SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

SBTi AUTOMOTIVE SECTOR NET-ZERO STANDARD

Version 0.1 - Second Public Consultation Draft

February 2026

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DISCLAIMER

SBTi reserves the right to revise this document according to a set revision schedule or as advisable to reflect the most recent emissions scenarios, regulatory, legal or scientific developments, and GHG accounting best practices.

The information and any proposed change or modification within this document is preliminary and subject to change based on stakeholder input, organisational needs and other considerations as applicable.

“Science Based Targets initiative” and “SBTi” refer to the Science Based Targets initiative. This Standard is issued by SBTi. Any feedback on SBTi Standards can be submitted to info@sciencebasedtargets.org for consideration of the SBTi.

VERSION HISTORY

Version	Change/update description	Release date	Effective dates
V0.0	**First Public Consultation Draft**	June 12, 2025	N/A
V0.1	**Second Public Consultation Draft**	February 3, 2026	N/A

CONTENTS

EXECUTIVE SUMMARY

Disclaimer: *The Executive Summary is intended to provide an overview and guidance for stakeholders and does not constitute a normative part of this draft standard. For the full scope of proposed requirements, users should refer to the main body of the consultation draft. Any translated version of this document is for informational purposes only. Companies should refer to the original document in English in case of any inconsistency.*

Introduction

The Science Based Targets initiative (SBTi) Automotive Sector Net-Zero Standard offers a framework for automakers and auto parts manufacturers to set greenhouse gas (GHG) emissions reduction targets aligned with limiting global warming and achieving net-zero emissions by 2050 at the latest.

The draft standard will replace relevant sections of the SBTi's Land Transport Guidance (March 2024) to align with the updated SBTi Corporate Net-Zero Standard V2.0 and incorporate best practices for decarbonization in the automotive sector. It lays out how automakers and auto parts manufacturers shall use the latest version of the SBTi Corporate Net-Zero Standard V2.0, along with the sector-specific criteria, to set targets covering all relevant emissions.

The SBTi Automotive Sector Net-Zero Standard provides sector-specific pathways, criteria and calculation rules that extend beyond the SBTi Corporate Net-Zero Standard V2.0, demonstrating how companies can use both standards to set targets that are meaningful to their context. These sector-specific criteria are intended to encourage more companies to set targets, amplifying the overall impact of science-based target-setting.

The criteria in the SBTi Land Transport Guidance will, however, remain in force for other types of companies. Automakers and auto parts manufacturers with approved targets under the previous guidance will not need to update them until they expire, though earlier updates are encouraged. Companies may use either the SBTi Land Transport Guidance or the SBTi Automotive Sector Net-Zero Standard for six months after the standard is published for use. After that, the SBTi Automotive Sector Net-Zero Standard will become mandatory.

Key elements of this Standard

The second public consultation draft of the SBTi Automotive Sector Net-Zero Standard introduces several significant changes to the criteria for automakers and auto parts manufacturers as compared to the first public consultation draft of the Standard:

- A direct link with the draft SBTi Corporate Net-Zero Standard V2.0, including clarity on how to apply the criteria from each Standard.
- A new pathway and metric has been introduced that requires companies to set targets on their scope 3, category 11 emissions associated with the vehicle use phase.
- New criteria that require companies to increase their share of zero-emission vehicle sales.

- Regional emissions pathways designed to reflect economic and market differences.
- Enhanced guidance on emissions calculations, including a detailed well-to-wheel methodology with standardized default inputs.

Structure of this Standard

The draft SBTi Automotive Sector Net-Zero Standard mirrors the structure of the draft SBTi Corporate Net-Zero Standard V2.0 to allow for the easy cross-reference of the two. It is organized into six chapters:

1. *Net-Zero ambition:* Includes criteria on how companies shall communicate their intentions to set net-zero science-based targets.
2. *Base year assessment*: Defines the organizational and operational boundaries companies shall use, in addition to how a company shall measure their climate-related performance in their target base year.
3. *Target setting*: Outlines how companies shall use data from their base year to develop targets using the SBTi's methodology.
4. *Taking responsibility for ongoing emissions*: Describes how companies shall take responsibility for the emissions they release during their transition to net-zero.
5. *Assessing performance and renewing targets*: Defines how companies shall measure and share progress against validated science-based targets, as well as how companies shall set new targets based on their previous performance.
6. *SBTi claims*: Focuses on ensuring that any claims companies make related to SBTi Standards are accurate and verifiable.

Each chapter includes a table showing how the draft SBTi Corporate Net-Zero Standard V2.0 criteria apply to those using the draft SBTi Automotive Sector Net-Zero Standard.

Participating in the second public consultation

The SBTi Automotive Sector Net-Zero Standard project was initiated in March 2024, and the Standard development process was adapted to follow the Standard Operating Procedure for Development of SBTi Standards.

The draft was developed through extensive research and input from a dedicated Expert Advisory Group (EAG). This first draft was open for public consultation from June 12, 2025, until August 11, 2025. The SBTi received 104 responses via an online survey, emails, and direct feedback. The SBTi has summarized this feedback in the First Public Consultation Feedback Summary Report and First Public Consultation Feedback Log. All feedback and comments have been anonymized. The SBTi has addressed the feedback via revisions to the draft Standard as outlined in the Main Changes Document.

This second public consultation draft of the SBTi Automotive Sector Net-Zero Standard is being published for public consultation from February 3, 2026 until March 22, 2026. The SBTi welcomes all feedback on this second public consultation draft.

You can submit feedback on the entire standard or specific aspects of it using the SBTi Automotive Sector Net-Zero Standard Second Consultation Survey. Whether you complete the entire survey or focus on the sections most relevant to you, your feedback will help strengthen the clarity, credibility, and ambition of the standard. The survey takes as little as 20 minutes, depending on the topics you choose to cover.

Next steps

In parallel with the second public consultation, the SBTi will conduct pilot testing on this draft. Feedback from the second public consultation and pilot testing will then be analyzed and revisions will be made to the draft. A final version of the Standard will then be presented for approval to the SBTi Technical Council and adoption by the Board of Trustees.

All updates on the SBTi Automotive Sector Net-Zero Standard development will be communicated on the SBTi's Automotive and Land Transport webpage, newsletter and social media channels.

A. INTRODUCTION

A.1 Introduction to SBTi

The Science Based Targets initiative (SBTi) is a corporate climate action organization that enables companies and financial institutions worldwide to play their part in combating the climate crisis. We develop standards, tools and guidance which allow companies to set GHG emissions reductions targets in line with what is needed to keep global heating below catastrophic levels and reach net-zero by 2050 at the latest. The SBTi is incorporated as a UK charity, with a subsidiary SBTi Services Limited, which hosts target validation services (together with SBTi, the “SBTi Group”).

A.2 Purpose of the SBTi Automotive Sector Net-Zero Standard

The 2015 Paris Agreement set the goal of limiting global temperature rise to well below 2°C above pre-industrial levels and pursuing efforts to limit it to 1.5°C. Climate science shows that achieving this requires rapid and deep reductions in GHG emissions to avoid irreversible impacts.

Meeting the Paris Agreement’s goals demands reaching global net-zero emissions by mid-century and fundamental changes in how energy and resources are produced and used. Companies are central to this effort. The SBTi’s Standards help companies transition toward business models compatible with a net-zero economy by addressing emissions across their operations and value chains, and by aligning their activities with a net-zero future.

The road transport sector directly contributes approximately 21-23% of man-made GHG emissions depending on the exact metrics and boundaries used (ICCT, 2025). The future trajectory of road sector emissions will depend on many factors, including behavioural, operational and technological developments.

The automotive sector emissions come primarily from vehicle usage (tailpipe emissions). This is the largest source of CO_2 emissions, primarily from burning fossil fuels:

- **Passenger Cars:** responsible for about **45% of global transport emissions**.
- **Trucks & Buses:** account for around **30%** of transport emissions.
- **Motorcycles & Other Vehicles:** contribute **smaller fractions**.

This is why the automotive sector (comprising automakers and auto parts manufacturers) plays a decisive role in shaping the future emissions trajectory. The efficiency and emission intensity of new vehicles and components brought to market will determine which emission reductions are technically feasible. New vehicle technologies will also determine the extent to which complementary actions taken in the energy supply sector and by vehicle users, in response to external policy and financial signals, can result in real future emissions reductions.

The SBTi's vision is that "By 2050, the world will have transitioned towards a net-zero and equitable economy that serves the needs of the population within the limits of the planet". The SBTi Automotive Sector Net-Zero Standard (hereby referred to as "this Standard") supports SBTi's vision, and its purpose is to provide science-based pathways for automakers and auto parts manufacturers to rapidly transition to efficient and near zero-emission powertrains and vehicles, seizing the unprecedented opportunity for electrification in road transport to deliver cost-effective, deep GHG emissions reductions.

A.3 Terminology

Within the SBTi's criteria, the terms "shall," "should," and "may" are used as follows:

1. "**Shall**" indicates criteria that are required as conditions for organizations that decide to submit science-based targets to the SBTi for validation.
2. "**Should**" indicates a recommendation. Recommendations are important as they reflect adherence to best practices, but are not required for validation.
3. "**May**" indicates an option that is permitted, allowed, or permissible.

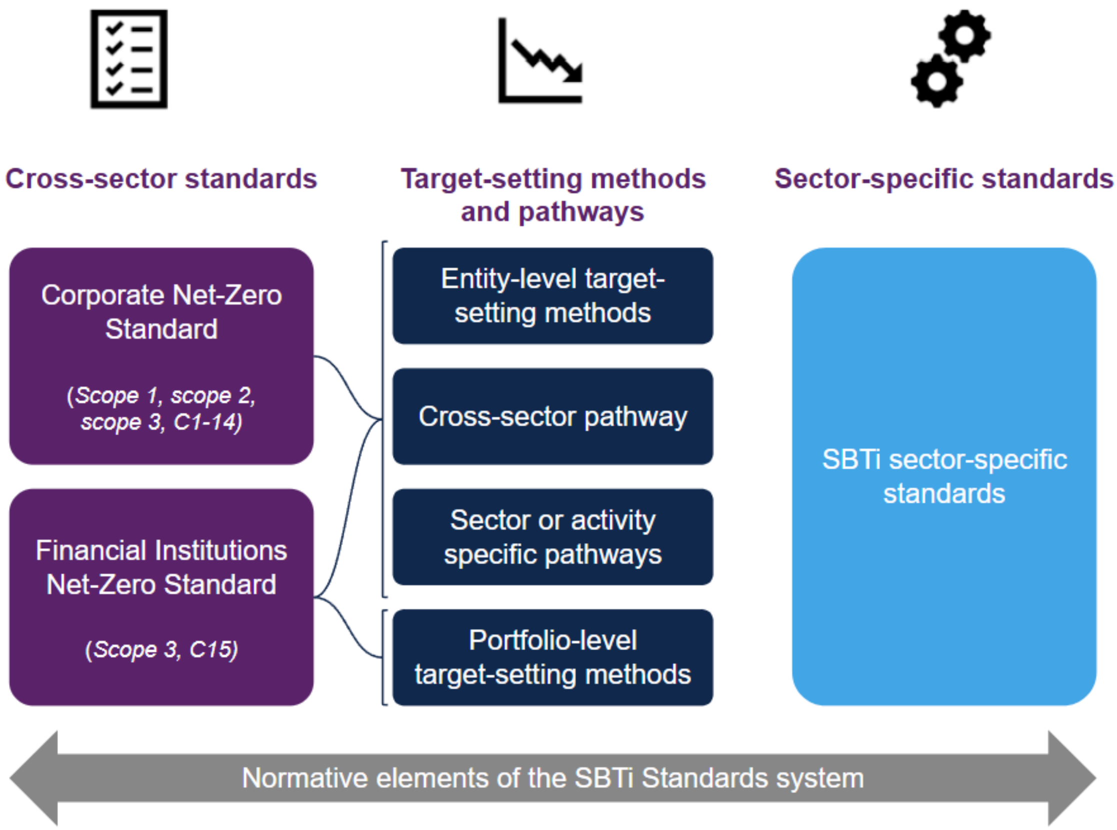
In SBTi Standards, the term "can" indicates possibility or capability, referring to options or actions available to the user. "Must" denotes external constraints that are not requirements of this document but are provided for informational purposes. For instance, "must" could pertain to compliance with applicable laws in a user's country, region, or sector, while "can" might describe permissible actions that do not affect validation—such as using a specific technology or approach to mitigate GHG emissions.

The SBTi Glossary provides a list of terms, definitions, and acronyms used in the SBTi's technical resources.

A.4 Framework of SBTi Standards

SBTi Standards are structured in a modular framework, comprising two cross-sector standards—the SBTi Corporate Net-Zero Standard and the SBTi Financial Institutions Net-Zero Standard. The suite of SBTi Standards also includes multiple Sector Standards intended for use by the highest-emitting industries to complement the cross-sector standards The term "Sector Standards" in this document refers to sector-specific SBTi documents which may be variably entitled Sector Standards, sector criteria, or sector guidance.

Figure 1. Overview of SBTi Standards System



The SBTi Corporate Net-Zero Standard provides cross-sector requirements and recommendations for scope 1, scope 2, and scope 3 emissions, categories 1-14. The SBTi Financial Institutions Net-Zero Standard provides requirements and recommendations for financial activities (scope 3 emissions, category 15).

Companies shall assess their business activities against scope and applicability of the SBTi Automotive Sector Net-Zero Standard as detailed in A.5.

The criteria stipulated in the **SBTi Sector Standards** are linked to and built upon the cross-sector criteria of the **SBTi Corporate Net-Zero Standard** (and the SBTi Financial Institutions Net-Zero Standard, if applicable).

All companies shall use the SBTi Corporate Net-Zero Standard as the starting point, in which they are required to determine the applicability of SBTi Sector Standards (CNZS-C9).

When a company falls within the scope of an SBTi Sector Standard, it shall conform to that standard on the corresponding scope of applicability to seek validation

All criteria from the SBTi Corporate Net-Zero Standard V2.0 apply to all companies on all their activities, unless superseded by SBTi Sector Standards.

In each chapter of the SBTi Automotive Sector Net-Zero Standard, all criteria from the SBTi Corporate Net-Zero Standard V2.0 are referenced and their application status on the scope of the SBTi Automotive Sector Net-Zero Standard is detailed.

A.5 Scope of the SBTi Automotive Sector Net-Zero Standard

The SBTi Automotive Sector Net-Zero Standard applies to companies as outlined below.

Automakers

Any company engaged in vehicle manufacturing (see Table A.1) with production exceeding ten thousand units annually, shall adhere to the criteria for automakers within this Standard

Auto parts manufacturers

Any company engaged in auto parts manufacturing (see Table A.1), where at least 20% of total company turnover is derived from auto parts production, shall adhere to the criteria for auto parts manufacturers within this Standard.

Powertrain suppliers

Within auto part manufacturers that meet the threshold above, powertrain suppliers (defined in Table A1 in Annex A) shall apply criteria APSS-C2 and APSS-C3, which cover use-phase emissions (scope 3, category 11) in addition to the rest of the auto parts criteria.

Companies producing both vehicles and auto parts

Companies manufacturing vehicles and meeting the automaker thresholds above, but also manufacturing auto parts, shall apply the automaker criteria for all activities that lead to a final vehicle being produced. Auto parts manufactured for use in a company’s own vehicles shall be treated as part of the vehicle manufacturing criteria.

If auto parts sales make up more than 20% of total company revenue, then the auto parts criteria shall be applied to this portion of the company operations to assess performance and set targets that are separate to the automaker targets.

If auto parts sales make up less than 20% of total company revenue, the company may, but is not obliged to, apply the auto part criteria, and can instead cover this activity (and any other activity) using cross-sector criteria from the SBTi Corporate Net-Zero Standard V2.0.

Automakers offering financial services

According to the SBTi Glossary, the SBTi defines a financial institution (FI) as an entity that generates 5% or more of its revenue from investment, lending or insurance activities, and are therefore typically required to follow the SBTi Financial Institutions Net-Zero Standard.

However, automakers often offer financial products such as loans or insurance for sold vehicles that can generate significant revenue. This Standard introduces an exemption to the use of SBTi Financial Institutions Net-Zero Standard for automotive sector companies. Automotive sector companies that fall into the scope of this Standard should apply the SBTi Corporate Net-Zero Standard V2.0 and this Standard and are not required to follow target setting requirements applicable to financial institutions for financial activities related to vehicle loans or insurance on sold vehicles, regardless of the share of their revenue coming from these financial activities. This exemption is justified because emissions associated with vehicle loan revenue are already covered by other components of this Standard. Automotive sector companies that fall into the scope of this Standard with revenue from investment or lending activities other than vehicle loans and insurance shall assess the applicability of the SBTi Financial Institutions Net-Zero Standard to these activities and, if applicable, apply the SBTi Financial Institutions Net-Zero Standard in parallel with this Standard.

Company categorization

The SBTi Automotive Sector Net-Zero Standard uses the same categorization model as the SBTi Corporate Net-Zero Standard V2.0, with companies segmented into two categories. Please refer to the SBTi Corporate Net-Zero Standard V2.0 for segmentation criteria to identify the category your company belongs to. The criteria of the SBTi Automotive Sector Net-Zero Standard apply differently according to the company's category. The applicability is mentioned as "Company segment" under each criterion.

Definition of activities in the scope of this Standard

Table A.1 lists activities that fall within the scope of the SBTi Automotive Sector Net-Zero Standard according to the International Standard Industrial Classification of All Economic Activities (ISIC) Section and Class codes. All these activities are part of Section C – Manufacturing.

Table A.1. Activities within the scope of the SBTi Automotive Sector Net-Zero Standard and related ISIC Class codes

ISIC Section	ISIC Class	Activity	Automaker criteria apply	Auto parts criteria apply
C Manufacturing	2910	Manufacture of motor vehicles	✓	
	2920	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers		✓
	2930	Manufacture of parts and accessories for motor vehicles		✓
	3091	Manufacture of motorcycles	✓	

Note: for details on the content of these classes, see ISIC, 2008. Also, all relevant parts for motor vehicles, including rubber and plastics products, non-metallic mineral products, basic metals, fabricated metal products, except machinery and equipment, computer, electronic and optical products, electrical equipment and machinery and equipment (individually listed under ISIC Divisions 22 to 28, in general terms) are considered included under ISIC class 2930 when manufactured for motor vehicles.

In particular, ISIC Classes 2910 and 3091 are part of the manufacturing of road transport vehicles, and ISIC Classes 2920 and 2930 are part of the manufacturing of parts and components to the automotive sector.

Definition of activities outside the scope of this Standard

Table A.2 lists the activities (based on ISIC Sections and specific Classes) that relate to the subject covered in this Standard but fall beyond its current scope.

Table A.2 Activities (and related ISIC Classes) that relate with the subject covered in the SBTi Automotive Sector Net-Zero Standard but fall beyond its current scope

ISIC Section	ISIC Class	Activity
G Wholesale and retail trade; repair of motor vehicles and motorcycles	4510	Sale of motor vehicles
	4520	Maintenance and repair of motor vehicles
H Transportation and storage	4922	Other passenger land transport
N Administrative and support service activities	7710	Renting and leasing of motor vehicles

Additional activities are indirectly related to the SBTi Automotive Sector Net-Zero Standard but fall outside its scope. These include the following activities – detailed based on ISIC categories at the highest level (sections) and including most representative/relevant items:

- Agriculture, forestry and fishing (ISIC Section A), for biofuels.
- Mining and quarrying (ISIC Section B) for energy and minerals extraction.
- Manufacturing (ISIC Section C) for the parts related with fuels (needed for vehicle use and also as energy inputs for the production of fuels and vehicles).
- Manufacture of other transport equipment not elsewhere classified (ISIC Class 3099)
- Steam and air conditioning supply (ISIC Section D), needed for vehicle use and as energy inputs for the production of fuels and vehicles.
- Transportation and storage (ISIC Section H), relevant for vehicle and energy trade and distribution.

Emissions from capital goods manufacturing are excluded from the minimum boundary for the automaker criteria in this Standard. This applies to vehicle manufacturing, energy production, transport, and distribution facilities. This approach aligns with the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Additionally, the construction sector (ISIC Section F) is not included in this Standard.

Please note that the activities outside the scope of this Standard fall within the scope of the SBTi Corporate Net-Zero Standard V2.0.

Optional application of this Standard

Companies that do not meet the applicability thresholds in A.5 but still conduct activities within the scope of this Standard (listed in A.5) may optionally apply the SBTi Automotive Sector Net-Zero Standard. Alternatively, they may address the emissions resulting from these activities following the SBTi Corporate Net-Zero Standard V2.0.

Addressing emissions from activities not covered in this Standard

All GHG emissions from activities outside the scope of this Standard shall be addressed in accordance with the SBTi Corporate Net-Zero Standard V2.0.

A.6 Structure of SBTi Automotive Sector Net-Zero Standard

The structure of SBTi Automotive Sector Net-Zero Standard is aligned with that of the SBTi Corporate Net-Zero Standard V2.0. The SBTi Automotive Sector Net-Zero Standard covers six key topics which are presented over the following six chapters:

1. **NET-ZERO AMBITION**
2. **BASE YEAR ASSESSMENT**
3. **TARGET SETTING**
4. **TAKING RESPONSIBILITY FOR ONGOING EMISSIONS**
5. **ASSESSING PERFORMANCE AND RENEWING TARGETS**
6. **SBTi CLAIMS**

The criteria for automakers and auto parts manufacturers are aligned in intent, methods, and pathways, but the requirements for each type of company differ slightly and therefore the criteria are provided separately in each chapter.

Structure

Each chapter includes a table referencing the different criteria from the SBTi Corporate Net-Zero Standard V2.0 and how they apply within the SBTi Automotive Sector Net-Zero Standard.

After this table, each chapter includes (if any):

- **The sector-specific criteria** (identified by "**AMSS-C**" or "**APSS-C**[1]" followed by whole numbers) **and sub-criteria** (identified by "C" followed by decimal numbers). Criteria and sub-criteria identified by "AMSS-C" apply to automakers and criteria identified by "APSS-C" apply to auto parts manufacturers in this Standard. Criteria and sub-criteria are the rules that companies shall adhere to in order to be validated by the validation body.
- **Recommendations** (identified with an "R") followed by numbers. Recommendations are the best practices companies are encouraged to follow but that are not validated.

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[1] The acronyms stand for Automaker Sector Standard Criterion and Auto Part Sector Standard Criterion respectively.

Some criteria are marked as “optional”, meaning companies may choose to follow them. If optional criteria are adopted, they shall be followed in full, including all related sub-criteria and are validated by the validation body.

It is recommended that users of this Standard open the document twice to:

1. Use the first copy to read the criteria.
2. Use the second copy to view annexes, when useful, to complement the reading of criteria.

Annex documents

This Standard also includes 10 annexes. An annex is a normative, prescriptive document that entities—including those applying for target validation—must follow to comply with SBTi’s standard requirements.

Table A.3. Description, classification and status of normative annexes to the SBTi Automotive Sector Net-Zero Standard.

Annex	Description	Classification (normative or informative)	Status
Annex A: Key Terms	Key terms and acronyms introduced in this version of the SBTi Automotive Sector Net-Zero Standard that are not already included in the SBTi Glossary.	Normative	Draft for public consultation
Annex B: Metrics, benchmarks and methods	Provides sector-specific metrics designed to support the adoption of targets and the assessment of progress and performance over time.	Normative	Draft for public consultation
Annex C: Baselines and pathways	Overview of pathways and trajectories used in target-setting methods.	Normative	Draft for public consultation
Annex D: Reference Data	Reference for default data and indicators.	Normative	Draft for public consultation
Annex E: Vehicle energy intensity calculations	Additional information on conversion of vehicle energy intensity based on country-specific test procedures.	Normative	Draft for public consultation
Annex F: Energy efficiency ratios	Weighting factors for the assessment of the sales shares of low-emission vehicles.	Normative	Draft for public consultation
Annex G:	Convergence approach description for	Normative	Draft for

Convergence approach	the applicable target setting criteria.		public consultation
Annex H: Percentage improvement approach	Percent improvement approach description for the applicable target setting criteria.	Normative	Draft for public consultation
Annex I: Assignment of parts to vehicle powertrains	Default zero-emission vehicle share for parts without powertrain documentation.	Normative	Draft for public consultation

Other supporting documentation

This Standard is supported by appendices that provide descriptive documentation designed to help entities, including applicants for validation, understand the concepts presented in the normative documents. It helps ensure consistency, transparency, and accountability. These materials provide details on how to implement this Standard effectively, concepts and metrics rationale, additional information on emission calculations, and vehicle manufacturing end-of-life emissions management.

Table A.4. Description, classification and status of documentation (non-normative) to support the implementation of the SBTi Automotive Sector Net-Zero Standard.

Appendices or document	Description	Classification (normative or informative)	Status
Appendix J: Life-cycle assessment components	Rationale for the life-cycle assessment approach taken in this Standard.	Informative	Draft for public consultation
Appendix K: Well-to-tank emissions	Additional information regarding the well-to-tank emission calculation of various energy carriers.	Informative	Draft for public consultation
Appendix L: Vehicle manufacturing and end-of-life emissions	Additional information regarding vehicle manufacturing and end-of-life emissions.	Informative	Draft for public consultation
Appendix M: Methodological considerations on	Additional guidance on accounting for zero-emission vehicles.	Informative	Draft for public consultation

the accounting of energy efficiency ratios for zero-emission vehicles			
Synthesis Report	Additional insights derived from research and scientific analysis that has informed this Standard.	Informative	Completed
Appendix O - Key Assumptions	Summary of key assumptions and dependencies underlying the pathways used in this Standard	Informative	To be prepared after public consultation

A.7 Validation model

The validation model of SBTi Sector Standards follows the same cycle as the model in the SBTi Corporate Net-Zero Standard V2.0: all targets need to be validated and assessed together. The following conformity assessments occur over a defined cycle for targets that are set over a five-year target time: entry check, initial validation and renewal validation. Additionally, the SBTi may carry out post checks to confirm conformity with SBTi Standards.

