

Transport CO₂ and the Paris Climate Agreement

Reviewing the Impact of Nationally
Determined Contributions



Decarbonising Transport Series

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Executive summary

What we did

In preparation for the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties held in Paris, December 2015 (COP21), parties publically communicated their climate commitments as Intended Nationally Determined Contributions (INDCs). This report gives first an introduction to Nationally Determined Contributions (NDCs) and provides an overview of economy-wide CO₂ reduction targets that were defined in these pledges. It then assesses the impact of transport commitments provided in NDCs on national-level transport CO₂ emissions. Given the often limited information in NDCs concerning transport-sector ambitions and planned CO₂ mitigation measures, an assessment methodology was set up that is based on several assumptions. Countries are clustered into four different groups based on transport-related information provided in the NDCs; for each group a distinct method was established to estimate the impact of transport CO₂ mitigation actions/ambitions that are (more or less clearly) defined in the countries' respective NDCs. The methods are based on the use of ITF's transport modelling framework and their baseline and low-carbon scenarios.

What we found

NDCs provide CO₂ reduction ambitions, but not yet clear pathways or measures to reach ambitions set by the Paris agreement. Often, measures in the NDCs are desired outcomes and remain vague at the best. In some cases, the mitigation potential of identified “measures” is contestable.

Results of the assessment show that the estimated ‘NDC scenario’ projects global national-level CO₂ emissions in 2030 to attain a similar as in 2015 (reflecting a reduction of CO₂ emissions of around 1400 MT CO₂ compared to a baseline scenario). However, achieving a two-degree scenario (2DS) would require further reductions of around 600 MT CO₂. To attain the level of the low-carbon scenario (a scenario that results from the combination of the most optimistic scenario from all modes and points to a lower bound for CO₂ emissions with currently foreseen technology and mode choice trajectories) further reductions of around 800 MT CO₂ would be required.

Results by region show that especially Asian, upper-middle income countries, are planning to exploit most of the currently foreseeable transport CO₂ reduction potential (as per the low-carbon scenario). Other regions appear to leave some of the CO₂ mitigation potential unused up to 2030. The transport ambitions for CO₂ reductions of such countries especially need to be intensified to ensure that the “Well-below 2 degree” ambition, as defined at COP21 in Paris in 2015, can be achieved.

What we recommend

Move from ambitions to concrete actions for the transport sector

The 2016 Paris climate agreement must still be translated into concrete actions for the transport sector. A wide range of policy levers are needed to reduce transport emissions and understanding their effectiveness is crucial. This means continued research on the effectiveness of mitigation measures. ITF's Decarbonising Transport project aims to help stakeholders identify effective measures by assessing them under a coherent framework. This will help countries to transform their ambitions to actions.

Keep track of transport pledges in NDCs after each revision cycle

To understand whether national climate actions have increased, it is important to keep track of further revisions of the Nationally Determined Contributions, especially in comparison with the ambitions set out in the Paris climate agreement. Tracking national plans for CO₂ reduction ambitions specific to the transport sector will also help to decrease uncertainty over future CO₂ emissions of the sector

Introduction

In preparation for the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties held in Paris, December 2015 (COP21), parties publically communicated their climate commitments as Intended Nationally Determined Contributions (INDCs). These intended contributions have been converted to Nationally Determined Contributions (NDCs) as countries have formally been joining the Paris agreement by submitting their respective instrument of ratification, accession, or approval.

NDCs are thus at the heart of the Paris Agreement and the achievement of the long-term climate goals. They embody efforts by each Party to reduce national emissions and adapt to the impacts of climate change. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of their contributions. These climate actions will determine whether the world achieves the long-term goals of the Paris Agreement and reaches global peaking of greenhouse gas (GHG) emissions as soon as possible, consequently undertaking rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century. It is understood that the peaking of emissions will take longer for developing country Parties, and that emission reductions are undertaken on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty, which are critical development priorities for many developing countries (UNFCCC, 2017a).

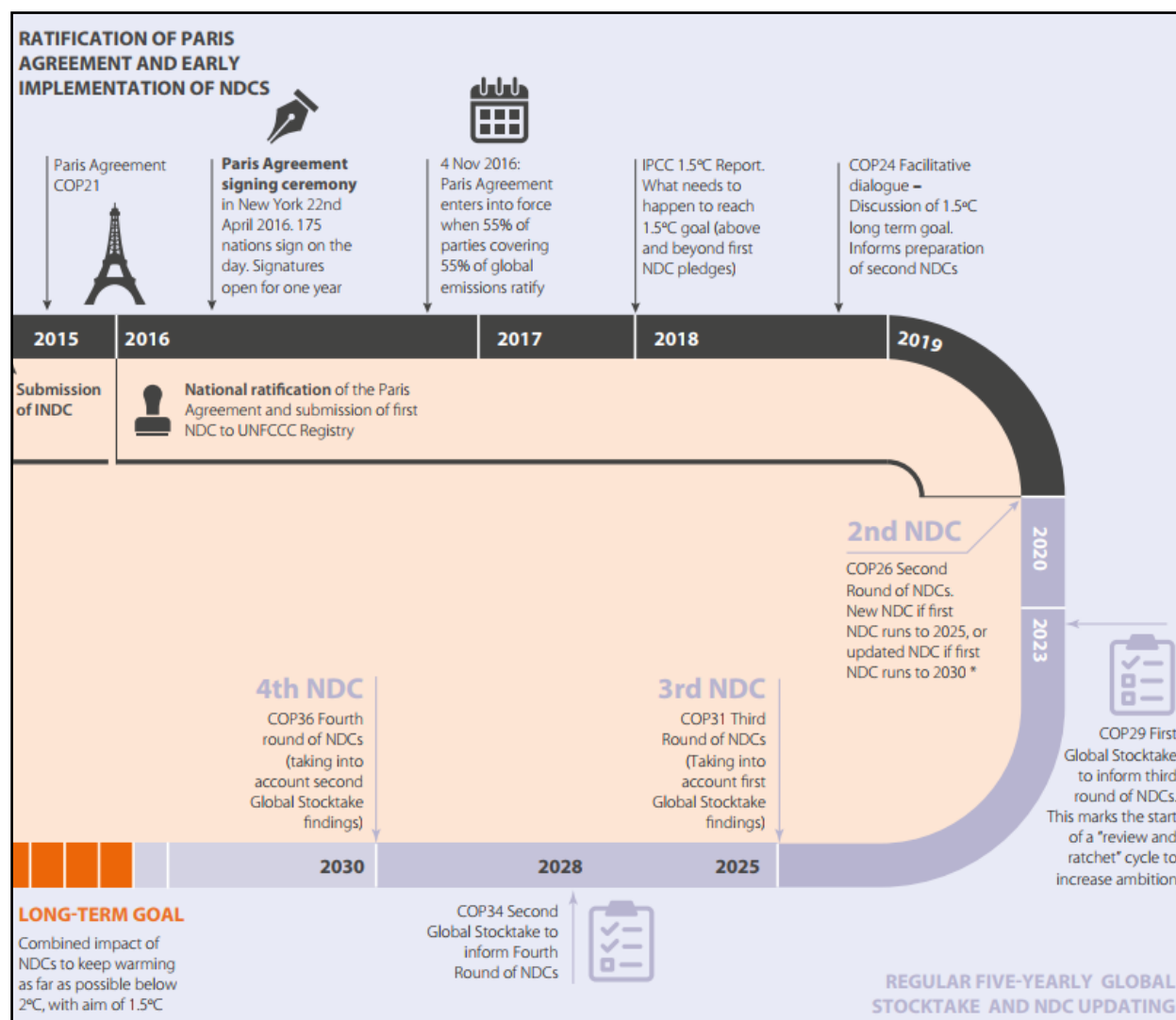
In accordance with Article 4, paragraph 12 of the Paris Agreement, NDCs communicated by Parties are recorded in a public registry maintained by the UNFCCC secretariat. According to this registry, as of 13 November, 2017, 163 NDCs have been registered. 31 further Parties have submitted their INDCs that have either not yet been converted into an NDC and/or have not been registered on the NDC Registry (2017). In total, 193 Parties have submitted either their INDCs or NDCs (not counting the NDC of the EU28 in addition to the ones of its Member States) (NDC Registry (2017). Based on recent estimates of emissions (including the land-use change and forestry sectors), the share of global emissions covered by these Parties amounts to approximately 95% (WRI, 2017).

Under the provisions of the Paris Agreement, countries are expected to submit an updated NDC every five years, to show a progression beyond the country's then current NDC to reflect its highest possible ambition. Figure 1 sets out the respective process.

This report provides an overview and assessment of the transport CO₂ reduction commitments that countries around the globe communicated in the preparation and aftermath of the COP21 as part of their NDCs. It first provides more background on NDCs and their general content, then gives an overview of the treatment of the transport sector in NDCs, and finally estimates the impact of the commitments on transport sector CO₂ emissions.

The International Transport Forum intends to review updated NDC submissions every five years to track the ambition level of transport components in the NDCs and provide a regular update.

