SCIENCE BASED TARGETS

TRANSPORT SCIENCE-BASED TARGET SETTING GUIDANCE

Developed by

WWF

SCIENCE BASED TARGETS

ACKNOWLEDGEMENTS

This guidance was developed by WWF on behalf of the Science Based Targets initiative (SBTi). The Science Based Targets initiative mobilizes companies to set science-based targets and boost their competitive advantage in the transition to the low-carbon economy. It is a collaboration between CDP, the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF) and one of the We Mean Business Coalition commitments.

For this project we counted on the support of three technical partners which are global organizations working on sustainability and transport:

- Smart Freight Centre (SFC)
- Partnership on Sustainable, Low Carbon Transport (SLoCaT)
- International Council on Clean Transportation (ICCT)

During the development of this work we also had the advice from technical experts:

- Ecofys, a Navigant Company
- International Energy Agency (IEA)

A technical advisory group of dedicated experts from industry and NGOs provided detailed input during the planning phase and on various drafts of the guidance and tool.

A public workshop was organized in Paris in July 2017 to get input on key methodological choices from other stakeholders not directly engaged in the project, plus two consultation webinars were held during the month of August 2017.

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ABOUT OUR TECHNICAL PARTNERS

Smart Freight Centre (SFC) was established in 2013 as a global non-profit organization leading the way to a more efficient and environmentally sustainable global freight and logistics sector. SFC works with businesses and other stakeholders to remove market barriers catalyzing sector-wide action to improve fuel efficiency, reduce emissions and lower operating costs.

The Partnership on Sustainable, Low Carbon Transport (SLoCaT) promotes the integration of sustainable transport in global policies on sustainable development and climate change and leveraging action in support of the implementation of the global policies. SLoCaT consists of a multi-stakeholder partnership of over 90 organizations, which is supported by the SLoCaT Foundation.

The International Council on Clean Transportation is an independent nonprofit organization founded to provide first-rate, unbiased research and technical and scientific analysis to environmental regulators. Its mission is to improve the environmental performance and energy efficiency of road, marine, and air transportation, in order to benefit public health and mitigate climate change.

CONTENT

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FOREWORD

Implementation of the Paris Agreement calls for ambitious climate action at global scale. The transition to a low/zero carbon economy is underway and accelerating globally. Every sector in every market is undergoing transformation. Non-state actors play a key role in driving change and already commenced to do so: so far more than 400 companies have joined the Science Based Targets initiative (SBTi) and committed to set GHG emission reduction targets in line with the Paris Agreement goals. Leading businesses recognize this opportunity and the imperative to be part of the solution.

The transport sector must not lag behind. Today it represents 23% of all energy-related global emissions and it is one of the fastest growing sectors. The analysis of sectoral transformations implied by current Nationally Determined Contributions (NDCs) shows that transport is one of the sectors where climate action ambition is particularly insufficient in the light of the requirements of mid-century Paris-compatible transformations. And yet, decarbonizing the transport sector is feasible through disruptive technological innovation, land-use planning and transport demand management, modal shift and shifting to electric mobility, but we need to make it happen faster. Companies setting ambitious science-based targets on transport can send a strong signal for local, regional and national policies to increase the level of ambition and steer the transition.

Science-based targets specify how much and how quickly a company needs to reduce its greenhouse gas emissions to future-proof its growth. This report does not present a new approach; it is based on current science-based target methods, and GHG accounting standards. It shows the conclusions of a group of experts (industry and non-industry representatives) that have over the past year focused on developing best practices for science-based target-setting in the transport sector. By using the Sectoral Decarbonization Approach- Transport tool and this report, companies can get on track with a well-below 2°C world.

Thanks to its holistic vision and international network, WWF, the world's foremost NGO dedicated to nature conservation, active in over 100 countries, calls for strong action to prepare and radically transform the transport systems around the world towards a decarbonized economy.

Special thanks to our Technical Partners, Advisors and Consultative Group members for contributing to the realization of this project.

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ABOUT THIS GUIDANCE

This document supports companies that are interested in setting science-based targets for transport greenhouse gas (GHG) emissions according to the new, refined pathways in the Sector Decarbonization Approach (SDA) Transport tool (Learn more about the SDA method and tool in Section 4.3). It builds on the existing manual and guidance of the Science Based Targets initiative (SBTi) for setting science-based targets.

The underlying data in the SDA Transport tool are sourced from the detailed transport pathways in the International Energy Agency's (IEA) Mobility Model (MoMo)[1]. The emissions scenarios embedded in the SDA tool are the 2˚C scenario (2DS) and the Beyond 2˚C scenario (B2DS).

This document contains guidance on how to set targets for transport emissions across different emissions scopes and for different tool end-users. Examples of end-users are: passenger transport companies, logistics service providers, shippers, carriers, postal companies, road vehicle manufacturers, auto part manufacturers, and in general companies with large transport emissions in their value chain.

Policymakers can also use this guidance to inform the development of transport programs and regulations.

The Guidance is divided into three chapters. Chapter 2 is a user's general guidance on the transport categories included in the tool, the data to use in the target modeling exercise and the output users can expect to obtain. Chapter 3 contains more specific guidance per end-user, divided into companies that own or control a fleet of vehicles, companies that manufacture new road vehicles, companies with large transport emissions in their value chain and companies that manufacture road vehicle parts. The type of guidance provided is GHG emissions that the company should estimate to model a target -including aggregation of emissions scopes to obtain Well-to-Wheel (WTW) emissions-, definitions of activity units, the approaches a company can use to set science-based targets, and the interpretation of results derived with the SDA Transport tool.

Finally Chapter 4 describes the methodological choices made to build the tool and to produce this Guidance document.

1 IEA (2017), Mobility Model, August 2017 version, database and simulation model, www.iea.org/etp/etpmodel/transport/

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GENERAL GUIDANCE ON SCIENCE-BASED TARGET-SETTING FOR TRANSPORT

2.1 BASIC STEPS TO USE THE SDA TRANSPORT TOOL

1 **Identify the transport categories you will need to model your company's target.**
The following transport categories are available in the tool:

Table 1. Transport pathways available in the SDA Transport tool

Tool end-users	Type of transport-related emissions	Transport category	Description
Companies that own / control vehicles Companies that subcontract/ purchase transport services	Passenger transport emissions	2-3 Wheelers	All motorized vehicles having two or three wheels aimed at the mobility of persons on all types of roads
		Light duty vehicles (LDV)	All motorized vehicles having four wheels aimed at the mobility of persons on all types of roads, up to nine persons per vehicle and 3.5 t of gross vehicle weight
		Buses	Buses (more than nine seats) and BRT systems (Bus Rapid Transit)
		Mini-buses	Minibuses
		Urban rail [2]	Metros, high capacity/high frequency commuter rail services, tramways and light rail [3]
		Non-urban rail	High-speed rail (intercity rail services crossing long distances between stations and having a maximum speed that exceeds 250 km/h)

2 While countries may define rail modes different, the SBTi adopts the definitions from the Rail Handbook (2017) from the IEA and the International Union of Railways (UIC).

3 • Metros are urban rail transport services with short headways and high commercial speed operated by vehicles specifically designed for high capacity transport (e.g. including standing passengers and a large number of doors to enable rapid boarding and operations), running on an exclusive right-of-way urban network with regular station spacing, without any interference from other traffic or level crossings, and often developed as an underground and/or elevated network.
• Commuter rail includes heavy rail services operating in urban areas and at the boundary between urban and suburban areas, primarily to serve transport needs of commuters needing access to urban environments.
• Tramways and light rail, i.e. urban guided transport systems with extensive segregated network sections, mostly at-grade.

Table 1. (continuing)

Tool end-users	Type of transport-related emissions	Transport category	Description
	Freight transport emissions	2-3 Wheelers	All motorized vehicles having two or three wheels aimed at the mobility of goods on all types of roads
		Light commercial vehicles (LCV)	Pickups, vans and small trucks with a gross vehicle weight (GVW) of less than 3.5 t, used for the transportation of goods [4]
		Medium freight trucks (MFTs) [5]	Commercial vehicles with a GVW from 3.5 t to 15 t; they include small lorries, rigid trucks and tractor-trailers as well as large vans [6]
		Heavy freight trucks (HFTs) [7]	Commercial vehicles with a gross vehicle weight (GVW) greater than 15 tonnes (t), they typically serve long-haul delivery of goods, have from two or more axles and a power rating of between 200 and 600 kW
		Rail [8]	Trains to transport goods in dedicated or shared rail tracks
	Aviation & Shipping emissions	Sea transport	Passenger cruises. Maritime transport activities (domestic and international marine bunkers; containerized and non- containerized)
		Air transport	Air transport activities (commercial and non-commercial flights for passenger and freight)
Companies that manufacture new road vehicles	Emissions from new vehicles	Passenger- New light duty vehicles	WTW emissions related to the use-phase of original equipment manufacturers (OEMs)
		Freight- New light commercial vehicles	
		Freight- New medium freight trucks	
		Freight- New heavy freight trucks	
		Passenger- New light duty vehicles (Fuel economy)	Fuel economy of OEMs -the related emissions are tank-to-wheel (TTW)
		Freight- New light commercial vehicles (Fuel economy)	
		Freight- New medium freight trucks (Fuel economy)	
		Freight- New heavy freight trucks (Fuel economy)	

Note: This document also provides general guidance for companies that manufacture road vehicle parts (See Section 3.4).