Please refer to the SBTi Corporate Net Zero Standard V2.0 and to the SBTi Services webpage for more information on targets' validation.

The assessment stage of each criterion is detailed in every chapter and sub-sections of SBTi Standards. It provides information on when conformance with the criterion will be validated.

A.8 Development process

Revisions to existing resources

In March 2024, the SBTi released the updated SBTi Land Transport Guidance. This included an interim method for automakers to set 1.5°C-aligned emissions reduction targets based on a 4.2% annual absolute reduction of WTW emissions.

The March 2024 update was needed to provide automakers, who requested the opportunity to set 1.5°C-aligned emissions reduction targets, the chance to do so as the previous SBTi Transport Sector Guidance and emission reduction trajectories were developed for less stringent emission reduction targets.

This Standard introduces several enhancements and, upon publication, is intended to supersede the applicable requirements from the SBTI Land Transport Guidance for the activities covered in this Standard.

The most relevant changes to users are based on the following methods and principles:

- Introduction of a new pathway and metric that requires companies to set targets on their scope 3 category 11 emissions associated with the vehicle use phase in WTW basis.
- Regionalized pathways to reflect the reality of economic and market differences.
- Replacement of the requirement to commit to the Zero Emissions Vehicles (ZEV) Declaration by a 'zero-emission vehicle sales share' criterion; with specific reporting requirements (both retrospective and future company strategy).
- Use phase emissions continue to be based on WTW, but this Standard introduces a more detailed WTW methodology and associated default values for data inputs such as emission factors specifically designed for the vehicle use phase.
- More guidance on calculating emissions including data inputs such as default vehicle lifetime mileage, required to calculate use-phase emissions.

A six-month transition period will be provided following publication, during which companies may use either the SBTi Land Transport Guidance or the SBTi Automotive Sector Net-Zero Standard. After the transition period concludes, the SBTi Automotive Sector Net-Zero Standard will become mandatory.

Standard development process

This Standard is being developed through a formal and transparent multi-stakeholder process in accordance with the Standard Operating Procedure for Development of SBTi Standards.

The content of this Standard may change as a result of this process. The Project Terms of Reference for this revision process can be found here (SBTi Automotive Sector Net - Zero Standard ToR).

The SBTi Automotive Sector Net-Zero Standard was developed through a series of key steps, each of which was subject to review and approval in accordance with the standard development process for all SBTi sector-specific standards.

Process of the First Public Consultation

The first draft of the SBTi Automotive Sector Net-Zero Standard was open for public consultation from 12 June to 11 August 2025. During this period, the SBTi received 104 responses through an online survey, email submissions, and direct feedback. All feedback and comments were anonymized and compiled in the First Public Consultation Feedback Summary Report and the First Public Consultation Feedback Log.

Each submission was individually reviewed and considered by the SBTi. The feedback received was used to inform and enhance the revised draft of the Standard, as detailed in the Main Changes Document for the Second Public Consultation of the SBTi Automotive Sector Net-Zero Standard. In addition, the EAG provided valuable input throughout this process. Their recommendations were incorporated to further refine and strengthen the second public consultation draft.

Purpose of the second Public Consultation

The second public consultation process gives all stakeholders the opportunity to review and improve the proposed content, ensuring the final Standard is robust and effective. We have included consultation questions at the end of each chapter, to gather public feedback on the key elements and options presented in this draft.

Next steps

Responses to feedback will be published in the Public Consultation Feedback Report, the Pilot Testing Feedback Report, and the Project Feedback log. A Basis for Conclusions Report will be published at launch to summarize the main points of feedback received on the project and the responses to it.

Between one and five years after the approval of an SBTi Standard, the SBTi shall oversee a formal consultation to undertake a review of the SBTi Standard to ensure and improve its continuing relevance and effectiveness in meeting its objectives. The exact review date will be determined based on the evolving needs of stakeholders and advancements in the relevant field.

Stakeholders are able to submit feedback not only during the public consultation phase but also throughout the course of the project through the Project Feedback Form.

A.9 Compliance with regulatory requirements

In addition to meeting the criteria within SBTi Standards, companies are responsible for meeting or exceeding national, subnational, and regional legislation and regulation in the countries where the Standards are applied on topics covered in the SBTi Standards.

A.10 Language and translations

The working language for SBTi Standards is English. As necessary, the SBTi may arrange translations of SBTi Standards into languages other than English. Translated versions of a Standard are for information only. In case of doubt, the official English-language version shall be deemed definitive.

Consultation questions

This subsection presents the key consultation questions related to this chapter. Stakeholders are invited to review the questions below and submit responses via the online survey.

Section	Criterion	Question	Rationale
A.5	General	Do you agree that auto part manufacturers defined as powertrain suppliers (as per revised definition in Annex A) should be required to cover use-phase emissions scope 3, category 11?	Powertrain suppliers play a critical role in determining a vehicle's operational efficiency and overall emissions during use.
A.5	General	Do you agree that automotive sector companies with revenue from investment, lending, or insurance activities other than vehicle loans or vehicle insurance should be required to assess the applicability of the SBTi Financial Institutions Net-Zero Standard to these activities?	Some automotive firms generate revenue from investment, lending, or insurance activities, which may fall under the scope of the SBTi Financial Institutions Net-Zero Standard
Chapters 1 - 6	General	Do you find the explanation of the draft Corporate Net-Zero Standard V2.0's criteria applicability clear enough to allow both this standard and the Automotive Standard to be applied efficiently in parallel? If not, do you have any suggestions for improving this guidance?	The standards are designed to work in parallel. The CNZS provides overarching guidance, while the Automotive Sector Net-Zero Standard covers aspects specific to automotive companies not addressed by the CNZS.

1. NET-ZERO AMBITION

Background: Demonstrating corporate climate leadership requires embedding net-zero ambition into operations, signaling accountability toward global goals. Strong climate action is underpinned by robust governance, transparent reporting, and alignment of core business practices.

Intent: To position the company's ambition to be net-zero by 2050 as its guiding north star for target setting, ensuring that near-term actions align with long-term goals, supported by credible transition plans that demonstrate climate ambition to stakeholders.

1.1. Applicability of criteria from the SBTi Corporate Net-Zero Standard V2.0

The following table specifies the applicability of criteria from the SBTi Corporate Net-Zero Standard V2.0 for companies who apply both the SBTi Corporate Net-Zero Standard V2.0 and the SBTi Automotive Sector Net-Zero Standard in parallel. This table is currently based on the SBTi Corporate Net-Zero Standard V2.0 draft for second public consultation.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
CNZS-C1. Companies shall set an ambition to transition their operations and value chains in alignment with the goal to be net-zero by no later than 2050.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards).
CNZS-C2. Companies shall publish a transition plan to substantiate their targets and net-zero ambition within 12 months from Initial Validation.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards).

Please note that the SBTi is currently researching the best way to clearly explain the applicability of the SBTi Corporate Net-Zero Standard V2.0 criteria within Sector Standards' scopes, which means that the above table might evolve in future versions of SBTi Standards.

1.2. Additional requirements introduced in this Standard

No additional requirements need to be followed by companies in the sector.

2. BASE YEAR ASSESSMENT

Background: By tracking a comprehensive set of metrics, including leading indicators that capture the transition of key activities and lagging indicators like absolute GHG emissions, companies can effectively manage their decarbonization progress. By monitoring these metrics companies can focus near-term actions where they will have the greatest impact, while using absolute emissions to confirm long-term progress over time.

Intent: Companies set clear organizational boundaries and select a base year that reflects their typical operations.

2.1. Applicability of criteria from the SBTi Corporate Net Zero Standard V2.0

The following table specifies the applicability of criteria from the SBTi Corporate Net-Zero Standard V2.0 for companies who apply both the SBTi Corporate Net-Zero Standard V2.0 and the SBTi Automotive Sector Net-Zero Standard in parallel. This table is currently based on the SBTi Corporate Net-Zero Standard V2.0 draft for second public consultation.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
CNZS-C3. Companies shall define organizational boundaries that determine the scope for applying all SBTi Standards' criteria.	Companies shall apply this criterion and corresponding sub-criteria at the entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards).
CNZS-C4. Companies shall select a target base year that accurately reflects the company's structure and performance.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards).
CNZS-C5. Companies shall determine the value of each applicable metric for the target base year.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard, nor by any other SBTi Sector Standard. Companies shall apply AMSS-C1 and AMSS-C2 and/or APSS-C1 and APSS-C2, (for automakers/auto parts manufacturers respectively) for the activities and corresponding GHG emissions covered by the SBTi Automotive Sector Net-Zero Standard.
CNZS-C6. Companies shall	Companies shall apply this criterion and corresponding

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
calculate an emissions inventory according to the GHG Protocol Standards for the target base year.	sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards). In the SBTi Automotive Sector Net-Zero Standard, AMSS-C1 and/or APSS-C2 apply in addition to CNZS-C6.
CNZS-C7. Companies shall obtain third-party assurance of the calculated values for metrics used in target-setting.	Companies shall apply this criterion and corresponding sub-criteria to the total GHG inventory done as per CNZS-C6, and on the GHG inventories done as per AMSS-C1, APSS-C2, within the scope of the SBTi Automotive Sector Net-Zero Standard. When applying this criterion and corresponding sub-criteria the scope of the SBTi Automotive Sector Net-Zero Standard C7.1 is replaced by the following: "The assurance shall cover emissions covered by the SBTi Automotive Sector Net-Zero Standard."
CNZS-C8. Companies shall publicly report on the target base year and target information.	Companies shall apply this criterion and corresponding sub-criteria for all the targets set by applying the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards. Regarding the targets set through the SBTi Automotive Sector Net-Zero Standard, companies shall only report the information in Annex B of the SBTi Corporate Net-Zero Standard V2.0 that is relevant to these targets.
CNZS-C9. Companies shall conform to all applicable SBTi Standards.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards). Companies shall assess whether other SBTi Standards apply to them beyond the SBTi Corporate Net-Zero Standard V2.0 and the SBTi Automotive Sector Net-Zero Standard.

Please note that the SBTi is currently researching the best way to clearly explain the applicability of the SBTi Corporate Net-Zero Standard V2.0 criteria within Sector Standards' scopes, which means that the above table might evolve in future versions of SBTi Standards.

2.2. Additional requirements introduced in this Standard

Please note that this chapter is divided into two sub-chapters: sub-chapter 1 includes criteria applicable to automakers, and sub-chapter 2 includes criteria applicable to auto parts manufacturers. **Companies that both manufacture vehicles and auto parts shall apply criteria located in both sub-chapters**, if they meet the applicability conditions provided in section A.5 of this document.

SUB-CHAPTER 1 - CRITERIA APPLICABLE TO AUTOMAKERS

AMSS-C1. Companies shall assess base year performance for scope 3 category 11 emissions, if they choose to adhere to AMSS-C3 when setting targets.

Company segment: *All companies*
Activity type: *Automakers*
Assessment stage: *Initial Validation, Renewal Validation*

C1.1 **Base year performance:** Companies shall determine base year performance for the metric "Vehicle portfolio use phase emission intensity (new vehicles)" in Metric-Auto.1 in Table B1.

C1.2 **Assessment:** Companies shall make the assessment for each vehicle category (defined in Table A3) (to be) sold by the automaker and for each of the three global regions (defined in Annex A).

C1.3 **Boundary:** The boundary shall be the "fuel-cycle" (vehicle use and related energy production on a WTW basis [Scope 3, Category 11]) using a common functional unit: g CO_2e/vkm.

a. **Subsidiaries:** Where the company has over a 33% financial interest in an entity considered an automaker and the consolidation approach chosen results in the emissions from this company falling into Scope 3 category 15 (investments), the company shall either:
   - Include scope 3 category 11 emissions of this subsidiary in the boundary for the purposes of assessing base year performance as if it were inside the organisational boundary.
   - Ensure the subsidiary has, or has committed to, setting targets using this Standard.

C1.4 **Calculation:** Companies shall calculate the fuel-cycle emissions using Annex B.

C1.5 **Current Performance:** Companies shall assess their current level of performance against the net-zero aligned benchmarks included in Annex B**.**

C1.6 **Data sources:** For the purpose of benchmarking and reporting on previous annual sales, and to designate the country and region to which new vehicles are allocated, the following data types shall be used, in the following preference order, depending on data availability:

- Annual vehicle sales (e.g. in Europe) or registrations (e.g. in North America) data.
- Factory shipments (e.g. in China) with explicit reporting of those shipments bound for export, by country/region of destination for final sale/registration.
- If none of the above data types are readily available in a given market, the automaker can report based on production volumes, and is required to provide documentation to attribute these to sales markets.

Recommendations:

R1.1 **Base year data**: Companies should calculate emissions in the base year using data which has a high level of accuracy such as:

- Vehicle sales shares.
- Vehicle in-use energy consumption according to vehicle test procedures listed in the guidelines for criterion AMSS-C2.
- Verified energy use data and associated emission factors from direct energy supplier agreements.
- Verified vehicle lifetime and mileage values, including annual mileage, were recorded by in-house telematics.
- Verified utility factors for PHEVs were monitored using in-house telematics.

R1.2 **Default data:** Companies should rely on data available in Annex D as a reference for default data and indicators.

AMSS-C2. Companies shall assess zero-emission and near-zero-emission vehicle sales share covering their overall annual vehicle sales/registration portfolio for the target base year, if they choose to adhere to AMSS-C4 when setting targets.

Company segment: *All companies*
Activity type: *Automakers*
Assessment stage: *Initial Validation, Renewal Validation*

C2.1 **Base year performance:** Companies shall determine performance in the base year for zero-emission vehicle sales share Metric-Auto.2 in Table B1.

a. **Inclusion:** The zero-emission vehicle (ZEV) sales share shall also consider the share of near-zero-emission vehicles (near-ZEVs)[2]. Sales of near-ZEVs can partially contribute toward the zero-emission vehicle sales share metric. A near-ZEV's contribution to the zero-emission vehicle sales share shall also depend on its WTW energy efficiency. These shall be based on the energy efficiency ratios, set out in Annex F, with battery electric vehicles (BEV) as the reference point (due to the best energy efficiency performance among powertrains).

C2.2 **Current Performance:** Companies shall assess their current level of performance against the net-zero aligned benchmarks included in Annex B**.**

C2.3 **Assessment:** Companies shall make the assessment for each vehicle category (defined in Table A3) sold by the automaker and for each of the three global regions (defined in Annex A).

[2] The California Air Resources Board's near-ZEV designation was developed for the Advanced Clean Truck rule, and applies to plug-in hybrid trucks or hybrid electric trucks capable of conductive or inductive charging. In this Standard, the definition is applied across all relevant vehicle categories (i.e. light-duty vehicles and heavy-duty vehicles), as a more general and globally applicable alternative to the California-specific regulatory requirements for PHEVs or other vehicles with low criteria pollutant emissions (i.e. partial-ZEVs, or near-ZEVs in the context of California's zero-emission assurance project).

SUB-CHAPTER 2 - CRITERIA APPLICABLE TO AUTO PARTS MANUFACTURERS

APSS-C1. Companies shall assess and disclose the sales share of parts that they sell for vehicles defined as zero-emission and near-zero-emission, taking into account vehicle energy efficiency ratios.

Company segment: *Category A (mandatory); Category B (optional)*
Activity type: *Auto parts manufacturers*
Assessment stage: *Initial Validation, Renewal Validation*

C1.1 **Assessment:** Companies shall assess performance by the sales share of parts linked to each vehicle category (defined in Table A3) and for each of the three global regions (defined in Annex A).

C1.2 **Boundary:** The boundary shall be total annual component (parts) sales. Companies shall calculate the total contribution of their component (parts) sales to annual zero-emission vehicle sales shares.

C1.3 **Inclusion:** Zero- and near-zero-emission vehicles shall be determined as in AMSS-C2. As in AMSS-C2, near-zero-emission vehicles (near-ZEVs) shall be eligible for partial ZEV credits, based on their WTW energy efficiency ratio, with BEVs as the reference point.

C1.4 **Contribution:** Parts equipping new vehicles produced by SBTi-validated automakers can be considered as contributing to the zero-emission vehicles sales share.

C1.5 **Differentiation:** Companies shall differentiate whether the parts they produce are supplied to zero-emission vehicles or other vehicles, based on the total share of new zero-emission vehicles produced by the automakers. In cases where companies are unable to establish the powertrain of the vehicle to which their parts are supplied, the parts are designated to the least performant powertrain according to the attribution methods detailed in Annex I.

C1.6 **Attribution:** Companies shall attribute their parts to each vehicle category, based on the vehicle category for which they are manufactured. In case of ambiguity, average market shares by vehicle category or company-specific shares, supported by documented evidence, can be used to allocate parts to different vehicle categories.

Recommendations:

R1.1 **Disclosure:** Companies should disclose the share of sales of parts for zero-emissions vehicles should be further broken down into two datapoints: share of sales of parts destined for new zero-emissions vehicles and share of sales of parts destined for existing zero-emissions vehicles (i.e. replacement parts).

APSS-C2. Companies shall determine the value of each applicable metric for the base year

Company segment: *All companies*

Activity type: *Powertrain suppliers*
Assessment stage: *Initial Validation, Renewal Validation*

C2.1 **Base year performance:** Companies shall determine performance in the base year for the chosen applicable target-setting method specified for powertrain suppliers in Annex B, Table B.2.
[*The SBTi is exploring options for additional metrics, methods, and pathways, such as alignment metrics, that may be applicable to powertrain suppliers for setting targets to address scope 3 category 11 emissions from sold products*.]

C2.2 **Current Performance:** Companies shall assess their current level of performance against the net-zero aligned benchmarks included in Annex B**.**

CONSULTATION QUESTIONS

This subsection presents the key consultation questions related to this chapter. Stakeholders are invited to review the questions below and submit responses via the online survey.

Section	Criterion	Question	Rationale
2. Determining performance in the target base year	AMSS-C2	Do you think that near-ZEVs should partially contribute to the ZEV sales share alignment target via the ratios described in Annex F?	Near-ZEVs can contribute to the transition toward ZEVs by offering significantly reduced life-cycle GHG emissions as compared to ICEVs.
2. Determining performance in the target base year	AMSS-C1, AMSS-C2	Do you think the SBTi should require companies to submit base year performance data as required for both the scope 3 category 11 metric for automakers (AMSS-C1) AND the ZEV sales share metric (AMSS-C2), even though only one of these metrics shall be chosen for target-setting?	Gathering the required data for both metrics would require companies to be aware of their level of performance for both an emissions-intensity and ZEV sales share, both of which are critical for climate action. Gathering such data in the base year would also be advantageous for companies in case they may choose to "switch" their chosen target setting method from one metric to the other in the future.
2. Determining performance in the target base year	AMSS-C1	Do you agree with the revised criteria that requires automotive companies with over a 33% stake in an entity considered an automaker, whose emissions fall under scope 3, category 15 (investments), should be required to either include the subsidiary's emissions within their boundary for base year performance assessment or ensure the subsidiary has, or commits to, setting targets in line with this Standard?	The proposed 33% threshold aims to establish a clear and consistent boundary for when companies should account for emissions from entities they have substantial influence over. Providing two compliance options, either including the subsidiary's emissions or ensuring it sets its own targets, offers flexibility while maintaining accountability and alignment with the objectives of this Standard.

Section	Criterion	Question	Rationale
2. Determining performance in the target base year	General	Do you agree that the Standard is now better aligned with definitions for zero-emission vehicles (ZEVs), instead of low-emission vehicles (LEVs) as in the previous draft?	This change reflects feedback received from stakeholders and aims to better align the Standard with the broader goal of accelerating decarbonization in the automotive sector.
2. Determining performance in the target base year; Demonstrating progress toward targets	AMSS-C1	The SBTi is proposing a revision to the default emission factors for renewable natural gas (RNG) from negative values to zero, as shown in Annex D, Table D.2, and described further in Appendix K. Do you agree with this revision?	Due to the lack of demonstrability of permanence and additionality, as well as wide variability in counterfactual practices (further outlined in Appendix K), the SBTi is seeking consultation on whether to 1) include the negative emission factors adopted by CORSIA for biogas, biomethane, and RNG as defaults, or 2) include a lower-bound default emission factor of zero. In both cases a cap is set at 3% of the fuel used by road vehicles. Beyond this percentage, a default emission value of 13 gCO_2e/MJ applies, unless lower indirect impacts are demonstrated and disclosed in a way that enables third-party verification.

3. TARGET SETTING

Background: After assessing climate performance, companies set targets to align with net-zero. Comparing performance to science-based benchmarks ensures targets are ambitious, credible, and tailored to companies' context.

Intent: Companies set public, science-based, measurable, time-bound targets to improve climate performance and align with pathways consistent with the global goal of reaching net-zero emissions by mid-century.

3.1. Applicability of criteria from the SBTi Corporate Net Zero Standard V2.0

The following table specifies the applicability of criteria from the SBTi Corporate Net-Zero Standard V2.0 for companies who apply both the SBTi Corporate Net-Zero Standard V2.0 and the SBTi Automotive Sector Net-Zero Standard in parallel. This table is currently based on the SBTi Corporate Net-Zero Standard V2.0 draft for second public consultation.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
CNZS-C10. Companies shall set targets to address emissions from their operations and value chain consistent with their net-zero ambition.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard, nor by any other SBTi Sector Standard except for: - C10.2 on target timeframe; - C10.3 on mid-term targets; - C10.6 on maintaining net-zero alignment; - C10.10 on dependencies. These four sub-criteria from the SBTi Corporate Net-Zero Standard V2.0 apply to the activities in the scope of the SBTi Automotive Sector Net-Zero Standard.
CNZS-C11. Companies shall set near-term targets to reduce or eliminate emissions from sources owned or controlled by the company.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard, nor by any other SBTi Sector Standard.
CNZS-C12. Companies shall set long-term targets to reach residual emissions level across all owned and operated assets by 2050 or earlier.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard, nor by any other SBTi Sector Standard.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
CNZS-C13. Companies shall implement scope 1 targets using credible measures that are eligible under the applicable target-setting approach.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard.
CNZS-C14. Companies shall set near-term targets to address emissions from the electricity, steam, heating and cooling they purchase and consume.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard, nor by any other SBTi Sector Standard.
CNZS-C15. Companies shall set one or more long-term targets to address emissions from their purchased and consumed electricity, heat, steam, and cooling.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard, nor by any other SBTi Sector Standard.
CNZS-C16. Companies shall implement scope 2 targets using measures that are eligible under the applicable target-setting approach and satisfy quality criteria.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard.
CNZS-C17. Companies shall set near-term targets consistent with achieving net-zero value chain emissions by 2050 or earlier.	Companies shall apply sub-criterion C17.1 at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards): all significant scope 3 categories shall be covered by near-term targets set through the SBTi Corporate Net-Zero Standard V2.0 and/or SBTi Sector Standards. Companies shall apply sub-criterion C17.4 at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards). Companies shall apply sub-criteria C17.2, C17.3, C17.5 to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard, nor by any other SBTi Sector Standard.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
CNZS-C18. Companies shall set targets using any target-setting approach eligible for the corresponding scope 3 category.	Companies shall apply this criterion and corresponding sub-criteria to all activities (and corresponding GHG emissions) that are not covered by the SBTi Automotive Sector Net-Zero Standard, nor by any other SBTi Sector Standard.
CNZS-C19. Where an activity is embedded within an activity pool and traceability to the individual emission source is not feasible, companies may take action and demonstrate performance against alignment targets at the activity pool level.	Companies shall apply this criterion and corresponding sub-criteria to the activities covered by the SBTi Corporate Net-Zero Standard V2.0.
CNZS-C20. Where companies are unable to source sufficient volumes of aligned goods or services, they may support the scale-up of low-carbon alternatives at the sector level by procuring unbundled commodity and energy EACs from low-carbon sources to meet volume alignment targets.	Companies shall apply this criterion and corresponding sub-criteria to the activities covered by the SBTi Corporate Net-Zero Standard V2.0.
CNZS-C21. Companies may set one or more long-term targets to reach net-zero emissions across their value chains by 2050 or earlier.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and SBTi Sector Standards), except for sub-criterion C21.1 that does not apply to the activities covered by the SBTi Automotive Sector Net-Zero Standard. C21.1 is superseded by AMSS-C3 and AMSS-C4 and/or APSS-C3 as relevant for activities and corresponding GHG emissions covered in the scope of the SBTi Automotive Sector Net-Zero Standard.

Please note that the SBTi is currently researching the best way to clearly explain the applicability of the SBTi Corporate Net-Zero Standard V2.0 criteria within Sector Standards' scopes, which means that the above table might evolve in future versions of SBTi Standards.

3.2. Additional requirements introduced in this Standard

Please note that this chapter is divided into two sub-chapters: sub-chapter 1 includes criteria applicable to automakers, and sub-chapter 2 includes criteria applicable to auto parts manufacturers. **Companies that both manufacture vehicles and auto parts shall apply criteria located in both sub-chapters**, if they meet the applicability conditions provided in section A.5 of this document.

Automotive manufacturers (Automakers) are given the option to set targets according to ***either*** reductions in scope 3 category 11 emissions intensity (AMSS-C3), increasing sales shares of zero-emission vehicles (AMSS-C4), or both. Automakers will address emissions related to scope 1 and 2, and significant scope 3 categories (other than scope 3 category 11 emissions from sold vehicles), such as scope 3 category 1, based on the relevant criteria in the SBTi Corporate Net-Zero Standard V2.0.