Figure 1. Overview of the implementation process for the Paris Agreement, including the NDC updating cycle



Source: CDKN (2016); Notes: In 2020, countries whose NDC contains a timeframe up to 2025 are urged to communicate an updated NDC by 2020 and every five years thereafter, while countries whose NDC contains a timeframe up to 2030 are requested to communicate or update their contributions by 2020 and to do so thereafter every five years. The timeline is divided into three distinct sections: (1) Preparation and early implementation (black); (2) Five-yearly review and NDC updating (blue); and (3) Long-term goals (orange).

Background to Nationally Determined Contributions

Recognising the risks that climate change poses to communities and ecosystems around the world, the international community has adopted the Paris Agreement with the goal to limit global warming to well below 2°C compared to pre-industrial temperatures. Meeting this goal will require rapid reductions of carbon emissions. The longer emissions reductions are delayed, the more difficult it will be to meet this goal. Choices on infrastructure developments (such as power plants, transportation systems, buildings, and the ways in which cities are built) made without considering climate change mitigation could lock societies into emission-intensive pathways that may be impossible or very expensive to change in time to limit global warming (WRI, 2015).

Benefits of developing an NDC

Against the backdrop of rising emissions and an increased urgency for action, there are significant domestic and international benefits that can be realised through the development and implementation of an NDC, including (WRI, 2015):

- **Getting on track towards the climate goal:** The greater the number of countries that put forward national contributions, the greater is the likelihood that the well below 2°C target can be met.
- **Demonstration of a political commitment:** Putting forward an NDC demonstrates a political commitment to limit global warming and, in turn, to limit future risks posed by higher temperatures. The NDC process is an opportunity for countries around the world to come forward with their best efforts, regardless of whether their mitigation potential is high or low. If an adaptation component is included in the NDC, the NDC can also raise the profile of adaptation, articulate a country's long-term vision for adaptation, and help Parties gain international recognition for national adaptation actions and investments.
- **Realisation of non-climate benefits associated with mitigating climate change:** NDCs can provide an opportunity to design policies that mutually reinforce economic growth and climate objectives. For example, policies that advance renewable energy supply can lower emissions, reduce countries' vulnerability to energy price volatility and supply disruptions, and produce benefits for human health and ecosystems by curbing air pollution.
- **Strengthening institutional and technical capacity:** The NDC preparation and implementation process has the potential to strengthen national institutional capacity and transfer knowledge to sectoral institutions. As progress is tracked toward the implementation of NDCs over time, the capacity of technical staff will increase and a foundation will be built for tracking progress not only in implementing the contribution, but also other climate change interventions.
- **Policy integration:** Developing an NDC enables countries to link climate change to other national priorities, such as sustainable development and poverty reduction. It can also help countries coordinate among sectors that currently work too much in isolation from each other, and allow decision makers to identify synergies among sectoral plans.

- **Informing key stakeholders:** The communication of NDCs can provide the opportunity to advance the understanding of national stakeholders, as well as the international community, regarding future policymaking, implementation strategies, and expected emissions reductions and non-climate benefits that may result from the NDC. This can help build political will for mitigation and adaptation action, and encourage stakeholders to engage in climate change policy development or planning.
- **Communicate resource needs:** The communication of an NDC can also represent an opportunity for developing country Parties to communicate the additional action that could be taken if further resources were available. It can help Parties describe support needs for completion and implementation of low emissions development strategies and national adaptation plans or activities.

Content of an NDC

The UNFCCC did not provide any specific template, structure or content requirements for the development of NDCs. As a result, several guidance documents for the preparation of (I)NDCs were developed by other institutions. Most notably, the following are listed on the UNFCCC website: Climate & Development Knowledge Network (CDKN) 2015, International Partnership for. Mitigation and MRV (IPMM) 2014, and World Resources Institute (WRI) 2015. On the UNFCCC website, it is highlighted that the Secretariat does not promote any particular guidance or methods.

IPMM (2014) provides a set of components and illustrative examples of the level of detail for each element that could be provided, depending on the country's capability and level of ambition (Table 1). The focus here is put on how to present (CO₂ mitigation) targets and respective policies or projects that will be put in place in order to meet these targets. CDKN (2015) provides a more comprehensive template for the content of an NDC (Table 2). It also describes the national context, the planning process and the foreseen or required means of implementation. WRI (2015) provides detailed descriptions of the possible content of an NDC regarding both CO₂ mitigation and adaption.

Table 1. **Proposed (I)NDC components and respective information according to IPMM (2014)**

Component	Higher ← Level of country capability → Lower		
Inspirational national long-term emissions goal	Year of intended phase out of GHG emissions	Long-term peak and decline pathway or range	-
National short-term emissions target	Precisely defined, economy-wide, multi-year target until 2025 and/or 2030	Mitigation ambition until 2025 and/or 2030 (below BAU, intensity, range)	-
Energy / sectoral targets	Precisely defined national energy efficiency or renewable targets and targets related to non-energy emissions	National energy efficiency or renewable targets and/or targets related to land-use and forestry	National energy efficiency or renewable targets, if any
Highlight policies and projects	Governance structures; Highlight policies / projects with intended impacts	Governance structures; Highlight policies / projects with intended impacts	Selection of a few, yet ambitious policies and/or projects

Explanations and international support needs	Detailed explanation for why the contribution is an ambitious and equitable contribution to the global goal	Explanation for why the contribution is an ambitious and equitable contribution to the global goal; Precise purpose and value of support needed	Order of magnitude of support needed
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Source: IPMM (2014).

Table 2. **INDC template of the Climate and Development Knowledge Network (CDKN)**

National Context
This section provides the overall national context for the INDC, including how the actions set out in the INDC fit with national sustainable development priorities and existing plans and strategies. It can also contain a headline summary of the INDC as a whole.
Mitigation
<p>Contribution</p> <p>This section contains a summary of the mitigation contribution, including type of contribution, level of ambition and any conditionality that may be relevant for the contribution. It should be noted that countries may wish to specify a long-term outcome (e.g. up to 2050) as well as short-term outcome for the period to 2025 or 2030.</p> <p>Information to facilitate clarity, transparency and understanding</p> <p>This section includes detailed information to improve understanding of the contribution and allow comparability with other contributions.</p> <p>Fair and ambitious</p> <p>This section sets out how the contribution is considered to be fair and ambitious in light of the country's national circumstances and the objective of the UNFCCC set out in Article 2.</p>
Adaptation
This section provides an opportunity for countries to highlight current and future adaptation action including adaptation-mitigation synergies, as well as the support that may be required for implementation of adaptation plans, developing capacity or scaling up interventions.
Planning Process
This section provides an overview of existing or planned domestic processes for monitoring and supporting the implementation of the INDC.
Means of Implementation
This section describes the financial, capacity-building, technology transfer or other types of international support related to the INDC; this information may help international partners to better understand and target their support.

Source: CDKN (2015).

Given that the format of NDCs is flexible, NDCs submitted by Parties are structured differently, vary in their content, length and in the level of detail provided.

Setting of CO₂ reduction targets in (I)NDCs

Most relevant for the work carried out for this report was how Parties defined their CO₂ reduction targets in their NDCs. Target setting can take different forms. Table 3 and respectively Figure 2 show five possible ways. Specific targets can be converted into other types of targets by using simple equations. The review of NDCs carried out for this study showed that base year emission targets and baseline scenario targets were most frequently used by Parties to define their emissions reduction ambitions.