4 In general, the LCV fleet consists of vans, chassis cab-style vehicles, small open lorries and pickup trucks. They are used for a variety of tasks, including small-scale 'last-mile' deliveries, such as a postal or commercial delivery services, and for transporting industrial goods and building materials to and from work sites. They are also used to provide services, such as repairs, plumbing and heating, and office support.

5 Definitions provided in the report: "The Future of Trucks" (IEA, 2017).

6 They tend to perform regional operations but also include public and commercial service vehicles, such as garbage trucks or fire-fighting trucks. In countries with a less-developed highway network infrastructure, the function of some MFTs is similar to that of heavy-freight trucks: they are used in long-haul operations and for transporting goods from central distribution hubs (warehouses and ports) to their final destinations, such as retail firms, or for transporting bulk building materials and resources.

7 Together, HFTs and MFTs comprise heavy-duty trucks.

8 The MoMo definition leaves open specifications of speed, distance and wagon type. This category also includes road trains: multiple trailers pulled by a single tractor unit.

2 **Define a commitment period.** As per the SBTi criteria *all targets must cover a minimum of 5 years and a maximum of 15 years from the date the target is submitted to the SBTi for an official validation*. The SBTi recommends choosing the most recent year for which data is available as the base year, taking into consideration the representativeness of the year to your company's operations. Preferably, the selected base and target year should ensure forward-looking ambition of an emissions reduction target, rather than covering emissions reductions achieved to date. The earliest base year that can be selected by the company in the tool is 2010 and the latest target year is 2050. Companies are encouraged to develop long-term targets (e.g. 2050) in addition to mid-term targets.

3 **Collect all base year data required to model a target with the tool.** Collect all data per transport category for your global operations for the selected base year.

Table 2. Required data to use the SDA Transport tool

Type of transport-related emissions		WTW base year GHG emissions (CO_2e)	Base year activity			Informative
			Passenger-kilometer (pkm)	Tonne-kilometer (tkm)	Vehicle-kilometer (vkm)	Base year fuel economy: Liters of gasoline equivalent (lge)/ 100 Km
Companies that own / control vehicles Companies that subcontract/ purchase transport services	Passenger	●	●			
	Freight	●		●		
	Aviation and Shipping	●				
Companies that manufacture new road vehicles	Passenger	●			●	●
	Freight	●			●	●

4 **Estimate the activity in the target year:** Project the activity for the selected target year. For example by calculating the growth rate based on historical data or by using future growth rates as estimated by the company. Alternatively, you may project your activity for the selected target year by applying the default growth rate of the transport category selected which is provided in the tool.

5 **Select the type of transport-related emissions.** The types of transport-related emissions available in the tool are: passenger transport, freight transport, emissions from new vehicles and aviation and shipping.

6 **Select a transport category and enter required data.** The SDA Transport tool allows the modeling of targets for a single transport category at a time. When users select a transport category from the dropdown menu, the tool will automatically show the input data you will need to enter. Users are required to fill-in all fields with their data as per previous steps [9].

7 **Review the target-modeling results.** The SDA Transport tool currently models targets using two emissions scenarios (2DS and B2DS). For more information on emissions scenarios and the Mobility Model please consult Section 4.2. Two sections are shown below the input section, one for each scenario. The tables summarize the emissions and emissions intensity in the base year and target year selected, as calculated by the SDA Transport tool. The tool also produces graphs showing the emissions intensity pathway of the transport category if available, and the carbon budget for the company. All pathways provided in the tool are global pathways.

9 Fields labeled "Well to Tank emissions in base year" and "Tank to Wheel emissions in base year" are optional.

2.2 TARGET FORMULATION

Target formulations must indicate the emissions covered, the base year and target year selected, the percentage reduction and the units. As per the SBTi criteria, targets can be expressed on an absolute basis (tCO2e) or intensity basis (e.g. gCO2e/pkm, tCO2e/tkm).

Shorter statements are clearer and more transparent. Activities, strategies or additional information (e.g. percentage of electric vehicle sales) can be part of other documents, like sustainability reports. Example:

> Company A commits to reduce its scope 1, 2 and 3 emissions (from upstream transportation and distribution) 40% by 2030 from a 2017 base-year.
>
> Company B commits to reduce its scope 1, 2 and 3 emissions (from fuel and energy related activities) per passenger-kilometer 35% by 2025 from a 2015 base-year.

Companies setting a target for multiple passenger transport categories or multiple freight transport categories can aggregate the tool results to obtain a single GHG reduction target by using weighted averages.

To participate in the SBTi, companies need to complete a submission form. The form requires disclosure of emissions per scope in the base year, activity figures, and other data to perform the assessment. The SBTi also recommends providing detailed information such as regionalized targets, percentage of vehicles sales per power train, occupancy rates or load factors used, etc. All information is treated as confidential and is only used for the purpose of assessing compliance against current science-based target methods and SBTi criteria.

For resources related to the SBTi Call to Action, the business case for science based targets and other available materials, please consult:
http://sciencebasedtargets.org/resources/

2.3 TARGET RECALCULATION

To ensure consistent performance tracking over time, the target should be recalculated to reflect significant changes that would compromise its relevance and consistency. The SBTi recommends that companies check the validity of their target projections annually. At a minimum, targets should be reassessed every five years. The company should notify the SBTi (if participating in the initiative) of any significant changes and report these major changes publicly.

A target recalculation should be triggered by significant changes in:

- Company structure (e.g. acquisition, divestiture, mergers, insourcing or outsourcing)
- Growth projections
- Data used in setting the target (e.g. discovery of significant errors or a number of cumulative errors that are collectively significant)
- Other assumptions used with science-based target-setting methods

The SBTi reserves the right to withdraw or adjust the tool at any time for updates and/or amendments to its calculations or third-party data. Adjustments can include changes to the decarbonization pathways embedded in the tool, which need to reflect model improvements and changes in the remaining carbon budget available as the world strives to mitigate GHG emissions across all sectors in the economy. For further details please refer to the terms of use and disclaimer in the SDA transport tool.

2.4 TOOL BOUNDARIES AND FUTURE IMPROVEMENTS

The embedded decarbonization pathways in the tool are those of the International Energy Agency's (IEA) Mobility Model (MoMo) [10]. The pathways cover WTW emissions expressed as CO_2-equivalent [11], this includes the footprint of electricity in electric vehicles. The WTT part covers the emissions of fossil fuels and biofuels [12], yet it excludes land use change (LUC) emissions. The possibility of adding LUC emissions to the pathways was explored, as MoMo provides an estimate (not in the default figures). Due to the high uncertainty associated with LUC emissions, a decision was made to exclude them from the underlying decarbonization pathways for the time being.

However, this is almost entirely ameliorated since LUC is included in neither the base year nor the future year of the scenario, so the relative change is not all that different. Also, both the GHG Protocol Scope 3 Standard and the Product Standard, require companies to use Life Cycle Analysis to calculate emissions and removals from biogenic sources, non-biogenic sources and land-use change impacts, when applicable (e.g. sectors with scarce opportunities to decarbonize such as aviation, shipping and long-haul road transportation).

This means that while the scenarios defining the decarbonization rate do not include LUC, companies must use WTW accounting including LUC in calculating their emissions. Thus, companies are inherently incentivized against shifting to high carbon biofuels, as this would either have a limited reduction potential or actually increase emissions after LUC is included.

Since methods to calculate LUC can widely differ, companies should disclose the method used to calculate these impacts in the inventory report. It is important to note that bioenergy (aka biogenic) emissions and removals [13] must be reported within the WTW boundary, to accurately reflect emissions reductions across time.

Also, the embedded decarbonization pathways in the tool models are global, meaning the tool provides no regional focus. This does not mean that the company will have to use a global emission factor for their activities in different regions in their reporting, but that it will converge to a global pathway when using the SDA Transport tool.

Although this might be perceived as not equitable for companies with electric vehicles operating in countries with low-carbon grid electricity, it does provide the right incentive to penetrate those markets.