SUB-CHAPTER 1 - CRITERIA APPLICABLE TO AUTOMAKERS

AMSS-C3. Companies shall set near-term and long-term targets either to reduce scope 3 category 11 use-phase emissions intensity or to increase the share of zero- and near-zero-emission vehicle sales share, or both. Targets on scope 3 category 11 emissions shall be set according to this criterion.

Company segment: *All companies*
Activity type: *Automakers*
Assessment stage: *Initial Validation, Renewal Validation*

C3.1 **Granularity:** Companies shall calculate targets using the same granularity (vehicle type, region) as in AMSS-C1 using Metric-Auto.1 in Table B1.

C3.2 **Maintaining net-zero alignment:** For activities where companies have already achieved net-zero-aligned performance, they shall maintain that level of performance.

C3.3 Target Setting methods:

a. **Ambition – LDVs:** Minimum ambition of targets for LDVs (cars and vans) shall be assessed against a defined emission intensity trajectory, globally and for each region and vehicle category, located in Annex C, using a convergence method that aligns with global emission intensities by 2050, and calculated according to Annex G methods via the Automotive Target-Setting Tool. Targets at the regional and vehicle category level for LDVs may be aggregated into a global weighted average using projected sales in the target year and companies may assess target progress using this aggregated target.
b. **Ambition – non-LDVs:** Minimum ambition of targets for 2/3 wheelers,

buses and medium/heavy trucks shall be assessed against a defined emission intensity trajectory for each region and vehicle category, located in Annex C, using a contraction (percent improvement) method, calculated according to the formulas in Annex H via the Automotive Target-Setting Tool. Progress against targets at the regional and vehicle category level for 2/3 wheelers, buses and medium/heavy trucks shall be assessed separately.

C3.4 **Disclosure:** Automakers shall disclose as part of the target submission supporting information regarding how they intend to reduce vehicle use-phase emissions.

AMSS-C4. Companies shall set near-term and long-term targets either to reduce scope 3 category 11 use-phase emissions intensity or to increase the share of zero- and near-zero-emission vehicle sales share, or both. Targets on zero- and near-zero-emission vehicle sales share shall be set according to this criterion.

Company segment: *All companies*
Activity type: *Automakers*
Assessment stage: *Initial Validation, Renewal Validation*

C4.1 **Granularity:** Targets shall be calculated for each vehicle category (defined in Table A3) (to be) sold by the automaker and for each of the three global regions (defined in Annex A). Targets at the regional and vehicle category level may be aggregated into a global weighted average using projected sales in the target year and companies may assess target progress using this aggregated target.

C4.2 **Maintaining net-zero alignment:** For activities where companies have already achieved net-zero-aligned performance, they shall maintain that level of performance.

C4.3 **Ambition:** Minimum ambition of targets for each vehicle category shall be assessed via the Automotive Target-Setting Tool against a defined minimum sales share for each region and vehicle category using a convergence method within each regionalized country grouping calculated according to Annex G. Convergence with the regional zero-emission sales shares trajectories for each vehicle category at a global level shall be aligned by 2050, as set out in Annex C.

C4.4 **Alignment:** Companies shall calculate zero-emission vehicle sales share aligned to the definition in AMSS-C2.

AMSS-C5. Companies shall set near-term and long-term targets to address scope 3 category 1 emissions

Company segment: *All companies*
Activity type: *Automakers*
Assessment stage: *Initial Validation, Renewal Validation*

C5.1 **Target-setting method:** Companies shall set targets to address scope 3 category 1 emissions from any purchased priority commodities as defined in the Corporate Net-Zero Standard, and from any other materials purchased to be used in the manufacture of vehicles that represent greater than 5% of their scope 3 category 1 emissions. Targets shall be set using any applicable criteria in the Corporate Net-Zero Standard**.**

SUB-CHAPTER 2 - CRITERIA APPLICABLE TO AUTO PARTS MANUFACTURERS

APSS-C3. Companies shall set near-term and long-term targets to address scope 3 category 11 emissions using any applicable method for powertrain suppliers.

Company segment: *Category A (mandatory); Category B (optional)*
Activity type: *Powertrain suppliers (mandatory)*
Assessment stage: *Initial Validation, Renewal Validation*

C3.1 **Maintaining net-zero alignment:** For activities where companies have already achieved net-zero-aligned performance, they shall maintain that level of performance.

C3.2 **Target-setting method:** Companies shall set targets, using any applicable target-setting method specified for powertrain suppliers in Annex B, Table B2.

[*The SBTi is exploring options for additional metrics, methods, and pathways, such as alignment metrics, that may be applicable to powertrain suppliers for setting targets to address scope 3 category 11 emissions from sold products*.]

APSS-C4. Companies shall set near-term and long-term targets to address scope 3 category 1 emissions

Company segment: *All companies*
Activity type: *Auto parts manufacturers*
Assessment stage: *Initial Validation, Renewal Validation*

C4.1 **Target-setting method:** Companies shall set targets to address scope 3 category 1 emissions from any purchased priority commodities as defined in the Corporate Net-Zero Standard, and from any other materials purchased to be used in the manufacture of auto parts that represent greater than 5% of their scope 3 category 1 emissions. Targets shall be set using any applicable criteria in the Corporate Net-Zero Standard**.**

CONSULTATION QUESTIONS

This subsection presents the key consultation questions related to this chapter. Stakeholders are invited to review the questions below and submit responses via the online survey.

Section	Criterion	Question	Rationale
3. Target Setting	AMSS-C3, AMSS-C4	Do you agree with the option to allow automakers to set targets on EITHER scope 3 category 11 emissions OR zero-emission vehicle sales shares?	Allowing companies to choose between reducing scope 3 category 11 emissions intensity or increasing the share of zero- and near-zero-emission vehicle sales recognizes the diversity of business models, product portfolios, and market contexts across the automotive sector while recognizing that the majority of emissions associated with the sector occur in the use-phase. This flexibility ensures targets remain ambitious and relevant, while enabling companies to focus on either overall fleet efficiency improvements or accelerating the adoption of zero-emission vehicles.
3. Target Setting	AMSS-C3, AMSS-C4	Do you agree with the option to allow targets set using the regional and/or vehicle-type pathways to be aggregated into a single global target, to be achieved together? This aggregation would apply to all targets for LDVs and ZEV sales-share targets for non-LDVs.	Combining targets set using the separate vehicle type and regional pathways would allow for the simplification of targets and would provide flexibility in demonstrating target progress for companies with a diverse sales portfolio.

Section	Criterion	Question	Rationale
3. Target Setting	AMSS-C3	Do you agree that scope 1, scope 2, and other scope 3 emissions categories (other than scope 3 category 11) shall be disaggregated and addressed via criteria from the SBTi Corporate Net-Zero Standard V2.0?	Addressing these emissions via the Corporate Net-Zero Standard V2.0 would ensure target coverage and consistency with companies in other sectors.
3. Target Setting	AMSS-C3	Does the current SBTi Corporate Net-Zero Standard V2.0 draft for second public consultation provide viable options for automakers to set scope 3 category 1 and 12, and scope 1 and 2 targets, if these emissions are disaggregated from scope 3 category 11 as proposed in the Automotive Standard?	
3. Target Setting	APSS-C3	The SBTi has revised the definition of “powertrain suppliers” that must include in their target scope 3 category 11 emissions from sold products. Do you agree with the revised definition, which has been narrowed to only include suppliers of complete powertrain systems (such as engines or electric motors)?	The definition of powertrain suppliers has been narrowed to avoid confusion in applicability of criterion APSS-C3.
3. Target Setting	APSS-C3	Should the revised definition of “powertrain supplier” include both suppliers of internal combustion powertrains and electric powertrains?	The SBTi is seeking input on whether targets on scope 3 category 11 emissions from suppliers of electric motors should be addressed by the existing criterion APSS-C3.

Section	Criterion	Question	Rationale
3. Target Setting	APSS-C3	The SBTi is exploring additional metrics in addition to an emissions intensity metric that may be allowable as options for powertrain suppliers to set targets addressing scope 3 category 11 emissions. These may include alignment metrics for ZEV or near-ZEV powertrain sales share. Do you agree that technology alignment metrics may provide useful options for powertrain suppliers?	The SBTi is exploring how best to ensure powertrain suppliers are aligned with a net-zero trajectory on emissions in downstream value chain of their sold products.
3. Target Setting	AMSS-C5, APSS-C4	Do you agree with the proposal to require companies to set targets on scope 3 category 1 emissions associated with any purchased materials that represent more than 5% of their scope 3 category 1 emissions, using the applicable criteria from the Corporate Net-Zero Standard V2.0?	By requiring companies to set targets for priority commodities and for other purchased materials that represent more than 5% of their Category 1 emissions, the approach ensures that high-impact products are appropriately addressed without creating excessive reporting or target-setting burdens for immaterial emission sources.

4. TAKING RESPONSIBILITY FOR ONGOING EMISSIONS

Background: Companies will continue to emit GHGs on the path to net-zero. By taking responsibility for these ongoing emissions, they can help limit temperature overshoot, reduce transition risks, and support climate solutions. To encourage this, the SBTi is launching an optional recognition program for ongoing emissions responsibility.

Taking responsibility for ongoing emissions will remain optional until 2035, after which Category A companies will be required to take increasing responsibility for these emissions. By their net-zero year, all companies shall neutralize 100% of their residual emissions or, in the case of indirect value chain emissions, ensure that they are neutralized by value chain counterparties.

Intent: Companies take responsibility for ongoing emissions as they transition to net-zero and neutralize the impact of their residual emissions by their net-zero target year and thereafter.

4.1. Applicability of criteria from the SBTi Corporate Net Zero Standard V2.0

The table below outlines which SBTi Corporate Net-Zero Standard V2.0 criteria apply to companies using both it and the Automotive Sector Net-Zero Standard in parallel. This table is currently based on the SBTi Corporate Net-Zero Standard V2.0 draft for second public consultation.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
CNZS-C22. During validation, companies shall disclose whether they plan to take responsibility for the impact of their ongoing emissions during the upcoming near-term target timeframe.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards) and corresponding GHG emissions.
CNZS-C23. Companies seeking “Recognized” status shall take responsibility for the impact of 1% or more of ongoing emissions (scopes 1, 2 and 3) over the	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards) and corresponding GHG emissions.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
near-term target timeframe through supplementary climate contributions.	
CNZS-C24. Companies seeking “Leadership” status shall take responsibility for the impact of 100% of their ongoing emissions (scopes 1, 2 and 3) over the near-term target timeframe through supplementary climate contributions.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards) and corresponding GHG emissions.
CNZS-C25. Companies seeking recognition for their ongoing emissions responsibility shall disclose their actions and contributions to the SBTi for public display and ensure that all contributions adhere to integrity principles.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards) and corresponding GHG emissions.
CNZS-C26. Companies seeking recognition for taking responsibility for ongoing emissions shall ensure that the resulting mitigation outcomes are not counted towards value chain targets.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards) and corresponding GHG emissions.
CNZS-C27. Companies seeking recognition shall ensure that mitigation outcomes counted toward ongoing emissions responsibility are not simultaneously claimed by another entity for compliance, offsetting, or compensation purposes.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards) and corresponding GHG emissions.
CNZS-C28. From 2035,	Companies shall apply this criterion and corresponding

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
companies shall take responsibility for the impact of a portion of their ongoing emissions by undertaking supplementary mitigation action.	sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards) and corresponding GHG emissions.
CNZS-C29. Companies shall achieve a state of net-zero through the reduction of their scope 1, 2, and 3 emissions to zero or residual levels, and the neutralization of all residual emissions at the net-zero target year and thereafter.	Companies shall apply this criterion and corresponding sub-criteria at entity level, including all activities (activities covered by the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards) and corresponding GHG emissions.

Please note that the SBTi is currently researching the best way to clearly explain the applicability of the SBTi Corporate Net-Zero Standard V2.0 criteria within Sector Standards' scopes, which means that the above table might evolve in future versions of SBTi Standards.

4.2. Additional requirements introduced in this Standard

No additional requirements apply to companies in this sector.

5. ASSESSING PERFORMANCE AND RENEWING TARGETS

Background: Clear and transparent communication of performance against targets strengthens credibility by demonstrating measurable progress toward net-zero goals. While companies are expected to make best efforts to achieve their targets, they should also disclose any deviations openly, explain the underlying causes, and outline corrective actions to realign with their net-zero trajectory. This principle applies both to annual performance reporting and at the end of each target cycle. Companies should assess progress and establish new targets, ideally before the current cycle concludes, and subsequently publish an end-of-cycle performance report.

Intent: Companies regularly report on their progress, assess and transparently disclose their performance against targets, and set new targets to ensure continued alignment with their net-zero transition.

5.1. Applicability of criteria from the SBTi Corporate Net Zero Standard V2.0

The table below outlines which SBTi Corporate Net-Zero Standard V2.0 criteria apply to companies using both it and the Automotive Sector Net-Zero Standard in parallel. This table is currently based on the SBTi Corporate Net-Zero Standard V2.0 draft for second public consultation.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
CNZS-C30. Companies shall track and publicly report progress against metrics that are used to set targets on an ongoing basis.	Companies shall apply this criterion for all targets set under the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards.
CNZS-C31. Companies shall recalculate their target base year GHG emissions and other metrics and, if necessary, their targets, in response to significant changes.	Companies shall apply this criterion for all targets set under the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards.
CNZS-C32. Companies shall substantiate performance against	Companies shall apply this criterion for all targets set under the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards.

targets with mitigation measures that are accurate, permanent, transparent, and verifiable.	
CNZS-C33. Companies shall determine performance against their targets at the end of the target timeframe, and set new targets based on their current performance.	Companies shall apply this criterion for all targets set under the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards.
CNZS-C34. Companies shall publicly report on their performance against targets at the end of their target cycle.	Companies shall apply this criterion for all targets set under the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards. C34.5 applies this way to targets set by applying the SBTi Automotive Sector Net-Zero Standard: "Any communication related to target progress or renewal validation shall adhere to requirements stipulated in the Claims Section of the SBTi Automotive Sector Net-Zero Standard and any other applicable SBTi policies".

Please note that the SBTi is currently researching the best way to clearly explain the applicability of the SBTi Corporate Net-Zero Standard V2.0 criteria within Sector Standards' scopes, which means that the above table might evolve in future versions of SBTi Standards.

5.2. Additional requirements introduced in this Standard

No additional requirements apply to companies in this sector.

6. SBTi CLAIMS

Background: This chapter introduces general criteria for substantiating claims related to science-based target setting and SBTi validation. The aim is to enable companies to substantiate claims related to their target-setting and target progress, and communicate their efforts in a clear and credible way. A company that has completed the performance assessment and set a new target will be able to make claims regarding their continuing progress to net-zero. The SBTi is exploring ways to recognize companies that have credibly met their targets, and how to highlight those showing leadership beyond the minimum requirements of target setting.

***Note**: Eligible claims will be subject to legal review. Only claims made in association with, or referencing, the SBTi are subject to these requirements.*

Intent: Companies ensure that all claims covered in this Standard are accurate, verifiable, and adhere to high-integrity standards and applicable regulations.

6.1. Applicability of criteria from the SBTi Corporate Net Zero Standard V2.0

The table below outlines which SBTi Corporate Net-Zero Standard V2.0 criteria apply to companies using both it and the Automotive Sector Net-Zero Standard in parallel. This table is currently based on the SBTi Corporate Net-Zero Standard V2.0 draft for second public consultation.

SBTi Corporate Net-Zero Standard V2.0 Criterion	Applicability to companies using both standards in parallel
CNZS-C35. Companies shall ensure all claims are accurate, transparent, verifiable and compatible with SBTi Standard's requirements and policies.	Companies shall apply this criterion to all targets set under the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards. To apply C35.8 to targets within the scope of the SBTi Automotive Sector Net-Zero Standard, companies shall refer to the sector-specific criteria (sub-chapter 6.2) of this Standard.
CNZS-C36. Companies shall ensure that conformance claims are accurate and up-to-date.	Companies shall apply this criterion to all targets set under the SBTi Corporate Net-Zero Standard V2.0 and Sector Standards.

Please note that the SBTi is currently researching the best way to clearly explain the applicability of the SBTi Corporate Net-Zero Standard V2.0 criteria within Sector Standards' scopes, which means that the above table might evolve in future versions of SBTi Standards.

6.2. Additional requirements introduced in this Standard

This chapter is divided into two sub-chapters: sub-chapter 1 covers criteria for automakers, and sub-chapter 2 includes criteria for auto parts manufacturers. **Companies that manufacture both vehicles and auto parts shall apply criteria from both sub-chapters**, if they meet the applicability conditions in Section A.5 of this document.

SUB-CHAPTER 1 - CRITERIA APPLICABLE TO AUTOMAKERS

AMSS-C6. Automakers shall adhere to the target wording provided

Company segment: *All companies*
Activity type: *Automakers*
Assessment stage: *Initial Validation, Renewal Validation*

C6.1 For AMSS-C3, the following target language shall be used:

a. For targets expressed separately by vehicle category and region (required for 2&3 wheelers, buses, medium and heavy duty trucks):

"[Company name] commits to reduce the average scope 3 category 11 GHG emission intensity covering vehicles sold in [category X] and [country grouping Y] X% by [target year] relative to a [base year] base year".

This shall be expressed for all applicable vehicle category / country grouping combinations.

b. For targets expressed as an aggregated global target (applicable only for passenger cars and light commercial vehicles):

"[Company name] commits to reduce the average scope 3 category 11 GHG emission intensity covering vehicles sold in [category X] X% by [target year] relative to a [base year] base year".

C6.2 For AMSS-C4, the following target language shall be used:

[Company name] commits to increase the sales share of zero-emission vehicles in [category X] across all countries to X% in [target year] from Y% in a [base year] base year."

This shall be expressed for all applicable vehicle category / country grouping combinations.

a. For targets expressed as an aggregated global target:

"[Company name] commits to increase the sales share of zero-emission vehicles in to X% in [target year] from Y% in a [base year] base year."

SUB-CHAPTER 2 - CRITERIA APPLICABLE TO AUTO PARTS MANUFACTURERS

APSS-C5. Auto parts manufacturers shall adhere to the target wording provided

Company segment: *All companies*
Activity type: *Auto parts manufacturers*
Assessment stage: *Initial Validation, Renewal Validation*

C5.1 For APSS-C3, the following target language shall be used

[Company name] commits to reduce scope 3 category 11 emissions from the use of [sold auto parts] X% by [target year] from a [base year] base year."

ANNEX A: KEY TERMS

This Annex provides key reference information to support the interpretation and application of this Standard. It includes definitions and reference materials specific to the Automotive Sector Net-Zero Standard, including relevant terminology, acronyms, vehicle category definitions, and regional groupings used for target-setting and assessment purposes.

A full list of the SBTi terms, definitions, and acronyms is in the SBTi Glossary. Please find here a list of new or updated key terms used in this Standard. Terms marked 'revised' differ from the current definitions in the SBTi Glossary.

Table A1. Automotive Sector Net-Zero Standard Glossary

Term	Definition
Emerging economy	Amalgamation of the World Bank classifications for low, lower middle and upper middle income countries: World Bank country classifications by income level for 2024-2025. Also designated as 'emerging markets and developing economies' (EMDEs)
Emission factor	A coefficient that quantifies the emissions or removals of a gas per unit activity. Emission factors are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level under a defined set of operating conditions (IPCC, 2006)
Energy Efficiency Ratio (EER)	Ratio of the WTW energy efficiency of a zero-emission vehicle compared to a comparable ICE/fuel combination (i.e. taking into account the energy efficiency of vehicle operations, factoring in losses associated with the production of different low-emission energy pathways). Further details are included in Appendix N.
End of Life (EoL)	Dismantling, consisting of processes like the collection and separation of a final product's materials and components, with some parts being landfilled or incinerated, and others being separated and prepared for recycling.
[1] Fuel-cycle emissions (based on GREET Transportation Fuel-Cycle Model - Volume 1: Methodology, Development, Use, and Results)	All GHG emissions from the production, transportation, storage, and distribution of the fuel/energy used to move the vehicle, the recovery, transportation, and storage of the feedstock needed by the same fuel/energy, and resulting from the use of the

	fuel/energy for vehicle operations. Synonymous with well-to-wheel (WTW) emissions.
High-income economy:	According to the World Bank definition: World Bank country classifications by income level for 2024-2025
Near-zero-emission vehicle (Near-ZEV)	Near-ZEVs are vehicles that use zero-emission technologies and are capable of operating during some portion of their operations without emitting tailpipe emissions of any air pollutant (or precursor pollutant) or greenhouse gas emissions from the onboard source of power, such as plug-in hybrid electric vehicles (PHEVs).
Powertrain supplier	A company that designs, manufactures, and/or supplies complete systems related to the powertrain of a vehicle. This includes technologies responsible for generating and delivering power to the wheels, such as internal combustion engines, electric motors, and batteries. Their activity is at the intersection of the ISIC Division 29 (Manufacture of motor vehicles, trailers and semi-trailers, including parts) and the ISIC Division 28 (Manufacture of machinery and equipment n.e.c.), including in particular the ISIC class 2811 (Manufacture of engines and turbines, except aircraft, vehicle and cycle engines), although ISIC Division 28 does not apply specifically to motor vehicles.
Tank-to-wheel / Tank-to-wake (TTW)	Tank-to-wheel (or tank-to-wake for air and sea transport) refers to the stage of the energy carrier's life cycle where the energy carrier is converted to propulsion energy.
Tank-to-wheel (TTW) emissions:	All GHG emissions resulting from the TTW phase energy for vehicle operations (mainly combustion emissions from vehicle operations, in the case of internal combustion engine [ICE] vehicles).
Vehicle category	Six vehicle categories (passenger cars, LCVs, buses, medium trucks, heavy trucks and 2&3 wheelers) are used to match the approach taken by different organisations in their scenario definition process.
Vehicle-cycle emissions (as defined by GREET-2)	All greenhouses gas emissions of vehicle material recovery and production, vehicle component fabrication, vehicle assembly, and vehicle disposal/recycling.
Vehicle-kilometer	Unit of measurement representing the movement of a vehicle over one kilometer.
Vehicle life-cycle emissions	The sum of the vehicle-cycle and fuel-cycle (WTW) emissions.

Vehicle-to-grid	Technology that enables plug-in electric vehicles (battery electric and plug-in hybrid electric vehicles) to provide services to the electricity grid (including frequency modulation, energy provision, and other services),
Well-to-tank (WTT)	Well-to-tank (WTT) is the portion of transport related fuels and electricity that occur in the value chain before combustion e.g., gasoline, diesel, electricity for electric vehicles, extraction, production, refining, and distribution of the fuel.
Well-to-tank (WTT) emissions:	All GHG emissions resulting from the WTT phase.
Well-to-wheel / Well-to-wake (WTW)	WTW refers to a specific scope or boundary used for measuring GHG emissions from transportation activities. It encompasses the full life cycle of the energy carrier used by a vehicle, from: ● Well-to-tank (WTT): the extraction, production, refining, and distribution of the fuel (e.g., gasoline, diesel, electricity for electric vehicles). ● Tank-to-wheel or Tank-to-wake (TTW): the combustion of the fuel in the vehicle's engine and the resulting emissions released at the tailpipe.
Well-to-wheel/ Well-to-wake (WTW) emissions	All GHG emissions from the WTW life-cycle of an energy carrier—i.e., the sum of WTT and TTW emissions. Synonymous with fuel-cycle emissions.
Zero-emission vehicle:	A vehicle that produces zero exhaust emissions of any local pollutant ('criteria' pollutant, per the California Air Resources Board's definition) or precursor pollutant, under all possible operational modes and conditions. A zero-emission vehicle also produces no toxic air contaminants or greenhouse gas emissions (GHGs) when stationary or operating (excluding emissions from air conditioning systems). (CARB, 2022)

Table A2. List of acronyms used in this Standard

Acronyms	Explanation
2/3W	Two- and three-wheeled vehicles
AEs	Advanced Economies (synonymous with high-income economies)
ANL	Argonne National laboratory

Acronyms	Explanation
APS	Announced Pledges Scenarios (International Energy Agency)
BEV	Battery Electric Vehicle
EER	Energy efficiency ratio
EMDEs	Emerging Markets and Developing Economies
EoL	End of Life
FCEV	Fuel Cell Electric Vehicle
HDT	Heavy-duty truck
HEV	Hybrid Electric Vehicle
ICAO	International Civil Aviation Organization
ICCT	International Council on Clean Transportation
ICE	Internal Combustion Engine
ICEV	Internal Combustion Engine Vehicle
IEA	International Energy Agency
ISIC	International Standard Industrial Classification of All Economic Activities
ITF	International Transport Forum
LCV	Light commercial vehicle (van)
LDV	Light duty vehicle (cars and vans)
LULUCF	Land Use, Land Use Change and Forestry
MDT	Medium-duty truck
MJ	Megajoule
NGO	Non-Government Organization
NZE	Net Zero Emissions scenario (International Energy Agency)
OBFCM	On-board fuel consumption monitor
OECD	Organization for Economic Cooperation and Development

Acronyms	Explanation
OEM	Original Equipment Manufacturer
PLDV	Passenger Light-Duty Vehicle
PHEV	Plug-in Hybrid Electric Vehicle
RCF	Recycled Carbon Fuel
RD	Renewable Diesel
RNG	Renewable Natural Gas
RFNBO	Renewable Fuel of Non-Biological Origin
SMR	Steam methane reformation
UNECE	United Nations in the Consolidated Resolution on the Construction of Vehicles
V2G	Vehicle-to-grid
vkm	Vehicle-kilometer
ZEV	Zero-emission vehicle (i.e. zero tailpipe pollutant emissions)

Definition of vehicle categories

The choice of vehicles made for the SBTi categories in the Automotive Sector Net-Zero Standard reflects the common approach of the three main global modelling efforts by ICCT, IEA and ITF. It is also consistent – to the extent possible – with the classifications developed at the United Nations in the Consolidated Resolution on the Construction of Vehicles (R.E.3) (UN, 2023) for its part regarding power-driven vehicles, and in the Special Resolution no. 1 concerning the common definitions of vehicle categories (UN, 2023), masses and dimensions as detailed in Table A1.