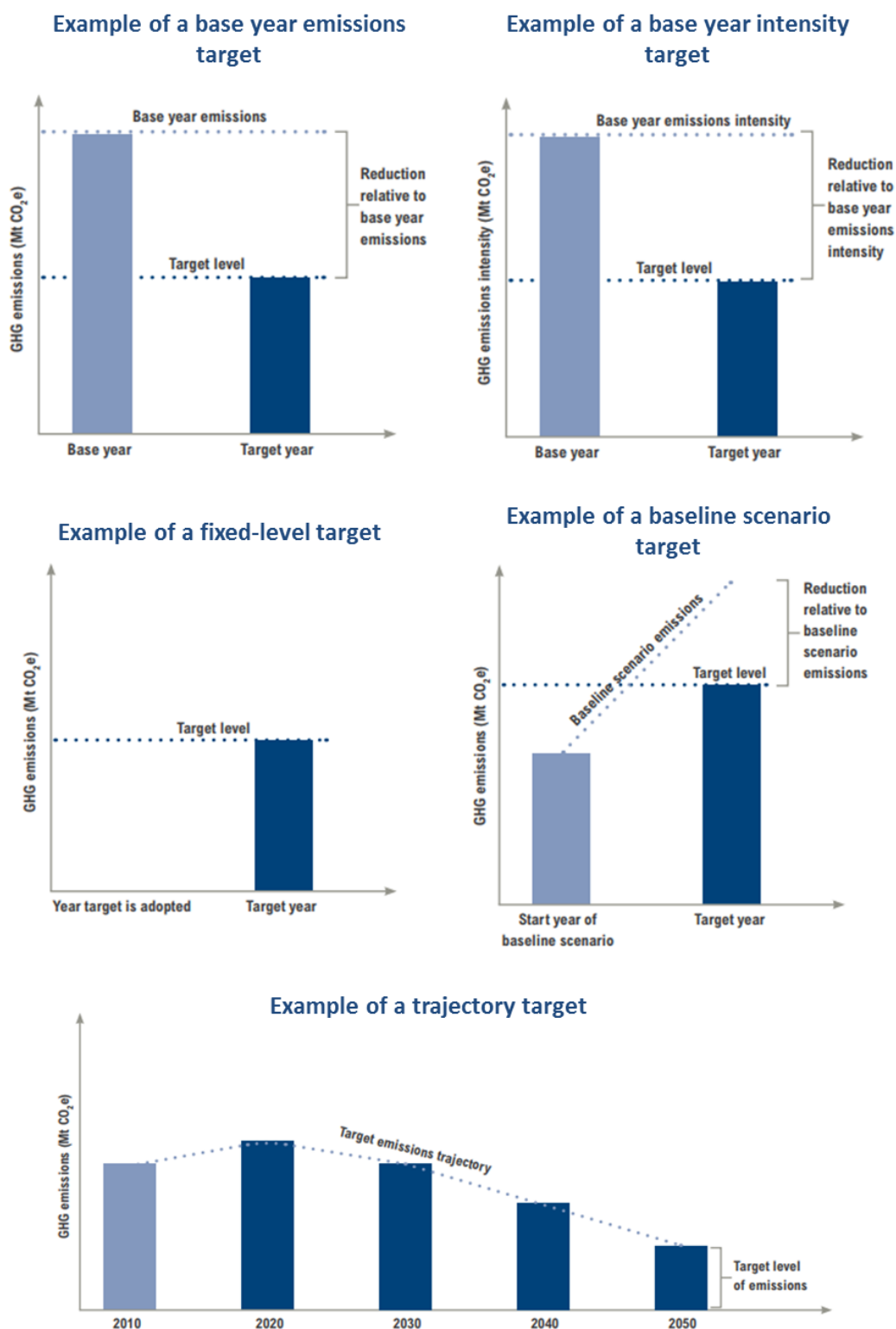
Table 3. Ways to express a reduction target

Type of target	Description	Reduction in what?	Reduction relative to what?
Base year emissions target	A commitment to reduce, or control the increase of, emissions by a specified quantity relative to a historical base year. For example, a 25% reduction from 1990 levels by 2020. These are sometimes referred to as “absolute” targets. Example: United States’ pledge to reduce emissions 17% below 2005 levels by 2020	Emissions	Historical base year
Fixed-level target	A commitment to reduce, or control the increase of, emissions to a specified emissions quantity in a target year/period. Fixed-level target include carbon neutrality targets or phase-out targets, which aim to reach zero net emissions by a specified date. For example, zero net emissions by 2050. Example: Costa Rica’s pledge of ‘long-term economy-wide transformational effort to enable carbon-neutrality’.	Emissions	No reference level
Base year intensity target	A commitment to reduce emissions intensity (emissions per unit of another variable, typically GDP) by a specified quantity relative to a historical base year. For example, a 40% reduction below 1990 base year intensity by 2020. Example: China’s pledge to reduce CO ₂ emissions per unit of GDP 40-45% by 2020 compared with the 2005 level	Emissions intensity	Historical base year
Baseline scenario target	A commitment to reduce emissions by a specified quantity relative to a projected emissions baseline scenario. A baseline scenario is a reference case that represents future events or conditions most likely to occur in the absence of activities taken to meet the mitigation target. For example, a 30% reduction from baseline scenario emissions in 2020. These are	Emissions	Projected baseline scenario

Type of target	Description	Reduction in what?	Reduction relative to what?
	<p>sometimes referred to as business-as-usual or BAU targets.</p> <p>Example: Brazil’s pledge to reduce emissions 36.1% to 38.9% below projected emissions in 2020</p>		
Trajectory target	<p>A commitment to reduce, or control the increase of, emissions to specified emissions quantities in multiple target years or periods over a long time period (such as targets for 2020, 2030, and 2040 over the period 2020-2050). Trajectory targets also include “peak-and-decline” targets, such as emissions peaking at a specified level in 2025 and declining thereafter, or a “peak, plateau, and decline” target which additionally specifies that emissions will remain constant for a period after peaking and before declining.</p>	Emissions	No reference level

Source: WRI (2015).

Figure 2. Ways to express a reduction target



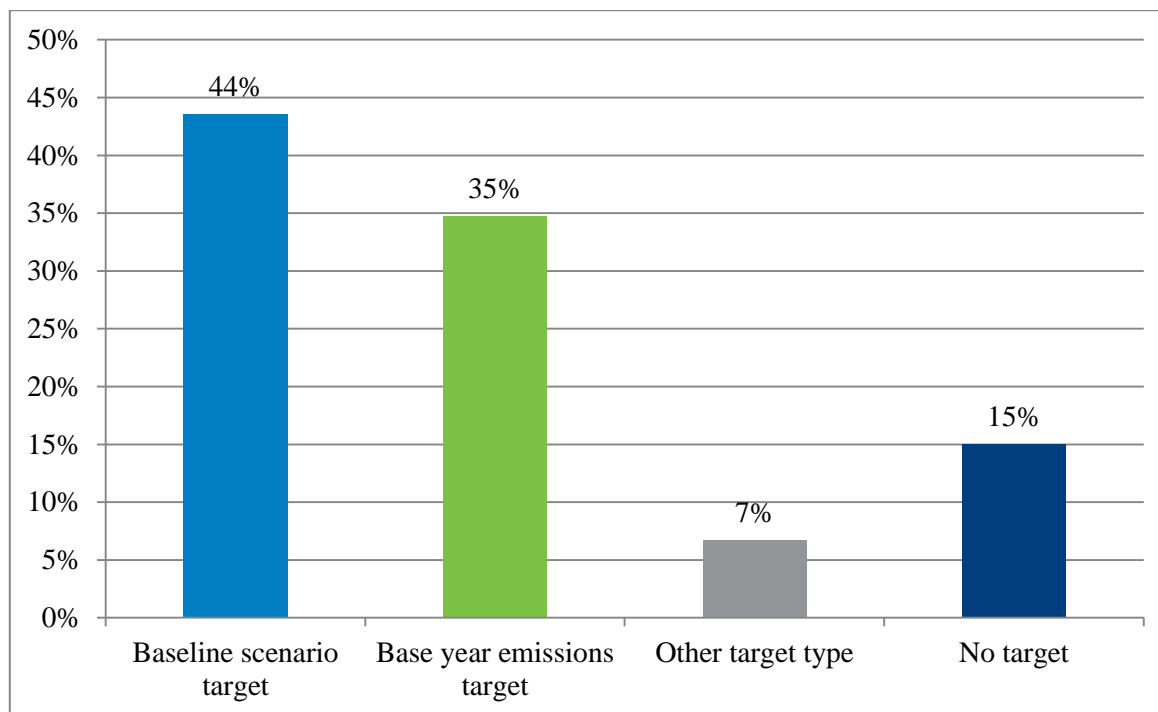
Source: WRI (2015).

Economy-wide ambitions defined in (I)NDCs

In the wake of COP21 in Paris, the Partnership on Sustainable Low Carbon Transport (SLoCaT) updated their analysis of transport commitments mentioned in submitted (I)NDCs (SLoCaT, 2016). The ITF further updated this analysis in early 2017 in the context of its Decarbonising Transport project (ITF, 2017a) and presented assessment results at its annual summit in Leipzig in May 2017 (ITF, 2017b). The list of (I)NDCs considered was again updated in November 2017 for this report. More specifically, all 163 NDCs that were registered as of 13 November, 2017 and a further 31 INDCs (of those Parties for which respective NDCs had not yet been submitted) were included in the analysis presented in this report (unless stated otherwise). These 194 (I)NDCs represent 193 Parties.

Types of defined targets

Figure 3 shows the types of economy-wide mitigation targets that were defined in Parties' (I)NDCs. Most targets are defined as baseline scenario targets, defining the reduction compared to a business-as-usual scenario in the year 2030. Only six Parties define the baseline scenario target in comparison to a different year (i.e. either 2025, 2035, 2040 or 2050). Base year emission targets are set by 35% of the Parties. Here, the base year varies from 1990 (e.g. all EU Member States) to 2014 (e.g. Dominica). 7% of Parties defined their target in other ways (e.g. South Africa aims to limit emissions to a maximum of 614 MTCO₂eq by 2030 (a fixed-level target); Malawi aims to limit CO₂eq emissions to 0.7-0.8t per capita in 2030 (fixed intensity target); Mozambique aims to achieve a total reduction of 76.5 MT CO₂eq in the period from 2020 to 2030 (cumulative emissions target)). 15% of the Parties do not define any economy-wide target in their (I)NDC.

