, technologies need to be deployed that achieve near-zero emissions levels in physical terms – that is, the emissions for the supply chain of one full tonne of steel or cement together fall at or below the near-zero emissions threshold. In other words, offsetting emissions from outside the supply chain or aggregation of emissions reductions credits/certificates across multiple units of production and/or supply chains is not permitted for near-zero emissions recognition. Additionally, primary data with appropriate verification should be used in emissions measurement and reporting for major process steps, to demonstrate actual performance.
- **Transparent.** The boundaries of emissions included and accounting methods used must be made clear to ensure comparability. Additionally, reporting based on definitions should make clear which input materials are used and provide some indicator of how emissions performance compares to typical vales when using those materials. This is in no way to disincentivise use of certain input materials, but rather to provide an indication of the extent to which there are "additional" emission reductions from production. Including the actual CO_2 footprint on a label in addition to a "decarbonisation effort rating" that compares to typical performance would be ideal for full transparency.
- **Accessible.** For ready use by policy makers and the private sector, definitions should be as simple and easy-to-understand as possible, without compromising rigour. Where possible, details of definitions and certifications against them should be communicated in the public domain for accountability and broad understanding of the industry transition.

Principles for low-emissions definitions

Given that low-emissions definitions target technologies along the transition to net zero, and the transition pathway will differ considerably over time and according to regional circumstances, the approach to defining low-emissions has greater

variation and flexibility than defining near-zero emissions. Nevertheless, several principles should be adhered to when using low-emissions definitions, to ensure that low-emissions definitions support the transition, result in substantial emissions reductions leading towards the ultimate near-zero goal, and ideally incentivise transformational technologies rather than only smaller incremental emissions reductions. These principles have parallels to the principles for near-zero emissions definitions but are more flexible.

The principles are as follows:

- **Ambitious, with clear communication on the ambition level.** Low-emissions definitions should be ambitious in terms of aiming to incentivise progress to reduce emissions. Any label, certification or policy must clearly communicate the ambition level it is targeting, including whether it is, for example, recognising 1) emissions substantially lower than best available technology (BAT); 2) current best performers; or 3) compatibility with an average net zero pathway. Use of different categories (e.g. A, B and C level performance) may be appropriate to distinguish between different performance levels within the broader low-emissions category; and/or publication of the carbon footprint alongside the current average performance of the relevant production route as a frame of reference. Communication should be clear that such performance is different from that which is already compatible with the net zero endpoint for the energy system (i.e. different from near-zero emissions material production).
- **Signals need for progressive improvement over time.** The definition should have and make use of some mechanism to increase ambition over time, according to a country's circumstances and policy ambition. This might be either a stable set of thresholds (e.g. categories A through E), that enables the eligible categories used in a policy to be reduced over time, or it may be a single dynamic threshold that reduces over time. Regardless, such recognition of low-emissions technologies may be phased out once actual near-zero emissions technologies become widespread in markets.
- **Technology neutral.** As with near-zero emissions thresholds, low-emissions thresholds should not imply a specific production pathway, nor should they exclude a specific strategy. The ability to reduce emissions is key, not the type of furnace, fuel or emissions reduction technology. Notably, technology neutral does not imply emissions neutral nor input material neutral.
- **Global coherence while accounting for regional starting points.** Where possible, use of globally recognised definitions is preferred, to enable clear communication across global markets. However, application of low-emissions definitions within policies should have sensitivity to the current regional technology mix and performance characteristics, so that progressive improvements are incentivised in all regions relative to their specific starting points.
- **Clear communication on chain of custody.** Where possible, priority should be given to achieving physical reductions for low-emissions recognition. If alternative

chain of custody models are used (for example, aggregation of emissions reductions certificates), robust rules must be followed and the methods used need to be clearly and explicitly communicated on any labelling or certification.

- **Transparent.** This principle is the same as that for near-zero emissions definitions (see above).
- **Accessible.** This principle is the same as that for near-zero emissions definitions (see above).

Summary of principles

The principles for near-zero and low-emissions definitions are summarised in the table below. As noted, the principles for each are in parallel but accommodate the different purposes of the two types of definitions. Given the precise aim of the near-zero definition, the principles for near-zero definitions are more exact and rigid. Meanwhile, the low-emissions definitions take into account the broader potential applicability of low-emissions and the wider diversity of approaches.

Summary of principles for near-zero emissions and low-emissions definitions

Near-zero emissions	Low-emissions
Ambitious	Ambitious, with clear communication on the ambition level
Stable	Signals need for progressive improvement over time
Technology neutral	Technology neutral
Globally consistent	Global coherence while accounting for regional starting points
Physical	Clear communication on chain of custody
Transparent	Transparent
Accessible	Accessible

It should be noted that these principles for definitions focus in particular on performance with regards to GHGs. Other criteria around the sustainability of materials could also be included in definitions, labels, certifications and policy requirements (e.g. impacts on air quality, water use, land use, waste generation, biodiversity, jobs or other social indicators). Such criteria would be helpful for additional transparency and to minimise negative impacts on other sustainability considerations.