Some companies operating only in developed countries might already be below the global intensity pathways for the sector. It can also be that country sector-targets considered in the National Determined Contributions (NDCs) or national regulations are more stringent than the global sector pathways in this tool. In these cases, the SBTi strongly encourages companies to use regional or country pathways that are more ambitious than the global pathway.

Some potential improvements to be considered for a second phase of this project include:

- Inclusion of 1.5˚C scenarios, when available
- Inclusion of LUC emissions guidance
- Development of regional pathways for transport modes that operate only at the national or regional level
- Development of transport pathways for subsectors not currently covered by the tool, for example river transportation which is relevant in some geographies
- More in-depth study and refinement of the aviation (e.g. inclusion of non-CO_2-forcings) and shipping sector

In addition, it is desirable to explore a more holistic approach for vehicle manufacturers to also consider emissions from materials sourcing and the impacts across the value chain due to the uptake of new technologies.

Since reducing transport emissions requires a profound transformation of mobility and freight services, apart from setting science-based targets, companies together with other stakeholders need to identify concrete actions as well as understand the challenges, the opportunities and the enabling conditions at different scales to succeed in this task to decarbonize the sector. Several international initiatives [14] launched since COP21 are exploring their complementarities and committed to scale-up bold action at different levels. These initiatives are producing global macro-road maps, national road maps, evaluating the effectiveness of mitigation actions and actively engaging with companies.

10 Except for Aviation and Shipping; for these two sectors, the tool calculates targets based on the absolute emissions reductions recommended by the IPCC at the global level (IPCC, 2014).

11 Best practice for GHG reporting and science-based target-setting is to use CO2equivalent across all scopes (scopes 1, 2 and 3). For the purpose of joining the initiative, emissions exclusions cannot be greater than 5%.

12 Largely based on data from the Joint Research Centre, EUCAR and CONCAWE (JEC, 2014).

13 The GHG Protocol Accounting and Reporting Standard for scope 1 and 2 emissions recommends to report biogenic emissions outside the scopes, but as an item in the company's GHG inventory. The WTW approach commonly used in the transport sector does not make such a distinction.

14 For example: The Paris Process on Mobility and Climate (PPMC), led by Movin'On (successor of former "Michelin Challenge Bibendum") and the Partnership on Sustainable, Low Carbon Transport (SLoCaT); The "Decarbonising Transport" initiative of the International Transport Forum (ITF) and The Deep Decarbonization Pathways Project for Transport (DDPP-T) led by the Institute for Sustainable Development and International Relations (IDDRI).

2.5 DATA QUALITY

Companies must use data that is most representative of the actual fuel and energy consumption. Default activity data is acceptable, but they are less accurate and limit a company's ability to truly track performance and progress towards targets. Thus, when used, the source and potential uncertainty of the adopted default data should be clearly disclosed.

Companies should collect high quality ('primary') data from suppliers and other value chain partners for scope 3 activities deemed most relevant (i.e. emissions hotspots by mode or region) and/or strategically targeted for GHG reductions. Chapter 7 of the GHG Protocol Scope 3 Standard provides further guidance on data quality issues; the Global Logistics Emissions Council (GLEC) Framework offers additional details for freight transport.

Regardless of the limitations around data quality, companies are encouraged to set science-based targets as soon as possible to have a likely chance to reach the goals of the Paris Agreement. Companies can have targets in place while continue to improve their reporting through collaboration with suppliers. Any resulting adjustments that lead to increases or decreases in emissions due to improvements in data quality needs to be transparent and justified.

3

USER-SPECIFIC TARGET-SETTING GUIDANCE

3.1 COMPANIES THAT OWN / CONTROL VEHICLES

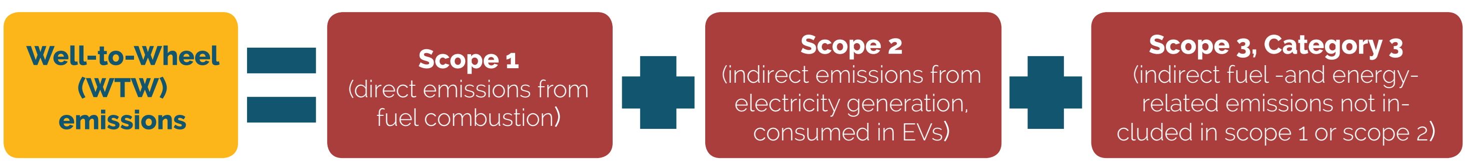
3.1.1 GHG emissions and activity

The emissions trajectories in the Mobility Model (MoMo) are derived from a series of mode specific technological and efficiency assumptions embedded in the model across time. Although the SDA Transport tool uses these trajectories to assign targets to companies, the aim is not to prescribe any mitigation option in particular but to reach the emissions reductions required within a given temperature scenario to limit the most dangerous impacts of climate change.

To use the tool, companies must use WTW emissions accounting for all their transport operations. Usually companies adhere to the GHG reporting guidance of the GHG Protocol.

Figure 1 shows the approximate equivalence between the scopes used in the GHG Protocol and the WTW accounting.

Figure 1 Aggregation of scopes to obtain Well-to-Wheel emissions



Note: Tank-to-Wheel emissions are equivalent to scope 1 emissions.

Emissions from ports, storage rooms and other supportive facilities and services should be reported under the appropriate scope in the company's GHG inventory. For the purpose of the modeling exercise, these should be excluded when using the SDA Transport tool. Companies can in fact, use other methods (sectorial or not-sectorial) to model targets for the company's non-transport emissions. In the end, the expectation is that company-wide targets will be set covering all GHG emissions sources.

MoMo activity projections per transport mode are expressed either in passenger-kilometer (pkm) or tonne-kilometer units (tkm). The emissions intensity pathways constructed in the SDA Transport tool use these units, which are based on global average occupancy rates and load factors embedded in MoMo (See Annex II).

BOX 1. GLEC Framework Guidance – idling, repositioning and empty running

All emissions related to the operation of vehicles should be included in the base year emissions of the company. This includes the emissions from idling, repositioning and empty running. This is common practice for scope 1 and scope 2 reporting, where empty running and idling is inherently included vis a vis the actual fuel use.

Carbon intensity calculations should take the total amount of fuel used for both loaded and empty trips and divide it by the tonne-kilometers related to the actual useful work done (e.g., the loaded trips).

When using the tool, companies will be asked to provide pkm or tkm figures for all their global operations in the base year and target year selected. Companies may include the operating personnel in their pkm figures. Generally, passenger transport companies use the metric "revenue passenger kilometer" which is the number of kilometers traveled by paying passengers (number of revenue passengers multiplied by the total distance traveled). Likewise, companies may include the operating personnel and extra fuel when optionally carried in their tkm figures.

This is the so called "payload distance" which refers only to revenue-generating cargo. Companies should publically disclose the assumptions on occupancy rates and load factors used to estimate their inventory's figures.

MoMo considers a number of decarbonization measures that impact the global growth demand assumption, including "shift" and "avoid" measures. The extent to which polices drive measures leading to avoidance of transport activity or modal shifts is different in the 2DS and B2DS, therefore requiring different levels of policy interventions and technology deployment.

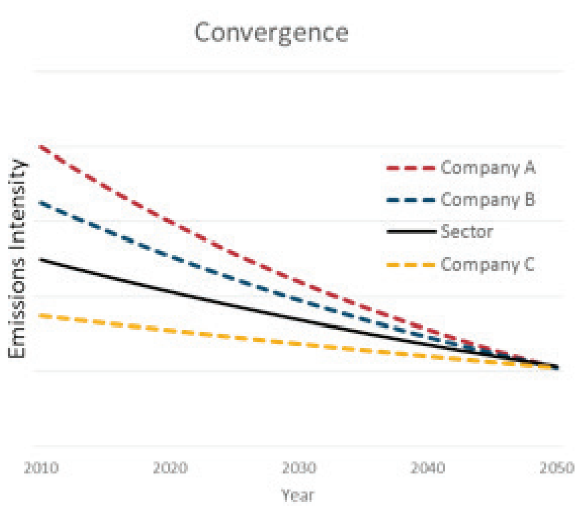
3.1.2 Target-setting approaches & results interpretation

The principle of intensity convergence is used for almost all transport categories available in the tool (except aviation and shipping). The convergence approach is applied to homogeneous sectors (sectors that can be described with a common metric, eg. tkm, pkm), and assumes that the carbon intensity of a company converges towards the carbon intensity of the sector at a rate that ensures not exceeding the emissions scenario carbon budget. The carbon budget can be that for 2°C, well-below 2˚C, or any other emissions scenario embedded in the tool.