Figure 3. **Types of economy-wide mitigation targets defined by Parties in their (I)NDCs**

Note: (100% = 193 Parties)

Economy-wide ambition levels

In terms of ambition levels, targets are not always represented as a single value, but rather as a range of values or a conditional value (e.g. conditional on finance means made available for developing nations). This is mostly to have flexibility in operationalising the NDC commitment (SLoCaT, 2016). With regards to baseline scenario targets, ambition levels range from a reduction of 2- 89% compared to 2030 business-as-usual scenario estimates. However, business-as-usual (BAU) scenario estimates for 2030 may be more or less ambitious. Some Parties may have decided to account for already planned or likely CO₂ mitigation measures in their BAU scenarios, while others may have not. A direct comparison of countries' ambitions on the basis of such provided percentage-reduction values is therefore not conclusive. Base year emission targets are not a straight-forward means to compare across countries, as base years (and partly also target years) vary.

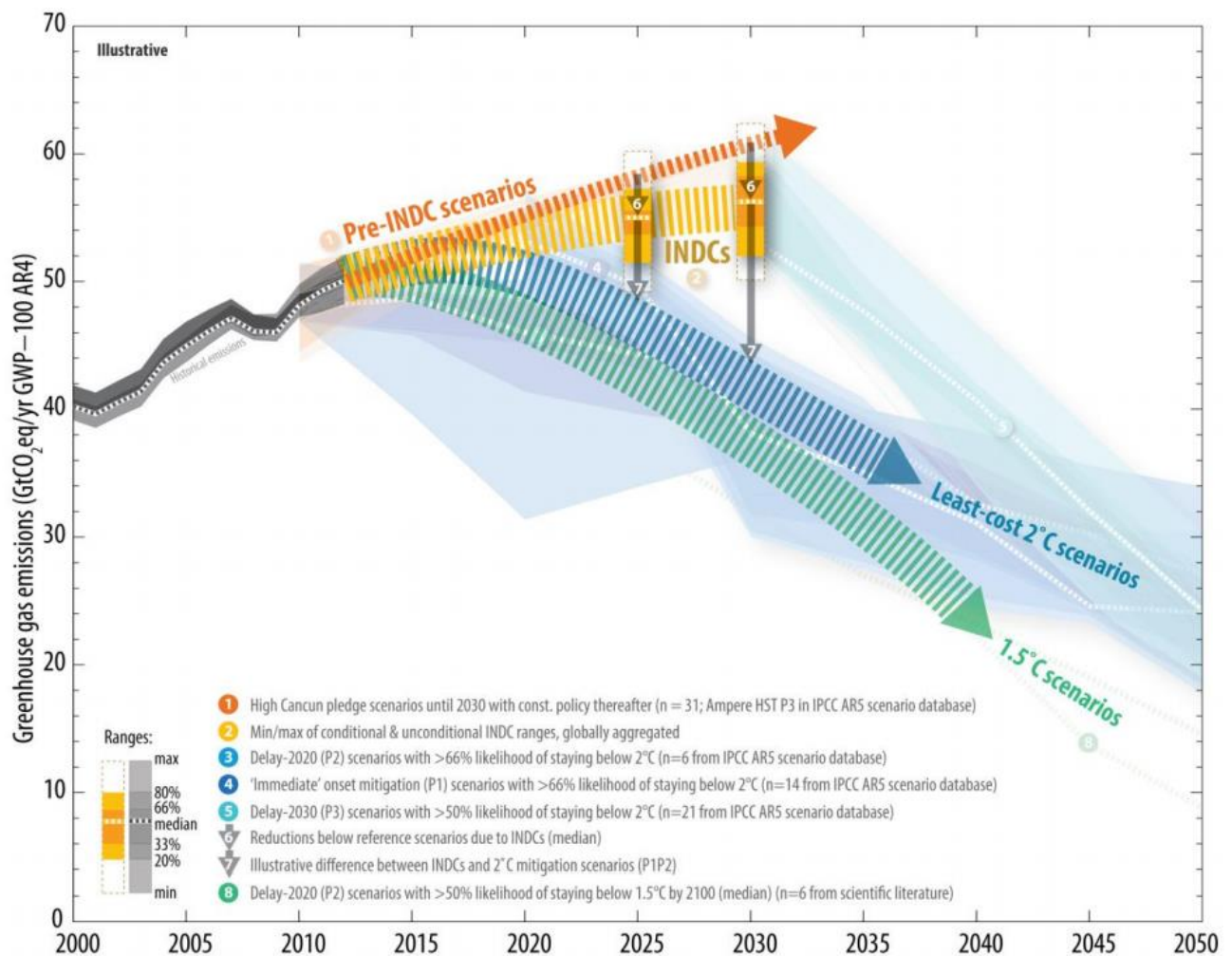
The UNFCCC secretariat published a synthesis report on the aggregate impact of INDCs on 1 November, 2015. The report became one of the key documents for governments to understand their collective effort on climate change. It was updated in May 2016 to include all INDCs that had been submitted by 4 April, 2016 (i.e. 189 (or around 97% of all) Parties to the UNFCCC, with a total CO₂ coverage of ca. 95%) (UNFCCC, 2017a) (UNFCCC, 2016).

The report estimates that the implementation of the communicated INDCs results in aggregate global emission levels of 55.0% (51.4% to 57.3%) GtCO₂eq in 2025 and 56.2% (52.0% to 59.3%) GtCO₂eq in 2030. Aside from various uncertainties in the aggregation of the effect of the INDCs, the provided ranges capture the effect of both unconditional and conditional targets. These levels mean that compared with global emission levels in 1990, 2000 and 2010, global aggregate emission levels resulting from the implementation of INDCs are expected to be higher by 44% (34% to 53%) in 2030 in relation to

the global emission level in 1990. However, global average per capita emissions are expected to decline by 10% and 5% by 2030 compared with the levels in 1990 and 2010, respectively.

Figure 4 compares the global emission levels resulting from the implementation of the INDCs in 2025 and 2030 with those under pre-INDC reference scenarios and 2°C scenarios. It also shows pathways for a 1.5°C scenario. It can be seen that the estimated aggregate annual global emission levels resulting from the implementation of the INDCs do not attain 2°C scenarios by 2025 or 2030. Ambition levels defined in INDCs (that are largely identical to the ones then also communicated in the respective NDCs) need to be intensified over the coming five-year revision cycles to ensure a 2°C or well below 2°C scenario (WB2DS) can be attained.

Figure 4. Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions and under other scenarios (based on INDCs of 189 Parties)



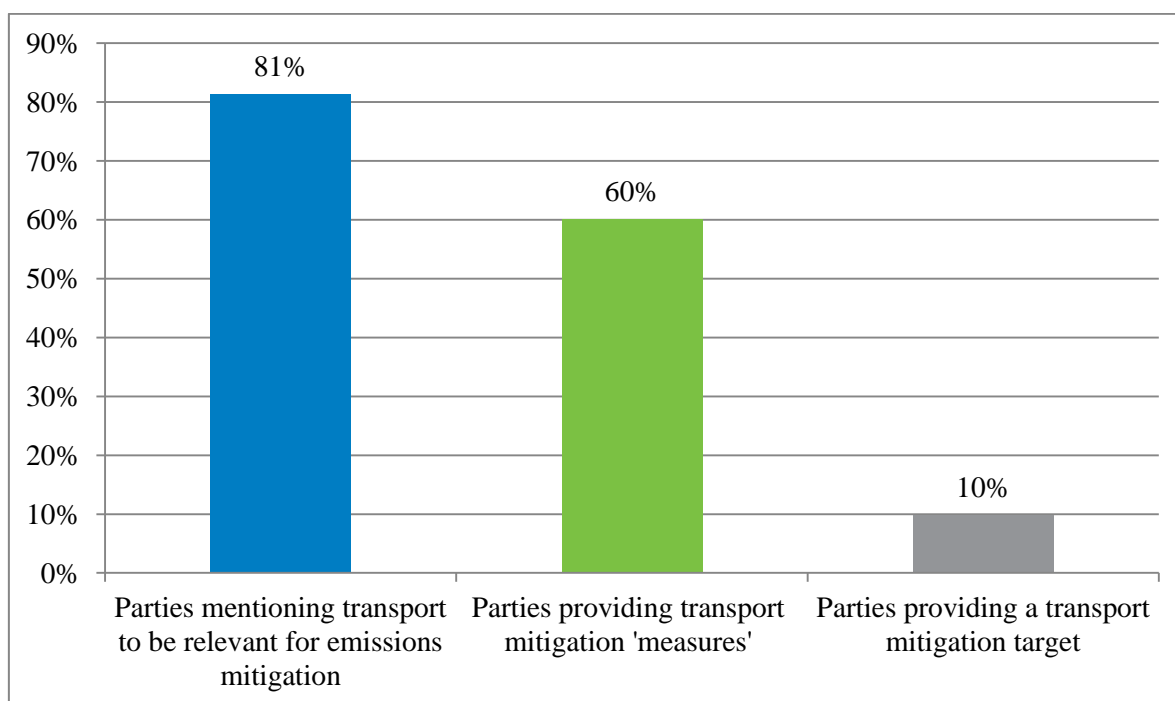
Source: UNFCCC (2016).