Table A3. Updated SBTi vehicle categories compared with the UN R.E.3 and the S.R.1

Vehicle categories in this Standard	R.E.3	S.R.1
2- and 3-wheelers	L-category	Category 3
Passenger cars	M_1	Category 1-1
Buses and minibuses	M_3 and M_2	Category 1-2

Light commercial vehicles (LCVs)	N_1 (maximum gross vehicle weight of 3.5 t)	Category 2
Medium duty trucks (MDTs)	N_2 (maximum mass exceeding 3.5 t but not exceeding 12 t)	Category 2
Heavy duty trucks (HDTs)	N_3 (maximum mass exceeding 12 t)	Category 2

Definition of regional groupings

Countries are classified according to the World Bank's categories (World Bank, 2024). "High income" countries are considered to be Advanced Economies (AEs); those in the three other income categories (upper-middle, lower middle, and low income) are considered to be emerging economies (Emerging Markets and Developing Economies (EMDEs) in full). For the purposes of target-setting according to this standard, the China Region (including China and Hong Kong) is added as a third, separate regional grouping, reflecting significant differences in that market.

The China Region represents a uniquely significant share of global automotive production and sales, particularly for electric vehicles. Sales shares of BEVs and PHEVs in the light-duty segment are substantially higher in China than in other major automotive markets, including Europe when considered as a single entity. Given the size of China's light-duty vehicle market, this results in more than half of global EV sales occurring in China. A similar pattern applies to electric buses and trucks. In addition, many of the world's largest pure-play EV manufacturers are based in China, and China plays a dominant role across the EV battery value chain, including critical mineral ownership, processing, and battery cell manufacturing.

These factors together justify treating China as a separate region for benchmarking and trajectory setting under this Standard. Distinguishing the China Region ensures that emission intensity reduction pathways and low-emission vehicle sales share benchmarks appropriately reflect market realities, support continued ambition within China's automotive sector, and avoid the risk that progress in one region disproportionately substitutes for progress in others. Companies shall account for activity at the country level and aggregate as appropriate for regional reporting.

For consistency and to allow benchmarking with previous years, the definition of high income countries is kept static to the same as the initial year of submissions to the SBTi and revised at recommitment/revision to the automotive standard.

ANNEX B: METRICS, BENCHMARKS AND METHODS

This annex provides metrics, benchmarks, and methods used to set targets. Applicable to companies in the automotive sector, these three elements support assessing performance toward net-zero over time and setting targets. They are used to guide companies in performing a benchmark assessment and to determine whether it is in line with the trajectories that characterize science-based targets and improvement plans.

Metrics and benchmarks

Metrics measure quantitative information about the company's activities that are relevant to setting climate targets and tracking progress against them. The SBTi Automotive Sector Net-Zero Standard covers two categories of SBTi metric:

- GHG impact and performance, which relate to criteria AMSS-C1 and AMSS-C3 for automakers, and APSS-C2 and APSS-C3 for auto parts manufacturers (or powertrain suppliers, i.e. a subset of auto parts manufacturers), where a form of GHG intensity is calculated and tracked against a corresponding trajectory.
- Activity, which relates to criteria AMSS-C2 and AMSS-C4 for automakers and APSS-C1 for auto parts manufacturers, where the company’s sales portfolio is compared with requirements related to zero-emission vehicles.

Tables B1 and B2 set out the metrics and benchmarks that apply to automakers and auto parts manufacturers respectively under this standard. Entities shall use these tables to select the required metrics to be measured to reach net-zero aligned performance by 2050.

Table B1. Metrics, net-zero aligned benchmarks and target-setting methods for Automakers

Code	Metric	Unit	Description	Net-zero aligned benchmark value	NZ Reference year	Reference Scenario	Target- setting method
Metric-Auto.1	Vehicle portfolio use phase emission intensity (new vehicles)	gCO_2e/ vkm	Measures the scope 3 category 11 emission intensity of the manufacturer's annual production portfolio (light-duty vehicles only)	Global and (separately) regional emission intensities for AE, EMDEs and the China region, expressed in gCO_2e/vkm according to the values in Tables C.1, C.3, C.5 and C.7 in Annex C	2050 or earlier	ITF “All Out” scenario (for WTW emissions)	Convergence (according to Annex G)
			Measures the scope 3 category 11 emission intensity of the manufacturer's annual production portfolio (for all non-light-duty vehicle types)	Global and (separately) regional emission intensities for AE, EMDEs and the China region, expressed in gCO_2e/vkm according to the values in Tables C.1, C.3, C.5 and C.7 in Annex C	2050 or earlier	ITF “All Out” scenario (for WTW emissions)	Percent Improvement Approach (detailed in Annex H)
Metric-Auto.2	Zero-emission vehicle share	Percentage (%)	Measures the zero-emission vehicle share of the annual sales/registration portfolio	100% (as shown in Tables C.2, C.4, C.6 and C.8 in Annex C)	2050 or earlier	ITF “All Out” scenario	Convergence (according to Annex G)

Table B2. Metrics, net-zero aligned benchmarks and target-setting methods for Auto-parts manufacturers

Code	Metric	Unit	Description	Net-zero aligned benchmark value	Reference year	Reference Scenario	Target- setting method
Metric-Auto.3	Scope 3 category 11	gCO_2e/ vkm	Measures the fuel-cycle emission intensity of powertrains for sale to the automotive sector (light-duty vehicles only)	Global and (separately) regional emission intensities for AE, EMDEs and the China region, expressed in gCO_2e/vkm according to the values in Tables C15, C16, C17 and C18 in Annex C	2050 or earlier	ITF "All Out" scenario (for WTW emissions)	Convergence (according to Annex G)
Metric-Auto.3	Scope 3 category 11	gCO_2e/ vkm	Measures the fuel-cycle emission intensity of powertrains for sale to the automotive sector (for all non-light-duty vehicle types)	Global and (separately) regional emission intensities for AE, EMDEs and the China region, expressed in gCO_2e/vkm according to the values in Tables C15, C16, C17 and C18 in Annex C	2050 or earlier	ITF "All Out" scenario (for WTW emissions)	Percent Improvement Approach (detailed in Annex H)
Metric-Auto.X*	TBD	TBD	TBD metric(s) to be applicable to powertrain suppliers.	TBD	2050 or earlier	TBD	TBD

**The SBTi is exploring options for additional metrics, methods, and pathways, such as alignment metrics, that may be applicable to powertrain suppliers for setting targets to address scope 3 category 11 emissions from sold products.*

Methods for the assessment of fuel-cycle (scope 3 category 11) emissions

Assessment methods are mathematical formulae or algorithms used to calculate interim performance values that serve as the reference for entities to set targets and assess performance against them

In formulating this standard a target-setting method is applied to each metric to determine the required interim performance value, thus guiding the formulation of science-based, measurable, and time-bound targets aligned with pathways that are consistent with limiting warming to 1.5°C with no or limited overshoot. In this way the SDA produces a pathway between base year and target year representing the company's level of minimum ambition associated with each metric.

Calculation Methods for emissions accounting for Criteria AMSS-C1 and AMSS-C3 (Scope 3 category 11 GHG emission intensity reduction target)

For each vehicle category, powertrain and energy combination, the fuel-cycle emission intensity shall be calculated, over the vehicle lifetime, as the ratio of:

a) the energy used (per energy type), multiplied by the related emission factor – at the numerator, and

b) the distance travelled – at the denominator, as follows:

$$Fuel\ cycle\ emission\ intensity\ (\frac{gCO_2\ e}{vkm}) =$$

$$\Sigma_p\ (\frac{\Sigma e_i y\ (Energy\ required\ (MJ) e_i y\ Emission\ factor\ (\frac{gCO_2\ e}{MJ})\ e_i y}{\Sigma y\ (Distance\ travelled\ (vkm) y)})_p$$

Where:
p stands for the WTT and TTW phases,
y for the years of vehicle life, and

e for the types of energy needed by the powertrain (e.g. electricity and oil-based gasoline, for a PHEV).

For vehicles using liquid and gaseous hydrocarbons (ICE, HEV, PHEV), energy use shall be disaggregated from region to country of use[3] (designated by location of registration, then sales location). For FCEVs, or vehicles with thermal engines that use hydrogen, the specific energy pathway for the China region based on local conditions would need to be used.[4]

Default region- and fuel-specific annual GHG emission factors shall be calculated for each year, as indicated in Table B.3. They can be based on the emission intensity reductions estimated based on the IEA Announced Pledges Scenario, as outlined in Annex C, in the section titled "Annual default fuel-specific WTW emissions reductions." Claims of GHG emission savings paired with biofuel, hydrogen and RFNBO market shares exceeding those reported in the IEA APS - outlined in detail in Annex C, in the section titled "Annual default fuel-specific WTW emissions reductions, derived from the IEA APS" - shall be thoroughly documented (i.e. by contracts for low-emission fuel provision). Default emission factors for selected pathways and emission assessment methodologies are provided in Annex D and further detailed in Appendix K.

Table B.3. GHG emission assessment by fuel group

Energy	GHG emission factor assessment
Biofuels	The WTW emission factor for biofuels shall take into account the CO_2 removed from the atmosphere during the growth of the feedstock, the GHGs emitted during the different phases of biofuel production and distribution and their final combustion. Hence, WTW emission factors for biofuels shall be entirely allocated to WTT emissions, while TTW emissions include only non-CO_2 (incomplete) combustion products. Claims of GHG emission savings paired with biofuel market shares exceeding those reported in the IEA APS - and outlined in detail in Annex C, in the section titled "Annual default fuel-specific WTW emissions reductions, derived from the IEA APS" - shall be thoroughly documented. Default emission factors for selected pathways are provided in Annex D and emission assessment methodologies are further detailed in Appendix K.

[3] To determine more accurate biofuel or renewable fuels of non-biological origin (RFNBOs) blend share and associated emission factors. Further details on this subject are outlined in Appendix K.
[4] Hydrogen use in transport is currently limited and almost entirely derived from unabated fossil energies; with specific taxi, bus, or truck fleet deployments that may be using low-emission hydrogen, e.g. electrolytic hydrogen from renewable or nuclear electricity or fossil-derived hydrogen with carbon capture and storage (CCS). Since most hydrogen is currently produced from natural gas steam methane reforming (NG SMR) without CCS, except in China and South Africa, where it is made mostly from coal gasification, these pathways shall be used in the absence of documented evidence that it is derived from low-emission options (as RFNBO), Further details on this subject are outlined in Appendix K.

Electricity	Electricity emission factors shall include emissions from the production phase, transmission and distribution losses and upstream emissions associated with the production, processing, and transport of the primary energy and the embodied emissions in the electricity generation facilities. Claims of GHG emission savings paired with electricity exceeding those reported in the IEA APS - and outlined in detail in Annex C, in the section titled "Annual default fuel-specific WTW emissions reductions, derived from the IEA APS" - shall be thoroughly documented. Default emission factors for selected pathways are provided in Annex D and emission assessment methodologies are further detailed in Appendix K.
Hydrogen, other RFNBOs and RCFs	WTT emissions intensities for hydrogen, other RFNBOs and RCFs shall include emissions related with their production, distribution and their final combustion, according to the relevant production pathway (e.g., steam methane reforming, for hydrogen, or electrolysis). In the case of electrolytic hydrogen production, the electricity emission factors shall include the same system boundaries as for electricity, as described in the previous box, based on the fact that these emissions contribute substantially to the aggregate emission factor (i.e. materiality). Claims of GHG emission savings from hydrogen, other RFNBOs and RCFs resulting in carbon intensities lower than those reported in the IEA APS - and outlined in detail in Annex C, in the section titled "Annual default fuel-specific WTW emissions reductions, derived from the IEA APS" - shall be thoroughly documented. Default emission factors for selected pathways are provided in Annex D and emission assessment methodologies are further detailed in Appendix K.

Emission factors shall be multiplied by vehicle category-specific default mileages given in Table D6 in Annex D. In calculating total lifetime vehicle km, the vehicle km per year shall be consistent with values used in other parts of this Standard. Default lifetime and annual distance travelled (km/year) values shall be used (as detailed in Annex D), unless the automaker can justify an alternative value, e.g. based on telematics data regarding lifetime vehicle-km (i.e. annual vehicle-km and vehicle lifetime) and share sufficient details about this alternative data to enable third-party verification. If documented and verifiable, these alternative values may apply to specific vehicle, fuel and powertrain types and location combinations.

Calculation Methods for Metrics Accounting for Criteria APSS-C2 and APSS-C3 (fuel-cycle GHG emission intensity reduction target for powertrain suppliers)

For powertrains supplied to each vehicle category, the fuel-cycle emission intensity shall be calculated, over the vehicle lifetime, as the ratio of:

a) the energy used by vehicles equipped with the powertrain (by energy type), multiplied by the corresponding emission factor (numerator), and

b) the distance travelled by those vehicles on which the powertrain is installed (denominator), as follows:

$$Fuel\ cycle\ emission\ intensity\left(\frac{g\ CO_2e}{vkm}\right) = \sum_p \left(\frac{\sum_{e,y}\left(Energy\ required\ (MJ)_{e,y}\ Emission\ factor\left(\frac{g\ CO_2e}{MJ}\right)_{e,y}\right)}{\sum_y\left(Distance\ travelled\ (vkm)_y\right)}\right)_p$$

Where:
p stands for the WTT and TTW phases,
y for the years of vehicle life, and
e for the types of energy needed by the engine (e.g. electricity and oil-based gasoline, for a PHEV).

For vehicles using liquid or gaseous hydrocarbons (ICE, HEV, PHEV), energy use shall be disaggregated from region to country of use[5] (designated by location of registration, then sales location). For FCEVs, or vehicles with thermal engines that use hydrogen, the specific energy pathway for the China region based on local conditions would need to be used.[6]

Default region and fuel-specific annual GHG emission factors shall be calculated for each year, as indicated in Table B.4. They can be based on the emission intensity reductions estimated based on the IEA Announced Pledges Scenario, as outlined in Annex C, in the section titled “Annual default fuel-specific WTW emissions reductions, derived from the IEA APS”. Claims of GHG emission savings paired with biofuel, hydrogen and RFNBO market shares exceeding those reported in the IEA APS need to be thoroughly documented (i.e. by contracts for low-emission fuel provision). Default emission factors for selected pathways are provided in Annex D and emission assessment methodologies are further detailed in Appendix K.

Table B.4. GHG emission assessment by fuel group

[5] To determine more accurate biofuel or renewable fuels of non-biological origin (RFNBOs) blend share and associated emission factors. Further details on this subject are outlined in Appendix K.
[6] Hydrogen use in transport is currently limited and almost entirely derived from unabated fossil energies; with specific taxi, bus, or truck fleet deployments that may be using low-emission hydrogen, e.g. electrolytic hydrogen from renewable or nuclear electricity or fossil-derived hydrogen with carbon capture and storage (CCS). Since most hydrogen is currently produced from natural gas steam methane reforming (NG SMR) without CCS, except in China and South Africa, where it is made mostly from coal gasification, these pathways shall be used in the absence of documented evidence that it is derived from low-emission options (as RFNBO), Further details on this subject are outlined in Appendix K.

Energy	GHG emission factor assessment
Biofuels	The WTW emission factor for biofuels shall take into account the CO_2 removed from the atmosphere during the growth of the feedstock, the GHGs emitted during the different phases of biofuel production and distribution and their final combustion. Hence, WTW emission factors for biofuels shall be entirely allocated to WTT emissions, while TTW emissions include only non-CO_2 (incomplete) combustion products. Claims of GHG emission savings paired with biofuel market shares exceeding those reported in the IEA APS - and outlined in detail in Annex C, in the section titled “Annual default fuel-specific WTW emissions reductions, derived from the IEA APS” - shall be thoroughly documented. Default emission factors for selected pathways are provided in Annex D and emission assessment methodologies are further detailed in Appendix K.
Electricity	Electricity emission factors shall include emissions from production, transmission and distribution losses, upstream emissions from primary energy production, and embodied emissions in the electricity generation facilities. Claims of GHG emission savings paired with electricity exceeding those reported in the IEA APS - and outlined in detail in Annex C, in the section titled “Annual default fuel-specific WTW emissions reductions, derived from the IEA APS” - shall be thoroughly documented. Default emission factors for selected pathways are provided in Annex D and emission assessment methodologies are further detailed in Appendix K.
Hydrogen, other RFNBOs and RCFs	WTT emissions intensities for hydrogen, other RFNBOs and RCFs shall include emissions related with their production, distribution and their final combustion, according to the relevant production pathway (e.g., steam methane reforming, for hydrogen or electrolysis). In the case of electrolytic hydrogen production, the electricity emission factors shall include the same system boundaries as for electricity, as described in the previous box, based on the fact that these emissions contribute substantially to the aggregate emission factor (i.e. materiality). Claims of GHG emission savings from hydrogen, other RFNBOs and RCFs resulting in carbon intensities lower than those reported in the IEA APS - and outlined in detail in Annex C, in the section titled “Annual default fuel-specific WTW emissions reductions, derived from the IEA APS” - shall be thoroughly documented. Default emission factors for selected pathways are provided in Annex D and emission assessment methodologies are further detailed in Appendix K.

Emission factors shall be multiplied by vehicle category-specific default mileages given in Table D6 in Annex D. In calculating total lifetime vkm, the vkm per year shall be consistent with values used in other parts of this Standard, and in particular with the AMSS-C1 and AMSS-C3 criteria. Default lifetime and annual distance travelled (km/year) values shall be used (as detailed in Annex D), unless the automaker can justify an alternative value, e.g., based on telematics data regarding lifetime vkm (i.e., annual vkm and vehicle lifetime) and share sufficient details about this alternative data to enable third-party verification. If documented and verifiable, these alternative values may apply to specific vehicle, fuel and powertrain types and location combinations.

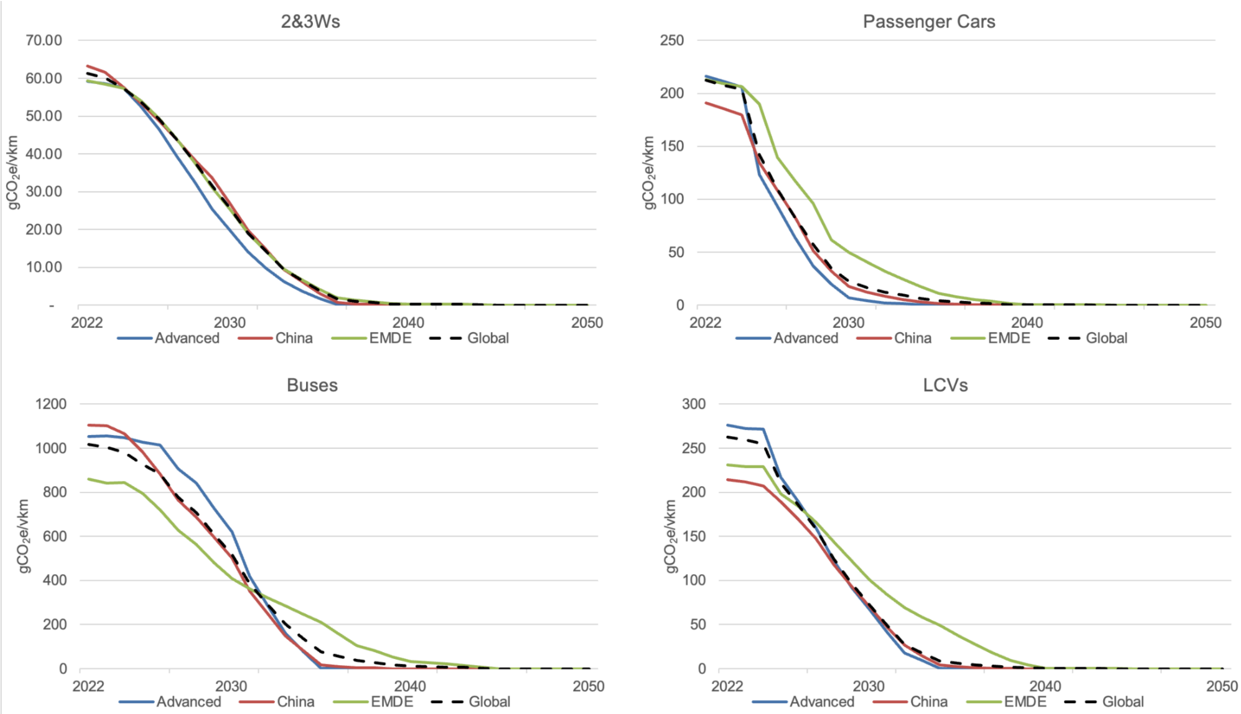
ANNEX C: BASELINE AND PATHWAYS

The pathways and associated benchmarks of WTW emission intensities and zero-emission vehicle sales shares are based on an “All-Out” decarbonization scenario modelled by the International Transport Forum (ITF, forthcoming)[7]. Figures C.1 and C.2 show the WTW emission intensity trajectories and the zero-emission vehicle sales shares (i.e., BEVs and FCEVs) for new vehicles, from 2010 to 2060, across each of the six vehicle categories and for AEs, EMDEs and for the China region, as well as at the global level.[8]

The China region is presented separately, as the specifics of its automotive and energy market make a distinct scenario essential for meaningful results.

These serve as the basis for the AMSS-C1 and AMSS-C3 criteria.

Figure C.1. Well-to-wheel GHG emission intensity of new vehicle sales in the ITF All-Out scenario



[7] The selection of pathways was made from a wider range of available pathways following SBTi principles. More information can be found in the Synthesis Report.
[8] Note that the WTW emission intensity trajectories shown in Figure C2 were adapted to extend the system boundaries beyond carbon intensity of primary electricity generation (used by ITF) to (i) include GHGs other than CO_2, (ii) include emissions incurred in production, processing, and provision of fuels in thermal plants and embodied GHG emissions in renewables, and (iii) to include T&D losses. The methods adopted to perform this extension are described in further detail below.