Therefore, companies using the tool for transport activities should interpret the resulting goal as a function of the company's initial carbon intensity, the sector's decarbonization trajectory (e.g. for 2˚C or well below 2˚C) and the company's projected growth relative to the growth of the sector. The growth projection of the company is taken into account to estimate the market share parameter in the convergence equation.

Figure 2 shows the graphic interpretation of the emissions intensity convergence approach.

Figure 2. Intensity convergence approach



The rate of intensity decarbonization is not the same for all companies within the sector. It is also important to mention that for companies already below the sector's intensity can still converge towards the sector's intensity in 2050, or continue a decarbonization trajectory below the sector's average without necessarily converging in 2050. As mentioned before, the sector trajectory is a global one, which intrinsically requires companies below the sector's average to continue on such trend.

Aviation & Shipping

Aviation and shipping are an interesting case in the transport sector due to their international presence and the existence of global decarbonization goals for these two. In the case of aviation, the Air Transport Action Group (ATAG) set environmental goals for the short, medium and long-term in 2016, including: an annual efficiency goal for 2020, a goal to stabilize emissions growth from 2020 with the use of offsets, and to reduce net emissions from aviation 50% by 2050 compared to a 2005 base-year (ATAG, 2018).

Since the SBTi does not allow the use of offsets to report progress against science-based targets, and since the sector's 50% reduction goal (if interpreted as gross emissions) is comparable to the Intergovernmental Panel on Climate Change (IPCC) 2˚C minimum requirement at the global level, the SDA Transport tool uses a linear interpretation of the IPCC 2˚C range which is between 49 and 72% reduction [15].

Therefore, the tool only asks for tCO2e figures from air transport-related activities in the base year, and no activity figures, as the target-setting approach is contraction. This approach requires all companies within a given sector, region or globally to reduce emissions at the same rate. The contraction approach will result in a company's trajectory parallel to the sector, regardless of the company's starting carbon footprint.

Figure 3 shows the graphic interpretation of the absolute emissions contraction approach.

Figure 3. Absolute emissions contraction approach.

In the case of shipping, the International Maritime Organization (IMO) recently reached an agreement for the sector that includes as for aviation, a target on emissions intensity by 2030, and a long term target to reduce emissions at least 50% by 2050 compared to a 2008 base-year (Greenbiz, 2018). The level of ambition for the sector goal may be increased in the future as negotiations continue, and in light with the 1.5˚C upcoming IPCC report.

For the same reasons than for aviation and to boost ambition in the short-term, the SDA Transport tool also uses the IPCC reduction range 49-72% (linear trajectory) to calculate targets for shipping activities. This range may be updated with the introduction of new science. Also, the SBTi will review new emissions trajectories for these sectors as they become available, for potential integration into the tool.

Manuel Pulgar-Vidal, leader of WWF's global climate and energy programme, said: "The new goal of IMO is very welcome news, a good first step and an important policy signal. Shipping is responsible for more than 2 per cent of global emissions, and this is growing. The agreement today is an opportunity to bend this curve to align with the Paris Agreement, but it needs to translate into urgent action - now."

Even when using the contraction approach, a company can define an intensity target. The SBT tool calculates the required absolute emissions trajectory towards a target year. Together with sector-wide or company-specific growth projections, an intensity target can be calculated using the absolute emissions target level from the SBT tool and the company's projected activity in the target year. When companies commit to such an intensity target, it is essential to regularly review the growth projections. This should be done at least every five years, ideally even in shorter cycles. In addition, companies may not set a weaker target in the case of negative growth.

BOX 2. Recommendations for companies that own / control vehicles

- Logistics service providers, shippers and carriers using more than one transport mode (multimodal) would need to model their targets by using each of the transport modes in which it operates, by providing the share of activity for each of these and the projected growth. Since projections can change over time, companies are recommended to check the validity of their targets every five years, and adjust the targets accordingly.
- Companies are encouraged to consider different mitigation options in line with the "avoid, shift and improve" concept.
- Companies are also encouraged to develop strategies to improve their service efficiency (for example, increasing the number of passenger per kilometer or the number of tonnes per kilometer as allowed by local regulations).

15 The range of percent decrease in emissions is due to uncertainty in emissions modeling projections. Additionally, a decrease of 49% is actually the lower threshold when recognizing that global net negative emissions would be required (-103 to -118%) in the second half of the century; Table 6.3 in Chapter 6 of the Fifth Assessment Report, Working Group III).

3.2 COMPANIES THAT SUBCONTRACT / PURCHASE TRANSPORT SERVICES

3.2.1 GHG emissions and activity

Emissions from transport activities that occur in a company's value chain are indirect emissions (scope 3) that are reported by the company buying the services to fulfill its core business operations. These emissions are generally emissions from logistics operations (e.g. transportation of raw materials or finished products) or business travel. Companies using the SDA Transport tool for their scope 3 emissions in the value chain can use the trajectories available for companies that own / control vehicles.

Figure 4. Transport activities in the value chain (scope 3)

	Passenger transport	Freight transport
Scope 3. Categories in the GHG Protocol	**Category 6:** Business travel **Category 7:** Employee commuting	**Category 4:** Upstream transportation and distribution **Category 9:** Downstream transportation and distribution

Emissions and activity data (pkm or tkm) can be challenging to obtain for subcontracted transport. However, the GLEC Framework provides guidance on how companies can estimate these figures from supplier's data. Nevertheless, in some cases it might be necessary to rely on default data that may not accurately represent actual transportation activities. Despite uncertainty, companies are encouraged to set targets while continue improving data quality.

As for scope 1 and 2, default data life cycle emissions factors should be considered as they normally include WTT and TTW emissions.

BOX 3. GLEC Framework Guidance – scope 3 guidance for idling, reposition and empty running

The GLEC Framework suggests three options for including idling, reposition and empty running in scope 3 absolute emissions calculations (e.g. tonnes CO_2e):

a) Adopt an average load factor (e.g. 50%). If using a default factor, such as from Defra or the GLEC Framework, adjustments for empty running, repositioning and idling are embedded in the default values.

b) Adopt a company or region-specific load factor based on actual operating conditions.

c) Scale by loaded distances by appropriate factors to consider empty running.

In the case of logistics, the Smart Freight Centre through the GLEC Framework and other organizations are creating new collaboration platforms to gather more accurate / granular data in the supply chain:
http://www.smartfreightcentre.org/

3.2.2 Target-setting approaches & results interpretation

For categories 4 and 9 in the GHG Protocol, upstream and downstream transportation and distribution, companies can use the SDA Transport tool with the convergence approach for GHG target-setting. Alternatively, companies may use the contraction approach with the IPCC 5th AR reduction range mentioned before. This second approach is recommended for transport emissions in the value chain when activity data is not available.

The SBTi also accepts supplier engagement targets to mainstream science-based targets in the value chain [16]. A target language example is:

Company A commits to have 70% of its key suppliers by emissions (including transporting services) setting science-based targets by 2020.

For Categories 6 and 7, business travel and employee commuting, an absolute approach is recommended with the IPCC 5th AR reduction range. Although companies could use the tool with the convergence approach to determine a target for these categories if emissions and activity data is available, the limited market share attributed in the tool to employee commuting and business travel will result in inappropriate targets; especially if the travel is sporadic.

16 Please consult the SBTi criteria on supplier engagement targets.

BOX 4. Recommendations for companies that subcontract / purchase transport services

- In order to meet the 2DS and B2DS for freight transportation, systemic improvements in the near term are required. For example, by taking action in the supply chain, improving logistics and routing, and by deploying energy efficiency measures. Collaboration and coordination among shippers, logistics service providers and carriers is therefore crucial to decarbonize freight transport despite a projected growth in demand.
- Companies are implementing strategies to reduce emissions from air travel, as it is one of the most carbon intensive modes. They do so, for example, by promoting the use of online meetings and web conferencing, and by implementing internal policies for employee travel. It is expected that corporate users of air travel compare the service providers in the market, not only based on economic factors, but also on environmental ones (e.g. preference for companies with a climate strategy including science-based targets).
- Companies are starting to implement car-sharing programs with employees, to reduce emissions and to promote employee integration. Other strategies are based on incentive schemes to encourage employees to bike, walk or take the train to work.

3.3 ROAD VEHICLE MANUFACTURERS

3.3.1 GHG emissions & activity

Use phase emissions from newly manufactured vehicles are indirect emissions (scope 3) that are reported by the manufacturing company that sells the vehicles. Use phase emissions of vehicle manufacturers is therefore part of the transport carbon budget. The SDA Transport tool only has pathways for road vehicle manufacturers (WTW). Emissions during manufacturing are not covered in the SDA Transport tool, nor emissions from battery manufacturing for electric vehicles.

Figure 5. Emissions covered in the pathways for newly manufactured vehicles.

Note: As per the GHG Scope 3 Standard, Category 11 includes the total expected lifetime emissions from all relevant products sold in the reporting year across the company's product portfolio. A reporting company's scope 3 emissions from use of sold products include the scope 1 and scope 2 emissions of end users, and it uses life cycle emission factors for fuels and for electricity.

Road vehicle manufacturers are required to test the emissions generation from the exhaust of newly produced vehicles. Different test procedures can yield performance figures that do not correspond to actual driving emissions.

Fuel economy of LDVs: The values used in the embedded pathways in MoMo are estimated through a normalization of regional test procedures to the Worldwide Harmonized Test Cycle (WLTP), based on the conversion factors developed by ICCT (ICCT, 2014) [17]. The assumed gap between the WLTP and real-world (on-road) emissions is 1.1 for all regions and at all times.

According to the IEA (OECD/IEA, 2017), to be able to meet the 2DS targets, it is necessary to reduce the gap between tested and on-road fuel economy. Moving towards the WLTP would better reflect real-world vehicle operation. Therefore, for science-based target-setting, companies must use the adjustment factors / formulas of the WLTP to obtain real / actual emissions if using a different standard.

17 The IEA specifically used equation 4.2 (Single regression with zero intercept – all data), with the slopes given in table 5.2 (Single regression with zero intercept)..

Fuel economy of HDVs: From the IEA's report The Future of Trucks (IEA, 2017): "Estimations of the fuel economies for LCVs, MFTs and HFTs relied primarily on research on tested and real-world specific fuel consumption under various drive cycles, vehicle loads and mission profiles, largely leveraging on the analysis recently developed by the ICCT for the Global Fuel Economy Initiative (GFEI, 2016), complemented by information on the fuel consumption of vehicles reported by communities of vehicle users, such as those reviewed by Tietge et al. (2015) in the case of cars."

As with LDVs, for LCVs a 1.1 conversion factor is used in the MoMo and the values are for the WLTP test cycle. For MFTs and HFTs, the values are real-world operations, under representative loads.

In absence of a normalized test procedure for MFTs and HFTs, companies are invited to present and justify their own estimates / simulations based on fuel consumption specific duty cycles to the SBTi.

Well-to-Wheel emissions

The emissions pathways built in the SDA Transport tool for the manufacturing of new road vehicles is composed by WTT emissions from stock vehicles, and by TTW emissions for new vehicles (mix of power trains). The former was taken as an approximation because MoMo does not have WTT emissions for newly manufactured vehicles. The WTW approach reflects the shift of emissions from one scope to another, for example due to electrification. The WTW emissions pathways are then divided by the activity in vkm for new vehicles to build the intensity pathways.

As companies make assumptions for the type of fuels plugged into the fuel tanks, original equipment manufacturers (OEMs) can also make assumptions of the average grid electricity factors for their sales across markets.

3.3.2 Target-setting approaches & results interpretation

Manufacturers of LDVs and HDVs can use the SDA Transport tool directly for scope 3 GHG target-setting (convergence approach).

The carbon intensity of new vehicles (per transport category) will converge towards the carbon intensity pathway for new vehicles [18]. These pathway differ from those applied to companies that own or control vehicles, since they exclude the stock vehicles emissions.

The unit used in the convergence formula is gCO2e/vkm[19]. Manufacturers are encouraged to use the occupancy rates factors and load factors of MoMo (Annex II) to covert target year results from vkm to pkm or tkm.

Vehicle manufacturers producing different vehicle types must aggregate their intensity figures to set a company-wide science-based target for their scope 3 emissions. Example:

> Company A commits to reduce the emissions intensity (gCO_2e/vkm) of its product portfolio X% by 2030 from a 2015 base-year.

The SDA Transport tool also provides the possibility for road vehicle manufacturers to obtain results in liters of gasoline equivalent per 100 kilometers (lge/100 km). This metric purely reflects the fuel economy of new vehicles (TTW portion). The lge numerator already reflects the effect of power train electrification.

BOX 5. Recommendations for road vehicle manufacturers

1. Check the validity of your targets. To ensure consistent tracking of performance over time, the target should be recalculated to reflect significant changes that would compromise its relevance and consistency. For example, changes in growth projections, significant changes in the mix of products, company structure (e.g. mergers, divestments), and other relevant assumptions used in the target modeling exercise.

2. Engage with regulators to promote demand of more efficient low or zero carbon vehicle types.

3. Explore new business models. Electrification of road transport is required to meet the 2DS and B2DS goals. Therefore, the decarbonization of the power sector and the development of a smart grid systems (including vehicle-to-grid technologies) will require close collaboration among governments, users and solutions providers.

3.4 COMPANIES THAT MANUFACTURE ROAD VEHICLE PARTS

3.4.1 GHG emissions and activity

For auto part manufacturers, category 11 of scope 3 is the "Indirect use-phase of sold products". While it is more common for vehicle manufacturers, in reality a vehicle is composed of a number of components / auto parts that contribute to the consumption of energy in the vehicle. Some components contribute more than others to the ultimate vehicle emissions, and the determination of the exact percentage contribution can be complicated.

Product use emissions can be direct or indirect. Under the GHG Protocol, companies are required to report direct use phase emissions, and may also include indirect-use emissions when these are expected to be significant. However, there is no guidance on significance thresholds. Therefore, indirect use-phase emissions of auto part manufacturers are of voluntary reporting.

For auto part manufacturers reporting these emissions, the recommendation is to use WTW emissions factors, as vehicle manufacturers.

There are different levers of decarbonization that can reduce the energy needs in a vehicle, for example: improved aerodynamics, reduced rolling resistance, weight reductions, internal combustion (ICE) efficiency gains, enhanced power train efficiency, etc. Together with vehicle manufacturers, auto part manufacturers can work towards influencing one or more of these levers to different degrees.

BOX 6. Michelin's scope 3 emissions

According to Michelin's research, the tire's contribution to fuel consumption is between 20 and 25% for passenger cars, and 30-35% for trucks. A fraction of this is used to overcome the rolling resistance, the rest of the energy is consumed within the dynamic elements of a vehicle.

Michelin reports on these emissions every year as a key part of their climate strategy. The company is working with its researchers to further push the boundaries of rolling resistance of its tires to reduce energy consumption and therefore emissions.

These improvements must be balanced by regulatory limits, since there is a trade-off between improving rolling resistance and safety.

Michelin and WWF are currently exploring a target-setting approach based on the assumption of current and long-term fuel consumption contribution from tires across vehicles with different powertrains.

3.4.2 Target-setting approaches & results interpretation

During the development of the SDA Transport tool, the possibility of building a science-based pathway for auto part manufacturers was considered. Such an exercise would require a more in-depth analysis and understanding of the assumptions in MoMo.

The aggregation level in MoMo does not currently allow the development of specific pathways for different auto part manufactures. An approach for tire manufacturers is being explored. The pathway would reflect the contribution of tires to the fuel consumption of the vehicle (different per power train) and the need to decarbonize the transport sector in line with a well-below 2˚C world.

In the absence of 2˚C/Well-below 2˚C pathways for auto part manufacturers, companies can use other approaches for indirect use-phase emissions target-setting:

- Absolute emission reduction targets that are consistent with the level of decarbonization required to keep global temperature increase below 2˚C compared to pre-industrial temperatures.

- Ambitious performance-based targets that contribute to the reduction of energy needs in a vehicle.

18 This method is not applicable to companies with a product portfolio that already yields a zero emissions footprint in the TTW part (e.g. EV manufacturers), although they are welcome to apply to and participate in the SBTi.

19 The assumed average lifetime of road vehicles in MoMo varies by vehicle type, region, and over time. The assumed average global kilometers per year can be found in Annex III,

4

METHODOLOGICAL CHOICES

4.1 SELECTION OF DECARBONIZATION SCENARIOS FROM THE INTERNATIONAL ENERGY AGENCY

The International Energy Agency low carbon scenarios are created using the ETP-TIMES model (OECD/IEA, 2017). It is used to determine the least-cost technology mix needed to meet the final demand for three sectors: industry, transport, and buildings.

The ETP-TIMES model starts from primary energy supply and conversion to final energy demand up to 2060. It models the current situation in the conversion sectors (e.g. existing capacity stock, operating costs, and conversion efficiencies) and then integrates the technical and economic characteristics of existing technologies that can be added to the energy system. In this way it can determine the least-cost technology mix needed to meet the final demand. This final demand is determined by the sub-models of the specific end-use sectors. The transport sector is modeled with Mobility Model (MoMo).

MoMo is a simulation model of detailed transport activity projections, vehicle activity, energy demand, and well-to-wheel greenhouse gas (GHG) and pollutant emissions according to user-defined policy scenarios to 2060.