Transport in (I)NDCs

Figure 5 provides insight into how (if at all) Parties mentioned the transport sector in their (I)NDCs. It shows the share of the 193 Parties that (i) mentioned the transport sector in relation to CO₂ mitigation efforts (81%), (ii) proposed (more or less specific) transport mitigation measures (60%), and (iii) defined a specific transport sector CO₂ reduction target (10%). It can be seen that the transport sector is largely acknowledged as relevant source of CO₂ and therefore an important sector to focus on when defining CO₂ reduction ambitions and measures. However, the share of Parties that defined specific transport mitigation targets is, with 10%, relatively low. According to SLoCaT (2016), the reason for this lack of sector-specific targets is that countries often do not allocate emissions targets to specific sectors, including transport, as they do not have detailed data on the costs and benefits of CO₂ mitigation for a specific sector. As a result, the 2030 targets established in NDCs of most countries are typically ‘only’ economy-wide.

The following sections provide more information on how Parties were identified as providing transport mitigation measures, and what type of transport mitigation targets were set (if any).

Figure 5. **Mentioning of transport in (I)NDCs** (100% = 193 Parties)



Defined transport mitigation “measures”

The way Parties have defined transport mitigation “measures” (if any) varies. The term is therefore to be used with care. For example, measures often refers to desired outcomes rather than to actions that may be implemented to reach those outcomes. In other instances, measures remain vague and at a high-level only. In some cases, also the mitigation potential of what is classified as ‘measure’ is contestable. Table 4 provides examples of what has been collectively called “measure” in this analysis (and for

establishing Figure 4), despite the term not being fully appropriate. As shown in Figure 4, 60% of Parties go beyond only mentioning the transport sector in their (I)NDC and mention at least one transport mitigation “measure” as referred to in this report.

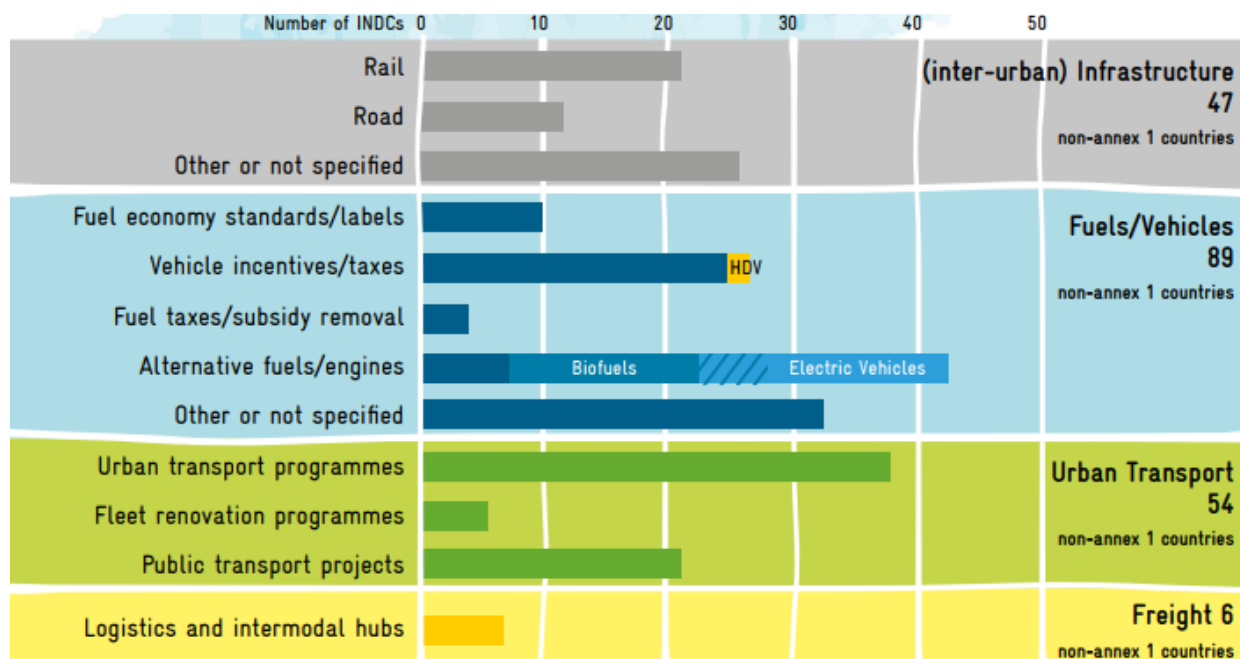
It is to note that Parties were by no means obliged to provide any mitigation measures in their (I)NDCs. Rather, the main purpose of these documents is to provide mitigation targets. Also, countries may have preferred to refer to more specific (transport) sector plans or programmes in their (I)NDCs, rather than listing and potentially repeating measures that had already been defined elsewhere. As a result, an analysis based on submitted (I)NDCs cannot be conclusive with regards to policy measures that Parties may have already planned, but can only give a rough indication.

Table 4. Examples of what is classified as ‘transport mitigation measure’ in the underlying analysis

Measures that...	Example found in one or more (I)NDCs
Refer to a desired outcome	<i>“More efficient vehicles”</i> <i>“Improve the share of public transport”</i> <i>“Advocate use of environmentally friendly forms of transport”</i>
Remain vague / at a high level	<i>“Propose efficient transport policies”</i> <i>“Urban transport improvements”</i> <i>“Improve the freight sector through multi-modal options”</i>
Not necessarily lead to CO₂ reductions	<i>“Building of expressways to relieve congestion”</i>
Can be considered as actual CO₂ mitigation measures/actions	<i>“Electrification of railway lines”</i> <i>“Introduce fuel economy standards for light-duty vehicles”</i> <i>“Extensions of mass rapid transit lines”</i> <i>“Introduce green vehicle procurement policy for government vehicles”</i>

GIZ (2017) has carried out an analysis of the transport mitigation measures (or actions) that are proposed by 149 Non-Annex I Parties (i.e. mostly low-income, developing countries) in their NDCs (see Figure 6). They conclude that there is a strong focus on fuels, vehicles and urban transport. Freight transport (i.e. measures with regards to logistics or inter-modal freight transport) has rather been neglected. It is also highlighted that some measures may be cross-cutting. For example, infrastructure measures may also benefit (intermodal) freight transport. In practice, measures across the different transport sectors may therefore be more balanced than indicated in the NDCs.

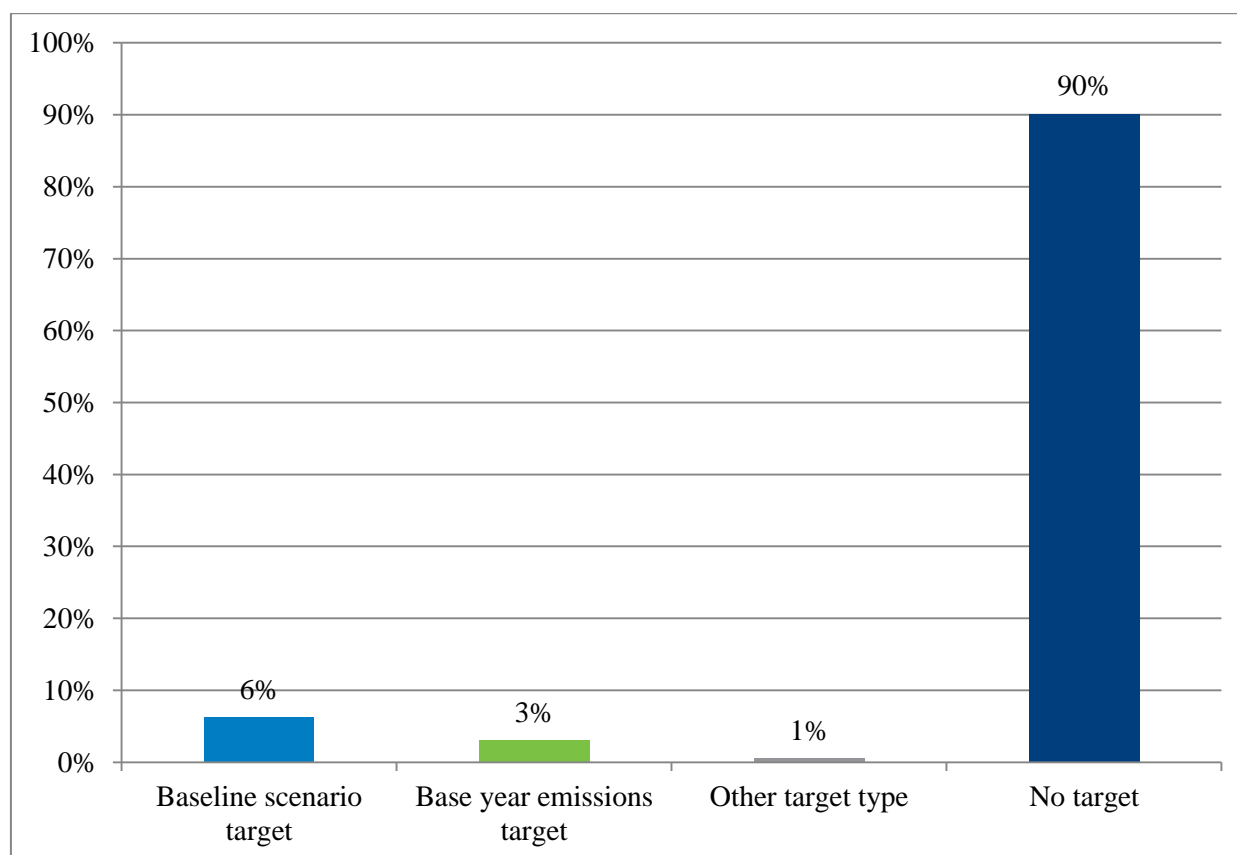
Figure 6. NDC transport mitigation actions in 149 non-annex I countries



Defined transport mitigation targets

Explicit transport sector mitigation targets were defined by 19 Parties (or 10 %). Figure 7 shows the type of targets that were defined. Again, most Parties defined baseline scenario targets. They range from a 3 % GHG reduction by 2030 compared to a Business-As-Usual scenario (BAU) (in Cambodia) to a 42 % reduction GHG reduction compared to 2030 BAU (in Burkina Faso). Base year emission targets were again defined in reference to different base years (e.g. compared to 2010 by Marshall Islands and Grenada, or compared to 2014 by Dominica).