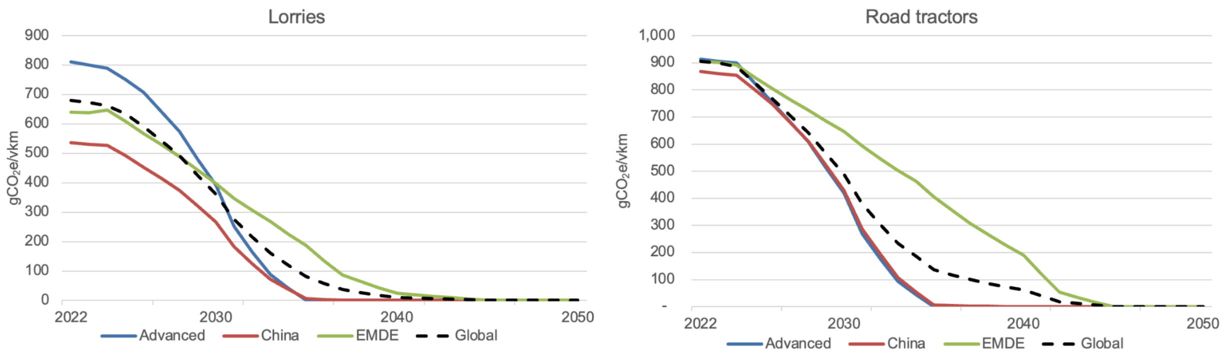
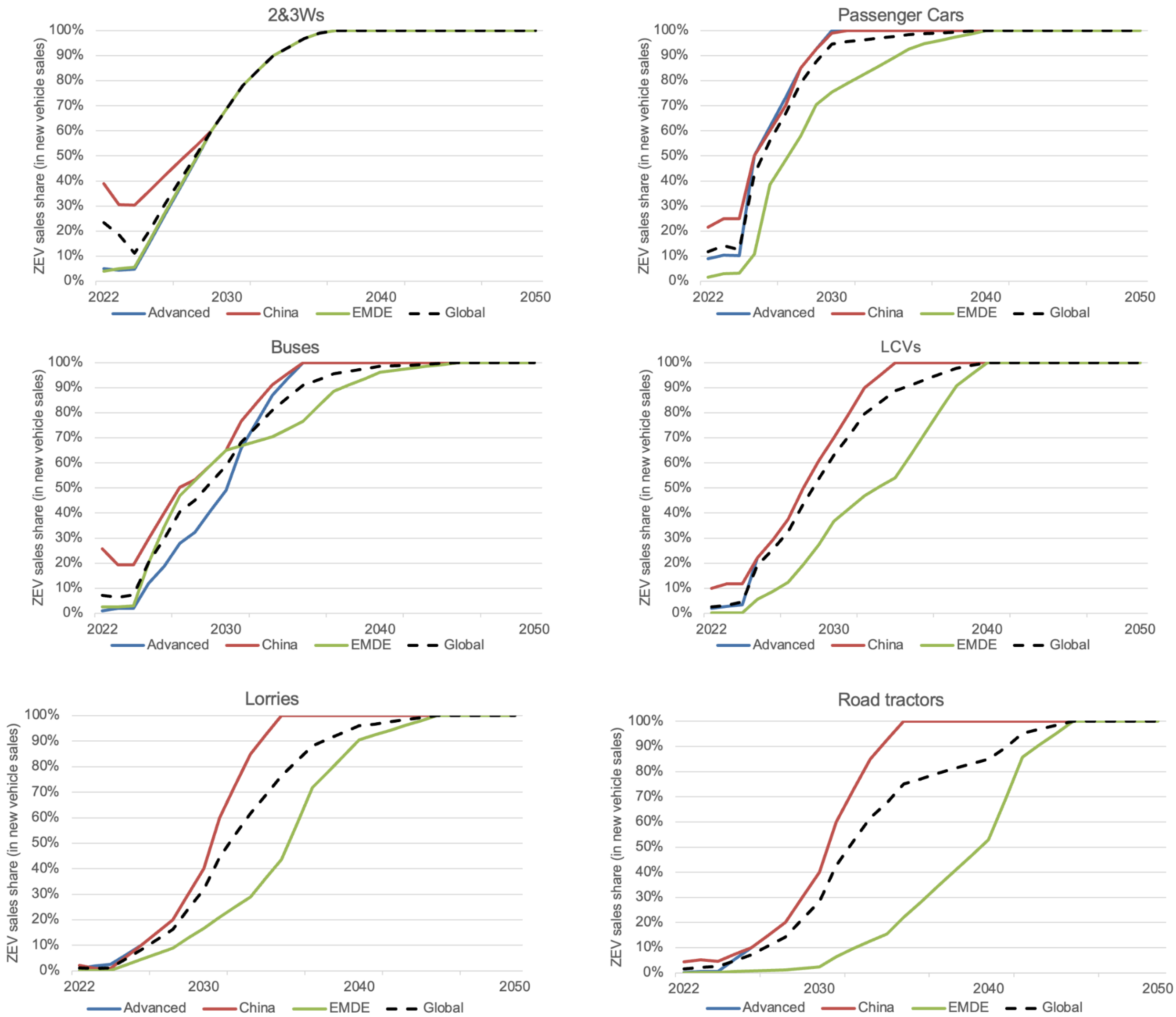


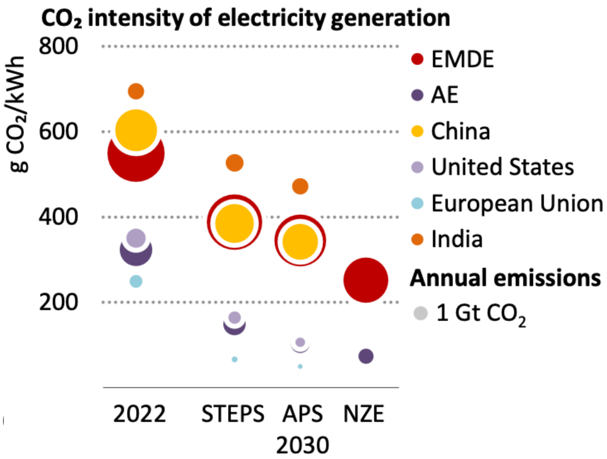
Figure C.2. Sales shares of zero-emission vehicles in new vehicle sales in the ITF All-Out scenario

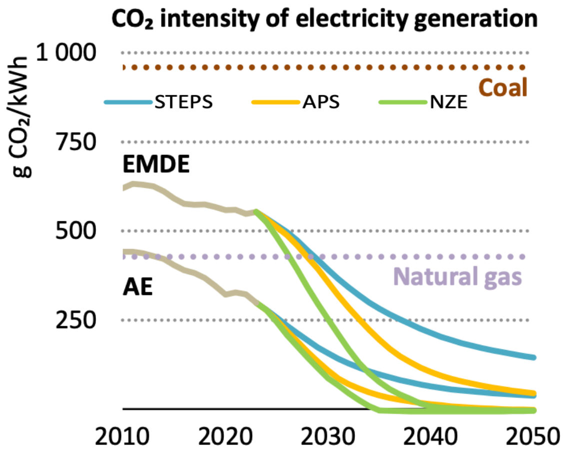


Trajectories of the emission intensity of final electricity (in gCO_2e/vkm) that are both consistent with a 1.5° C-aligned trajectory and consistent with the system boundaries defined for electricity (as summarized in Appendix K) are necessary to ensure that the WTW emission intensity of vehicles that directly use grid electricity (i.e., BEVs and PHEVs), or indirectly use electricity to produce fuels (i.e., all vehicles using RFNBOs and H2) are estimated to use electricity from grids whose emissions intensity declines in ways consistent with the 1.5° C-aligned trajectory. The steps taken to estimate these trajectories are summarized here.

Trajectories of the carbon intensity of (primary) electricity generation (in gCO_2/vkm) aggregated by country for AEs, EMDEs and the China region, are shown in Figure C.4. This figure shows the trajectory of primary electricity for each of the three regional groups as reported in Figure 3.17 of the 2023 edition of the IEA World Energy Outlook, and as reported in the 2024 IEA World Energy Outlook, where the direct carbon intensity of primary electricity the analogous Figure 3.26 shows only the trajectories for AEs and EMDEs (excluding the China region).

Figure C.4. IEA NZE regional trajectories of the carbon intensity of primary electricity generation, in gCO_2/kWh, in the WEO 2023 (left-hand figure), and WEO 2024 (right-hand)





Base year data precision is enhanced using the 2024 edition of the Ember [Yearly Electricity Data] dataset. These trajectories are adjusted annually by the difference between CO_2 emissions reported in the base year (2023) and GHG emissions in that year, to include GHG emissions beyond CO_2, using data reported in the freely available version of the IEA [GHG Emissions from Energy Data Explorer], and to include GHG emissions from fossil fuel extraction, processing, and provision, and embodied emissions of power generation facilities, using the [Life Cycle Upstream Emissions Factors 2024] data product, and weighted for countries with data available by the IEA [GHG Emissions from Energy Data Explorer]. Transmission and distribution (T&D) losses were benchmarked at 5.8% for high-income countries, 14.1% for EMDEs, and 3.7% in the China region (based on the [CIA World Factbook]). Gaps between primary emission (GHG) and CO_2 intensity and between fuel provision and embodied GHG emissions versus direct CO_2 emissions are projected to decline at region- and scenario-specific rates, reflecting the projected adoption of renewable energy generation resources. T&D losses are assumed to decline, again at region-specific rates informed by historical trajectories, by around 2% (2.5% for the China region, 1.5% for EMDEs) annually in the NZE and around 1% (1.5% for the China region, 0.5% for EMDEs) annually in the APS.

Resulting benchmarks and trajectories, for the IEA NZE (which were also used to inform the WTW emissions trajectories in the ITF modelling, and embedded in the estimates of WTW emissions shown in Figure C1, and for the APS (to benchmark and apply default and region-specific electricity-sector emission intensity reductions), are shown in Figure C.5.

Figure C.5. Aggregated GHG emission intensity of final electricity demand, derived from the IEA NZE and APS scenarios, in gCO_2e/kWh

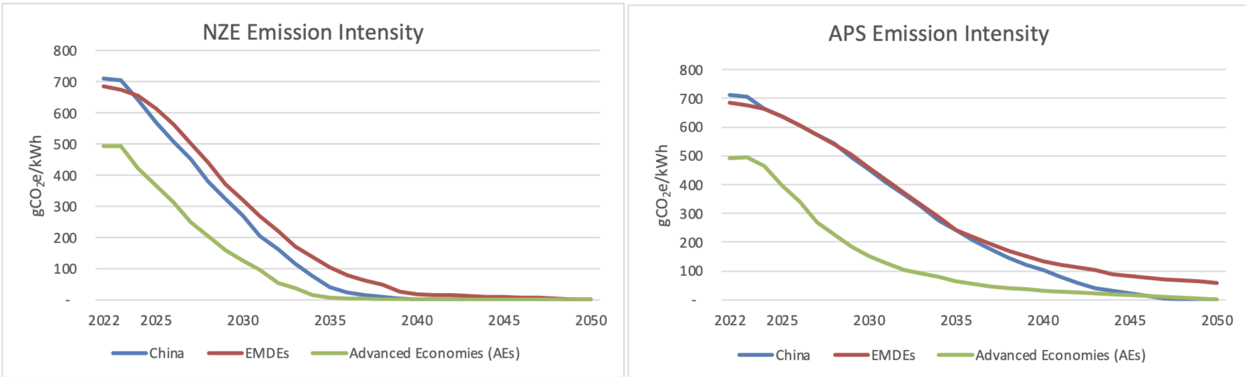


Table C.1. Global fuel-cycle GHG emission intensity of new vehicle sales (gCO_2e/vkm)

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	61.3	212.3	1016.9	262.8	679.2	905.8
2023	60	207.5	1004.2	259.5	673.2	898.8
2025	53.8	142.1	925.9	210.6	633.9	825.8
2030	25.5	22.2	516.8	72.3	362.2	488.6
2035	3.8	3.9	75.0	6.2	81.0	136.5
2040	0.2	0.1	10.8	0.1	10.5	61.9
2045	0	0	0	0	0	-
2050	0	0	0	0	0	-

*Table C.2. **Global** zero-emission vehicle sales shares (percent of new vehicle sales)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	23.3%	11.9%	7.1%	2.5%	1.1%	1.7%
2023	18.6%	14.2%	6.4%	3.2%	0.9%	2.1%

2025	20.5%	42.6%	20.4%	19.1%	4.7%	4.9%
2030	69.0%	94.6%	58.9%	63.0%	32.0%	28.4%
2035	96.7%	98.4%	90.9%	91.0%	76.3%	75.0%
2040	100%	100%	98.5%	100.0%	96.0%	85.0%
2045	100%	100%	100%	100%	100%	100%
2050	100%	100%	100%	100%	100%	100%

*Table C.3. **AEs** fuel-cycle emission intensity of new vehicle sales (gCO_2e/vkm)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	59.1	215.9	1052.4	275.8	811.6	913.9
2023	58.58	211.2	1055.8	272.4	800.9	906.4
2025	52.5	123.5	1027	216.7	750.5	825
2030	19.6	6.8	619.1	67.1	392.8	418.5
2035	1.71	0	0.7	0	0	0
2040	0	0	0	0	0	0
2045	0	0	0	0	0	0
2050	0	0	0	0	0	0

*Table C.4. **AEs** zero-emission vehicle sales shares (percent of new vehicle sales)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	5.0%	8.9%	1.1%	2.0%	0.9%	0.2%
2023	4.4%	10.3%	2.0%	2.8%	1.9%	0.6%
2025	15.8%	50.0%	12.0%	22.2%	6.2%	5.3%
2030	69.0%	100.0%	49.1%	70.0%	40.0%	40.0%
2035	96.7%	100%	100%	100%	100%	100%
2040	100%	100%	100%	100%	100%	100%
2045	100%	100%	100%	100%	100%	100%
2050	100%	100%	100%	100%	100%	100%

*Table C.5. **China region** fuel-cycle GHG emission intensity of new vehicle sales (gCO_2e/vkm)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	63.2	190.9	1105.5	214.3	535.7	867.5
2023	61.59	185.6	1102.7	211.7	530.8	860.4
2025	53.39	134.5	982.5	189.3	491.7	800.1
2030	26.73	17.5	502.1	70.4	266.9	428.9
2035	3.09	1.4	18.0	2.1	6.7	7
2040	0	0	0	0	0	0
2045	0	0	0	0	0	0
2050	0	0	0	0	0	0

*Table C.6. **China region** zero-emission vehicle sales shares (percent of new vehicle sales)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	38.9%	21.6%	25.7%	9.9%	2.2%	4.5%
2023	30.4%	25.0%	19.3%	11.8%	1.0%	5.1%
2025	36.4%	50.0%	29.7%	22.2%	5.5%	7.3%
2030	69.0%	99.0%	64.9%	70.0%	40.0%	40.0%
2035	96.7%	100%	100%	100%	100%	100%
2040	100%	100%	100%	100%	100%	100%
2045	100%	100%	100%	100%	100%	100%
2050	100%	100%	100%	100%	100%	100%

*Table C.7. **EMDE** fuel-cycle GHG emission intensity of new vehicle sales (gCO_2e/vkm)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	59.4	212.8	859.5	231.1	640.6	905.2
2023	58.4	209.1	840.8	229.2	637.8	900.7
2025	54.1	190.0	795.8	198.4	609.9	845.6
2030	25.2	49.9	408.1	100.7	398.1	647.4
2035	4.1	11.3	209.5	37.6	186.0	405.1
2040	0.3	0.3	33.1	0.4	24.9	191

2045	0	0	0	0	0	0
2050	0	0	0	0	0	0

*Table C.8. **EMDE** zero-emission vehicle sales shares (percent of new vehicle sales)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	4.0%	1.6%	2.5%	0.1%	0.1%	0.0%
2023	4.9%	3.1%	2.6%	0.2%	0.2%	0.1%
2025	16.5%	10.8%	20.1%	5.6%	2.4%	0.5%
2030	69.0%	75.5%	65.0%	36.6%	16.7%	2.4%
2035	96.7%	92.6%	76.6%	63.2%	43.7%	22.1%
2040	100%	100%	96.2%	100.0%	90.6%	52.9%
2045	100%	100%	100%	100%	100%	100%
2050	100%	100%	100%	100%	100%	100%

Annual default fuel-specific WTW emissions reductions, derived from the IEA APS

Reporting and target-setting for the criterion AMSS-C1 requires the calculation of the WTW emission intensity (in gCO_2e/MJ) of all fuels used by vehicles. Minimum reporting of the emission intensity for each vehicle category and in each regional grouping, and for each fuel category outlined below. In cases of blended fuels (i.e., automotive gasoline, diesel, and natural gas) where a fuel pool contains blended shares of fossil-derived fuels, biofuels, and RFNBOs and/or RCFs, default shares based on the IEA APS scenario are provided below.

In this context, the choice of the IEA APS, and not NZE scenario, is grounded on the desire to acknowledge progress, based on policy and collective industry action, while still requiring the specific demonstration of efforts capable to align action in the automotive sector to a trajectory that is aligned with SBTi requirements. This avoids taking for granted that other parts of the economy (and the energy industry in particular) will take sufficient action, and at the same time allows, should this action actually materialize in a way that can be documented, to consider it, beyond the default.

Electricity

Annual percentage reductions in emission intensity (in gCO_2e/kWh) is derived for each regional grouping based on the methods described above and as is shown in the right-hand side of Figure C.5. Table C.9 shows the default percent reduction emission intensity to be applied to the direct use of grid electricity in BEVs and PHEVs. These percentage reduction factors are to be applied at the country level to the final aggregated emissions intensity of final electricity (in gCO_2e/kWh) for all countries where BEVs and/or PHEVs are sold in each region grouping.

Table C.9. Default GHG emissions intensity of final electricity APS scenarios, by region grouping, indexed to 2022 within each region grouping

Year	AEs	EMDEs	China region
2022	100%	100%	100%
2023	103%	94%	99%
2024	94%	97%	93%
2025	80%	93%	90%
2026	69%	88%	85%
2027	54%	84%	81%
2028	46%	79%	76%
2029	37%	73%	69%
2030	31%	67%	63%
2031	26%	61%	57%
2032	21%	54%	52%
2033	19%	48%	46%
2034	16%	42%	39%
2035	13%	35%	34%
2036	11%	32%	29%
2037	10%	28%	25%
2038	8%	25%	21%
2039	8%	22%	17%
2040	6%	20%	14%
2041	6%	18%	11%
2042	5%	17%	8%
2043	5%	15%	6%
2044	4%	13%	5%
2045	3%	12%	3%
2046	3%	11%	2%
2047	2%	10%	1%
2048	1%	10%	0%
2049	1%	9%	0%
2050	0%	9%	0%

Oil and gas

Default emission intensity reductions for reporting purposes over ICE vehicle lifetimes for oil- and gas-based fuels are derived from the IEA APS trajectories outlined in the 2023 IEA publication The Oil and Gas Industry in Net Zero Transitions. Key levers to reduce emission intensity in oil supply chains, including production and refining, are: (i) preventing methane leaks, capturing vented methane, and flaring; (ii) implementing electrification and efficiency measures; (iii) shifting to low-emission hydrogen; (iv) CCUS; and (v) improving the efficiency and reducing the emission intensity of liquids transport. The figures in that report that provide benchmarking and trajectory data, by reporting on the efficiency and/or emission intensity improvements achieved by the above five levers, are:

- Figure 1.6: Reductions in oil demand in the APS and NZE Scenarios (paired with Figure 2.6 to calculate scope 1 and 2 emission intensity trajectories for oil)
- Figure 1.8: Natural gas demand by scenario, 2000-2050 (paired with Figure 2.6 to calculate scope 1 and 2 emission intensity trajectories for natural gas)
- Figure 2.6: Scope 1 and 2 oil and gas emissions in the APS and NZE Scenario

From these three figures, trends in the APS in the WTT emissions intensity of oil and gas production, processing/refining, and transport can be derived, as shown in Table C.10.

Table C.10. WTT GHG emission intensity of oil and gas production and refining, processing, and transport, as derived from the IEA APS

Parameter	Year				Unit	Source
	2022	2030	2040	2050		
Oil demand	96.5	93	74*	55	mb/d	Figure 1.6
Oil - Emissions	3.4	2.27	1.34	0.848	Gt CO_2e	Figure 2.6
NG demand	4156	3861	3004	2421	Bcm	Figure 1.8
NG - Emissions	1.653	1.07	0.635	0.449	Gt CO_2e	Figure 2.6
Oil – EI	35.23	24.54	18.19	15.47	Gt CO_2e / kb/d	Derived
NG – EI	398	277	211	185	Gt CO_2e / m3	Derived
Oil and Gas - EI	88.4	60.8	47	39.4	kt CO_2-eq/boe	Figure 2.5

Source: The Oil and Gas Industry in Net Zero Transitions (IEA, 2023).
Note: EI = emissions intensity. *Oil demand in 2040 is interpolated.
The above scope 1 and 2 GHG emission reductions from oil and gas translate to reductions in the WTT emission factor for fossil-derived automotive oil-derived (gasoline, diesel, LPG) and natural gas-derived (CNG, LNG) fuels. Assuming linear improvements in years not reported in the above table, and applying the emissions intensity reductions to the WTT emissions of these fuels, results in annual WTW emission factors reported in Table C.11.

Table C.11. WTW GHG emission intensity of fossil-derived automotive gasoline, diesel, natural gas (CNG/LNG), and LPG, as derived from the IEA APS, in gCO_2e/MJ

Year	Petroleum (oil-based)		Fossil-natural gas-based		Fossil-derived LPG
	Gasoline	Diesel	CNG	LNG	
2022	90.20	91.30	70.80	74.80	73.50
2023	90.20	91.30	70.80	74.80	73.50
2024	90.20	91.30	70.80	74.80	73.50

2025	89.34	90.45	70.09	73.90	73.08
2026	88.48	89.60	69.38	73.00	72.65
2027	87.62	88.75	68.68	72.10	72.23
2028	86.76	87.90	67.97	71.20	71.80
2029	85.90	87.05	67.26	70.30	71.38
2030	85.04	86.20	66.55	69.40	70.95
2031	84.73	85.90	66.32	69.11	70.80
2032	84.43	85.60	66.09	68.81	70.65
2033	84.12	85.29	65.86	68.52	70.50
2034	83.82	84.99	65.63	68.22	70.35
2035	83.51	84.69	65.40	67.93	70.19
2036	83.20	84.39	65.17	67.64	70.04
2037	82.90	84.08	64.93	67.34	69.89
2038	82.59	83.78	64.70	67.05	69.74
2039	82.28	83.48	64.47	66.75	69.59
2040	81.98	83.18	64.24	66.46	69.44
2041	81.85	83.05	64.15	66.34	69.37
2042	81.72	82.92	64.06	66.23	69.31
2043	81.59	82.79	63.97	66.11	69.24
2044	81.45	82.66	63.87	65.99	69.18
2045	81.32	82.53	63.78	65.88	69.11
2046	81.19	82.40	63.69	65.76	69.05
2047	81.06	82.27	63.60	65.65	68.98
2048	80.93	82.14	63.51	65.53	68.92
2049	80.80	82.01	63.42	65.41	68.85
2050	80.67	81.88	63.33	65.30	68.79

Biofuels

The IEA publication Renewables 2024; Analysis and Forecast to 2030 outlines development for biofuels serving road transport in the “accelerated case”, which is used to benchmark APS developments. Relevant figures that can be used to estimate global and regional developments in WTW emission intensity and blend rates for ethanol in the gasoline fuel pool and biodiesel (including RD) in the diesel fuel pool, are:

- Road biofuel consumption by country and fuel, main and accelerated cases, 2010-2030 (page 139 – from which can be derived ethanol and biodiesel blend shares in the APS at the global level, for road transport)
- Road biofuel consumption by country and fuel, main and accelerated cases, 2023-2030 (page 144 – from which can be derived blend shares for ethanol, biodiesel, and RD in road can be allocated to AEs [United States and Europe], EMDEs [Brazil, Indonesia, and RoW].

- Road biofuel feedstock demand, main and accelerated cases, 2023-2030 (page 148 – from which can be derived feedstock allocations of sugars, starches, and other feedstocks for ethanol, and vegetable oils, residual oils, and other feedstocks allocations for biodiesel.
- In addition, the “Policies and assumptions, main and accelerated cases” outlines the policy frameworks and blend shares at the country or regional level for AEs (United States, Europe, Canada, United Arab Emirates), EMDEs (Brazil, India, Indonesia, Malaysia, Colombia, Egypt, Ghana, Kenya, Nigeria, Mozambique, South Africa, Uganda, Zambia and Zimbabwe), and the China region.

Figures used to estimate regional WTW GHG emission intensity projections for biomethane in the same publication include:

- Global historical and forecast production of biogases, and Net Zero Scenario target (page 159 – from which shares of biomethane in total NG demand in the main case – STEPS – and the accelerated cases – APS – can be derived)
- Demand for biogases by country/region and sector, main case, 2023 and 2030 (page 160 – from which regional shares of biomethane can be allocated to road transport for high-income countries [United States and EU], the China region, and EMDEs [India and other countries])
- The region-specific text in the biogases section summarizes growth in biomethane consumption in transport from 2023 to 2030.

Based on the above sources, and assuming linear improvements in the intervening years (2024-2029 and 2031-2049) estimates of the percent reduction in baseline emission intensity for ethanol, biodiesel, and biomethane, across each of the three regional groupings are derived. These are shown in Table C.12, and serve as the basis for default regional reductions in WTW GHG emission intensity for each biofuel type. The percentage reductions are to be applied to the benchmark value of the WTW GHG emission intensity (in gCO_2e/MJ) for liquid fuels of each type in each region or country.

Table C.12. Annual WTW GHG emission intensity of biofuels: ethanol, biodiesel, and biomethane, indexed to 2022-2024 regional values, as derived from the IEA APS.

Year	Ethanol			Biodiesel			Biomethane		
	AEs	EMDEs	China region	AEs	EMDEs	China region	AEs	EMDEs	China region
2022	100%	100%	100%	100%	100%	100%	100%	100%	100%
2023	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024	100%	100%	100%	100%	100%	100%	100%	100%	100%
2025	98%	99%	98%	97%	99%	99%	98%	97%	97%
2026	97%	97%	97%	94%	99%	99%	95%	93%	93%
2027	95%	96%	95%	90%	98%	98%	93%	90%	90%
2028	93%	95%	93%	87%	98%	98%	90%	87%	87%
2029	92%	94%	92%	84%	97%	97%	88%	83%	83%
2030	89%	91%	89%	77%	96%	96%	83%	77%	77%
2031	86%	89%	86%	75%	92%	92%	81%	74%	74%

2032	84%	87%	84%	73%	89%	89%	78%	71%	71%
2033	82%	85%	82%	71%	86%	86%	75%	69%	69%
2034	80%	82%	80%	69%	82%	82%	72%	66%	66%
2035	78%	80%	78%	67%	79%	79%	69%	64%	64%
2036	76%	78%	76%	65%	75%	75%	67%	61%	61%
2037	74%	76%	74%	63%	72%	72%	64%	59%	59%
2038	71%	74%	71%	61%	68%	68%	61%	56%	56%
2039	69%	72%	69%	59%	65%	65%	58%	54%	54%
2040	67%	70%	67%	58%	61%	61%	56%	51%	51%
2041	65%	68%	65%	56%	58%	58%	53%	48%	48%
2042	63%	66%	63%	54%	55%	55%	50%	46%	46%
2043	61%	63%	61%	52%	51%	51%	47%	43%	43%
2044	59%	61%	59%	50%	48%	48%	44%	41%	41%
2045	56%	59%	56%	48%	44%	44%	42%	38%	38%
2046	54%	57%	54%	46%	41%	41%	39%	36%	36%
2047	52%	55%	52%	44%	37%	37%	36%	33%	33%
2048	50%	53%	50%	42%	34%	34%	33%	31%	31%
2049	48%	51%	48%	40%	30%	30%	31%	28%	28%
2050	46%	49%	46%	38%	27%	27%	28%	26%	26%

RFNBOs, RCFs, and Hydrogen

There is no publicly available data on projections for RFNBO or RCF ("e-fuel") consumption in the IEA APS modeling. If dedicated production of such fuels does materialize, it can be assumed that the GHG emission intensity will be documented so that such fuels can be sold at a premium and be eligible for policy support. Therefore, no default annual percentage WTW GHG emission intensity reduction factors are provided for such fuels.

Very small volumes of hydrogen are projected to be allocated to road transport in the IEA APS scenario. Figure 3.2 in the [Global Hydrogen Review 2024] provides a basis for estimating a global trajectory for WTW GHG emission intensity reductions for hydrogen supplied to road transport vehicles in the APS. This figure shows a total of 7.5 Mt of low-emission H_2 production in 2030.

This compares with 97 Mt of hydrogen produced in 2023, nearly all via unabated NG SMR or, in China, from coal gasification. Assuming that road transport is allocated an equal proportion of low-emission H_2 as all other potential demand sectors, and assuming that around 70% of the hydrogen production is produced via electrolysis using primarily low-emission electricity, and 30% via SMR with CCS (and accounting for efficiency losses associated with hydrogen compression or liquefaction, transport, and dispensing) leads to an estimated global trajectory for low-emission hydrogen as shown in Table C.13.