3. Emerging common ground on near-zero emissions definitions

The IEA Secretariat has defined near-zero emissions thresholds with the aforementioned principles as a guide. These were recognised in the 2022 G7 Climate, Energy and Environment Ministers' Communiqué as "a robust starting point for a common understanding of ambitious general definitions for near-zero emissions steel and cement production". These definitions, which pertain to the production-level emissions boundaries laid out in the IEA report[4] (including direct and indirect combustion and process-related GHG emissions), are as follows:

For steel, progressive according to the scrap share of metallic inputs, falling between the following:

- 100% iron[5]: 400 kg carbon dioxide equivalent (CO_2-eq) per tonne of crude steel
- 100% scrap: 50 kg CO_2-eq per tonne of crude steel.

For cement, progressive according to the clinker-to-cement ratio, falling between the following:

- 100% clinker[6]: 125 kg CO_2-eq per tonne of cement
- no clinker: 40 kg CO_2-eq per tonne of cement (noting that cement production without clinker has not been proven at commercial scale).

The IEA Secretariat recommended that these production-level definitions could form the basis for comparable definitions at the product level, that is from crude steel to hot-rolled or finished steel, and from cement to concrete. The IEA definitions were intended as a robust but high-level international proposal, that could be used with various emissions measurement methodologies and reporting/labelling tools (see Section 5). The proposal would need to be taken forward by others to be implemented through accompanying detailed rulebooks,

[4] See Figures 3.1 and 3.4 of IEA (2022), Achieving Net Zero Heavy Industry Sectors in G7 Members.
[5] While all steel has some scrap as inputs, typically 25-30% for primary production, the value for hypothetical production with 100% iron is given here to enable calculation of the threshold for any share of iron and scrap.
[6] Similarly to steel, as noted above, cement typically has a clinker ratio less than 100%, and currently for most applications it is not possible to produce cement with no clinker. The values for hypothetical production with 100% clinker and no clinker are given here to enable calculation of the threshold for any clinker ratio.

including specifying robust emissions accounting methods that enable comparability and verification of data (as the IEA is neither a standards-setting nor a policy-making body).

As outlined below, a strong international convergence is emerging around similar near-zero emissions threshold values. This includes in certification and labelling systems emerging from the private sector and multi-stakeholder initiatives, as well as through adoption or application of the IEA definitions by key international initiatives.

Steel thresholds

Near-zero emissions steel thresholds similar to that of the IEA, including a progressive threshold according to the scrap share, are being applied directly at the crude steel production boundary[7] by the following standards or initiatives:

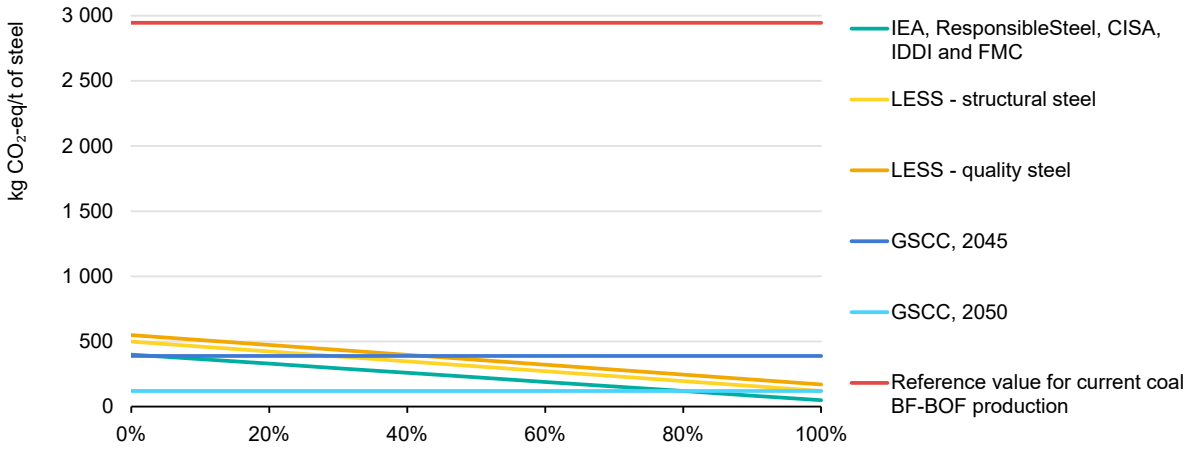
- The ResponsibleSteel International Production Standard (V2.1, Principle 10), developed by the multi-stakeholder forum ResponsibleSteel as one component of its certification that aims to accelerate the transition to net zero while ensuring responsible production.
- The Industrial Deep Decarbonisation Initiative (IDDI) Secretariat in its Green Public Procurement Pledge (noting that discussions are ongoing as to application by individual IDDI member countries).
- The China Iron and Steel Association (CISA)'s Low Carbon Emission Steel Evaluation Method, spearheaded by Baowu Steel Group and launched in October 2024.
- The First Movers Coalition, a global coalition of companies aiming to advance emerging technologies through their collective purchasing power, in its Steel Commitment.