Figure 7. Types of transport-sector mitigation targets defined by Parties in their (I)NDCs (100% = 193 Parties)



Impact of transport commitments in NDCs

This section assesses the impact of transport commitments in NDCs on global transport-sector GHG emissions. First, the applied method, using ITF's transport modelling framework (Box 1), is outlined. The section thereafter provides results and gives information on how results vary across different regions and country groups.

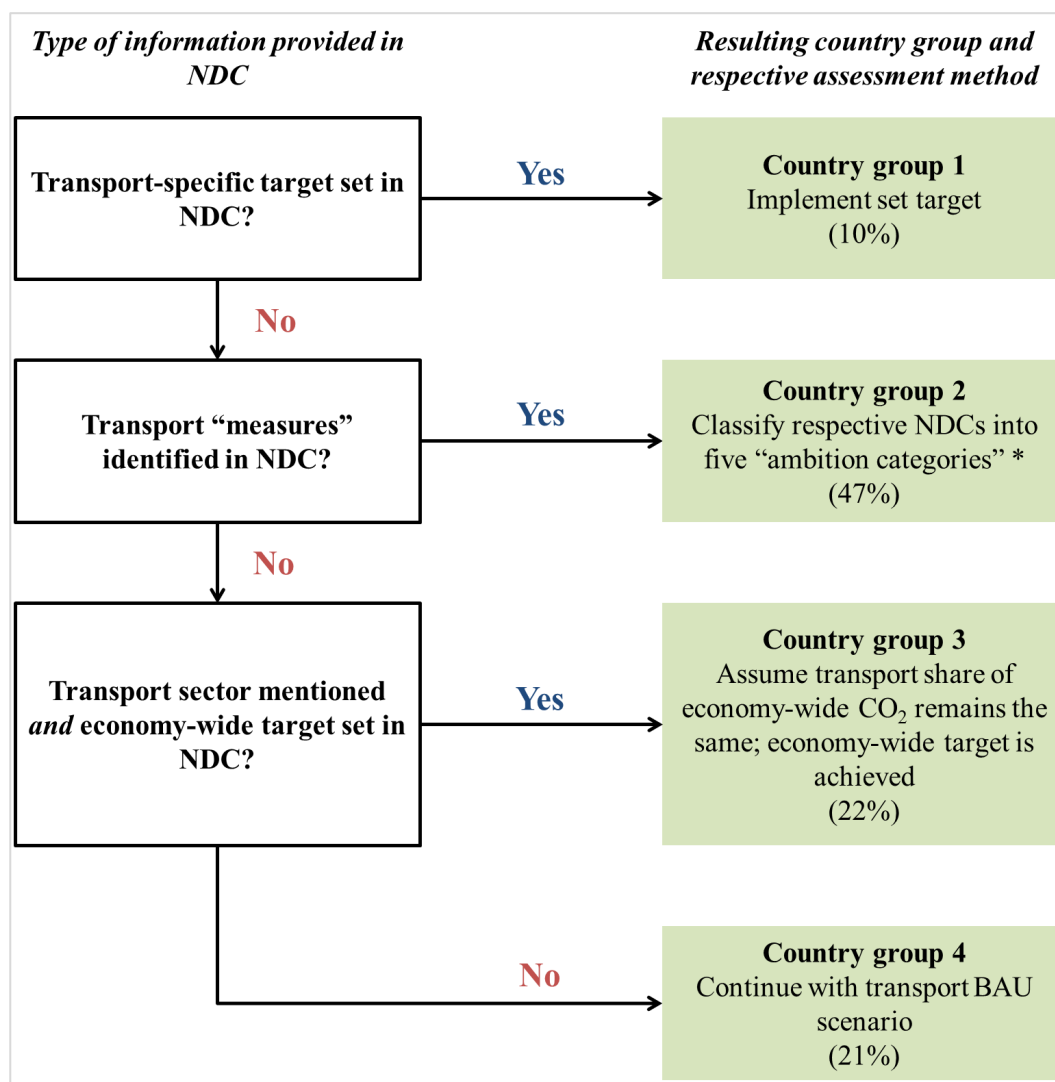
Applied assessment method

As mentioned earlier, assessing the impact of transport commitments in NDCs on global transport-sector CO₂ emissions is not straight-forward. This is because only around 10 % of all Parties indicated transport sector-specific CO₂ reduction targets that can be directly used for such an assessment. For all other Parties, assumptions regarding their transport sector ambitions had to be inferred from the information available in their NDCs. These assumptions may not accurately reflect actual transport-sector ambitions of the respective countries. Avoiding such an assumptions-driven assessment would require more research on, for example, transport-specific policy programmes or plans that may not be mentioned in the countries' NDCs. Such an assessment was, however, out of the scope of this study.

The assessment method established for this study is based on a classification of countries into four different country groups. For each country group, a distinct method is applied to estimate the likely transport-sector CO₂ reduction ambition of the concerned country.

Figure 8 shows the decision tree that was used to classify the countries into the four country groups on the basis of the information that is provided in their respective NDCs. It also outlines the applied assessment method for each of the country groups.

Figure 8. Decision tree to classify countries into country groups and respective assessment methods



Notes: * See Table 5 for a definition of the different ambition levels and the respective assessment methodologies

More specifically, the assessment methods for the different country groups are as follows:

- **Country group 1 (10% of NDCs):** NDCs of countries that fall into this group provide a transport-specific CO₂ reduction target. It is assumed that this target will be met. The achieved transport-sector CO₂ reduction of that country is directly derived. Where the target is defined as reference to a business-as-usual scenario (BAU), it is assumed that the baseline scenario of ITF’s transport modelling framework (Box 1) corresponds to the BAU scenario of the respective country.
- **Country group 2 (47% of NDCs):** NDCs of the respective countries do not provide a specific transport CO₂ reduction target. However, a set of transport “measures” (Table 4) is identified that will contribute to transport-sector CO₂ reductions if implemented in the future. For countries that fall into this group, a further sub-classification, depending on an

‘ambition level’, was introduced (Table 5). The ambition level for the respective countries depends on the exhaustiveness and level of detail of the proposed transport CO₂ reduction measures. The ambition levels were defined by the authors of this study after reviewing all transport measures proposed in all NDCs included in this assessment: countries with NDCs that provide a high level of detail and a comprehensive set of transport measures are assumed to have a ‘high’ ambition level. As a result, transport-sector CO₂ reductions are assumed to be (100%) in line with ITF’s low carbon transport scenario (Box 1). If ambition levels are lower (i.e. the proposed measures are less detailed and/or less exhaustive) CO₂ reductions in transport are assumed to be lower than in the low carbon scenario (i.e. ranging from 25% to 75% of the reductions achieved in the low carbon scenario (Table 5).

- **Country group 3 (22% of NDCs):** NDCs of these countries neither provide any transport-specific target, nor any transport mitigation measures. However, they do mention transport as relevant sector for reducing CO₂ emissions *and* provide an economy-wide CO₂ reduction target. In the absence of any further information regarding the transport sector, it is assumed that the share of transport sector CO₂ emissions will remain stable over time; the economy-wide CO₂ reduction target (e.g. reduction of x% compared to the BAU scenario) is assumed to apply also to the transport sector and to be achieved by 2030.
- **Country group 4 (21% of NDCs):** NDCs of these countries either do not mention the transport sector (19%), or do not provide any further detail on a specific transport-sector target, transport mitigation measures, or an economy-wide target (2%). In the absence of any such further information, it is assumed that transport-sector emissions will grow in line with the respective countries’ baseline scenarios.

Table 5 shows that the transport ambition levels of countries that fall into country group 2 are judged to be moderate (i.e. they are either low or medium for more than 70% of all countries that fall into that group).

Table 5. Ambition levels for NDCs that fall into country group 2

Ambition level	Share of total in country group 2	Description	Applied method
1 Low	42%	Very vague and/or very limited measures (e.g. introduction of vehicle efficiency standards only)	Apply 25% of the reductions of ITF’s Low Carbon (LC) Scenario (compared to its baseline scenario)
2 Medium	31%	Increasingly ambitious ↓	Apply 50% of the reductions of ITF’s LC scenario
3 Medium-high	19%		Apply 75% of the reductions of ITF’s LC scenario
4 High	8%	Specified measures covering most/all modes of transport (e.g. combination of vehicle efficiency, public transport and mode shift measures, incl. land-use planning considerations)	Apply 100% ITF’s LC scenario

Box 1. ITF's modelling framework and transport scenarios

ITF Transport modelling framework: The ITF has developed a set of modelling tools to build its own forward-looking scenarios of transport activity. Covering all modes of transport, freight and passenger, the tools are unified under a single framework. In contrast to existing transport and energy models, the ITF framework first estimates the demand for transport, based on a set of socio-economic drivers (population, Gross Domestic Product, trade, etc.) before analysing the way this demand may be satisfied. This second step includes a detailed modelling of mode choice. Finally, the models compute the CO₂ emissions linked to transport and, depending on the sector, other transport-related variables. The framework can assess the effect of a large range of policies and exogenous impacts. In all models, policies which may impact transport demand or the related CO₂ emissions become input parameters.

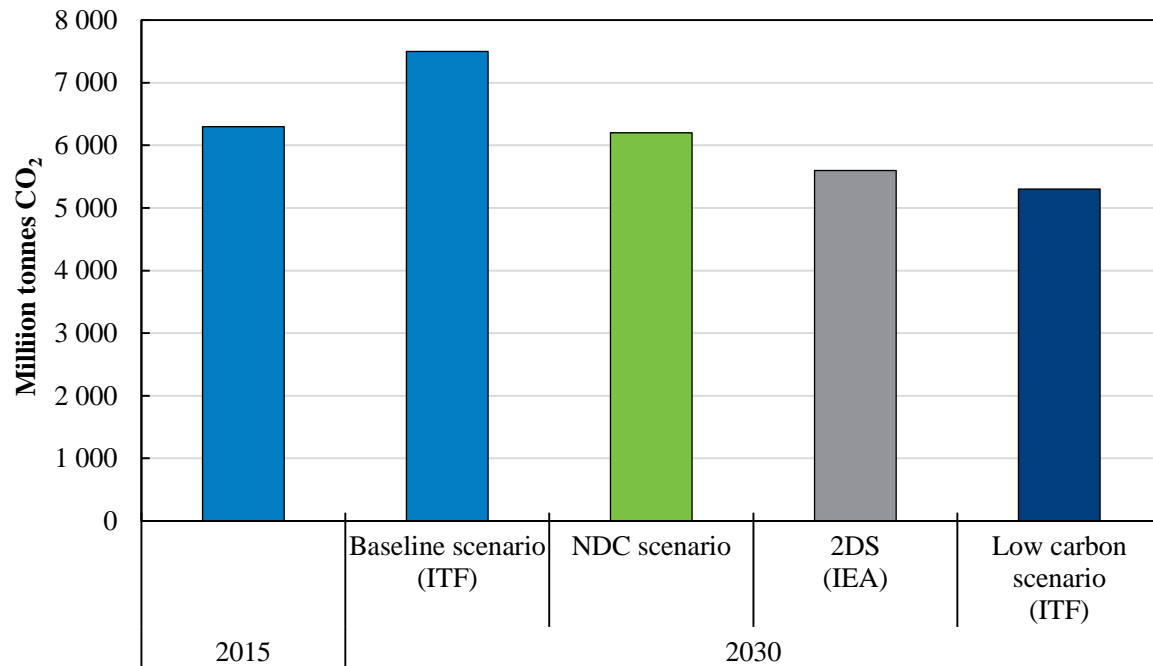
Baseline scenario: The baseline scenario is a projection of current transport trends and includes current policies and policy developments.

Low-carbon scenario: The low-carbon scenario corresponds to the aggregation of the least CO₂-intensive pathways for each transport sector. It results from the combination of the most optimistic scenario from all modes and points to a lower bound for CO₂ emissions for 2050 with currently foreseen technology and mode choice trajectories. It assumes higher efficiency gains for all vehicles, higher fuel taxes, full benefits of vehicle optimisation for road freight and land use and public transport planning in the urban sector.

Source: ITF (2017)

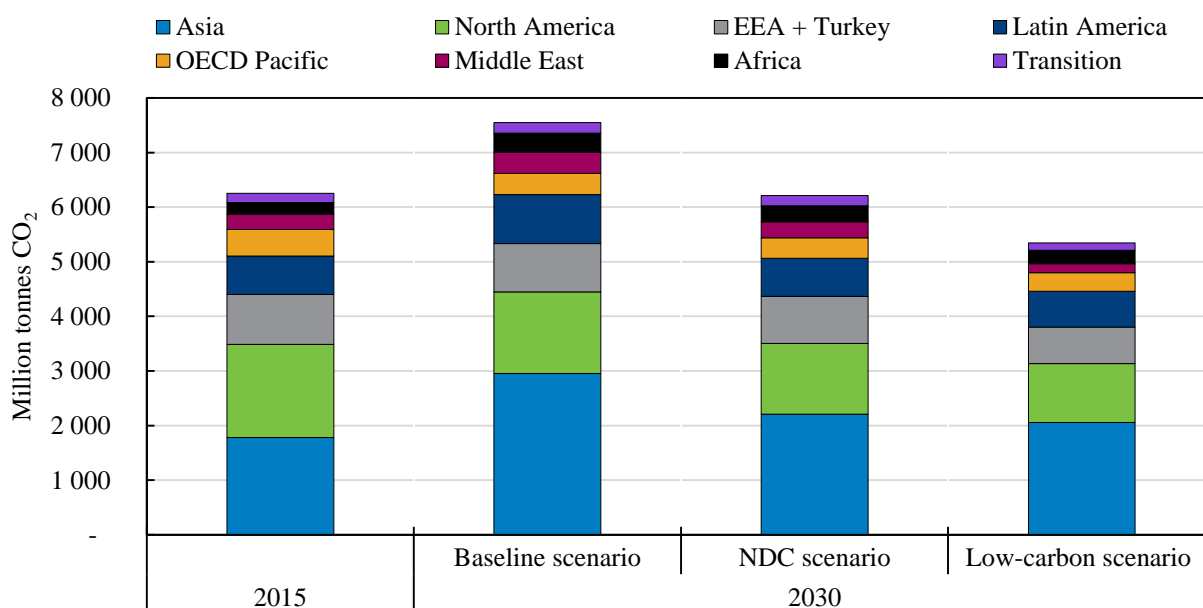
Global results

Figure 9 provides global national-level transport CO₂ emissions projections for the ITF baseline scenario, for the ITF low carbon scenario (Box 1) and the 'NDC scenario' (established on the basis of the assumptions/methodology provided in the previous section). It also provides the International Energy Agency's (IEA) two degree scenario (2DS), which provides the transport CO₂ emissions levels that should be reached by 2030 to limit of limiting the average global temperature increase to 2°C with at least a 50% chance. It can be seen that the NDC scenario is estimated to bring transport CO₂ emissions by 2030 to around the level of 2015. However, the estimated transport CO₂ reduction ambitions of the NDC scenario (a reduction of around 1 300 MT CO₂ compared to the baseline) are insufficient to meet the emissions trajectory of the 2DS scenario (and let alone a WB2DS). They also fail to achieve the emissions reductions that would, according to ITF estimations for the low-carbon scenario, be technologically feasible up to 2030 (by around 900 MT CO₂).

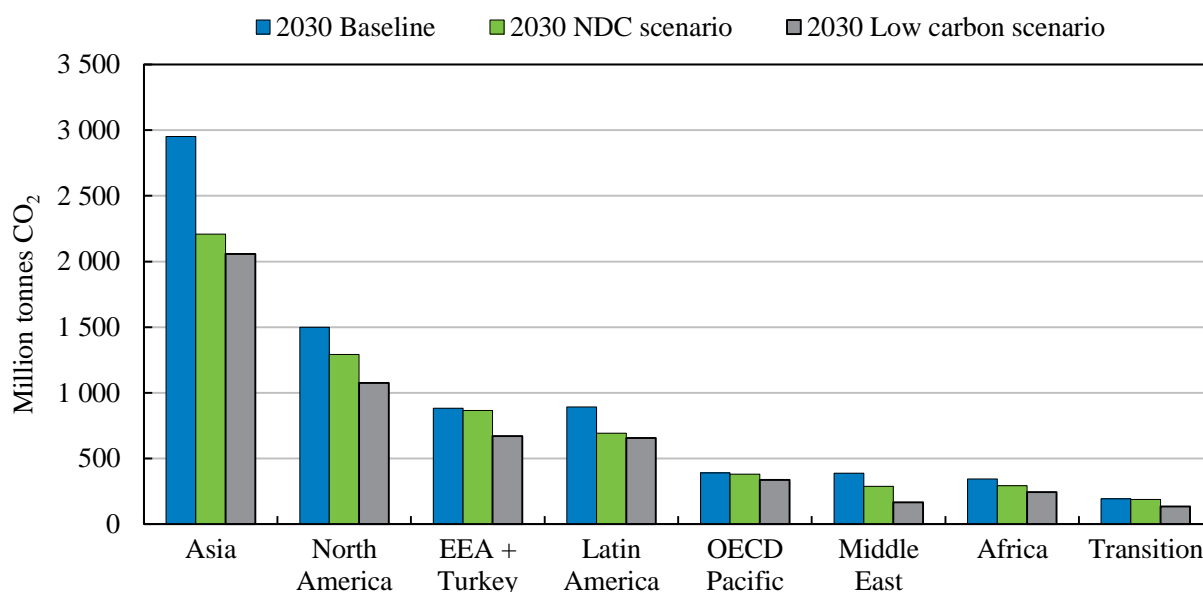
Figure 9. Global national-level transport CO₂ emissions by scenario

Results by region

Figures 10 and 11 show the above results by region. It can be seen that the biggest growth in transport CO₂ emissions between 2015 and 2030 is expected to happen in Asia. However, if estimated NDC reduction ambitions can be materialised, CO₂ levels in 2030 in Asia are close projections of the low-carbon scenario. Also Latin America has ambitions that come close to the low-carbon scenario. The ambitions of other regions come less close to the respective regions' transport CO₂ reduction potentials as estimated in the low-carbon scenario.

Figure 10. Global national-level transport CO₂ emissions by scenario and region (I)

Notes: *Africa*: Sub-Saharan Africa and North Africa; *Asia*: south and east non-OECD Asia; *European Economic Area (EEA) and Turkey*: EU28 and Switzerland, Norway, Turkey, and non-EU Nordic (Iceland); *Latin America*: South America and Mexico; *Middle East*: Middle East including Israel; *North America*: United States and Canada; *OECD Pacific*: Australia, Japan, New Zealand, and South Korea; *Transition*: former soviet countries and Non-EU Southeastern Europe.

Figure 11. Global national-level transport CO₂ emissions by scenario and region (II)

Results by income group

Figures 12 and 13 show results by county income group - countries were grouped into four different groups (low, upper middle, lower middle, and low income) according to their Gross National Income per capita (in US\$) in 2015 (World Bank, 2017).

High income and upper middle income countries were responsible for the main share of transport CO₂ emissions in 2015. This will continue up to 2030 in all scenarios. Especially upper middle income countries are projected to increase their transport CO₂ emissions in the baseline scenario (by around 1 000 MT) in the period from 2015 to 2030. However, also their CO₂ reduction intentions as estimated from their NDCs appear to be more ambitious than for the other income groups – their CO₂ reduction ambitions come close to the projected reduction potentials of the low-carbon scenario.

Figure 12. Global national-level transport CO₂ emissions by scenario and income group (I)

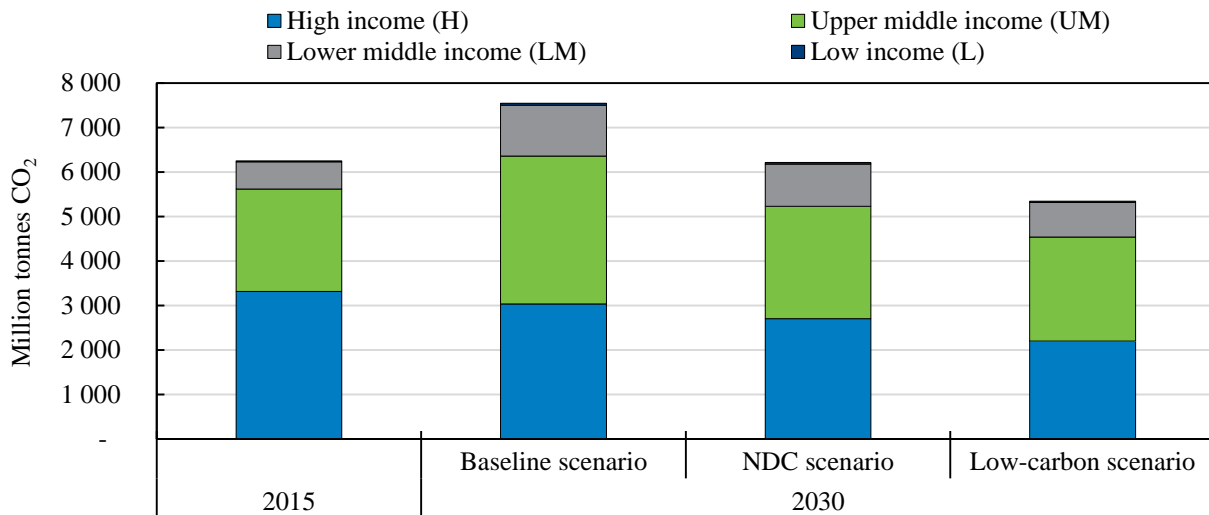
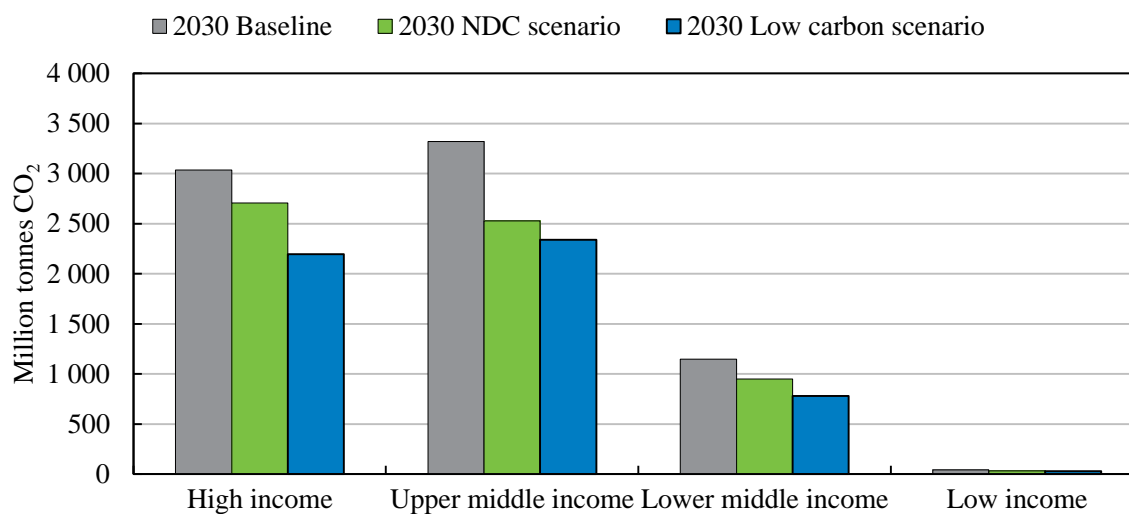


Figure 13. Global national-level transport CO₂ emissions by scenario and income group (II)

Summary and conclusions

This report gives first an introduction to Nationally Determined Contributions (NDCs) and provides an overview of economy-wide CO₂ reduction targets that were defined in these pledges. It then assesses the impact of transport commitments provided in NDCs on national-level transport CO₂ emissions. Given the often limited information in NDCs concerning transport-sector ambitions and planned CO₂ mitigation measures, an assessment methodology was set up that is based on several assumptions. Countries are clustered into four different groups based on transport-related information provided in the NDCs; for each group a distinct method was established to estimate the impact of transport CO₂ mitigation actions/ambitions that are (more or less clearly) defined in the countries' respective NDCs. The methods are based on the use of ITF's transport modelling framework and their baseline and low-carbon scenarios.

Results of the assessment show that the estimated 'NDC scenario' projects global national-level CO₂ emissions in 2030 to attain a similar as in 2015 (reflecting a reduction of CO₂ emissions of around 1400 MT CO₂ compared to a baseline scenario). However, achieving a two-degree scenario (2DS) would require further reductions of around 600 MT CO₂. To attain the level of the low-carbon scenario (a scenario that results from the combination of the most optimistic scenario from all modes and points to a lower bound for CO₂ emissions with currently foreseen technology and mode choice trajectories) further reductions of around 800 MT CO₂ would be required.

Results by region show that especially Asian, upper-middle income countries are planning to exploit most of the currently foreseeable transport CO₂ reduction potential (as per the low-carbon scenario). Other regions appear to leave some of the CO₂ mitigation potential unused up to 2030. Especially the transport CO₂ reductions ambitions of such countries need to be intensified to ensure that the "Well-below 2 degree" ambition, as defined at COP21 in Paris in 2015, can be achieved.

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Transport CO₂ and the Paris Climate Agreement

Reviewing the Impact of Nationally Determined Contributions

This report assesses the impact of transport commitments made in the Nationally Determined Contributions (NDCs) of the Paris Climate Agreement on national-level transport CO₂ emissions. It contains an introduction to NDCs and provides an overview of economy-wide CO₂ reduction targets that were defined in these pledges. The methodology, developed specifically for this report, allows a sectoral assessment despite the often limited information regarding specific ambitions for transport and planned CO₂ mitigation measures.

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