Table C.13. WTW GHG emission intensity hydrogen for use in road vehicles in gCO_2e/MJ

Year	WTW emission intensity ($g\ CO_2e/MJ$)
2022	96.3
2023	96.3
2024	96.3
2025	95.3
2026	94.3
2027	93.3
2028	92.1
2029	91.0
2030	88.6
2031	87.1
2032	85.7
2033	84.3
2034	82.8
2035	81.4
2036	79.9
2037	78.5
2038	77.0
2039	75.6
2040	74.1
2041	71.2
2042	68.3
2043	65.4
2044	62.5
2045	59.6
2046	56.7
2047	53.8
2048	50.9
2049	48.0
2050	45.1

Scope 3, category 11 emissions intensity reductions for powertrain manufacturers

Criterion APSS-C3 requires powertrain providers to meet scope 3, category 11 (fuel-cycle) emission intensity reduction trajectories (i) for LDVs (passenger cars and LCVs) on a global and basis, with calculations based on projected sales in each of the three regions, and (ii) for 2&3Ws, buses, and trucks (lorries and road tractors), on both a regional and global basis. For all vehicle categories, compliance is based on a convergence approach (according to Annex G). The reduction trajectories are based on the ITF "All-Out" scenario, and target values are shown in Tables C.15–C.18.

Table C.15. Global fuel-cycle GHG emission intensity of new vehicle sales (gCO_2e/vkm)

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	61.3	212.3	1016.9	262.8	679.2	905.8
2023	60.0	207.5	1004.2	259.5	673.2	898.8
2025	53.8	142.1	925.9	210.6	633.9	825.8
2030	25.5	22.2	516.8	72.3	362.2	488.6
2035	3.8	3.9	75.0	6.2	81.0	136.5
2040	0.2	0.1	10.8	0.1	10.5	61.9
2045	0.0	0.0	0.0	0.0	0.0	0.0
2050	0.0	0.0	0.0	0.0	0.0	0.0

*Table C.16. **AEs** fuel-cycle emission intensity of new vehicle sales (gCO_2e/vkm)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	59.1	215.9	1052.4	275.8	811.6	913.9
2023	58.6	211.2	1055.8	272.4	800.9	906.4
2025	52.5	123.5	1027.0	216.7	750.5	825.0
2030	19.6	6.8	619.1	67.1	392.8	418.5
2035	1.7	0.0	0.7	0.0	0.0	0.0
2040	0.0	0.0	0.0	0.0	0.0	0.0
2045	0.0	0.0	0.0	0.0	0.0	0.0
2050	0.0	0.0	0.0	0.0	0.0	0.0

Table C.17. ***China region*** *fuel-cycle GHG emission intensity of new vehicle sales (gCO_2e/vkm)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	63.2	190.9	1105.5	214.3	535.7	867.5
2023	61.6	185.6	1102.7	211.7	530.8	860.4
2025	53.4	134.5	982.5	189.3	491.7	800.1
2030	26.7	17.5	502.1	70.4	266.9	428.9
2035	3.1	1.4	18.0	2.1	6.7	7.0
2040	0.0	0.0	0.0	0.0	0.0	0.0
2045	0.0	0.0	0.0	0.0	0.0	0.0
2050	0.0	0.0	0.0	0.0	0.0	0.0

Table C.18. ***EMDE*** *fuel-cycle GHG emission intensity of new vehicle sales (gCO_2e/vkm)*

	2&3Ws	Passenger Cars	Buses	LCVs	Lorries	Road Tractors
2022	59.3	212.8	859.5	231.1	640.6	905.2
2023	58.4	209.1	840.8	229.2	637.8	900.7
2025	54.1	190.0	795.8	198.4	609.9	845.6
2030	25.2	49.9	408.1	100.7	398.1	647.4
2035	4.1	11.3	209.5	37.6	186.0	405.1
2040	0.3	0.3	33.1	0.4	24.9	191.0
2045	0.0	0.0	0.0	0.0	0.0	0.0
2050	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX D: REFERENCE DATA

For the purpose of accounting for WTT and TTW emissions for fossil fuels, representative emission factors are shown in Tables D.1 (fossil-derived fuels), D.2 (biofuels), D.3 and D.4 (hydrogen, carbon-bearing RFNBOs and RCFs). Further details on the origin and the use of these factors are included in Appendix K, this also contains details regarding emission assessment methodologies associated with indirect land use change, in the case of biofuels, and aspects related with additionality, temporal and geographical correlation, for RFNBOs and RCFs.

Table D.1. WTT and TTW emissions factor of fossil-derived fuels

Fuel	gCO_2e/MJ		Source
	WTT	TTW	
Petroleum (oil-based) gasoline	17	73.2	Simple average
	17	73	GREET-2023
	17	73.4	JEC v5
Petroleum (oil-based) diesel	16.8	74.5	Simple average
	15.3	75.7	GREET-2023
	18.9	73.2	JEC v5
Compressed natural gas (CNG)	14	56.8	Simple average
	16.7	57.4	GREET-2023
	11.9	56.2	JEC v5
Liquefied natural gas (LNG)	17.8	57	Simple average
	19	57.6	GREET-2023
	16.6	56.4	JEC v5
Liquefied petroleum gas	8.4	65.1	Simple average
	8.9	64.5	GREET-2023
	7.8	65.7	JEC v5

Sources: Cai et al., 2022, Tables S17, S18, and S19; R&D GREET1, 2023 version.

Table D.2. Default emission factor for biofuels (2024), in gCO_2e/MJ

Pathway	Feedstock	Fuel pool	Region	WTW	ILUC
Ethanol	Corn	Gasoline	USA	53.7	18.9
Ethanol	Corn	Gasoline	Global	53.7	26.6
Ethanol	Sugarcane	Gasoline	Brazil	26.1	9.0
Ethanol	Sugarcane	Gasoline	Global	26.1	10.3
Ethanol	Agricultural residues	Gasoline	Global	15	-
FAME	Soybean	Diesel	USA	45.3	26.4

FAME	Soybean	Diesel	Brazil	45.3	26.7
FAME	Soybean	Diesel	Global	45.3	27.1
FAME	Canola/rape	Diesel	EU	41.3	20.4
FAME	Canola/rape	Diesel	Global	41.3	21.7
FAME	Tallow	Diesel	Global	18.9	-
FAME	Used cooking oil	Diesel	Global	11.2	- (capped; (50 beyond a 2% cap)
RD/HVO	Soybean	Diesel	USA	40.7	23.7
RD/HVO	Soybean	Diesel	Brazil	40.7	24
RD/HVO	Soybean	Diesel	Global	40.7	24.3
RD/HVO	Canola/rape	Diesel	EU	41	19.9
RD/HVO	Canola/rape	Diesel	Global	41	21.1
RD/HVO	Used cooking oil	Diesel	Global	16.4	- (capped; (50 beyond a 2% cap)
RD/HVO	Forest residue	Diesel	Global	7.5	-
FT diesel	Forest residue	Diesel	Global	24.1	-
RNG	AD, manure	CNG	Global	[-96.6] or [0] (capped; 13 beyond a 3% cap)	-
RNG	AD, MSW	CNG	Global	[-45.5] or [0] (capped; 13 beyond a 3% cap)	-
RNG	AD, sewage sludge	CNG	Global	[-34.6] or [0] (capped; 13 beyond a 3% cap)	-

Notes: AD = Anaerobic digestion; FT = Fischer Tropsch; HVO = Hydrotreated vegetable oil; RD = Renewable diesel; RNG = Renewable natural gas.
Biofuels from feedstock produced on land with high biodiversity value or high-carbon stock shall be excluded.
The ILUC value for used cooking oil is only applicable within limits set by a cap corresponding to 2% of the fuel used by road vehicles. Beyond this percentage, a default indirect emission value of 50 gCO_2e/MJ applies, unless lower indirect impacts are demonstrated and disclosed in a way that enables third-party verification. Other waste oils and fats are subject to the same default values and limitations as used cooking oil.

Due to the lack of demonstrability of permanence and additionality, as well as wide variability in counterfactual practices (further outlined in Appendix K), the SBTi is seeking consultation on whether to 1) include the negative emission factors adopted by CORSIA for biogas, biomethane, and RNG as defaults, or 2) include a lower-bound default emission factor of zero. In both cases a cap is set at 3% of the fuel used by road vehicles. Beyond this percentage, a default emission value of 13 gCO_2e/MJ applies, unless lower indirect impacts are demonstrated and disclosed in a way that enables third-party verification.

Sources: Cai et al., 2022, Tables S17, S18, and S19; R&D GREET1, 2023 version; ILUC from CORSIA global defaults (ICAO, 2025), adapted based on direct WTW emission ratios (as the CORSIA values are for aviation fuels); European Union, 2018 and European Union, 2023; biofuel emission factor values are not exhaustive of pathway-feedstock combinations.

Table D.3. Default global emission factors for hydrogen, carbon-bearing RFNBOs and RCF benchmarks

Pathway	WTT emissions (g CO_2e/MJ)	WTW emissions (g CO_2e/MJ)
Hydrogen from steam methane reforming of natural gas (NG SMR)	96.3	Same as WTT
Gasoline benchmark	17	73.2
Diesel fuel benchmark	16.8	74.5

Sources: Hydrogen from NG SMR based on Cai et al., 2022 (simple average of GREET and JEC) and consistent with 35% losses in SMR and stoichiometric ratios of water and methane: 0.5 kg methane and 1.125 kg of water per kg of hydrogen. Gasoline and diesel benchmarks are based on petroleum gasoline and petroleum diesel for gasoline and diesel fuel, also from Cai et al., 2022 (simple average of GREET and JEC).

Table D.4. Default estimates of the emissions intensity of hydrogen, carbon-bearing RFNBOs, and RCFs (before and after 2040) for varying carbon intensities of electricity generation

Pathway	Emission intensity of electricity (g CO_2e/kWh)	WTW emissions (g CO_2e/MJ)
Electrolytic hydrogen	25	[1] 11.1
	50	[2] 22.2
	100	[3] 44.4
	150	[4] 66.7
	200	[5] 88.9
Synthetic gasoline or diesel (RFNBO, e-fuel)	25	17.8
	50	35.6
	75	53.4
	100	71.2
	125	89.0
Synthetic gasoline or diesel (RCF, e-fuel, before 2040)	25	14.9
	50	29.9
	75	44.8
	100	59.8
	125	74.7
	150	89.7
Synthetic gasoline or diesel (RCF, e-fuel, after 2040)	25	52.8
	50	60.3
	75	67.8
	100	75.3
	125	82.7
	150	90.2

Sources: Based on information retrieved from Soler et al., 2022, Bothe et al. (2021), Deutz and Bardow (2021), and IEA (2020), assuming 1.6 MJ of electricity requirements for the production of 1 MJ of hydrogen, 2.13 MJ/MJ of RCFs and 2.56 MJ/MJ of RFNBOs.

Default mileages by vehicle type are listed in Table D.5 for the purpose of accounting for emissions occurring during vehicle manufacturing, from the vehicle-cycle and expressed in gCO_2e/vehicle, alongside emissions from the fuel-cycle (energy production and use), in gCO_2e/km. Further details on the origin and the use of these factors are included in Appendix M.

Table D.5. Lifetime mileage defaults by vehicle category

Vehicle category	Lifetime km (thousands)
2- and 3-wheelers (2-3Ws)	100
Passenger light duty vehicles (PLDVs)	220
Buses	500
Light commercial vehicles (LCVs)	400
Medium duty trucks (MDTs)	550
Heavy duty trucks (HDTs)	900

Sources: Odyssee-Mure, 2025; U.S. DOE Alternative Fuels Data Center, 2024; Girardi et al., 2019; Weymar and Finkbeiner, 2016; Mao et al., 2021; Krishnamoorthy, Kelly and Elgowainy, 2023; ITF, 2020; Bieker, 2021; O'Connell, 2023; Rebouças and Cieplinski, 2023; Yadav et al., 2024; Mera and Bieker, 2023; Anup and Deo, 2021.

Default lifetimes by vehicle type, shown in Table D.6 are used to set specific delays for low-emission vehicle shares related to replacement parts.

Table D.6. Default lifetimes by vehicle category

Vehicle category	Lifetime (years)
2- and 3-wheelers (2-3Ws)	12
Passenger light duty vehicles (PLDVs)	18
Buses	12
Light commercial vehicles (LCVs)	16
Medium duty trucks (MDTs)	14
Heavy duty trucks (HDTs)	12

Sources: Hunt et al., 2021; Greene and Leard, 2024; US DOT, 2017; Weymar and Finkbeiner, 2016; Mao et al., 2021; Krishnamoorthy, Kelly and Elgowainy, 2023; ITF, 2020; Bieker, 2021; O'Connell, 2023; Rebouças and Cieplinski, 2023.

Default mileage decay values (i.e., the reduction in annual mileage over vehicle's lifetime), shown in Table D.7, are necessary to align projected fuel-specific WTW emission intensity with vehicle operations over its lifetime in the initial market of use.

Table D.7. Default mileage decay functions, in percent reduction from the initial year and in absolute annual mileage, by vehicle category

Vehicle category	*Age (yrs)*	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2-3Ws	km/year	10,792	10,345	9,898	9,451	9,004	8,557	8,110	7,663	7,216	6,769	6,322	5,875								
	% decay	100%	95.9%	91.7%	87.6%	83.4%	79.3%	75.1%	71.0%	66.9%	62.7%	58.6%	54.4%								
PLDVs	km/year	14,188	13,795	13,403	13,011	12,228	11,794	11,382	11,157	10,941	10,855	10,707	10,609	10,372	10,232	10,092	9,650	9,349	9,047	8,746	8,444
	% decay	100%	97.2%	94.5%	91.7%	86.2%	83.1%	80.2%	78.6%	77.1%	76.5%	75.5%	74.8%	73.1%	72.1%	71.1%	68.0%	65.9%	63.8%	61.6%	59.5%
Buses	km/year	77,042	65,999	57,781	49,050	42,630	37,494	33,898	30,817	27,992	26,708	25,681	24,910								
	% decay	100%	85.7%	75.0%	63.7%	55.3%	48.7%	44.0%	40.0%	36.3%	34.7%	33.3%	32.3%	31.4%	30.4%	29.5%					
LCVs	km/year	40,527	39,716	38,501	37,690	36,474	34,448	32,421	27,153	21,074	18,237	16,211	14,995	14,184	14,184	14,184					
	% decay	100%	98.0%	95.0%	93.0%	90.0%	85.0%	80.0%	67.0%	52.0%	45.0%	40.0%	37.0%	35.0%	35.0%	35.0%					
MDTs	km/year	78,625	68,404	58,969	51,106	44,030	38,526	34,595	31,065	27,895	25,049	22,493	20,197	18,136	16,286	14,624					
	% decay	100%	87.0%	75.0%	65.0%	56.0%	49.0%	44.0%	39.5%	35.5%	31.9%	28.6%	25.7%	23.1%	20.7%	18.6%					
HDTs	km/year	128,127	117,209	106,136	95,120	85,115	75,806	66,768	58,628	50,907	44,777	38,610	32,796								
	% decay	100%	91.5%	82.8%	74.2%	66.4%	59.2%	52.1%	45.8%	39.7%	34.9%	30.1%	25.6%								

ANNEX E: VEHICLE ENERGY INTENSITY CALCULATIONS

Specific energy consumption values, measured in MJ/vkm, shall be assessed based on internationally agreed, or in the absence of these, country-specific test procedures. On-road corrections shall also be applied to light-duty vehicles.

In the absence of testing obligations, estimates of fuel and/or electricity consumption of the vehicle's sales shall be supported by published methodologies and sufficient evidence to allow for third-party verification.

This information can be based on:

- Dedicated tests conducted voluntarily in unregulated markets
- Assessments based on tests already available in regulated markets in cases where the same technologies are used in vehicles sold in unregulated markets
- It can also rely on telematics data, based on onboard diagnostics and monitoring (while still requiring the release of sufficient information to enable transparent third-party verifications).

Relevant test procedures are summarised in Table E.1, for each vehicle category.

Table E.1. Cycles, simulation tools and procedures for energy consumption and gCO_2e/km measurements

Vehicle category	Test procedures
2- and 3-wheelers	Worldwide Harmonized Motorcycle Emissions Certification Procedure (WMTC)
Passenger cars and LCVs	Worldwide Harmonized Light Vehicles Test Cycle (WLTC) and Test Procedure (WLTP) Japanese JC08 Cycle (superseded by WLTP) New European Driving Cycle (superseded by WLTP) US Corporate Average Fuel Economy (CAFE), reliant on the Federal Test Procedure (FTP)-75 and Highway Fuel Economy Test (HWFET) cycles
Buses, minibuses and trucks	China GB/T 27840-2021, fuel consumption test methods for heavy-duty commercial vehicles EU Vehicle Energy Consumption calculation TOol (VECTO) Japanese Hardware in the Loop Simulator US Greenhouse Gas Emissions Model (GEM)

In the case of cars and light commercial vehicles, it is possible to convert to MJ/vkm calculated based on country- or region-specific test procedures in the internationally agreed Worldwide harmonized Light vehicles Test Procedure (WLTP), using conversions across country- or region-specific test cycles.

Test cycle conversions are based on analysis conducted by UC Davis and FIA Foundation (Trends in the Global Vehicle Fleet 2023, Global Fuel Economy Initiative [GFEI, 2023]), ICCT (ICCT, 2014, 2014a, and 2021), and are consistent with the JRC for the WLTP/NEDC ratio (Joint Research Centre, 2023), as embedded in the Automotive Standard reporting tool. Conversions from NEDC to WLTP for battery electric vehicles (for PLDVs and LCVs separately) are based on (JRC, 2017).

Test cycle conversions shall be carried out as outlined below, and based on the multipliers listed in Table E2. These scalars should be multiplied by initial specific energy consumption values (in MJ/vkm) to convert from the specific energy consumption in a given test cycle to WLTP.

- **NEDC to WLTP**: For all data reported in NEDC, separate powertrain-fuel specific scalars based on GFEI 2023 for PLDVs (passenger cars) and for light commercial vehicles, as determined by zero-intercept regression methods based on EEA type approval data for new cars and vans, shall be adopted to convert to WLTP. These scalars shall also be applied for regional variants of NEDCs testing (e.g. India, China, Japan), separately for PLDVs and LCVs.

- **JC08 to WLTP**: For all data reported in JC08, scalars shown in Table E2 shall be used. These were derived by correcting zero-intercept formulas converting from JC08 to NEDC based on (ICCT, 2014), Table 5.2, single regression with zero intercept (Formula 4.2), to account for the gap between NEDC and WLTP, following the methods described in (GFEI, 2023).

- **CAFE (EPA) (also known as U.S.-combined or FTP75 + HWFET) to WLTP**: For all data reported in CAFE, i.e. for cars and light-trucks tested on the CAFE cycle and sold in North America, Brazil, South Korea, and Mexico, scalars shown in Table E2 shall be used. These were derived by correcting zero-intercept formulas converting from CAFE to NEDC based on (ICCT, 2014), Table 5.2, single regression with zero intercept (Formula 4.2), to account for the gap between NEDC and WLTP, following the methods described in (GFEI, 2023).

While applying zero-intercept equations introduces uncertainty (reflected in the standard error of the regressions used to develop these estimates), the simple multiplier reduces ambiguity and increases clarity in the test cycle conversions. Future development of the standards could explore adopting non-zero intercept formulas. If this approach were to be adopted, care should be taken to ensure that test cycle conversions are consistent among one another and reflect current gaps, for instance between NEDC and WLTP, as reflected in recent EEA data for cars and vans (EEA, 2024a; 2024b).

Table E.2. Test cycle conversions for light-duty vehicles

Vehicle category	From cycle	To cycle	Powertrain-Fuel	Multiplier	Source
PLDV*	NEDC	WLTP	ICEV/HEV-Gasoline	1.185	GFEI, 2023, Table A5 (and supporting analysis)
PLDV*	NEDC	WLTP	ICEV/HEV-Diesel	1.234	GFEI, 2023, Table A5 (and supporting analysis)
PLDV*	NEDC	WLTP	BEV	1.283	JRC, 2017
PLDV*	NEDC	WLTP	FCEV	1.283	JRC, 2017
LCV	NEDC	WLTP	ICEV/HEV-Gasoline	1.166	GFEI, 2023, Table A5 (and supporting analysis)
LCV	NEDC	WLTP	ICEV/HEV-Diesel	1.284	GFEI, 2023, Table A5 (and supporting analysis)
LCV	NEDC	WLTP	BEV	1.21	JRC, 2017
PLDV*	JC08	WLTP	ICEV/HEV-Gasoline	1.246	ICCT, 2014; GFEI, 2023 (NEDC to WLTP update)
PLDV*	JC08	WLTP	ICEV/HEV-Diesel	1.208	ICCT, 2014; GFEI, 2023 (NEDC to WLTP update)
LCV	JC08	WLTP	ICEV/HEV-Gasoline	1.225	ICCT, 2014; GFEI, 2023 (NEDC to WLTP update)
LCV	JC08	WLTP	ICEV/HEV-Diesel	1.256	ICCT, 2014; GFEI, 2023 (NEDC to WLTP update)
PLDV*	CAFE	WLTP	ICEV/HEV-Gasoline	1.211	ICCT, 2014; GFEI, 2023 (NEDC to WLTP update)
PLDV*	CAFE	WLTP	ICEV/HEV-Diesel	1.306	ICCT, 2014; GFEI, 2023 (NEDC to WLTP update)
LCV	CAFE	WLTP	ICEV/HEV-Gasoline	1.19	ICCT, 2014; GFEI, 2023 (NEDC to WLTP update)
LCV	CAFE	WLTP	ICEV/HEV-Diesel	1.358	ICCT, 2014; GFEI, 2023 (NEDC to WLTP update)

*Note: PLDV = Passenger cars (PCs) in the European Union context.

For PHEVs, it is especially important to assess the shares of fuel and electricity consumption that reflect actual, real-world usage. In order to accurately calculate utility factors, for the purposes of estimating the specific (i.e. per vehicle-km) electricity and fuel consumption of new PHEV models, automakers will be required to disclose model-level information on the fuel consumption, electricity consumption, and range in the charge-depleting (CD) mode, and on fuel consumption in charge-sustaining (CS) mode.[9]

For passenger cars and LCVs, specific fuel consumption, GHG emissions, and/or electricity consumption shall be calculated using test procedures normalized to the WLTP. Fuel consumption/TTW GHG emissions and electricity consumption estimates will then be adjusted upwards using data available from the European Environment Agency (EEA, 2024), based on on-board fuel consumption monitoring (OBFCM) devices, of real-world energy consumption.

Multipliers to adjust for real-world performance that shall be adopted for the purposes of estimating specific energy consumption (in MJ/vkm) are shown in Table E.3.

Table E.3. Multipliers to estimate real-world specific fuel consumption based on WLTP performance

Vehicle category	Powertrain-Fuel	Multiplier
PLDV*	ICEV/HEV-Gasoline	1.2037
PLDV*	ICEV/HEV-Diesel	1.1719
PLDV*	PHEV-Gasoline	4.9605
PLDV*	PHEV-Diesel	5.8793
LCV	ICEV/HEV-Gasoline	1.1552
LCV	ICEV/HEV-Diesel	1.1267
LCV	PHEV-Gasoline	4.1479
LCV	PHEV-Diesel	7.2732
PLDV and LCV	BEV	1.25
PLDV and LCV	FCEV	1.25

*Note: PLDV = Passenger cars (PCs) in the European Union context.

Values for all powertrains except BEVs and FCEVs are derived from the vkm-weighted fuel-powertrain specific gaps for vehicles registered in 2023, as reported in (EEA, 2025).

[9] WTW emission factors related to the fuel and electricity use can then be calculated by either adopting regional / country-level defaults, or by providing verifiable documentation of contracts showing that some subset of the vehicles sold are operating on lower-emission electricity and/or fuels.

Values for BEVs and FCEVs are based on (TNO, 2024) and (TNO, 2025), with the on-road gap for FCEVs assumed to be equal to that of BEVs.

These adjustments include corrections for PHEVs, accounting for differences between utility factors (i.e., equivalent shares of driving in all-electric modes) deriving from WLTP tests and real-world records, reflecting actual PHEV usage.

Automakers that provide documented evidence showing their sold vehicles, regardless of powertrain, outperform the EEA or publicly available defaults may use specific fuel and energy consumption values based on annual, model-level aggregations of their own OBFCM data and charging data, by region and globally. Note that electricity consumption data must also include losses incurred during charging. If real-world electricity consumption data provided by the automaker does not include charging losses, a default assumed loss of 15% can be applied.

ANNEX F: ENERGY EFFICIENCY RATIOS

Weighting factors based on energy efficiency shall be applied to assess the sales shares of zero- and near-zero-emission vehicles in criteria AMSS-C2 and APSS-C1. Battery electric vehicles (BEVs), fuel cell electric vehicles (FCEVs), and plug-in hybrid vehicles (PHEVs) (including extended-range electric vehicles [EREVs] or vehicles that are able to charge via conductive or inductive on-road dynamic charging) are the only vehicles that qualify as ZEVs or near-ZEVs.

Energy efficiency ratios (EERs) applicable for this purpose are detailed in Table F1. These EERs represent the WTW efficiency of each technology relative to a BEV of the same type, using primary renewable electricity of the same type. The lower EER for FCEVs and PHEVs is indicative of the lower overall efficiency of converting renewable energy into power via these technologies as compared to a similar BEV powertrain. Appendix M contains further information on how these factors have been determined.

Table F.1. EERs by powertrain technology, for all vehicle categories

Powertrain technology	Energy efficiency ratio (EER)
Battery electric vehicles (BEVs)	1
Fuel cell electric vehicles (FCEVs)	0.45
Hybrid electric vehicles (HEVs)	0.3

As noted above, for PHEVs, it is especially important to assess the shares of fuel and electricity consumption that reflect actual, real-world usage. In order to accurately calculate utility factors as a basis for calculating the EER to apply for PHEVs, automakers will be required to disclose model-level information on the fuel consumption, electricity consumption, and range in the charge-depleting (CD) mode, and on fuel consumption in charge-sustaining (CS) mode.