It integrates 27 countries and regions, historical data from 1975 to 2015 (or 1990 to 2015 for certain countries). It models future trends over five-year steps to create scenarios to the year 2060, which are integrated into the broader ETP framework using a combination of "what if" analysis expert judgment and backcasting. It has national and regional resolution split for both urban and non-urban geographies into parameters including vehicle stock, activity, energy use and emissions; passenger and transport services by major motorized transport modes (including a wide range of power train technologies), as well as fuel supply options: gasoline and diesel, biofuels (ethanol and biodiesel via various production pathways) and synthetic alternatives to liquid fuels (coal-to-liquid and gas-to-liquid); gaseous fuels, including natural gas (CNG and liquefied petroleum gas) and hydrogen via various production pathways; and electricity (with emissions according to the average national generation mix as modelled by the ETP-TIMES model in the relevant scenario).

MoMo estimates on energy use are based on stocks, utilization (travel per vehicle), and vehicle energy intensity (energy use per vehicle, i.e. fuel economy). Emissions are calculated via fuel emission factors for CO2 and pollutants on a vehicle and well-to-wheel basis for all modes. The results of the modeling exercise are validated and calibrated against the IEA's energy balances.

Cost evolution of technology, policy frameworks and oil prices are the primary drivers of technology penetration in transport. In each scenario, the model aggregates the total costs across modes and regions of vehicle production, operations and maintanence, fuel outlays, and infrastructure investments.

To learn about MoMo:
https://www.iea.org/etp/etpmodel/transport/

To learn about the major assumptions in the IEA's modeling (GDP, oil prices and population growth):
https://www.iea.org/etp/etpmodel/assumptions/

To learn more about the penetration of road vehicle technologies:
https://www.iea.org/topics/transport/

MoMo adopts the "avoid, shift and improve" paradigm through the assumptions made on technologies and policies. Technological drivers in the model are mainly assumptions on the cost evolution of the technology and the policy framework. Elasticities and case studies on policy impacts are used to model the behavioural response to pricing, regulatory, and other policies (such as investment in compact cities or public transit infrastructure or fare subsidies). These factors together with oil prices can significantly alter technology penetration patterns.

The ETP 2017 describes the potential role and impact of the "autonomous and connected vehicles, electrification, and sharing" (ACES), yet it recognizes that to date, the magnitude of their effects and the direction of mobility patterns, energy use and emissions it still uncertain and it can only be speculated on.
The IEA Mobility Model (MoMo) was selected as the modeling scenario for the following reasons:

- **Compatibility with IEA ETP sectoral budgets (basis for SDA tool):** The Sector Decarbonization Approach uses the sector carbon budgets and activity projections from the IEA's annual publication: Energy Technology Perspectives (ETP) Report (OECD/IEA, 2017). IEA's modeling includes energy, industry, buildings and transport. The transport part is derived from the Mobility Model exercise. Table 3 shows the carbon budget of the 2DS and B2DS in the ETP report.

- **Availability of both B2DS and 2DS scenarios:** According to the Paris Agreement global emissions need to be reduced at a level to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change. Therefore, the SBTi encourages companies to set targets in line with these temperature thresholds. At the time of this project, the IEA's work was the closest readily available model that introduced the "well below 2°C" pathway. The IEA's B2DS scenario when projected to 2100 is expected to lead to 1.75°C temperature outcome with a 50% chance.

- **Its mitigation levers are transparent:** Although MoMo is only available through a License Agreement, its assumptions, including mitigation levers, can be tracked through the publicly available spreadsheets and the ETP Report. As for any other model, it is a perfectible model that it is updated every year through peer-review by experts in the field and the MoMo partners.

- **It covers both passenger and freight transport:** The main objective of the SDA tool refinement for the transport sector was to be as comprehensive as possible. The refinement and inclusion of passenger and freight transport pathways will not only facilitate the modeling of SBTs for vehicle owners, but also for other companies highly dependent on logistics services and for road vehicle manufacturers. MoMo's level of disaggregation is suitable to derive subsector pathways per transport mode.

Table 3. CO_2 budget assumptions in the 2DS and BD2DS ($GtCO_2$).

SCENARIO	Total CO_2 budget (2015-2100)	LULUCF (2015-2100)	Energy sector CO_2 budget (2015 -2100)	Energy sector CO_2 budget (2015-2060)
2DS	1,140	-30	1,170*	1,000*
B2DS	720	-30	750	750

* Includes emissions from industrial processes and fuel combustion. Source: IEA- ETP, 2017

BOX 7. The IEA's 2DS and B2DS modeling in a nutshell

Excerpt from the IEA's Energy Technologies Perspectives Report 2017:

- The final energy demand in the B2DS is around 45 EJ (10%) lower than the 2DS in 2060 and marginally lower (4%) than 2014 levels.
- Final energy demand in the B2DS reflects the significant role of electrification of end-use sectors (particularly ground transport and buildings) in order to achieve this ambitious pathway.
- Oil experiences the greatest decline in its share, from almost 40% in 2014 to 16%, an absolute decline of 96 EJ, reflecting the shift away from petrol- and diesel-fueled vehicles.
- In the B2DS, WTW emissions from transport have to decrease by 89% by 2060 compared to 2015 emissions, while in the 2DS 54% over the same time frame. All transport modes must contribute to decarbonization, not only through reducing emissions intensity, but also absolute emissions.
- The transport sector provides over 50 $GtCO_2$ of additional emissions reductions compared with the 2DS, primarily through energy efficiency (57%), fuel switching (28%) and renewables (15%).
- The role of biofuels in transport is lower in the B2DS than in the 2DS in 2060 – 24 EJ compared with 30 EJ – due in part to a 20% overall reduction in transport energy demand between the two scenarios.
- A 1.75°C pathway would require the emissions intensity of power generation to fall from around 520 gCO_2/kWh today to become carbon negative, at -10 gCO_2/kWh, in 2060.
- Scenario estimates of total expenditure on vehicles, infrastructure and fuels show that the cumulative costs of transport in the RTS are about USD 130 trillion (2015 USD PPP) higher than those of the 2DS, and USD 110 trillion higher than in the B2DS.

4.2 SECTORAL DECARBONIZATION APPROACH (SDA)

The Sectoral Decarbonization Approach (SDA) tool was developed by the SBTi partners with technical support from Ecofys. The SDA tool allocates the energy-related carbon budget to different sectors. The allocation takes into account inherent differences among sectors, such as mitigation potential and how fast each sector can grow relative to economic and population growth.

Within each sector, companies can derive their science-based targets based on their relative contribution to the total sector activity and their carbon intensity relative to the sector's intensity in the base year. Therefore, the rate of reduction varies per company depending on how close their intensity is at present compared to the sector. Using the detailed sector scenarios from the IEA's 2DS and B2DS models, it is possible to estimate the 2DS or B2DS compatible carbon intensity for each sector scenario by dividing the total direct emissions of the sector in any given year by the total activity of the sector in the same year. This yields a sector intensity pathway.

For homogeneous sectors physical activity indicators - for example, tons of cement, passenger-kilometers (pkm), kilowatt-hours (KWh) – convergence is used as the carbon allocation method. The assumption is that the emissions intensity of each company in the same sector will converge with the sector emissions intensity by 2050.

A company's intensity pathway—given by the SDA tool—multiplied by their projected activity yield a company's carbon budget in absolute terms for the target period. In principle, the sum of these budgets should be contained within the sector projected budget given by the IEA in each of the above-mentioned scenarios.

The pathways built in the SDA Transport tool are based on the MoMo's figures for stock vehicles. Stock vehicles are those already in circulation plus the new additions each year. Emissions are Well-to-Wheel (WTW) reflecting not only the direct use emissions from fuel combustion (TTW: Tank-to-Wheel) but also upstream emissions related to fuel production and distribution (WTT: Well-to-Tank), as well as electricity generation for electric vehicles.

The WTW emissions pathways are then divided by the corresponding activity (pkm, tkm) to build the intensity pathways. The WTW approach reflects the shift of emissions from one scope to another, for example due to electrification.

4.2.1 Convergence

In designing the SDA method for all sectors, it was anticipated that, in the long run, large companies will have equal opportunities to abate the GHG emissions of their activities. To reduce GHG emissions, three elements are important to consider: (1) the energy efficiency of the process; (2) the carbon intensity of the energy used; and, (3) the emissions related to the process and its design. Although there are still differences in energy efficiency among world regions, these differences will tend to disappear in the long term because of the convergence of the energy efficiency technologies, as shown by historic trends (WRI, CDP, WWF, 2015).

4.2.2 Market share parameter

One of the parameters used in the convergence approach for homogeneous sectors is the company's expected activity growth. This input parameter is used in the SDA tool to estimate the company's market share compared to the sector's total activity in any given year (selected target year).