Other approaches use an accounting boundary that includes additional emissions. The labelling and classification system "Low Emission Steel Standard" (LESS) was developed building on the IEA approach, applying a sliding scale for scrap, but expanding the coverage for emissions, in order to better incentivise emissions reductions in other parts of the supply chain (including alloy production and hot rolling). The threshold is adjusted slightly upwards to account for the wider scope and to recognise that higher-quality steel production tends to lead to higher emissions.

[7] It should be noted that the emissions measurement methodologies and boundaries are not yet identical among these organisation and initiatives.

The Global Steel Climate Council (GSCC) Standard – while taking a different approach, as described below in the low-emissions definitions section – requires similar ambition in the long term: by 2045, the emission intensity required is 380 kg to 400 kg CO_2-eq per tonne of hot-rolled steel (for long and flat steel respectively), and by 2050, 120 kg CO_2-eq per tonne of hot-rolled steel.

Steel emission threshold proposals compatible with the net zero endpoint from selected initiatives and organisations



Notes: CISA = China Iron and Steel Association; IDDI = Industrial Deep Decarbonisation Initiative; FMC = First Movers Coalition; LESS = Low Emission Steel Standard; GSCC = Global Steel Climate Council; BF-BOF = blast furnace-basic oxygen furnace. The boundaries/scopes have differences for some of the thresholds, which explains some of the differences in the thresholds themselves (for example, LESS has an enlarged emissions scope relative to the IEA definition). Most of the proposals are static thresholds, not tied to any particular point in time. The one exception is the GSCC, which changes over time; the threshold values for 2045 and 2050 are shown here, and are an average of the long and flat steel thresholds. The "Reference value for current coal BF-BOF production" assumes hypothetical production with 0% scrap share of metallics input for all values shown for illustrative purposes, using the emissions boundaries of the IEA's definitions proposals; note that typical BF-BOF production has about 25-30% scrap share of metallics input.

Cement and concrete thresholds

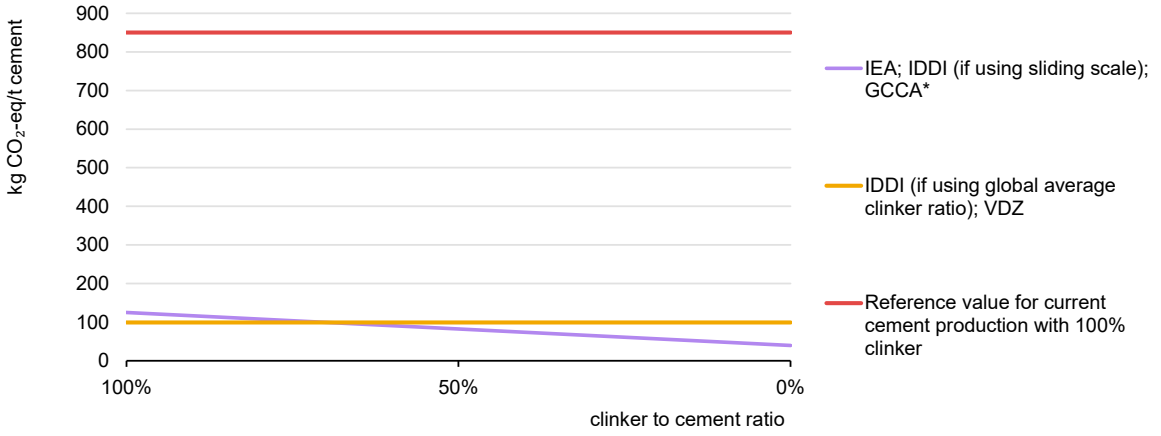
Similar near-zero emissions cement thresholds as that proposed by the IEA are being applied directly at the cement production boundary by the following initiatives, with the modifications described below:

- The IDDI Secretariat, in its Green Public Procurement Pledge, but allowing governments to choose to apply a static clinker-to-cement ratio, for example based on average values (the global average being 0.7) (again noting that discussions are ongoing as to application by individual IDDI member countries).
- The Global Cement and Concrete Association (GCCA) is proposing to adopt the same near-zero emissions cement threshold as proposed by the IEA, but would recommend that countries adopt a clinker-to-cement ratio relevant to them along the threshold line. With regards to whether the emissions intensity for comparison against the threshold would be measured in gross or net terms (where "gross" includes emissions from non-biogenic waste, and "net" excludes those emissions),

while GCCA currently prefers the net option, the GCCA normalisation method enables countries to choose the alternative to suit their custom. GCCA recommends that Environmental Product Declarations (EPDs) are used to compare products with the threshold.

- The German Cement Producers Association (VDZ) is planning to introduce a certification and labelling scheme for cement, based on the IEA's near-zero definition but applying a fixed clinker-to-cement ratio (0.7). The label is implementing the results of a broad stakeholder process led by the German Federal Ministry for Economic Affairs and Climate Action (BMWK). EPDs will be used for emissions reporting. The first certification of cement by VDZ is expected to be possible in the first half of 2025.

Cement emission threshold proposals compatible with the net zero endpoint from selected initiatives and organisations



* GCCA recommends that countries adopt a clinker-to-cement ratio relevant to them, along the proposed near-zero emissions cement threshold line.

Notes: IDDI = Industrial Deep Decarbonisation Initiative. The "Reference value for current cement production" assumes hypothetical production with a 100% clinker-to-cement ratio for all values shown, using the emissions boundaries of the IEA's definitions proposals.

Additionally, the GCCA has developed a proposal for concrete definitions, extending further down the value chain from cement. The IEA near-zero cement threshold is central to the proposal, using a fixed clinker-to-cement ratio of 0.52, which is the clinker ratio in 2050 in the GCCA 2050 Net Zero Roadmap. The GCCA proposal is a progressive threshold according to the concrete strength, and ranges from 21 kg CO_2-eq per metre cubed (/m^3) for cylinder strength of 20 megapascals (MPa) to 36 kg CO_2-eq/m^3 for 50 MPa strength. The GCCA proposal has the backing of its members, who account for a substantial portion of global cement production (approximately 40% of global production, including 80% outside of China). At the time of writing it is the only known major definitions proposal that specifically includes a near-zero emission threshold for concrete, thus constituting

a good starting point for industry and government stakeholders to consider in the interest of reducing multiple similar but slightly different proposals.

Cement and concrete thresholds are also being used by the First Movers Coalition, and concrete thresholds by ConcreteZero, in their commitment frameworks. However, as of October 2024, both are under review and so are not included in this summary.

Synthesis and possible next steps

The convergence of these various organisation and initiatives around similar emissions intensities, despite some differences in approaches, suggests that common ground is emerging on what constitutes near-zero emissions steel, cement and concrete. Thus these thresholds could perhaps serve as international guardrails, for consideration in ongoing and future national-level policy developments.

Next steps forward could include the following:

- **Stakeholder consultations:** for governments who have not yet consulted with their national industries and other stakeholders on definitions, undertaking such consultations could aid in determining their possible application within the relevant jurisdiction.
- **Equivalency determination:** developing procedures for determining the equivalency of different approaches, and where relevant for systems to officially recognise each other, so that similar approaches can be used in an interoperable manner. Such equivalency determination could occur either directly by those who manage the relevant definitions, labelling or certification schemes, or by governments who are employing such systems within their policies.
- **Policy adoption:** official implementation of definitions by governments within policy would formalise their adoption, and at the same time give a clear indication on the direction of travel to the private sector.

4. Emerging approaches to low-emissions definitions

In contrast to near-zero emissions definitions, where there is emerging convergence on thresholds, a wider range of approaches are being proposed for low-emissions. Depending on the policy objective, these different approaches may be suitable. However, care is needed to ensure that low-emissions definitions are used to facilitate the transition to near-zero, and that leaving open a wider range of interpretation for low-emissions does not lead to greenwashing.

The IEA Secretariat proposal for defining low-emissions steel and cement focuses on recognising emissions performance **substantially lower than the best available technology (BAT) performance** of the main currently used technologies, but does not yet achieve fully near-zero emissions. The intended purpose of the IEA low-emissions definitions is to help create lead markets for production using technologies that will be able to progressively transition towards near-zero emissions over time.

To enable application with increasing stringency over time and reflection of national circumstances, the IEA definition has five bands, A through E (whose values are multiplications of the near-zero emissions definition value). All of the bands fall below BAT performance for the current dominant conventional process routes (e.g. blast furnace – basic oxygen furnace production for primary steel, and a conventional kiln running on fossil fuels for cement production). For example, a country may choose to recognise all bands (A through E) as low-emissions in the short-term, and then reduce the band range gradually over time (e.g. A through C only) according to the speed of ambition in relevant policies.

Several other low-emissions definitions proposals are using a similar framework, involving multiple categories (either lettered or numbered). These include the aforementioned ResponsibleSteel, LESS, and GCCA systems. Another example is the Universal Embodied Carbon Classification Scheme for Concrete, developed by Arup and Innovate UK initially for use in the United Kingdom and the wider Europe region, but now being adapted for other markets globally. Some of these proposals include categories that cover current performance levels, rather than only performance below BAT.[8]

[8] Note that according to IEA (2022), Achieving Net Zero Heavy Industry Sectors in G7 Members, BAT reference values would be the following: 2 945 kg CO_2-eq/t crude steel for steel produced with 100% iron from the blast furnace-basic oxygen furnace

Other approaches to low-emissions definitions include the following:

- **Best in class performance:** such definitions recognise the top performers today, by giving recognition to, for example, the top 10% or 20% of performance today, or by giving recognition to measures to incrementally reduce emissions within existing plants and production routes. This would mean recognising, at least in the short-term, emissions performance at or slightly higher emissions than BAT with current technologies, rather than reserving recognition for performance with lower emissions than BAT. An example of such a definition is the US Environmental Protection Agency (EPA)'s Interim Determination of "substantially" lower embodied carbon construction materials, which would provide a label for the best performing 20% of materials in terms of global-warming potential (or a broader definition if such materials are not available in a particular project location). The EPA is continuing developments of its Label Program for Low Embodied Carbon Construction Materials, which will include setting thresholds.
- **Performance at or below an average global trajectory to net zero:** such recognition is given to production that falls below the global average trajectory on a net zero emissions pathway; as such, it recognises roughly the top half of performers at any given point in time, assuming the world is on track for net zero. This would mean in the short to medium-term giving equal recognition to performance at the global average, performance well below BAT, and performance compatible with the net zero endpoint, as there is only one category of recognition. An example of such a definition is GSCC's Climate Standard. It establishes a glidepath based on the global average emissions intensity of steel production overall in the IEA Net Zero Emissions by 2050 Scenario.

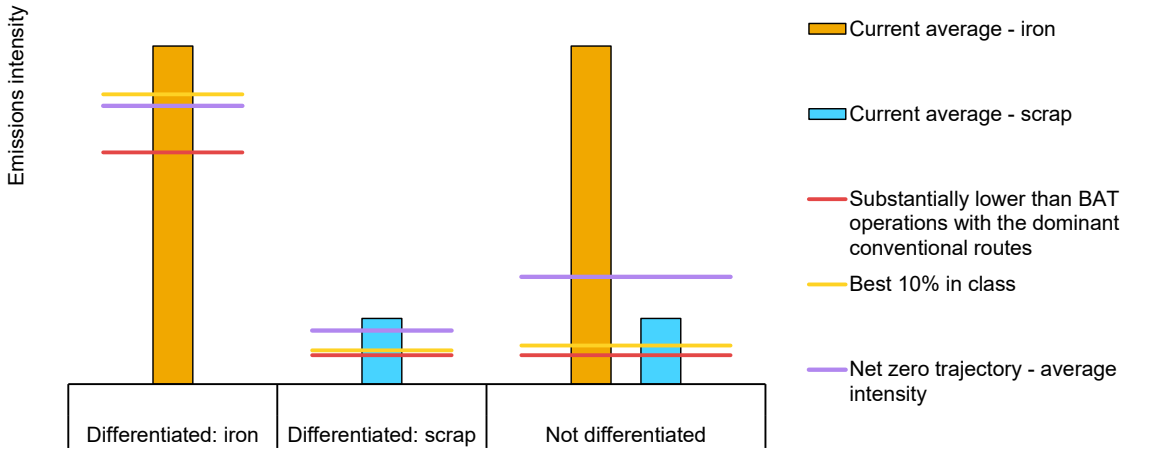
It should be noted that additional governments are currently considering definitions for low-emissions and near-zero emissions materials. For example, the European Union is currently developing its Construction Product Regulation (CPR) and conducting a preparatory study for a possible future Delegated Act for iron and steel products within the framework of the Sustainable Products Regulation (ESPR); either or both of these regulations may eventually result in determination of low-emissions and/or near-zero emissions thresholds or classes for materials.

Any of the three above-mentioned approaches may be compatible with helping to incentivise incremental emissions reductions and/or phasing out the highest-emitting production, including through government policies and within private sector markets. However, depending on the specifics of their design and application, approaches that focus on today's best performers and/or the average

route with pulverised coal injection; 285 kg CO_2-eq/t crude steel for steel produced with 100% scrap in the electric arc furnace route; and 850 kg CO_2-eq/t cement for cement produced with 100% clinker.

trajectory may create only a relatively weak pull for the scale-up of innovative technologies achieving deep emission reductions.

Illustrative range of performance qualifying as "low-emissions" steel in 2030 according to various different approaches



Notes: Differentiated = different requirements based on the iron and scrap shares of metallic inputs, where iron shows the requirements for 100% iron inputs and scrap shows the requirements for 100% scrap inputs. Not differentiated = the same requirements regardless of the scrap share of metallic inputs. Values are approximate values that could apply in 2030, to demonstrate how the approach taken may considerably impact the threshold and incentives provided; the actual thresholds will depend on the specifics of the design. For "not differentiated" the scrap-based values are used for "Substantially lower than BAT", since when looking at steel overall the lowest emissions intensity is achieved with scrap-based production; for "Net zero trajectory – average intensity", the weighted average of all steel production – including iron and scrap – is used. "BAT" and "Best 10% in class" are presumed to be based on current best available technologies, rather than a forecast of likely best available technologies in 2030 or an updated value in 2030.

As illustrated by the figure above, what qualifies as low-emissions varies considerably depending on which of the three approaches noted above is taken, and also on whether there is differentiation of thresholds according to input materials (iron and scrap for steel; clinker and supplementary cementitious materials [SCMs) for cement).

Factors to consider when designing low-emissions thresholds include the following:

- Whether the policy or standards development objective is to help incentive the scale up technologies to reduce emissions of iron and clinker production, or if the objective can be met by increasingly shifting to scrap-based production and use of SCMs. A threshold differentiated by input material may have a higher likelihood of incentivising the former but create less of an incentive for the latter; meanwhile a threshold with no differentiation may better incentivise the latter but create less of an incentive for the former.
- Best in class production is, by definition, already-existing production. There is therefore a relatively weak incentive for achieving a step-change in technology

performance. Best in class definitions would also need to be updated continuously to capture likely improvements over time.

- The average trajectory to net zero begins with a starting point of current average performance; therefore, in the near-term, the average trajectory is only moderately below current average performance.
- Given that there are substantial differences in current performance by country and region, using global values for “best in class production” or the “average trajectory to net zero” means that the current best-performing countries would have little incentive to reduce emissions further in the near-term.
- The share of production a policy is applied to matters. If a policy applies to all of a country’s production (e.g. an emission intensity regulation aimed at phasing out the highest-emitting production), requiring performance at or below the average trajectory to net zero would ensure that production overall is at or below the net zero trajectory. However, if the policy only applies to a smaller share of production (e.g. a voluntary labelling programme, public procurement policies), more ambitious requirements would be more suitable, to have a better chance that, on average, all of production stays under what is required by the net zero pathway.

As such, use of low-emissions definitions requires careful design of thresholds and the mechanisms that use them, if the policy objective is to incentivise additional emission reductions, rather than to recognise already-existing lower emissions production.

5. Principles for interoperability and net zero compatibility of underlying measurement methodologies

Emissions measurement methodologies underlie definitions, as well as multiple other mechanisms to enable the transition for the steel and cement sector. There may be rationales for some differences in methodologies according to the intended purpose (e.g. whether the methodology targets the production or product level). Nevertheless, moving towards interoperability and net zero compatibility[9] of different methodologies will help clearly communicate on performance and promote reproducibility, comparability and verifiability of information provided, thus helping enable the net zero transition and facilitate global markets for and trade of near-zero and low-emissions materials.

There is common ground emerging on what would be needed to move in this direction, including (as outlined below) from the Net Zero Measurement Principles proposed by the IEA Secretariat in its 2023 report Emissions Measurement and Data Collection for a Net Zero Steel Industry for the G7 Industrial Decarbonisation Agenda; in analysis by the IDDI Secretariat, hosted by UNIDO, on harmonisation of Product Category Rules; and in analysis by the Inclusive Forum on Carbon Mitigation Approaches (IFCMA), hosted by the OECD .

A first area of emerging common understanding is that policy measures and private sector initiatives should, wherever possible, use existing emissions measurement methodologies (e.g. ISO standards, EU Environmental Footprint Methods); product-level emissions reporting, verification and labelling tools (e.g. Environmental Product Declarations [EPDs], Digital Product Passports); and sectoral or production-level emissions reporting and accounting frameworks (e.g. Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories), rather than developing new methodologies, labelling tools and reporting frameworks. This would help avoid unnecessary fragmentation, limit duplication of efforts, reduce reporting burden on the private

[9] Interoperability means that different methodologies are coherent and can work together, enabling clear and consistent communication and interpretation, even though methodologies may not be exactly the same due to different purposes and/or scopes. Net zero compatibility means that measurement methodologies can be applied to the full range of technologies that are needed for the net zero transition and are designed in a way that incentivises choices in favour of the net zero transition.

sector, and promote comparability of emissions data. Such pre-existing methodologies, tools and frameworks should continue to be developed, revised and improved as needed; however, in most cases there should be no need to create these from scratch. It will also be valuable to ensure coherence and interoperability with measurement methodologies used in already-existing policies, such as emissions trading systems, and also with new and developing policies, such as the EU Carbon Border Adjustment Mechanism (CBAM).

Beyond that, there is growing common understanding that many existing methodologies would require some revisions to make them interoperable and net zero compatible. For this purpose, the IEA Secretariat has proposed the following Net Zero Measurement Principles to guide these revisions of existing methodologies (see box below). These principles were recognised by the G7 in the Industrial Decarbonisation Agenda annex to the 2023 G7 Climate, Energy and Environment Ministers' Communiqué. They were also acknowledged by a coalition of nearly 40 organisations at COP 28 within the Steel Standards Principles.

The IEA Net Zero Measurement Principles for industrial emissions

The IEA's Net Zero Measurement Principles, proposed by the IEA Secretariat in 2023 to guide revisions towards interoperability and net zero compatibility of emissions measurement methodologies in industrial sectors like steel and cement, are as follows:

- **Facilitate like-for-like comparison** between production from all facilities, including innovative near-zero emissions routes such as steel produced from hydrogen-based direct reduced iron or cement produced with carbon capture and storage. Reporting should note details required to facilitate comparison, including the production route, the input materials (quantities of scrap and iron used for steel; quantities of clinker and different SCMs for cement) and the types of products produced (product and grade for steel; strength for concrete).
- **Produce coherent and interoperable results for both production and products** (whether in separate or combined standards for each case). For steel, this means between crude steel production and finished/semi-finished steel products. For cement and concrete, this means between cement production and concrete products.
- **Have a comprehensive and transparent emissions boundary and scope** that covers the main sources of emissions in the supply chain. This includes – as a minimum – the following sources, whether on-site or off-site:
  - **For steel:** energy-related and industrial process emissions (CO_2, methane and nitrous oxide GHG emissions) from ironmaking, steelmaking, iron ore

agglomeration, the production of reduction agents, the use of lime fluxes and electrodes, raw material supply, fossil fuel supply, low-emissions fuel and electricity supply. For steel products, the relevant semi-finishing/finishing processes and alloying elements should be included.

- **For cement:** energy-related and industrial process emissions (CO_2, methane and nitrous oxide GHG emissions) from clinker production, production of SCMs when used to produce blended cements, raw material supply, fossil fuel supply, low-emissions fuel and electricity supply. For concrete products, any major downstream processes, use of SCMs directly for concrete production, and other input materials should be included.

- **Apply net zero compatible accounting rules for emissions credits and co-products**, i.e. rules that are compatible with a global pathway to net zero emissions for the energy system, and coherent and compatible across materials.
- **Incentivise the use of site- and product-specific auditable measured data**, as opposed to generic emissions estimates and other factors (for example through conservative default values that are higher than typical emissions performance; and drawing from best practices for verification from existing measurement, reporting and verification systems).

6. Outstanding questions and potential next steps on underlying measurement methodologies

There are several remaining questions related to emissions measurement methodologies to be resolved in order to progress towards interoperability and net zero compatibility. Two broad categories of questions comprise 1) suitable and mutually agreed accounting rules when several possibilities exist; and 2) how to operationalise interoperability and net zero compatibility.

Key outstanding questions on accounting rules

Suitable accounting rules, including for emissions credits and co-products, may vary by methodology, according to the intended objective or purpose of the given reporting system. For the specific purposes of applying definitions for near-zero emissions steel and cement, current thinking points towards the following as being net zero compatible and/or having the highest likelihood of reaching agreement:

- **Accounting for CCUS:** in alignment with IEA net zero scenario analysis, when CO_2 is captured and is verified to be destined for permanent storage (either through dedicated storage or via utilisation applications), the emissions should be considered zero. When utilisation does not result in permanent storage, the emissions should be counted. The IDDI is currently undertaking analysis and discussions on the details of accounting for CCUS, with analysis likely to be summarised in an upcoming paper.
- **Accounting for fossil fuel-based and mixed wastes used in cement production:** fossil fuel-based wastes should have an emissions intensity attributed to them, as per IPCC Guidelines. When primary data is not otherwise available on the emissions intensity of mixed wastes (wastes made up of multiple components likely to have both fossil and non-fossil origins), a conservative approach assuming 100% fossil waste should be used.
- **Accounting for production and use of blast furnace slag co-products:** use of economic allocation is currently viewed by the IEA Secretariat as a strong candidate if a common approach is to be targeted. Using a common approach for both steel and cement is valuable, and this approach so far appears the most likely to strike a compromise between the views of both, based on analysis by the IDDI Secretariat and the agreement reached between steel and cement sectors in the

development of definitions proposals in Germany.[10] Many different views exist on slag allocation; however, given the difficulty in achieving full consensus among stakeholders in the past, a political decision from governments may be needed if a common approach is to be achieved. Alternatively, if it is concluded that it is not necessary or too difficult to arrive at a common approach, a method to make the chosen approach transparent and to translate between approaches would be needed to make results interoperable.

Another key accounting issue that requires further analysis and discussion is suitable methodologies for **accounting for electricity emissions from the grid**, including the level of regional granularity needed and use of renewable electricity credits. The World Steel Association is currently undertaking analysis on this issue as part of a steel emissions methodology mapping exercise in support of the Steel Standards Principles discussions. Further discussion on this topic is likely to be needed.

Next steps to operationalise interoperability and net zero compatibility

Discussions on how to operationalise interoperability and net zero compatibility continue in several fora.

The IDDI Secretariat has proposed detailed recommendations for harmonising Product Category Rules. These recommendations are well aligned with the IEA's Net Zero Measurement Principles above. Several of the key IDDI Secretariat recommendations are around adding additional details within emissions reporting, which would help to 1) make more transparent the accounting methodologies used, especially when methodologies are not fully prescriptive, thus assisting with comparability and interoperability; and 2) enable use of emissions thresholds. See the box below for additional details.

The Steel Standards Principles forum, led by the World Trade Organization (WTO) Secretariat and the World Steel Association, also continues to discuss how to move towards interoperability. The World Steel Association is undertaking a mapping and comparison exercise of steel measurement methodologies to inform discussions. A key topic being discussed is the possibility of a common reporting point or boundary, which would be additional to existing boundaries.

There is also valuable work in this area being carried out by individual governments, which will be important to consider within in international discussions – both to benefit and advance international progress, and also to

[10] The IEA Secretariat is currently not aware of other jurisdictions in which the steel and cement sectors have come to a common agreement on an approach.

improve coherence and interoperability of national and regional approaches. For example, the US government is taking steps towards improving Product Category Rules (PCRs) that cover the construction sector through the US EPA's PCR Criteria. This effort has a similar intent to the above-mentioned IDDI Secretariat effort, and is developing a national-level approach to ensure that resulting accounting and reporting methodologies are consistent within a given sector to ensure comparable results. Additionally, the European Commission is developing a product carbon footprint method, building on its work on product environmental footprints. Again, the intent of the work is to define PCRs with more precision, to improve robustness, comparability, reproducibility and verifiability of results.

Increased detail of emissions reporting for greater transparency and interoperability

The IDDI Secretariat has identified key details to prioritise adding to emissions reporting, as requirements in policies and eventually by the measurement methodologies themselves. Transparency on such details would be a first important step towards interoperability. The following elements could be priority additions to reporting:

- Specifying the **emissions intensity with a common boundary or at a common reporting point** (e.g. crude steel production for steel; and cement production for cement and concrete), even for product-level methodologies, in order to enable comparison across different products. Notably, this would not replace the existing boundaries of methodologies, but rather add an additional emissions intensity datapoint for the common boundary.
- Specify the **ratio of material inputs** (scrap share of metallic inputs for steel; clinker ratio for cement and concrete), to enable evaluation against thresholds where these factors are taken into account.
- An **indicator of data quality**, such as the share of total emissions that are from primary data (also referred to as specific data in some contexts), as well as information on the sources of any secondary or default emissions factors used.
- The method used for any co-product allocation or credits applied, ideally as well as the value of such credits.
- Reporting both **gross and net emissions intensities** in relation to any use of alternative fuels.
- Clearly specifying **which greenhouse gases are covered**, including in particular whether methane emissions are covered and specifying the data source used for methane.

Other key outstanding accounting issues that the IDDI Secretariat has also identified are the following:

- Treatment of **carbon capture, utilisation and storage**, including the certainty and duration of carbon storage required to claim abatement, and whether green policy objectives should be reflected in product-level emission accounting.
- Permissibility, design and application of **alternative chain of custody models**, including use of emissions reductions certificates and book and claim. For these purposes, emissions reductions certificates would mean using certificates/credits to add up emissions reductions from multiple different sources of production and crediting them to one source of production (this approach has been referred to by some as a "mass balance" approach for emissions reductions and differs from mass balance chain of custody approaches for physical products that are certified and not). Book and claim means disconnecting physical products from credits for using products; that is, production at a particular emissions level would generate a credit for performance, that could be purchased and "claimed" by a user, regardless of physically purchasing that production.

As an interim step towards resolving these issues, the accounting choices used for each could also be stated within emissions reporting to provide transparency and assist with comparability.

Revising methodologies at the international level is likely to take time. Leadership is needed from multiple stakeholders, including:

- **Standards bodies**, in particular international standards bodies, including ISO, regional standardisation bodies, and ISO's member national standards bodies (NSBs), who co-ordinate the overall processes of standards development for the standards they oversee, as well as members of ISEAL – a global alliance of sustainability standards systems and accreditation bodies.
- **Private sector and non-governmental stakeholders, participants and multi-stakeholder initiatives**, including industry, civil society and academia, that contribute expert perspectives and technical inputs to international standards development activities.
- **Private sector steel and cement associations** that have developed or oversee methodologies and reporting tools that are commonly used by industry but sit outside of dedicated standardisation bodies, such as the World Steel Association with its CO_2 Methodology and Life Cycle Inventory (LCI) Methodology, and the GCCA with the Cement CO_2 and Energy Protocol and its EPD Tool.
- **Governments**, to encourage and provide clarity to such processes, including through engagement in relevant standards development activities (for example, via engagement with their respective NSBs). This is particularly important to

ensure coherence with ongoing policy development processes, and can be seen as a two-way dialogue – on the one hand, so that standards development, where relevant, can facilitate use of standards in policies, and on the other hand, so that development of methodologies by governments for policy purposes can, where relevant, eventually be fed back into interoperable standards development for the benefit of the international community.

There are a number of possible routes that could be taken to improve interoperability of methodologies at the international level. A potential strong candidate may be through increased engagement by governments, industry and other stakeholders in ISO processes, given that there is already extensive related standardisation work underway in ISO. Examples of possible avenues for governments and industry to engage in ISO processes include:

- **Direct engagement with Technical Committees (TCs):** Increasing engagement with relevant TCs would provide the most direct route to engaging in the standards development processes. If done in a co-ordinated way, this could be a direct route to raise for consideration recommendations coming out of discussions in other fora (e.g. IDDI, Steel Standards Principles, IEA WPID, Climate Club).
- **Leading a cross-cutting Workshop Agreement**: ISO offers the possibility for an International Workshop Agreement (IWA) to collaborate towards a specific deliverable (e.g. a set of guidelines) that sits outside of any particular TC. This could be a useful route for broader discussions and to develop common understanding on the types of changes that might be useful across multiple standards. To actually be implemented in standards, any outcome of such a process would still need to be taken back to relevant TCs and considered through the usual ISO consensus-based processes.

There may be other additional options to consider for engaging in international standards development processes. Continued discussions are needed to determine the best way forward, including through ISO but also potentially through other relevant standards development processes.

There are several other topics that are closely related to the interoperability of measurement methodologies, and deserve due consideration in future work. These include: the use of digital tools in enabling interoperability and comparability of methodologies, routes to increasing availability and use of primary/specific data, and efforts to increase the quality, accessibility and alignment of secondary data when primary data is unavailable. There are already ongoing efforts in several jurisdictions on such topics – increasing international collaboration and exchange would ensure better global coherence and likely reduce duplication of efforts.

IEA Publications
International Energy Agency
Website: www.iea.org
Contact information: www.iea.org/contact

Typeset in France by IEA - November 2024
Cover design: IEA
Photo credits: © Shutterstock