The EER for PHEVs shall be assessed considering the shares of electricity and fuel consumption and weighted using BEV energy efficiency ratio (1) for the share of equivalent all-electric travel ($a_{electricity}$) and the HEV energy efficiency ratio (0.3) for the remaining share (1 - ($a_{electricity}$). The factor $a_{electricity}$ can be calculated from the average fuel consumption ($FC_{average\ usage}$) and the fuel consumption in charge sustaining (CS) mode ($FC_{CS\ mode}$), as follows:

$$FC_{average\ usage} = a_{fuel}FC_{CSmode} = (1 - a_{electricity})FC_{CSmode}$$

$$a_{electricity} = \frac{(FC_{CS\ mode} - FC_{average\ usage})}{FC_{CS\ mode}}$$

also considering that

$$FC_{average\ usage} = a_{CDmode}FC_{CDmode} + a_{CSmode}FC_{CSmode}$$

where $FC_{CD\ mode}$ is the fuel consumption in charge depleting (CD) mode, $a_{CD\ mode}$ is the share of travel in CD mode, and $a_{CS\ mode}$ is the share of driving CS mode, and considering that all these values are available at the model level for PHEV from energy consumption and CO_2 emission tests. An example calculation for a sample PHEV model is shown in the box below.

Box F.1. Example calculations for determining model-specific EER and contribution to ZEV sales share metric for PHEVs

Tested data for a PHEV model is as follows:

$$FC_{CD\ mode} = 1.0\ L/100km$$
$$FC_{Cs\ mode} = 7.2\ L/100km$$

Average usage data for the PHEV model is as follows:

$$\alpha_{CD\ mode} = 40\%$$
$$\alpha_{CS\ mode} = 60\%$$

Calculate the EER for this particular PHEV model as follows:

$$FC_{averageusage} = \alpha_{CD\ mode}\ x\ FC_{CD\ mode} + \alpha_{CS\ mode}\ x\ FC_{Cs\ mode}$$
$$FC_{averageusage} = (40\%)(1.0\ L/100km) + (60\%)(7.2\ L/100km)$$
$$FC_{averageusage} = (40\%)(1.0\ L/100km) + (60\%)(7.2\ L/100km)$$
$$FC_{averageusage} = 4.72\ L/100km$$

$$\alpha_{electricity} = (FC_{Cs\ mode} - FC_{averageusage})\ /\ FC_{Cs\ mode}$$
$$\alpha_{electricity} = (7.2\ L/100km - 4.72\ L/100km)\ /\ 7.2\ L/100km$$
$$\alpha_{electricity} = 21.2\%$$

$$EER_{PHEV} = (1.0)(21.2\%) + (0.3)(1 - 21.2\%)$$
$$EER_{PHEV} = 0.45$$

This calculation should be performed for each PHEV model sold, and the sales-weighted EER should be computed. For this example, assuming that the sales-weighted average EER of all PHEVs sold across the entire portfolio is 0.45, the following calculation provides the contribution of PHEVs to the ZEV sales share metric, given the following sales share data:

% sales of ICE vehicles = 25%
% sales of PHEV model = 10%
% sales of BEV vehicles = 65%

$$ZEV\ sales\ share = (\%\ sales\ IC)(EER_{IC}) + (\%\ sales\ PHEV)(EER_{PHEV}) + (\%\ sales\ BEV)(1(EER_{BEV)}$$
$$ZEV\ sales\ share = (10\%)(0.45) + (65\%)(1)$$

ZEV sales share = 69.5%

ANNEX G: CONVERGENCE APPROACH

Companies selling passenger light-duty vehicles and light commercial vehicles may meet a single global target, based on the emission intensity targets calculated separately for each region, aggregated based on a weighted average using projected sales in each region in the target year. The requirement to meet global convergence thresholds, calculated based on projected vehicle sales within each of the three global regions (Advanced Economies [AEs], Emerging Markets and Developing Economies [EMDEs], and China) applies to both the emission intensity criterion (AMSS-C3) for light-duty vehicles and to the zero-emission vehicle sales share criterion (separately for each vehicle category), (AMSS-C2).

In the case of the emission intensity criterion (AMSS-C3), compliance based on a convergence approach is possible thanks to the fact that emission intensities can be harmonised under a single metric, based on the WLTP, by integrating conversions from other test cycles where needed and by applying an on-road correction. In the case of the zero-emission vehicle sales share criterion (AMSS-C2), the common metric is the ZEV sales share, including the ZEV credits accrued from near-ZEV sales.

Benchmarking of energy and emissions intensity in LDVs relies on established conversion methods across regional test cycles, as well as real-world measurements of the gap between rated (in WLTP) and on-road fuel consumption. Benchmarking of estimated on-road fuel consumption is far more accurate for light-duty vehicles than for all other vehicle types. As a result, as long as LDV manufacturers calculate their on-road emissions by applying the methodology detailed in the standard, the overall weighted-average on-road energy intensity (in MJ/vkm) and WTW emissions intensity (in gCO_2e/vkm) across each of the regional markets is likely to be reasonably accurately reflected by the ITF modelled values in historical and benchmark years (2020-2024).

This is not the case for other vehicle categories, where there is far more uncertainty and regional variability, both in the testing procedures and in the actual on-road vehicle performance. Taking medium- and heavy-duty vehicles (MHDVs) as an example, while testing procedures provide a strong basis for incentivizing fuel efficiency technologies in each regulated segment, they tend to provide biased (upwards or downwards) estimates when compared with real-world data (e.g. telematics and tracking by bus and truck OEMs). These biases vary across vehicle segments and differ by testing procedure (listed in Table E.1).

Adopting a convergence approach for each non-LDV vehicle category, within each regional test cycle, is likely to introduce two undesired impacts:

- Since global modelling adopts energy intensity estimates that are internally consistent but disconnected from regional test cycles, regional benchmarks will be higher or lower than tested energy intensities, in ways that cannot be estimated and evaluated across all global regions. This means that for certain regional trajectories and vehicle category combinations, automotive manufacturers could face a systematically less or more stringent baseline.
- The mismatch within and across regions would result in a further disconnect in terms of implied slopes of the emission intensity reduction pathways, effectively introducing

a major inconsistency in the stringency of emission intensity trajectories, across non-LDV segments and regions.

Note: These issues also exist with the proposed approach (absolute percentage reduction), especially for MHDTs together with the heterogeneity of vehicle duty cycles and operations (especially for trucks) also exist, although they are mitigated by a consistency in assumptions and methodology for estimating energy intensity in global modelling efforts.

This is the rationale for adopting a percent improvement approach (detailed in Annex H), rather than a convergence approach, for emissions intensity across all non-light-duty vehicle categories. The percent improvement approach reduces the margin for introducing bias across regions with different test cycles (and the gaps between test-cycles and on-road emissions intensity).

Compliance with both regional and global metrics shall be based on the weighted average of their sales—considering different powertrains and associated life-cycle CIs—in AE, EMDEs and the China region.

In the case of the ZEV sales criteria (AMSS-C2), the single metric is the share of sales, by vehicle category. Compliance with the regional and the global metric shall be based on the weighted average of vehicle sales, by type, and it shall be integrating energy efficiency-related factors.

A convergence approach ensures all automakers align with regional pathways by 2050.[10] It is implemented using convergence between each company's initial fuel-cycle emission intensity (expressed in gCO_2e/vkm) or the zero-emission vehicle sales share and the benchmark 2050 fuel-cycle emission intensity or zero-emission vehicle sales share trajectory defined for the SBTi Automotive Sector Net-Zero Standard, as detailed in the formulas below.

$$X_{Company}(t) = X_{Pathway}(t_C) + [X_{Company}(t_B) - X_{Pathway}(t_C)][\frac{X_{Pathway}(t) - X_{Pathway}(t_C)}{X_{Pathway}(t_B) - X_{Pathway}(t_C)}]$$

Where:

$X_{Company}(t)$	=	Relevant parameter for the company in any target year t between the base year and convergence year (2050)
$X_{Pathway}(t_C)$	=	Relevant parameter from the reference pathway in the convergence year (2050)
$X_{Company}(t_B)$	=	Relevant parameter for the company in the base year
$X_{Pathway}(t)$	=	Relevant parameter from the reference pathway in year t
$X_{Pathway}(t_B)$	=	Relevant parameter from the reference pathway in the base year

[10] This recognizes the need and the demonstrated capacity for industry laggards to catch-up with industry leaders, both within regionalized country groupings, and at a global level.

ANNEX H: PERCENT IMPROVEMENT APPROACH

Original Equipment Manufacturers (OEMs) that produce 2-3 wheelers, buses, or medium- and heavy-duty trucks in any of these regional markets are subject to regional and global GHG emission requirements in each market where they operate, given the lack of any methodology to harmonise rated fuel consumption across regional test cycles for these vehicle categories.

This is implemented as detailed in the formula below.

$$X_{Company}(t) = \frac{X_{Company}(t_o)}{X_{Trajectory}(t_0)} X_{Trajectory}(t)$$

Where

t_0 is the initial year, for which historical data are available

t is any year

$X_{Company}(t)$ is the value of the relevant parameter for a given company at a time t

$X_{Company}(t_0)$ is the value of the same company-specific parameter at the initial time t_0

$X_{Trajectory}(t)$ is the value of the relevant parameter in the trajectory at the time t

$X_{Trajectory}(t_0)$ is the value of the same trajectory parameter at the initial time t_0

ANNEX I. ASSIGNMENT OF PARTS TO VEHICLE POWERTRAINS

In the absence of documentation demonstrating the vehicle powertrain to which a given part is supplied, the part is assigned to the least performant powertrain (for a given vehicle category and within each region), for the purposes of calculating the WTW energy efficiency (and hence for calculating the partial ZEV credits it accrues), as follows:

1. For powertrain-specific components:

   - **Battery electric powertrains*:*** Parts that are unambiguously produced for battery electric powertrains (e.g., large-capacity lithium-ion batteries) are assigned to BEVs and receive a zero-emission vehicle sales share credit of 1.
   - **Fuel cell electric vehicle (FCEV) powertrains**: Parts that are unambiguously produced for fuel cell electric powertrains (e.g., fuel cell stacks and systems), are assigned to FCEVs. Hydrogen storage tanks and other parts that could be used in either hydrogen ICEs or FCEVs require documentation to be assigned to FCEVs.
   - **Hybrid powertrains***:* Components (e.g., electric motors) that could be designed for hybrid or plug-in hybrid vehicles are assigned to HEVs in the absence of documentation, effectively disqualifying them from accrual of partial ZEV credits as near-ZEVs.

APPENDIX J: LIFE-CYCLE ASSESSMENT COMPONENTS

The SBTi's land transport science-based target-setting guidance v1.1 takes a WTW emissions approach, without sufficient guidance on how to calculate this, as it notes that "As companies make assumptions for the type of fuels plugged into the fuel tanks, original equipment manufacturers can also make assumptions of the average grid electricity factors for their sales across markets."

The SBTi Automotive Sector Net-Zero Standard expands this scope to include use-phase or "fuel-cycle" (i.e., TTW and WTT emissions - both of which fall under Scope 3 category 11 emissions for both automakers and auto parts manufacturers).[11]

A key reason for the extension to the approach lies in the observation that battery electric vehicles are the most promising technology to drive cost-effective and substantial reductions in the use-phase emissions of road transport vehicles, despite higher upfront manufacturing-related emissions.

Ensuring that these and other ZEVs, which are in-fact only zero tailpipe emissions, can deliver on their full long-term potential to cut GHG emissions, also requires consideration of the energy efficiency implications of different pathways, including energy production, to achieve the timely decarbonization of the automotive sector.

Extending the analysis beyond the areas under direct OEM control presents a key limitation: OEMs cannot directly influence the GHG emission intensity of these fuel supply pathways.

However, to ensure that OEM decisions reflect the broader energy transition, including its emissions, operational, and economic constraints, a fair comparison of powertrain technologies must assess fuel supply chain emissions.

This Standard updates the Land Transport guidance adding a scope 3 category 11 emission intensity reduction criterion (AMSS-C1).

To support simplicity, accessibility, and transparency, calculations of fuel-cycle emissions are generally aligned with GREET defaults, system boundaries, and methodologies.

Exceptions are made where system boundaries must be expanded, such as for WTW accounting of electricity, RFNBOs, RCFs, and biofuels, with each exception clearly noted and justified.

Various other methodologies for automotive accounting are being developed, including:

- Under the UN Economic and Social Council's World Forum for Harmonization of Vehicle Regulations (WP.29) under the Working Party on Pollution and Energy

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[11] Vehicle-cycle emissions fall into multiple categories of the GHG Protocol: (i) direct and indirect energy use for vehicle and component manufacturing (Scopes 1 and 2, and scope 3, category 3), (ii) metals and materials used in vehicle manufacturing, (Scope 3, category 1), and (iii) End-of-Life (Scope 3, category 12).

(GRPE)'s Automotive Life-Cycle Assessment (A-LCA) working group (UNECE, 2023)
- The European Commission has commissioned several studies on vehicle life-cycle emissions, including comparative studies of conventional and alternatively fuelled vehicles (Ricardo, 2020); on-going Horizon-funded projects on zero-emission road transport (TranSensus LCA, 2024) and on biomass, including biofuels for all transport modes (Clever, 2023), as well as the carbon footprint of EV batteries (CFB) (JRC, 2023), in support of the EU Battery Regulation (Regulation (EU), 2023/1542).
- The Greenhouse Gas Protocol is also going through a period of revision that might have implications for some of the Scope 3 categories (e.g. boundary conditions and cut-offs) that contribute to the WTW emissions.

The SBTi will consider updates and revisions to the SBTi Automotive Sector Net-Zero Standard once the above standards are published, to ensure alignment and reduce administrative reporting burdens for companies committing to the Standard.

For reporting and compliance purposes, the Standard also refines the WTW emission accounting to define fuel-specific defaults and trajectories based on the IEA Announced Pledges Scenario (APS).

Finally, the WTW approach enables automakers to receive credit for lower-emission intensity fuels used in vehicles.

As further detailed in Box 1, the selection of the IEA APS represents a pragmatic compromise between the IEA Stated Policies Scenario (STEPS), which risks underrepresenting contributions from low-emission technology deployment (especially for technologies like wind and solar photovoltaic, and hence also for the emission factor of electricity and the availability of low-emission RFNBOs), and the IEA Net-Zero (NZE) scenario, which integrates significant actions to decarbonize incumbent technologies (e.g., oil-based transport fuels) but, given the track record of action to date, risks to offer disproportionate advantages to these same technologies, with the risk of significantly weakening the effectiveness of the Standard, if used as a default assumption.

Box J.1. Assumptions on fuel-specific WTT emission trajectories and guidance on the use of IEA APS scenario values for reporting/compliance purposes

The automakers' emissions intensity reduction criterion (AMSS-C1) requires estimates of gCO_2e/vkm of the portfolio of new vehicles sold each year. The SBTi Automotive Sector Net-Zero Standard also requires estimating emissions intensity reductions over the vehicle lifetime. Assumptions are therefore needed on plausible trajectories of the WTW emission factor for each form of energy used by road vehicles in the years following the initial benchmark.

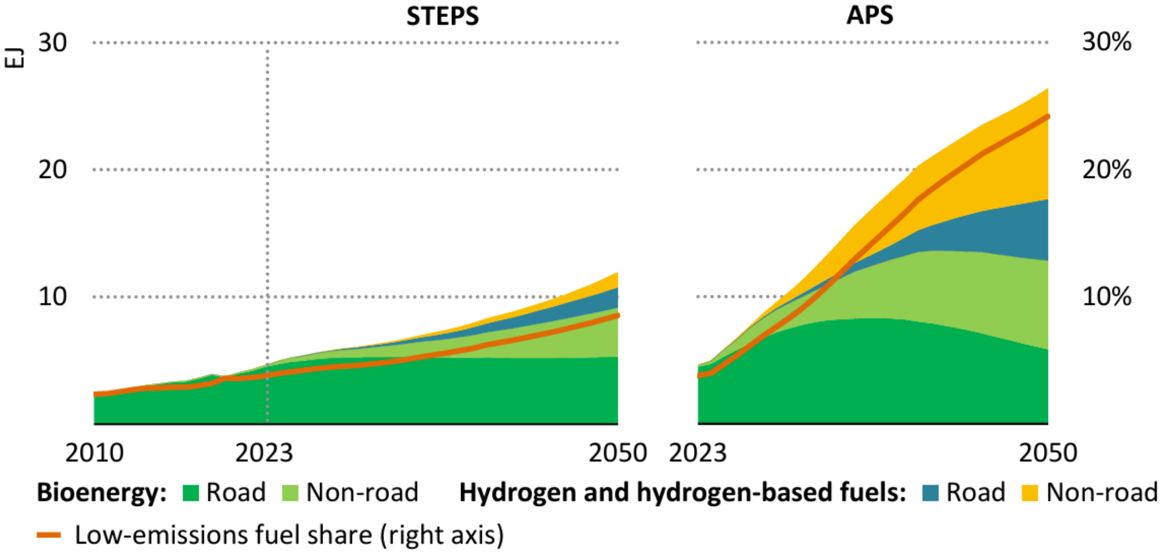
The IEA STEPS and APS provide regularly updated assessments under current policies and announced policy ambitions, respectively. Both scenarios, illustrated in Figure K1. for what concerns low-emission energy used in transport (excluding electricity), are regularly updated in major IEA publications, particularly in its World Energy Outlook (IEA, 2024).

If companies use fuel production technologies with emission intensities that allow larger savings enabled by the values implied by the IEA Announced Pledges Scenario (APS) in their assessments , they shall provide documentation and justification of how they ensure availability of less emission-intense energy to their customers (e.g. via validated long-term supply contracts between fleets that purchase the vehicles and fuels providers).

Each scenario includes data on projected changes in fuel production, transport, and processing technologies and in the shares of energy used in road transport (e.g., of ethanol in the gasoline fuel pool, biodiesel and renewable diesel in the diesel pool, and biomethane in natural gas), enabling, in combination with targeted complementary analyses[12] and assumptions (e.g., on emission factors of specific subsets of biofuels), where the available data is limited, to estimate trends in emission factors. Sufficient data on electricity and hydrogen emission factors also exist in other IEA resources, including its Global Hydrogen Review (IEA, 2024) and its Electricity Market Reports (IEA, 2024).

[12]E.g., the Renewables market report, for biofuels (IEA, 2024), or the OECD/FAO outlook (OECD/FAO, 2024).

Figure K.1. Low-emission fuels in transport in the Stated Policies (STEPS) and Announced Pledges scenarios (APS), 2010–2050



Source: (IEA, 2024)

Since the IEA first introduced these scenarios, STEPS has been closest to how the energy system has evolved, despite overestimations (e.g., in the cases of capture and sale of vented or flared methane; and scale-up of low-emission hydrogen production), and underestimations (e.g., in the case of BEVs, solar and wind electricity deployment) of specific technology options. APS projected trajectories have been far more rapid than historical progress, to date, aiming to reflect the impacts of policies oriented towards an acceleration of decarbonization, but they also tended to fall short (for technologies that are genuinely paired with low GHG emissions) of the changes that are included in the IEA NZE scenario.

Clear guidance on default values and on methodological choices adopted for calculating life-cycle emissions is essential to ensure a harmonized and fair approach and to reduce scope for misrepresenting different technologies.

Default values have been developed in the SBTi Automotive Sector Net-Zero Standard, together with tools and methodologies for calculating each TTW and WTW. These tools also incorporate efforts to leverage existing tools and align with established methodologies.

Life-cycle GHG emissions are intended to reflect estimates of climate forcing across all GHGs, based on 100-year global warming potentials (GWPs) aligned with either the IPCC AR5 or AR6 (depending on the vintage of the source of WTT, TTW, and WTW emission calculations) (GHG Protocol, 2024). Additionally, hydrogen has been assigned a GWP_{100} value of 11.6, (based on Sand et al., 2023).[13]

[13] Hydrogen's GWP is not direct, rather, chemical reactions induced by atmospheric hydrogen change the abundance of the GHGs methane, ozone, and stratospheric water vapor, as well as aerosols. The atmospheric science attributing a 100-year GWP to molecular hydrogen is relatively new, and not yet been integrated in the GHG Protocol documentation listing GWPs for other climate forcing gases.

APPENDIX K: WELL-TO-TANK EMISSIONS

The WTT methodology and default values outlined below aim to incorporate the most relevant elements for the effective decarbonization of the value chain and beyond value chain mitigation considerations.

Fuel-specific defaults and emission calculations are required to ensure that the operational emissions of vehicles are properly estimated and that reductions in fuel emission intensity are incentivized.

Fuel-specific emission factors over vehicle lifetimes shall also be estimated, under the SBTi Automotive Sector Net-Zero Standard, at the level of global macro-regions, to align with compliance requirements.

WTT emission factors shall be assessed for energy production pathways, differentiating between:

- Oil- and gas-based fuels, for which the assessment considers fuel types, and takes a conservative approach.
- Biofuels, which can be based on representative pathways and related market penetration data, for reasons due to both data availability and practical feasibility.
- Electricity, at the country level, as disaggregated data exist and are regularly updated, due to the potential for rapid improvements in emission intensity as the share of renewables and nuclear increases.
- Hydrogen, other RFNBOs and RCFs, at the fuel pathway level, since there are still very limited volumes of low-emission hydrogen, and of other RFNBO and RCF production, meaning that making further differentiation risks to be unnecessarily cumbersome. Further differentiation may become necessary if greater volumes of low-emission hydrogen, RFNBOs or RCFs become available in the road fuel pool.

Methodological approaches and system boundaries shall align with those of the WTT emission assessment used in GREET and the JEC analyses, for oil-based and biofuels, and with the EU delegated act on a methodology for renewable fuels of non-biological origin for hydrogen, other RFNBOs and RCFs (European Union, 2023), with one exception:

The emission intensity of electricity used to produce hydrogen, RFNBOs and RCFs will use an expanded system boundary, consistent with electricity accounting as described in greater detail below. Electricity emissions calculations are to include emissions associated with fuel provision (e.g., coal and natural gas production and processing) and embodied in electricity generation infrastructures (including PV solar, wind, and hydropower). These emissions are included due to materiality (i.e., these emissions contribute substantially to the emission factor of hydrogen, RFNBOs and RCFs), and consistency with emissions accounting for the direct use of electricity.

Previously developed tools may be used for reporting and compliance regarding direct emissions, if the methodological approach and the system boundaries are aligned and enable transparency through sufficient disclosure for third-party verification.

Default WTT emission profiles of different fuels can be combined with IEA APS market developments. The use of alternative (lower) WTT emission factors for fuel supplies is possible, including for a subset of vehicle sales/registrations, as long as automakers and/or their energy suppliers provide transparent information to back them, with sufficient documentation to enable third-party verification of their claims, including compliance with the methodological requirements outlined in the Standard.[14]

The following sections outline the methodologies for assessing WTT emission factors for each major automotive fuel technologies covered by the SBTi Automotive Sector Net-Zero Standard, aligned with the energy production pathways listed above.

Oil- and gas-derived fuels

There is significant regional variability in the emission intensity of oil extraction and refining, leading to a high degree of variability in the emission factors of oil- and gas-derived transport fuels (see, for example, Science, 2018, Nature Climate Change, 2020). There are also different methodologies to estimate and attribute emissions across the oil product slate (e.g., PRELIM, OPGEE).

Several IEA reports outline the ways that the oil and gas industry could reduce the emission intensity of its operations. The report The Oil and Gas Industry in Net-Zero Transitions shows how ceasing investments in exploration and exploitation of new oil and gas resources and shifting investments to capturing and monetizing currently leaked or flared methane resources, together with investments in electrification and efficiency of extraction and refining operations, shifting to low-emission hydrogen production, and CCUS, could reduce the emission intensity of oil and gas, thereby lowering the WTT emission factor of oil- and gas-derived road transport fuels. IEA analysis suggests that approximately 40% of current upstream emissions (i.e., about 7-8% of WTW emissions) could be cut at no net cost, primarily by capturing and selling leaked or flared methane.

However, IEA and others' efforts to track methane show a wide and growing disconnect between trends in methane emissions and capture rates that would be required for the sector to contribute to a Paris-aligned pathway, let alone to take advantage of methane capture opportunities with a net negative cost.

It is challenging to account for these complexities in globally differentiated modelling:

- Benchmarking a regional representative emission factor for each transport fuel is subject to significant uncertainty, due to shifting weights of country-level consumption in a global market for crude oil and refined automotive fuels and the difficulties in benchmarking and then accounting for potential changes in oil and oil products trade.
- Projecting how the emission factor of oil products might change over time in global scenario modeling is subject to a high degree of uncertainty.

[14] Note that the methodology used in this Standard strives for maximum alignment with existing tools, established practices and adopted regulations. However, emissions profiles and sustainability considerations are unique to each fuel/energy vector, so it is important to manage trade-offs between fuel-specific methods and resolution and fair treatment across all fuels.

For simplicity, and to focus company reporting and investment on the need to rapidly diversify the road transport fuel mix away from fossil fuels, this Standard adopts representative emission factors for fossil-based automotive fuels. These are shown in Table D1 in Annex D, and are derived as the simple average between assessments by the GREET team in the US and the JEC team in the EU. They are benchmarked in the base year (2023) on a global point estimate, based primarily on (Cai et al., 2022).

As upstream emission reductions vary across regions, based on trade, and may vary even more (e.g., based on regulatory requirements) in the future, and as this same topic is covered in the Oil & Gas Standard, the SBTi Automotive Sector Net-Zero Standard also leaves open an option to increase regional granularity in future developments. Regional differentiations would also need safeguards to prevent using changes in their market shares across regions, as there are regional differences in technology adoption, as an SBTi compliance strategy.