After beta-testing the first SDA Excel tool, stakeholders raised the potential threat of over allocating the carbon budget when companies underestimate their growth. To prevent this situation, the SBT team introduced a cap to the market share parameter, only in cases in which the company projects to decrease their market share (any market parameter above 1.00 is brought down to 1.00). In all other cases, the decarbonization pathway is maintained as if the market share remained constant throughout the target period. This safeguard is deemed robust and justifiable since it preserves the carbon budget integrity. Since the tool came after the SDA technical paper was published in 2014, this safeguard is not captured in the notes of the document.

According to Krabbe, et. al. (2015): "The intensity pathways of the fast-growing companies are steepened to account for their increase in market share. If this is not accounted for, the sector average intensity will increase owing to the growth, resulting in an exceedance of the sector's carbon budget. The opposite happens to the intensity pathways of the companies that show a decreasing market share. Although this might seem unrealistic or unfair, it makes sense from a business perspective, because when a company's market share is decreasing, it will probably invest less in new, more efficient technologies, and vice versa."

The convergence formula, including the market share parameter, comply with the following condition: for every year the sum of all individual company emissions targets does not exceed the sector's total carbon budget.

4.2.3 Sector developments

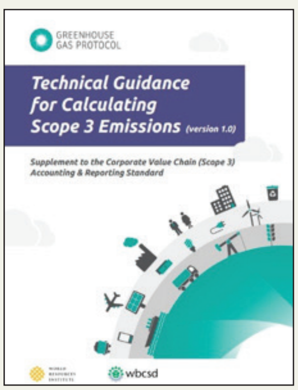
Some of the benefits of setting targets using a sector-specific method are the possibility of setting targets based on a common intensity unit used by peers (transparency), and the possibility to capture the mitigation opportunities and associated costs available for the sector (tailored).

However, acknowledging that some sectors are still highly aggregated, the Science Based Targets Initiative is working on other sector developments, and invites interested stakeholders to contribute to the development of new sector pathways in line with the Paris Agreement goals.

4.3 Carbon accounting methodologies

Science-based targets (SBTs) are based on the emissions calculated and reported by the company. As such, a target is only as good as the emissions data that feeds the model. Companies adopting SBTs will need to calculate emissions intensity and absolute emissions values for each transport mode.

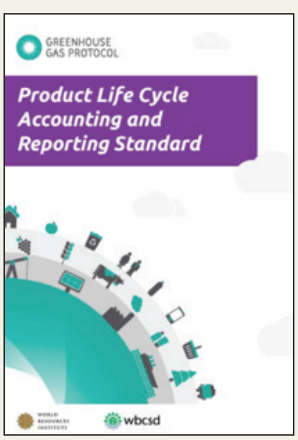
To promote comparability and transparency of emissions calculations, three methodologies are encouraged:



For general GHG reporting guidance and passenger transport:
Greenhouse Gas Protocol

Developed by the World Resources Institute and the World Business Council for Sustainable Development, the Greenhouse Gas Protocol is considered baseline methodology for carbon accounting and reporting, and is widely used by industry. The SBT has adopted the Corporate Accounting and Reporting Standard for scope 1 emissions and the Corporate Value Chain Accounting and Reporting Standard for scope 3 (WRI & WBCSD, 2004 and WRI & WBCSD, 2011, respectively).

The methodology provides a "basic training" on carbon accounting that is useful for understanding the terminologies, creating a plan for setting up accounting systems, and provides default factors where data are unknown. The GHG Protocol is the base methodology for CDP reporting.



For products GHG reporting guidance:
Greenhouse Gas Protocol

Developed by the World Resources Institute and the World Business Council for Sustainable Development, the GHG Protocol Product Life Cycle Accounting and Reporting Standard (referred to as the Product Standard) provides requirements and guidance for companies and other organizations to quantify and publicly report an inventory of GHG emissions and removals associated with a specific product. The primary goal of this standard is to provide a general framework for companies to make informed choices to reduce greenhouse gas emissions from the products (goods or services) they design, manufacture, sell, purchase, or use. The GHG Protocol Scope 3 Standard and GHG Protocol Product Standard both take a value chain or life cycle approach to GHG accounting and were developed simultaneously.

For freight transport specific guidance:
Global Logistics Emissions Council Framework

Developed by Smart Freight Centre, the Global Logistics Emissions Council (GLEC) Framework (Smart Freight Centre, 2015) is built in accordance with the GHG Protocol and includes guidance specific to the logistics sector and its customers. It covers all regions, modes of transport and scopes, and includes a set of default factors specific to freight transport. The GLEC Framework will be the methodology for freight transport, alongside the GHG Protocol, in the new 2018 CDP transport questionnaire.

4.4 Well to Wheel emissions boundary

The boundary for GHG inventories and reductions targets should be as wide and accurate as possible. Emissions not covered under a target cannot be managed / reduced.

The emissions from the use of a vehicle consists of WTT and TTW emissions. WTT emissions occur upstream in the value chain of the fuel production; these are based on attributional life-cycle assessment studies of fossil-derived fuels (e.g. gasoline, diesel, compressed and liquefied natural gas), biofuels and electricity (based on time -and scenario-specific estimated average grid carbon intensity) (OECD/ IEA, 2017). TTW emissions cover the energy used once transformed (e.g. combustion of the fuel during vehicle use). Together these form the WTW emissions.

The SBTi requires companies to cover WTW emissions for GHG target-setting, as more opportunities for mitigation are captured in a WTW basis, as well as the shift of emissions between TTW and WTT due to the switch in power train technologies.

5

ANNEX

Annex I. Default factors for fuel consumption and emissions

The Smart Freight Centre has produced an excellent compendium of consumption factors per tonne-kilometer for logistics in the GLEC Framework: **Module 1. Default consumption factors and sources**.

Also, Smart Freight Centre commissioned VTT Technical Research Centre of Finland to review the sources of fuel emissions factors used in standards, databases and methodologies, in the transport / logistics sector: **Module 2: Fuel-based emissions factors.**

Many of the sources listed by the SFC have also information on passenger transport:
- http://www.smartfreightcentre.org/glec/what-is-glec

The GHG Protocol also provides a life-cycle data bases and tools across sectors.
- http://www.ghgprotocol.org/life-cycle-databases
- http://www.ghgprotocol.org/calculation-tools

The MoMo 2017 uses the WTT emissions factors from the JRC Concawe 2011 study.
- http://iet.jrc.ec.europa.eu/about-jec/downloads

Global electricity intensity in MoMo 2017:

Intensity - Electricity generation (kgCO2/MWh), World							
	2014	2025	2030	2035	2040	2045	2050
2DS	572.02	360.85	245.22	150.87	97.38	55.77	36.50
B2DS	572.02	330.18	228.79	140.69	71.91	20.35	-8.02

Annex II. Average occupancy rates and load factors used in MoMo, 2017

Freight load (tonne per vkm), World, 2DS				
	2015	2020	2025	2030
2-3 Wheelers	0.24	0.24	0.23	0.22
Light vehicles	0.68	0.71	0.73	0.76
Large road	12.30	13.10	13.73	14.09
Rail	1,613.02	1,603.25	1,594.61	1,588.46
Shipping	20,496.07	21,051.66	21,359.83	21,769.62

Freight load (tonne per vkm), World, B2DS				
	2015	2020	2025	2030
2-3 Wheelers	0.24	0.24	0.23	0.22
Light vehicles	0.68	0.71	0.75	0.79
Large road	12.30	13.17	13.97	14.55
Rail	1,613.02	1,603.25	1,594.61	1,588.46
Shipping	20,496.07	21,007.56	21,295.55	21,673.05

Passenger load (people per vkm), World, 2DS				
	2015	2020	2025	2030
2-3 Wheelers	1.17	1.17	1.17	1.17
Light vehicles	1.59	1.62	1.62	1.60
Large road	15.11	15.46	15.71	15.87
Rail	349.11	353.84	353.32	340.16

Passenger load (people per vkm), World, B2DS				
	2015	2020	2025	2030
2-3 Wheelers	1.17	1.17	1.17	1.17
Light vehicles	1.59	1.62	1.62	1.60
Large road	15.11	15.42	15.61	15.62
Rail	349.11	353.04	350.49	333.60

Annex III. Assumed average km per year for road vehicles

From MoMo 2017:

Passenger mileage (thousand km/year per vehicle), World, 2DS				
	2015	2020	2025	2030
2-3 Wheelers	7.18	7.26	7.23	7.22
Light vehicles	13.56	13.10	12.77	12.55
Large road	31.10	30.14	29.74	29.42

Passenger mileage (thousand km/year per vehicle), World, B2DS				
	2015	2020	2025	2030
2-3 Wheelers	7.18	7.25	7.23	7.17
Light vehicles	13.56	13.03	12.64	12.11
Large road	31.10	30.16	29.86	29.81

Freight mileage (thousand km/year per vehicle), World, 2DS				
	2015	2020	2025	2030
2-3 Wheelers	6.56	6.65	6.92	7.23
Light vehicles	16.06	15.55	15.36	15.56
Large road	27.18	26.70	26.66	26.96

Freight mileage (thousand km/year per vehicle), World, B2DS				
	2015	2020	2025	2030
2-3 Wheelers	6.56	6.66	6.93	7.29
Light vehicles	16.06	15.49	15.25	15.38
Large road	27.18	26.46	26.42	26.51

GLOSSARY

Carbon dioxide emission budget (or carbon budget): For a given temperature rise limit, for example a 2˚C long-term limit, the corresponding carbon budget reflects the total amount of carbon emissions that can be emitted for temperatures to stay below that limit. Stated differently, a carbon budget is the area under a carbon dioxide (CO_2) emission trajectory that satisfies assumptions about limits on cumulative emissions estimated to avoid a certain level of global mean surface temperature rise.

Carbon dioxide equivalent (CO_2e): A way to place emissions of various radiative forcing agents on a common footing by accounting for their effect on climate. It describes, for a given mixture and amount of greenhouse gases, the amount of CO_2 that would have the same global warming ability, when measured over a specified time period.

Sectoral Decarbonization Approach (SDA): The SDA is differentiated from other existing science-based target methods by virtue of its subsector-level approach and global least-cost mitigation perspective, in line with the carbon budget related to a given temperature goal. Currently, the SDA tool uses the sector decarbonization trajectories of the International Energy Agency (IEA).

Convergence approach used in the Sectoral Decarbonization Approach (SDA): The convergence approach for homogeneous sectors in the SDA is based on the assumption that the carbon intensity of a company convergences towards the carbon intensity of the sector at a rate that ensures not exceeding the sectoral carbon budget. The rate of convergence of a company is a function of the initial carbon intensity of the company, the carbon intensity of the sector, and the growth of the company relative to the growth of the sector.

Contraction approach used in the Sectoral Decarbonization Approach (SDA): The contraction approach assigns to companies the same percentage of absolute emission reductions as is required for the sector selected within a given time period.

Scenario: A description of how the future may unfold based on 'if-then' propositions. Scenarios typically include an initial socio-economic situation and a description of the key driving forces and future changes in emissions, temperature or other climate change-related variables.

Integrated assessment models: Models that seek to combine knowledge from multiple disciplines in the form of equations and/or algorithms in order to explore complex environmental problems. As such, they describe the full chain of climate change, from production of greenhouse gases to atmospheric responses. This necessarily includes relevant links and feedbacks between socio-economic and biophysical processes.

International Energy Agency (IEA), 2˚C scenario (2DS): The 2˚C Scenario (2DS) lays out an energy system pathway and a CO_2 emissions trajectory consistent with at least a 50% chance of limiting the average global temperature increase to 2˚C by 2100. Annual energy-related CO_2 emissions are reduced by 70% from today's levels by 2060, with cumulative emissions of around 1,170 gigatonnes of CO_2 ($GtCO_2$) between 2015 and 2100 (including industrial process emissions). To stay within this range, CO_2 emissions from fuel combustion and industrial processes must continue their decline after 2060, and carbon neutrality in the energy system must be reached before 2100.

In transport, this reflects clear policy choices favouring less energy intensive modes, the rapid uptake of all cost-effective energy efficiency opportunities and the transition towards a much higher reliance on low-carbon energy carriers by 2060.

International Energy Agency (IEA), Beyond 2˚C scenario (B2DS): The Beyond 2˚C Scenario (B2DS) explores how far deployment of technologies that are already available or in the innovation pipeline could take us beyond the 2DS. Technology improvements and deployment are pushed to their maximum practicable limits across the energy system in order to achieve net-zero emissions by 2060 and to stay net zero or below thereafter, without requiring unforeseen technology breakthroughs or limiting economic growth.

This "technology push" approach results in cumulative emissions from the energy sector of around 750 $GtCO_2$ between 2015 and 2100, which is consistent with a 50% chance of limiting average future temperature increases to 1.75°C. Energy sector emissions reach net zero around 2060, supported by significant negative emissions through deployment of bioenergy with carbon capture and storage (CCS). The B2DS falls within the Paris Agreement range of ambition, but does not purport to define a specific temperature target for "well below 2°C". In transport, this requires even greater reliance on the most efficient modes, a very rapid deployment of zero-carbon vehicle technologies and energy carriers to shift away from fossil fuels, and needs to be accompanied by effective near-term accelerated and ambitious policy changes.

IEA's definition of Thank-to-wheel emissions (TTW): Tank-to-wheel emissions cover all the energy used once transformed, this is emissions occurring during the combustion of the fuels by vehicles.

IEA's definition of Well-to-thank emissions (WTT): Well-to-tank emissions are based on attributional life-cycle assessment studies of fossil-derived fuels (e.g. gasoline, diesel, compressed and liquefied natural gas), biofuels and electricity (based on time- and scenario-specific estimated average grid carbon intensity). Energy use and emissions resulting from pipeline transport are accounted for under "Energy industry own use" in the International Energy Agency own modeling.

IEA's definition of Well-to-wheel emissions (WTW): Together, TTW and WTT make up WTW GHG emissions. This does not include emissions from vehicle or battery manufacturing, or those offset by material recycling, among others.

Passenger – kilometer: A passenger-kilometer, abbreviated as pkm, is the unit of measurement representing the transport of one passenger by a defined mode of transport (road, rail, air, sea, inland waterways etc.) over one kilometer.

Tonne – kilometer: A tonne-kilometer, abbreviated as tkm, is a unit of measure of freight transport which represents the transport of one tonne of goods (including packaging and tare weights of intermodal transport units) by a given transport mode (road, rail, air, sea, inland waterways, pipeline etc.) over a distance of one kilometer.

SCOPES DEFINITIONS IN THE GHG PROTOCOL:

Scope 1 emissions: Emissions derived from the combustion of fossil fuels in the vehicle; generally derived from invoices (e.g. liters of gasoline purchased).

Scope 2 emissions: Emissions derived from the combustion of fossil fuels to produce electricity that is consumed in the companies' vehicles. The GHG Protocol Scope 2 Protocol allow companies to report these emissions in two ways.

Location-based method for scope 2 accounting: A method to quantify scope 2 GHG emissions based on average energy generation emission factors for defined locations, including local, subnational, or national boundaries.

Market-based method for scope 2 accounting: A method to quantify scope 2 GHG emissions based on GHG emissions emitted by the generators from which the reporter contractually purchases electricity bundled with instruments, or unbundled instruments on their own.

Scope 3 Category 3 "Fuel and energy related activities": This category includes emissions related to the production of fuels and energy purchased and consumed by the reporting company in the reporting year that are not included in scope 1 or scope 2.

This category includes emissions from four distinct activities: 1) upstream emissions from purchased fuels (extraction, production, and transportation of fuels consumed by the reporting company); 2) Upstream emissions of purchased electricity (extraction, production, and transportation of fuels consumed in the generation of electricity, steam, heating, and cooling that is consumed by the reporting company); 3) T&D losses (generation of electricity, steam, heating, and cooling that is consumed (i.e., lost) in a T&D system – reported by end user); and, 4) Generation of purchased electricity that is sold to end users (generation of electricity, steam, heating, and cooling that is purchased by the reporting company and sold to end users – reported by utility company or energy retailer).

Scope 3 Category 6 "Business travel": This category includes emissions from the transportation of employees for business-related activities in vehicles owned or operated by third parties, such as aircraft, trains, buses, and passenger cars.

Scope 3 Category 7 "Employee commuting": This category includes emissions from the transportation of employees between their homes and their worksites.

Scope 3 Category 4 "Upstream transportation and distribution": This category includes emissions from the transportation and distribution of products (excluding fuel and energy products) purchased or acquired by the reporting company in the reporting year in vehicles and facilities not owned or operated by the reporting company, as well as other transportation and distribution services purchased by the reporting company in the reporting year (including both inbound and outbound logistics).

Scope 3 Category 9 "Downstream transportation and distribution": This category includes emissions from transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer (if not paid for by the reporting company), in vehicles and facilities not owned or controlled by the reporting company.

Bioenergy: Energy derived from any form of biomass such as recently living organisms or their metabolic by-products.

Bioenergy and Carbon Dioxide Capture and Storage (BECCS): The application of Carbon Dioxide Capture and Storage (CCS) technology to bioenergy conversion processes.

Uncertainty: A cognitive state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable.

Resources

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Download our new transport-specific technical resources and explore science based target setting for your company today.