Future refinements may also be based on better representation of different pathways, using inputs from the SBTi Oil & Gas Standard or using data on actual emission intensities of fuels (including regional differences), if these data are publicly available.

Biofuels

Options for biofuel production include a wide range of possibilities, with significantly different attributes and performances. It is therefore important to enable the possibility to adequately account for their life-cycle emissions.

As the cultivation of feedstocks needed by biofuels can displace existing land uses, also causing land conversion elsewhere (or "leakage" effects), this Standard should not be limited to direct emissions, but also include ILUC effects. Not considering ILUC would risk to understate the true climate impact of biofuels.

These necessities have been well recognized, in specific geographies and internationally.

The carbon offsetting scheme for international aviation (CORSIA), developed in the context of the International Civil Aviation Organisation (ICAO) is the most articulated and up to date internationally agreed framework currently in place outlining clear methodologies for the determination of direct life cycle emission factors and indirect land use change impacts for biofuel pathways.

Considering the importance of relying on internationally agreed approaches, this Standard considers that, in principle, the transposition to road fuels of the CORSIA methodology for calculating actual life cycle emissions values (ICAO, 2025) would be the most relevant to account for the GHG emissions of biofuels, both in terms of direct emissions and ILUC.

This Standard therefore considers the fundamentals of the CORSIA methodology to define the way life cycle emissions shall be calculated as a very relevant guiding tool. This applies to:

1. System boundaries to be considered (feedstock cultivation, harvesting, collection, transport of feedstock, feedstock processing and extraction, feedstock transportation

to processing and fuel production facilities, feedstock-to-fuel conversion, fuel transportation and distribution to the vehicle using it, and fuel combustion).
2. The treatment of carbon capture and sequestration of CO_2 emissions.
3. The assignment of emission burdens for the co-production of multiple commodities, based on their energy content.
4. The emissions associated with electricity production and delivery, based on what is produced and/or procured for each process step.
5. Emission savings associated with soil carbon accumulation (e.g. from the use of sustainable agricultural practices).
6. The use of carbon balance to estimate biogenic carbon emissions.
7. The use of a baseline case where the waste or residue gas is (directly or indirectly) released into the atmosphere to account for net savings.
8. The definition of feedstock categories.
9. The consideration of low land use change (LUC) risk practices, including the use of zero ILUC values for cases where documentation that the fuel was produced using land use change-risk mitigation practices is available and meets internationally recognized Sustainability Certification Schemes.
10. The accounting of emission credits for fuels derived from wastes and residues, in particular for avoided landfill emissions and recycled emissions for fuels derived from Municipal Solid Waste (MSW) and agricultural methane (e.g. wet manure or maize residues), if this is documented on the basis of internationally recognized Sustainability Certification Schemes. Given the sensitivity of emissions credits to assumptions regarding the counterfactual behaviour (see for instance ICCT, 2021 and ICCT, 2024), as well as the wide variability of practices at a global level (dictated in part by the regulatory environment), the SBTi is seeking consultation on the use of negative emissions factors in the case of biomethane production.

In practice, however, ensuring that there is full alignment with the extended/adapted CORSIA framework is not straightforward. This is due to the following considerations:

1. Road transport fuels are certified at the level of country- or region-specific frameworks.
2. Alignment is only feasible for cases that are of comparable or greater stringency.
3. Only country- or region-specific frameworks enable to track volumes of fuels produced in the regions considered by this Standard.
4. Even if this is the case, data are generally only publicly available for aggregated fuel and feedstock types and not necessarily also differentiated based on the sustainability certification scheme that they are subject to.
5. Publicly available data are also not necessarily paired with carbon intensity ranges.

The simplified set of emission factors considered in Annex D reflects these considerations, while - at the same time - trying to leverage the work done to develop default values in relevant international fora, and while also acknowledging that the selection of default emission values is consistent with the most relevant biofuel production pathways currently supplied in to the transport sector, as documented in the OECD/FAO Agricultural Outlook series (OECD/FAO, 2025, Chapter 8).

More specifically:

1. For global point emission factor values attributable to direct and ILUC, WTT emissions defaults are adapted from CORSIA (CORSIA 2022a, 2022b and 2025). Default ILUC values are adjusted based on differences in emission factors between specific biojet kerosene production pathways and corresponding pathways of production of automotive-grade ethanol and biodiesel, with the aim to reflect differences in terms of energy efficiency of the conversion of the primary feedstocks.

2. For pathways based on wastes, residues, or by-products, the CORSIA framework sets ILUC emission factors at zero. This is based on the consideration that these are materials with inelastic supply. However, indirect emissions are highly sensitive to what would occur if the waste oils and or fats are already in use as feedstocks for other purposes (e.g. animal feed, pet food, other uses in the oleochemicals industry, for animal fats), (i.e., which product would substitute them). This is especially relevant in cases of rapid changes of demand, leading to supply imbalances. Existing estimates of impacts of indirect emissions from the use of waste oils and or fats span across a wide range of results, from 13 gCO_2e/MJ to more than 140 gCO_2e/MJ (O'Malley et al., 2021, Malins, 2023), with more frequent values between 20 and 80 gCO_2e/MJ, in the case of animal fats (Malins, 2023) and results that depend significantly on sourcing approaches.

   To prevent undesired indirect effects, as well as the risk of fraud (e.g., from downgrading other oils and fats to waste categories), the European Renewable Energy Directive caps used cooking oil and animal fats at 1.7% of the energy content of transport fuels supplied for consumption or use on the market (European Union, 2018, European Union, 2023). Considering that these precautions are well grounded, and also that the zero ILUC emissions do not provide sufficient tools to manage risks associated with strong increases of demand of biofuels from waste oils and animal fats, this Standard considers the default value for used cooking oil only applicable for up to 2% of the fuel used by road vehicles. Beyond this percentage, a default indirect emission value of 50 gCO_2e/MJ (informed by Malins, 2023) applies. This Standard also considers that other waste oils and fats are subject to the same default values and limitations as used cooking oil.

3. A similar approach is followed for the negative emissions credited by (Cai et al., 2022) to biomethane, only considered applicable to shares of energy use up to 3% of the fuel used by road vehicles. This is based on shares of biomethane use between 20% and 33% (in IEA, 2020), a total demand of 13 EJ in ambitious IEA scenarios (APS, NZE), (from IEA, 2024), leading to biomethane consumption ranging from 2.5 to 4.3 EJ, which corresponds to 2% to 3.5% of the total energy demand in transport of 2023. This is also aligned with the following considerations: a current focus of use in electricity generation next to agricultural facilities where it is produced, competing demand for biomethane in industry and buildings (where the IEA APS and NZE scenarios anyway focus its use) and infrastructure-related challenges to enable large-scale deliveries of biomethane to road transport vehicles. Beyond the 3%, a default emission value of 13 gCO_2e/MJ, corresponding to the value excluding credits and land use change effects for compressed methane in a medium scenario, including new biomethane plants, (based on Noussan et al., 2024).

4. As previously highlighted, in light of the sensitivity of emissions credits to the assumptions taken on counterfactual behaviour (see for instance ICCT, 2021 and ICCT, 2024), the SBTi is seeking consultation on the use of negative emissions factors in the case of biomethane production. Not allowing the use of negative emissions factors for these pathways may provide a safeguard against claiming of avoided emissions credits that may, in fact, be either not permanent or additional (or neither). This approach may also be prudent from the perspective of not assigning default emission factors that reflect only the upper bound of avoided emissions potential, given the wide variability of practices at a global level (itself dictated in part by the regulatory environment) (as reflected, for instance, in the RED II, in the table characterising emission factors for biomethane for transport from wet manure, maize residues, and MSW).

To enable greater flexibility, this Standard also remains open to the possibility, for automakers, to claim different emission factors for biofuel supplies than the defaults when assessing life-cycle emissions of their vehicle sales. To do so, they shall provide transparent information, sufficiently detailed to enable verification of their claims.

Carbon intensities of different biofuel production pathways should be paired with national or regional consumption-based data (in Brazil, South America, North America, Europe, China, India, Indonesia, and other countries) by pathway-feedstock combination, and accounting for blend shares in the gasoline, diesel, and natural gas automotive fuel pools. Key data sources allowing this assessment include the annual (OECD/FAO Agricultural Outlooks, 2024), the (USDA GAIN / Biofuels Annual country/region reports, 2024) and the (IEA Renewable energy market reports, 2024).

Future refinements of this Standard will strive to enable a better representation of different pathways, leveraging internationally agreed frameworks, sustainability certification schemes (including for the possibility, aligned with the provisions of CORSIA, to use a zero ILUC value for fuels produced from a feedstock obtained with the use of mitigation practices that avoid ILUC emissions), country- and regional-level databases reporting emission intensities and related volumes of biofuel supply, and better alignment amongst country- and region-specific approaches. However, this requires progress towards greater international alignment is also achieved. It also requires that sufficient information and data are publicly available and well documented, to be implementable.

Electricity

A fair and harmonized comparison across all energy vectors, including electricity, requires accounting for likely energy efficiency advantages of EVs (and BEVs in particular), on one hand, and for all emissions and energetic efficiency losses incurred in EV manufacture, electricity production, transport, distribution and use on the other. Similar considerations apply also to RFNBOs derived from electrolysis. Consideration of these aspects is done, for instance, in the ICCT's authoritative assessment of life-cycle emissions across powertrain-fuel combinations for passenger cars (Bieker, 2021).

Estimates of the annual average direct operational CO_2e/kWh of primary electricity generation are readily available at a country level (e.g., from EMBER). However, these data do not account for the following emissions:

- Upstream "fuel cycle" GHG emissions, incurred in extracting, processing, and transporting fossil fuels or radioactive elements used to fuel in fossil- or nuclear-thermal plants, respectively). These emissions are available from a data product assessing electricity lifecycle emissions factors (IEA, 2024).
- Embodied GHG emissions, incurred when constructing, maintaining, decommissioning all electricity generation technologies (and spread across the average assumed operational lifetime of the facility). These emissions are available from a data product assessing electricity lifecycle emissions factors (IEA, 2024) and are sourced from the central tendency values of the (US National Renewable Energy Laboratory (NREL) harmonization project, 2021).
- Transmission and distribution losses, which shall be accounted for in the case of EVs (as most assumed losses between the charging point and the EV).

Facility electricity own-use is also accounted for, either based on assumed averages or country-level data.

The SBTi Automotive Sector Net-Zero Standard considers benchmark values for WTT emission factors of electricity based on EMBER data, with inclusion of the above three aspects. It also considers the same approach for the way electricity-related emission factors shall be accounted for, in compliance. Automakers can claim different emission factors for electricity supplies than the defaults when assessing life-cycle emissions of their vehicle sales. To do so, they still need to provide transparent information, sufficiently detailed to enable third-party verification of their claims.

Hydrogen, carbon-bearing RFNBOs, RCFs and other synthetic fuels

WTT emissions from RFNBOs and RCFs (including hydrogen and its derivatives) based on unabated fossil-based production shall be considered based on the default values shown in Table D3 in Annex D. These are based on unabated steam methane reforming for hydrogen. For simplicity, and as there is no reason to use unabated fossil-based hydrogen for the production of other RFNBOs or RCFs (since other pathways of use of fossil resources are cheaper, more energy efficient and less carbon intensive), the same values are also used for fossil fuels for carbon-bearing RFNBOs and RCFs.

The use of lower emission factors is possible if stakeholders demonstrate that some of their vehicles are operating on RFNBO and or RCF supplies that have a lower emission intensity than the the value resulting from the IEA APS scenario (as detailed the section titled "Annual default fuel-specific WTW emissions reductions, derived from the IEA APS" of Annex C) in a given year.

Table D.4 in Annex D provides estimates of the carbon intensity of electrolytic hydrogen, RFNBOs and RCFs (before and after 2040), for different carbon intensities of electricity generation. The tables reflect a simplification that considers 1.6 MJ of electricity requirements for the production of 1 MJ of hydrogen, 2.13 MJ/MJ for RCFs and 2.56 MJ/MJ of RFNBOs, based on information retrieved from Soler et al., (2022), Bothe et al., (2021), Deutz and Bardow (2021) and IEA (2020), with electricity covering all energy input needs. They also exclude fugitive emissions of hydrogen and other GHGs.

For RFNBOs and RCFs reliant on electrolysis, low emission intensities do not only need to come from the use of low-emission electricity. Specific conditions also require the fulfilment of additionality and temporal correlation (including through power purchase agreements) and the disclosure of sufficient information about them to enable third-party verification. This is in line with the provisions considered in the European Union for the consideration of RFNBOs in the context of the Renewable Energy Directive (European Union, 2023).

For RCFs, this Standard allows the full accounting of life-cycle emission savings on the fuel side, before 2040. After 2040, it requires allocating savings between fuels and the upstream source of carbon (e.g. the industrial complex supplying it). This is again in line with the provisions considered in the European Union, based on the consideration that the origin of carbon used for the production of RFNBOs and RCFs is not relevant for determining emission savings of such fuels in the short term, as currently many carbon sources are available and can be captured while making progress on decarbonization (European Union, 2023).

APPENDIX L: VEHICLE MANUFACTURING AND EOL EMISSIONS

Assessing manufacturing emissions and EoL emissions

The recommended approach to vehicle manufacturing emissions is based on accounting approaches compatible with the methodology adopted by the GREET-2 model. Companies may choose to calculate scope 1, scope 2, and scope 3 emissions using different methods compatible with the GHG Protocol.

The GREET-2 approach includes the following steps, also described in Burnham et al., 2006:

1. Estimation of the mass of vehicle components.
2. Assessment of the material composition (i.e., breakdown into steel, aluminum, iron, plastic, rubber, and any other materials) of the component mass.
3. For components that are subject to replacement during a vehicle's lifetime (e.g., batteries, tires, and various vehicle fluids), assessment of replacement schedules (see also Annex D for default lifetimes and Annex I for default assumptions on replacement schedules for lead-acid batteries).
4. Assessment of the energy used from raw material recovery to vehicle assembly and related GHG emissions and assessment of the energy required and GHG emissions generated during recycling of scrap materials back into original materials for reuse.
5. Assessment of the energy use and emissions associated with component (and—where relevant—vehicle) assembly from the energy efficiency of assembly plants and life-cycle analyses of paint manufacturing and the painting process.
6. Assessment of the energy required for dismantling components (and—where relevant—vehicles) for disposal or recycling

The energy use of materials that are recycled and later used in a vehicle is part of what is listed under points 2 (for recycled materials used as inputs) and 4 (for the energy used during the processes from raw material recovery to vehicle assembly).

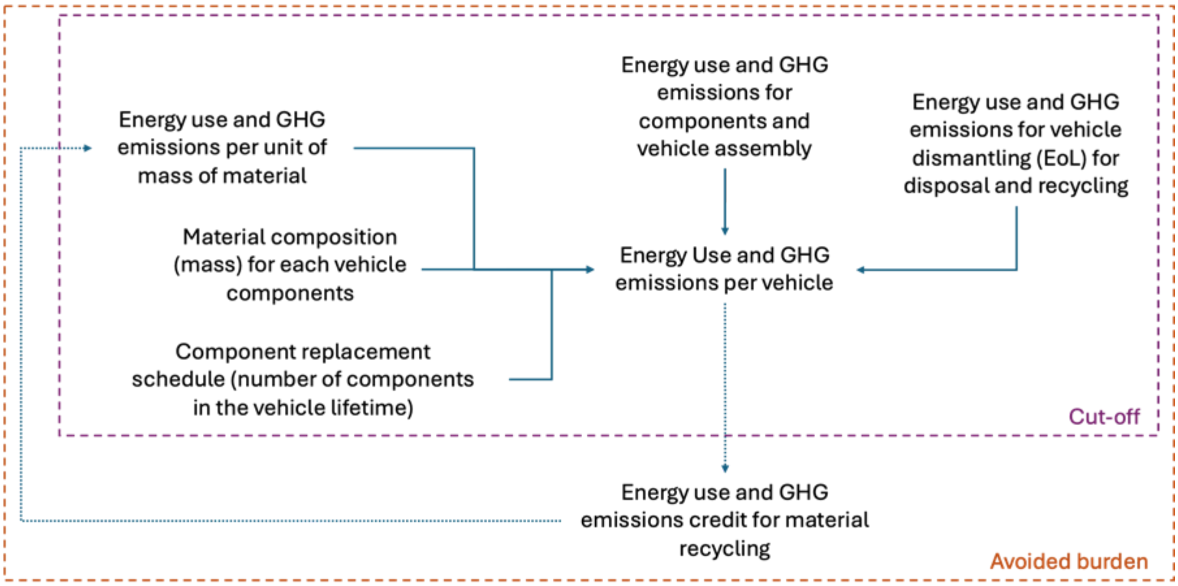
This is consistent with a system boundary characterized by the so-called "cut-off" approach, which does not account for impacts (or avoided impacts) beyond those directly related with the vehicle life. In the context of decarbonization, it comes with incentives to secure supplies of recycled materials (e.g. scrap steel, aluminum or plastics), irrespective of the sector supplying them, due to lower embedded carbon in their manufacturing processes

There are currently significant efforts ongoing in the European Union and at the United Nations, in the framework of the World forum for the harmonisation of vehicle regulations, to develop an internationally agreed methodology for the calculation of aggregate indicator emissions for road vehicles. Alternatives being considered share the same fundamental basis of vehicle-cycle emission accounting but differ from the cut-off approach, as outlined in Box 2. Considering the relevance of these efforts, this Standard remains open, in further developments, to the alignment with this multilaterally agreed approach.

Box 2. Differences between cut-off, avoided burden and Circular Footprint Formula (CFF) in life-cycle assessments

The cut-off life-cycle assessment approach excludes the attribution of lower GHG emissions for EoL management approaches that enable recycling of materials, in the form of credits, under the assumption that they replace the same quantity of virgin materials. This crediting system, instead, is what is integrated into the so-called "avoided burden" approach. In doing so, the avoided burden approach incentivises material recycling within the specific sector for which the life-cycle assessment is performed. Both approaches are illustrated in Figure M1.

Figure M1. Graphical representation of energy and GHG emission tracking in the vehicle-cycle, with the cut-off and avoided-burden approaches

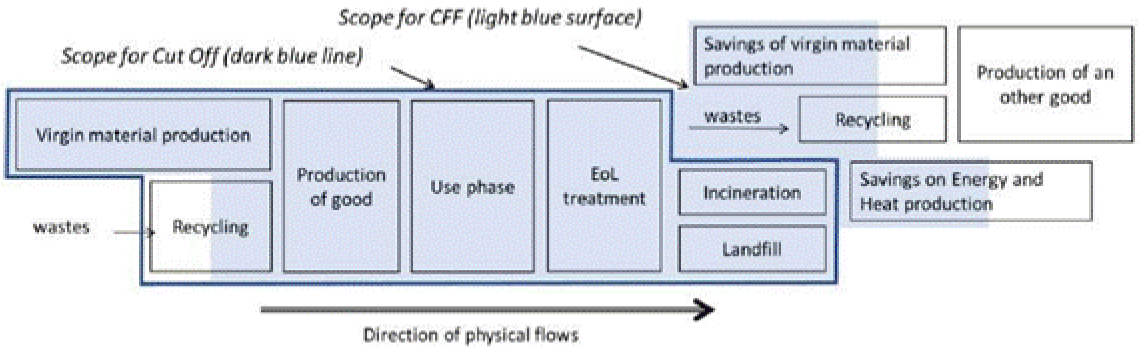


A third approach, based on the CFF, combines the cut-off and the avoided burden approaches, giving greater weight to the cutoff approach in cases where there is high supply of recyclable materials and a low demand, and to the avoided burden in cases where there is a low supply of recyclable materials and a high demand (Ardente et al., 2023), as illustrated graphically in in Figure M2.

Currently there is no consensus on the definitive approach to recycled content allocation, and life-cycle assessment calculation tools tend to enable all of these, since they are all grounded on the same fundamental basis of vehicle-cycle emission accounting (i.e., the sum of emissions embedded in the materials, also accounting for recycling, and emissions resulting from assembly and EoL dismantling and disposal phases).

A graphical representation of the cut-off approach, as opposed to the CFF approach, considering a 50/50 split between cut-off and avoided-burden, is shown in Figure M2.

Figure M2. Graphical representation of energy and GHG emission tracking in the vehicle-cycle, with the cut-off and CFF approaches



Source: (PFA, 2022)

Components covered in GREET-2 include vehicle body (including primary vehicle structure, closure panels, impact bars, energy absorbers, sealers, door modules), powertrain, transmission, chassis (including wheels, tires, steering modules, electrical signals), electric-drive and battery systems and fluids (including engine oils, power steering fluid, brake fluid, transmission fluid, powertrain coolant, windshield fluid, and adhesives) (Burnham et al., 2006).

Materials whose production processes are part of the scope of GREET-2 include steel, cast iron, aluminum (divided in wrought and cast aluminum), copper, zinc, magnesium, glass, plastics, rubber, fluids, battery materials (e.g., cathode materials, precursors, electrolytes, anode materials), fuel cell materials (including membrane, hardware materials, platinum group metals) and other materials (Burnham et al., 2006, Dunn et al., 2015 and Dai et al., 2018).

The aggregated assessment of GHG emissions should consider the bill of materials needed for the components (and—where relevant—the vehicles) sold at different points in time,[15] as well as the GHG emission intensities by material and those imputable to assembly and dismantling for disposal and recycling (EoL) of the same components (and—where relevant—the same vehicles).[16] GREET-2 also integrates default assumptions on part durability, for parts whose lifetime is lower than the lifetime of the vehicle. These lifetimes should also be considered by default, except for cases in which specific corrections are applicable (tires and lead-acid batteries), as detailed in Annex I. Table M.1 provides a

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[15] The GREET-2 model (U.S. DOE, 2025; ANL, n.d.) and an EU-specific study (European Commission, 2020) provide bills of materials and GHG emissions intensities for different vehicle categories, including passenger cars of different sizes, LCVs, buses, medium and heavy duty trucks. An assessment published by ITF in 2020 (ITF, 2020) and updated in 2024 (ITF, 2024) covers a wide range of passenger transport modes, including bikes, e-bikes, scooters/mopeds (ICE, EV), cars, large cars, and buses. The ICCT also carried out a global assessment comparing cars (ICCT, 2021), and regional assessments for other vehicle categories: buses and trucks in the EU (ICCT, 2023); buses in Latin America (ICCT, 2024), and, trucks in India (ICCT, 2024), 2-wheelers in India (ICCT, 2021) and Indonesia (ICCT, 2023).

[16] As this Standard requires forward-looking assessments and it targets GHG emission intensities, this requires information relative to expected vehicle weight developments.

summary of replacement schedules considered in GREET-2 for different vehicle types and for fluids and parts other than tires and lead-acid batteries, to be used as default for this Standard.

Table M.1. Replacement schedules

Vehicle category	Replacements during lifetime										
	Engine oil	Power Steering Fluid	Brake Fluid	Steer axle	Drive axle	Transmission Fluid	Powertrain Coolant	Windshield Fluid	Adhesives	Engine oil filter	Wiper blades
2- and 3-wheelers (2-3Ws)	44	0	4	0	0	1	4	22	0	6	2
Passenger light duty vehicles (PLDVs)	44	0	4	0	0	1	4	22	0	6	6
Buses	9	0	0	11	0	3	1	52	1	10	25
Light commercial vehicles (LCVs)	44	0	4	0	0	1	4	22	0	6	6
Medium duty trucks (MDTs)	9	0	0	11	0	3	1	52	1	10	25
Heavy duty trucks (HDTs)	19	0	0	39	1	1	1	32	1	19	7

Sources: Burnham, A., 2012, ANL, 2025 and complementary assumptions.

Life-cycle assessment tools may be used to assess vehicle-cycle GHG emissions if the methodology and system boundaries are consistent with those of GREET-2 and if they enable transparency through the disclosure of sufficient details to enable third-party verification. Similar considerations apply for systems of tools enabling the pass-through of life-cycle assessment-related information (such as mass by vehicle categories, energy and GHG emissions for assembly and dismantling) relative to components, for vehicle aggregated GHG emission assessment.

APPENDIX M: METHODOLOGICAL CONSIDERATIONS ON THE ACCOUNTING OF ENERGY EFFICIENCY RATIOS FOR ZERO AND NEAR-ZERO-EMISSION VEHICLES

Annex F sets out how companies shall calculate their zero- and near-zero-emission vehicle (or components/parts) sales share for each vehicle category.

A vehicle's contribution to the zero-emission vehicle sales share (or that of its components or parts) shall depend on its relative WTW low-emission energy efficiency of the vehicle (i.e., its operational efficiency, also factoring in energy production), in comparison to a reference BEV of the same type using primary renewable electricity of the same type, giving lower weight to vehicles with poorer energy efficiency. This concept is based on the greater overall efficiency of converting primary renewable energy into power by BEV powertrains compared to internal combustion powertrains.

Table F1 in Annex F contains details on vehicle powertrains and related energy efficiency ratios. The values are informed by energy efficiency assessments for RFNBOs and electricity from (Malins, 2022), (T&E, 2022), (Bieker, 2021, 2022), and (Trinomics, 2023).

Energy efficiency ratios are not differentiated by vehicle category in Table F1 in Annex F and they also consider losses occurring for the production of advanced low-emission biofuels and diesel/gasoline RFNBO substitutes as having similar magnitudes. Future updates of the SBTi Automotive Sector Net-Zero Standard may include further differentiations. These updates may also consider updates to the values in Table F1 in Annex F resulting from a switch to life-cycle energy efficiency accounting rather than based on WTW/operational energy efficiency.

The accounting for PHEVs in Annex F is informed by (Bieker et al., 2022).

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SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION