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PARIS PROCESS
ON MOBILITY AND CLIMATE

Partnership on Sustainable Low Carbon Transport

EMISSION REDUCTION POTENTIAL IN THE TRANSPORT SECTOR BY 2030

KEY FINDINGS

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TRANSfer

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Acronyms

AR5	Fifth Assessment Report
BAU	Business-as-usual
BUR	Biennial Update Report
EST	"Environmentally Sustainable Transport" Project
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GT	Gigatonne (1 billion tonnes)
ICCT	International Council on Clean Transportation
IEA	International Energy Agency
INDC	Intended Nationally-Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
ITDP	Institute for Transportation and Development Policy
LCS	Low carbon scenario
MRV	Measurement, reporting and verification
MT	Million tonne (1 million tonnes)
NC	National Communication
OECD	Organisation for Economic Co-operation and Development
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
2DS	Two-degree Celsius Scenario

Executive Summary

The objective of this study is to determine the magnitude of mitigation possible in the transport sector by 2030 considering low carbon policies investigated for implementation or proposed to be implemented or in individual countries. This study is the first known attempt to compare different transport related INDC scenarios against the IEA 2DS, which is generally recognized as a reference scenario for low carbon development within the transport sector. The report assesses a BAU scenario, as well as two hypothetical variants of LCS (average and aggressive) based on available mitigation potential studies, and three different variations of INDC transport related targets.

From 1990-2010 the transport sector was the largest energy consuming sector in 40% of countries worldwide, and in most remaining countries, transport was found to be the second largest energy consuming sector. In 2010, transport emission share in total economy-wide emissions in low, middle and high income countries were 3%, 8% and 22%, respectively. The average emission intensity of transport CO2 emissions relative to GDP decreased 58% between 1990 and 2010.

Under a Business as Usual Scenario, a continuation of current transport activity trends without low carbon policy interventions, could lead to a 55% increase in transport CO2 emissions by 2030 when compared with 2010 levels. Most of the projected transport sector emissions growth would be concentrated in developing countries where emissions are set to grow at a higher intensity (2-4 times) than economy-wide emissions. As countries become richer, the transport emission share in total economy-wide emissions increases. In high-income countries transport CO2 per capita is projected to decrease modestly from 2010 to 2030 (4% reduction); however this is offset by significant increases in middle income countries (125%) and low-income countries (167%).

Transport emissions in 2030 must be below 2010 levels in order to be in line with 2DS scenario. This analysis shows however an emission gap in 2030 of about 3.4 Gt (i.e. a gap of 42%) between BAU and 2DS projections for the 138 countries assessed in this report.

The Low Carbon Scenario developed for this report, on the basis of over 350 global and national level mitigation potential studies shows a growth in transport emissions to 6.2 billion tons of CO2 by 2030, which is equal to a decrease of 24% from the BAU scenario. LCS projections reveal that by 2030, transport emission intensity relative to GDP could decrease by 59%, which is higher when compared to the 46% emission intensity decrease in the BAU scenario (46%). With implementation of the low carbon scenario, the BAU emission gap of 3.4 billion tons relative to 2DS (41%) could be reduced to about 1.5 billion tons of CO2 (a 23% gap).

Investigations carried out by various institutions point to an economy wide emission gap of 11-16 billion tons of CO2 between 2030 economy wide targets in INDCs submitted to the UNFCCC an economy wide 2DS scenario. Only about 10% of INDCs have proposed a transport sector emission reduction target and about 9% and 15% of INDCs, respectively, include estimates of country-level BAU projections and transport mitigation potential estimates. Out of three approaches used in this analysis to compare derived INDC transport targets only in one case such a INDC related transport target would be close to the 2DS scenario and this is judged to be the least realistic of the three approaches.
The analysis concludes that based on current emission trajectories, expected LCS projections and actual transport emission targets, that the mitigation ambition in current INDCs will not be sufficient to achieve a 2DS within the transport sector by 2030.

The outcome of the analysis is cause for concern. If the scenarios described in this document would materialize it means that the transport sector would be not well placed in terms of making its long term (2050 and 2100) contribution to the 2DS. Investments would have been made up to 2030 that would lock in emission patterns that, at least for the medium term, are not compatible with the 2DS. This will require in the short and medium much deeper reductions from other sectors which may not be possible or cost effective, thus substantially increasing the difficulty of an economy wide transitioning to a 2DS pathway.

To address the emission gap low carbon policies (incorporating 'Avoid,' 'Shift,' and 'Improve' strategies) must be scaled up and accelerated to approach a 2DS within the transport sector (e.g. Manage the demand for travel through land-use planning and pricing; promote modal shift to low(er) carbon transport modes; implementing strict fuel economy standards and pricing to leapfrog technologies; promoting electrification and renewables in road transport.

Such a more forceful implementation of low carbon policies (both in scope and intensity), would position the transport sector better to reach 2DS requirements, if not by 2030 then beyond.

I. Introduction

Discussions on medium term climate change policy, e.g. linked to the Intended Nationally Determined Contributions (INDCs), are placing increasing importance on sector specific policies and measures. This study aims to enable the discussion for the land transport sector.[1] It provides a detailed overview of 2030 transport sector CO2 emission projections[2] for business-as-usual (BAU) and low carbon scenarios (LCS). It provides first a bottom-up aggregation of transport emissions growth under BAU and LCS for 138 countries.[3] This analysis is carried out for individual countries with INDC commitments (as of 1 November 2015) (referred to collectively as 'INDC countries'), which are then aggregated into different typologies.

The BAU and LCS are compared both at a global level and then for INDC countries and these scenarios are further compared with a 'two-degree Celsius scenario' (2DS), which considers policies and investments necessary to serve the IPCC-recommended target to limit the rise in long-term average global temperature to 2°C. Apart from mapping out transport emissions for 2030 under different scenarios this study is the first known attempt to analyze the implications of INDC commitments within the transport sector relative to a 2DS.

1 The authors thank Daniel Bongardt , German International Cooperation; Lew Fulton, University California - Davis; Jacob Teter, International Energy Agency; Colin Hughes, Institute for Transportation and Development Policy; Pierpaolo Cazzola, International Energy Agency; and Tali Trigg, German International Cooperation for reviewing this report. They, and Cristiano Façanha, International Council for Clean Transportation; and Nancy L. Vandycke and Andreas Kopp, World Bank are also thanked for their comments on the methodology underpinning the analysis in this report. The responsibility for this report and its conclusions rests solely with the authors.

2 Excluding international aviation and maritime.

3 As of 1st November 2015, 128 INDCs representing about 155 countries were submitted to UNFCCC. Out of these 155 countries, 138 countries had explicit economy-wide emission targets with adequate data required for detailed analysis and thus included in this analysis. The list of the countries considered in the analysis is provided in Annex-I. These countries are referred as INDC countries.

A. Historic Transport Emission Trends

A recent SLoCaT analysis reveals that in 2012, transport was the largest energy consuming sector in 40% of countries worldwide, and in most remaining countries, transport was found to be the second largest energy consuming sector.[4] In 2012, nearly two thirds of countries had a transport sector share of total emissions from fuel combustion greater than the global average of 23%. The share of countries in which transport accounted for more than 30% of total emissions from fuel combustion rose from 34% in 1990 to 47% in 2012 (Figure 1).

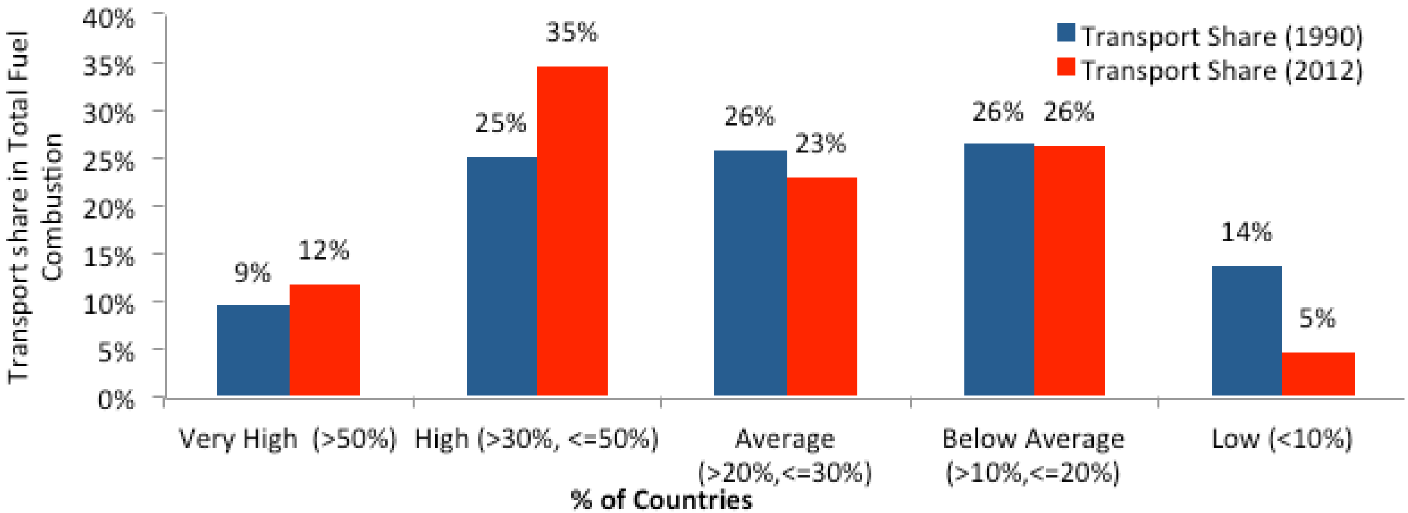


Figure 1: Transport Share of Total Fuel Combustion - Country Distribution[5]

Further, transport emission shares in non-Annex I countries (relative to Annex I countries) increased from 24% in 1990 to 45% in 2012 (Figure 2), due to high growth in transport activity in non-Annex I countries coupled with slower, or in some cases negative, growth in transport activity in Annex I countries, as well as greater deployment of emission reducing measures (e.g. fuel economy standards), in Annex I countries.[6]

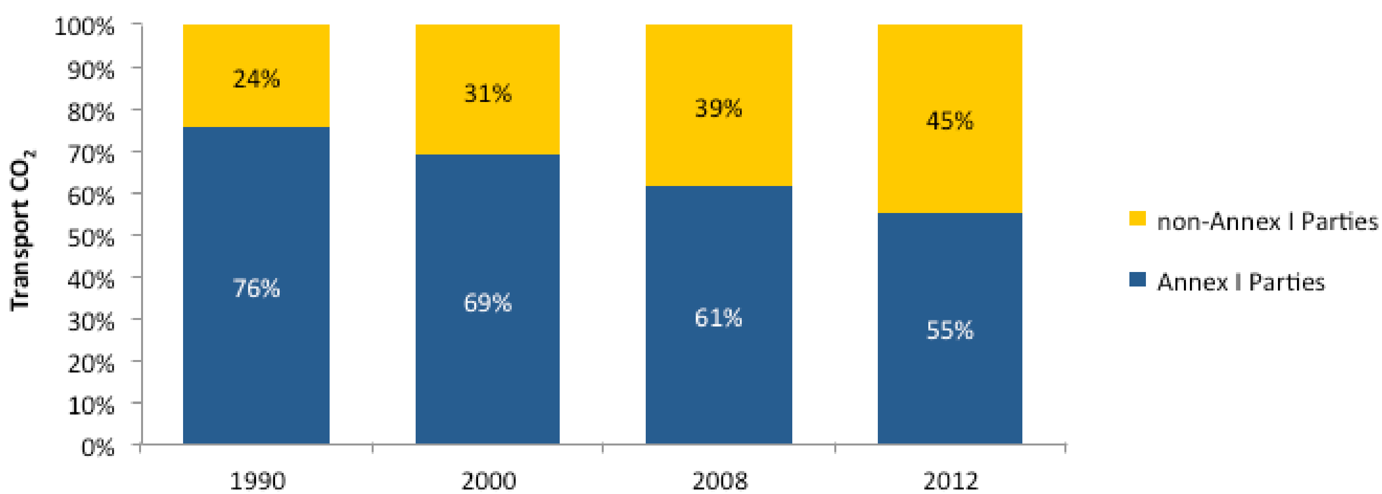


Figure 2: Transport Emissions Share of Annex I and non-Annex I Parties[7]

4 Partnership on Sustainable Low Carbon Transport (2015). SLoCaT Analysis of Transport Emission Trends, Shanghai. Available online at: http://ppmc-cop21.org/slocat-analysis-of-transport-emission-trends/

5 Partnership on Sustainable Low Carbon Transport (2015). SLoCaT Analysis of Transport Emission Trends, Shanghai. Available online at: http://ppmc-cop21.org/slocat-analysis-of-transport-emission-trends/.

6 Annex I Parties include the industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. Non-Annex I Parties are mostly developing countries.

7 Partnership on Sustainable Low Carbon Transport (2015). SLoCaT Analysis of Transport Emission Trends, Shanghai. Available online at: http://ppmc-cop21.org/slocat-analysis-of-transport-emission-trends/

There is a large differentiation among transport emissions trends between individual regions and countries both in the case of Annex I and non-Annex I countries, which underscores the necessity to taking a heterogeneous approach to tackling current and future transport sector emissions worldwide.

These historic transport emission trends underscore the fact that a growing number of countries will have to increase attention to the transport sector if they expect to substantially reduce overall transport related emissions.

B. Study Objectives

The main objective of this analysis is to determine the magnitude of mitigation possible in the transport sector by 2030 considering low carbon policies proposed to be implemented or investigated for implementation in individual countries. This analysis is conducted both on the basis of a large number of country specific policy analyses as well as on the basis of targets for emission reductions put forward in INDCs. This magnitude of possible reduction is compared for both cases with 2DS requirements to determine emission gap in the transport sector at 2030. Maximizing economy-wide mitigation ambition requires optimizing contributions from the transport sector, and this study gives a comprehensive picture of trends in transport emission share, growth, and absolute and per-capita magnitudes among Annex I and non-Annex I countries, which can serve as a key tool in addressing transport emissions in the context of economy-wide emissions.

In summary, this analysis will accomplish the following:

1. Project magnitude and growth of transport sector BAU scenario by 2030.
2. Investigate the magnitude of mitigation possible in LCS if countries implement a series of low carbon policies after 2010.
3. Determine as to what could be the potential impact if low carbon measures are aggressively implemented.
4. Compare how transport emissions (magnitude, share, per capita and emission intensity) compare among different country typologies
5. Determine how transport emissions among different scenarios (i.e. BAU, LCS, and estimated INDC targets) compare to IEA 2DS and determine resulting emission gap in transport sector by 2030.
6. Determine what intensity of reduction is required within transport sector with the current economy-wide commitments to reach 2DS.

10 http://unfccc.int/focus/indc_portal/items/8766.php
11 The UNFCCC secretariat is to prepare by 1 November 2015 a synthesis report on the aggregate effect of the INDCs communicated by Parties by 1 October 2015.
12 The analysis presented in this section is based on review of INDCs submitted till date. For details see Annex I as well a more detailed assessment by country at http://www.slocat.net/docs/1503.
13 UNFCCC Newsroom. 2015. Unprecedented Global Breadth of Climate Action Plans Ahead of Paris. http://bit.ly/1Pf1fq7
14 Regional breakdown is based on World Bank classification, in which 'North America' includes Bermuda, Canada and the United States, and 'Latin America & Caribbean' includes Mexico, Central America, South America, and Caribbean countries.

II. Methodology

This study is one of the most comprehensive attempts in aggregating transport CO2 bottom-up quantifications for BAU and LCS. A detailed literature review was carried out for 138 countries using insights from more than 350 studies to extract detailed bottom-up projections for BAU and LCS.[8] Together these 138 countries represented 80% of global transport emissions in 2010, and it is estimated that they will represent 82% of global emissions in 2020 and 88% by 2030. The detailed desktop review of the more than 350 studies, found that low carbon estimates were available for 62 of the 138 countries with economy-wide emission targets in their INDCs. These 62 countries represent about 95% of total transport emissions from the 138 countries. In order to fill data gaps for the other 76 countries with INDC targets, insights from countries with existing estimates on BAU and LCS are used to interpolate and estimate the emission growth in transport sector for the remaining 76 countries without detailed transport data (which represent about 5% of transport emissions from 138 countries). The projection methodology is described in detail in Annex II.

For each of the 62 countries with detailed data, emission estimates for BAU and LCS from different studies were compiled to determine average values for each for 2020 and 2030. These estimates help generate 'Tier I' National-Level Transport Emissions Factsheets.[9]

Tier I National-level factsheets include the following components:

- Historical and future BAU growth trajectories in the transport sector, based on National Communications (NCs) and Biennal Update Reports (BURs);
- Available transport sector mitigation potential studies derived from modeling efforts by government agencies, development banks, and research organizations; and
- A graphical representation of alternate emissions scenarios in the transport sector, which can help in determining an appropriate degree of mitigation ambition.

Figure 3 shows an example of transport sector emissions overview of European Union countries from Tier I factsheet.

These factsheets help identify how mitigation targets could be developed and improved for transport sector. By providing a detailed overview of historic and projected emissions they could also help in future MRV activities.

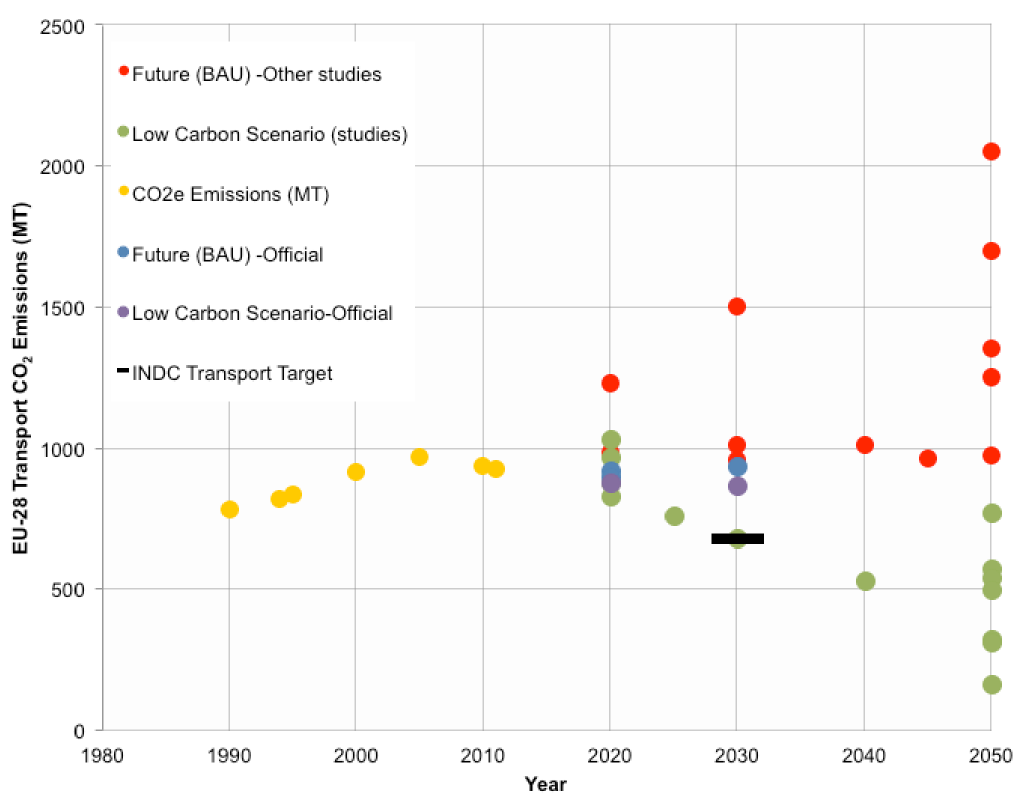


Figure 3: EU-28 Transport CO2 Emissions Overview (Tier I Factsheet Example)

8 Country level references are included in Annex IV.

9 Tier I National Level Emission Fact Sheets, Partnership on Sustainable Low Carbon Transport (2015). Transport GHG Emissions Database: National-level Transport Emissions Factsheets, Shanghai. Available online at: http://www.slocat.net/docs/1518

The aggregated data from Tier I: National-Level Transport Emissions Factsheets also serves as a building block for the analysis and comparison of different scenarios with 2DS scenario. This analysis is carried out for different typology of countries as indicated below:

1. Annex I and non-Annex I countries[10]
2. High-, Medium- and Low-Income countries[11]
3. Geographical regions[12]

The analysis is carried out from 1990 to 2010 (Historic) and 2010 to 2030 (Future). For the different typologies of countries listed above, the emission gap in 2030 and the cumulative emission gap from 2010 to 2030 are estimated.

For countries without detailed data, 'Tier II' national-level transport emissions fact sheets have been developed based on interpolation and estimates derived from an analysis of countries with detailed data.[13] Tier II fact sheets include the following components:

- Historical and future BAU growth trajectories in the transport sector, based on NCs and BURs;
- A graphical representation of transport sector BAU & LCS emissions, relative to an INDC derived transport sector target using its proportional 2010 share of economy-wide emissions, which can help in determining an appropriate degree of mitigation ambition

Figure 4 shows an example of transport sector emissions overview from a from Tier II factsheet for Ecuador.

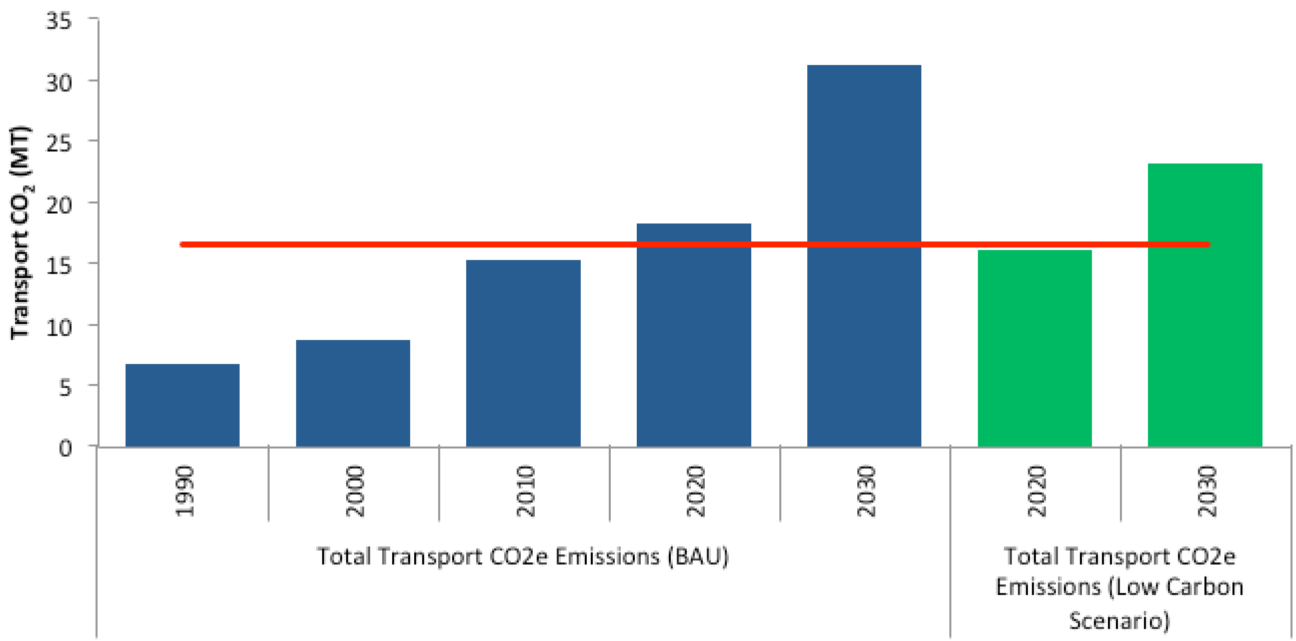


Figure 4: Ecuador Transport CO2 Emissions Overview (Tier II Factsheet Example)

The detailed methodology for producing national-level transport emissions fact sheets is described in Annex II, and the projected country specific values generated by this analysis are provided in Annex III.

10 Parties to the UNFCCC classified as Annex I (43) and non-Annex I (154).
11 Based on economies by per capita GNI in 2012. United Nations World Economic Situation and Prospects 2012. Available online at: http://www.un.org/en/development/desa/policy/wesp/wesp_archive/2012wesp.pdf
12 Regional classification is in terms of International Energy Agency (2015). World Energy Model (WEM) Documentation, Paris. Available online at: http://www.worldenergyoutlook.org/weomodel/documentation/
13 Tier II National Level Emission Fact Sheets. Partnership on Sustainable Low Carbon Transport (2015). Transport GHG Emissions Database: National-level Transport Emissions Factsheets, Shanghai. Available online at: http://www.slocat.net/docs/1518

III. Understanding & Analysis of the Scenarios

This report presents several different scenarios and future emission trajectories, which are differentiated mainly by intensity and implementation of low carbon policies and certain assumptions about future growth. The cornerstone of this analysis is the comparison of different scenarios with the International Energy Agency (IEA) 2DS related transport sector emissions projections. The IEA 2DS is widely acknowledged as the reference scenario for low-carbon development compliant with a future in which temperature increases would be limited to 2 Degrees Celsius by 2100.

Following a description of the IEA 2DS scenario for transport sector emissions three scenarios are developed and discussed in detail. Based on information availability and to ensure comparability the three scenarios are developed for 138 countries (i.e. INDC countries):

1. Business-as-usual projections for transport sector emissions by 2030 (138 Countries);
2. Low carbon scenario for transport emissions by 2030 (138 countries); and
3. 2030 estimated transport emission targets based on INDC 2030 economy-wide targets (138 countries).

A. IEA - 2DS Scenario

1. Description

This scenario considers policies and investments necessary to serve the IPCC-recommended target of limiting the rise in long-term average global temperature to 2 °C above pre-industrial levels. For this study, an economy-wide global 2DS scenario is considered from the UNEP Emission Gap Report,[14] while a transport sector-specific 2DS scenario is considered from IEA Energy Technology Perspectives 2012.[15]

The IEA 2DS scenario sets a target of cutting global energy-related CO_2 emissions by more than half in 2050 (compared with 2009) and ensuring that they continue to fall thereafter. Importantly, the 2DS acknowledges that transforming the energy sector is vital, but not the sole solution as non-energy sectors also needs to make significant contribution in support of a 2DS.

The 2DS is broadly consistent with the World Energy Outlook (WEO) 450 Scenario[16] (referring to concentration levels of 450 parts per million in the atmosphere). Fundamentally, this scenario is not a future projection but rather a desired outcome based on detailed investigations and it serves as the benchmark in this analysis.

The policy framework assumed in the transport sector underpinning the 2DS scenario for transport includes six key pillars:[17]

1. International sectoral agreements in the passenger light-duty vehicles (PLDV) sector and aviation (both domestic and international), which provide CO2 emission limits for new cars and aircraft in all countries;
2. Full technology spill-over from PLDVs to light commercial vehicles (LCVs);
3. Improve efficiency of medium- and heavy-duty vehicles to achieve the maximum economic potential by 2040;
4. Alternative fuel support policies;
5. National policies and measures in other segments of the transport sector, (including Avoid and Shift related measures);
6. Retail fuel prices are kept (through taxation in OECD countries and subsidy removal in non OECD countries) at a level similar to that reached in the New Policies Scenario.

The analysis in this report modifies the global IEA 2DS requirement for the transport sector by applying the global transport 2DS requirement to 138 countries based on the share of 138 countries in the global transport emission share for 2020 and 2030.[18] This modified 2DS scenario utilized for the analysis of the 138 countries is described in detail in the next section i.e. BAU scenario. Since, the focus of this study is to compare aggregated emissions from different scenarios in individual countries, international aviation and maritime emissions are neglected as they are not considered in individual country projections. International aviation and maritime emissions are therefore deducted from the 2DS scenario.[19]

14 United Nations Environment Programme (UNEP) (2015).The Emission Gap Report 2015-Executive Summary. Available online at: http://uneplive.unep.org/theme/index/13#indcs
15 International Energy Agency (2012). Energy Technology Perspectives 2012 - Pathways to a Clean Energy System, Paris. Available online at: https://www.iea.org/publications/freepublications/publication/ETP2012_free.pdf
16 International Energy Agency (2015). World Energy Model (WEM) Documentation, Paris. Available online at: http://www.worldenergyoutlook.org/weomodel/documentation/
17 It has been argued that the IEA 2DS underestimates the emission reduction potential of the transport sector because of the strong focus on technology related policies in its analysis and limited emphasis on retaining, or expanding the modal share of walking and cycling as well as public transport for passenger transport and expanding the modal share of railways and inland shipping for freight transport.
18 2DS global is scaled to (138) INDC countries using the projected transport sector emissions share INDC within these countries in 2020 and 2030 (i.e. 82% and 88% respectively).
19 IEA recently established that despite several efforts to limit emissions from international transport, marine and aviation bunkers, they are growing faster than road transport emissions. International

2. Findings

The IEA projects global 2DS requirements[20] for the transport sector to produce no more than 5.45 billion tons of CO2 emissions in 2030 i.e. approximately at about the same levels as 2010 (Figure 5). For INDC countries (138), this translates to about 4.79 billion tons of CO2 emissions.

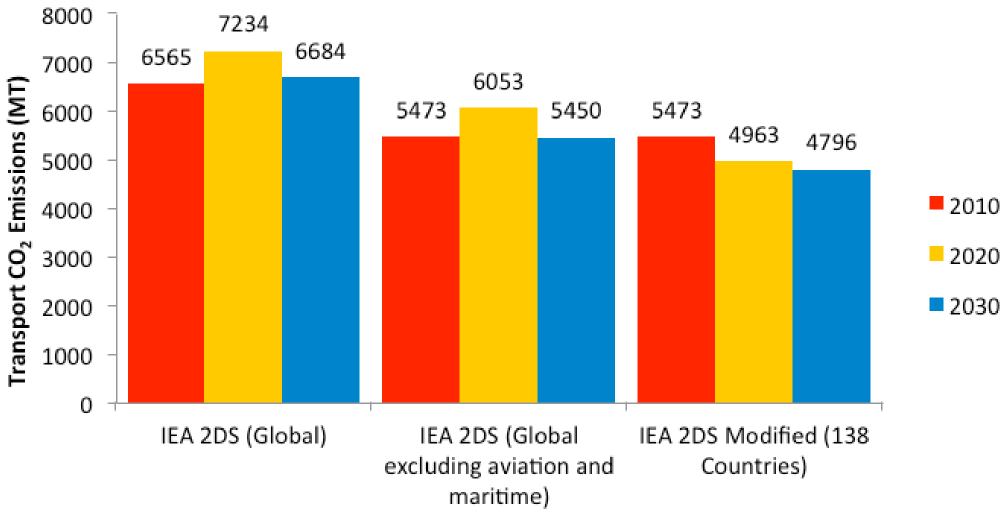


Figure 5: Transport CO_2 2DS Emissions

The total magnitude of emissions for 2DS requirement by 2030 for different regions is highlighted in Figure 6. While transport sector emissions in 2030 are projected to be largely the same as in 2010, there are significant variations among different regions due to varied socio-economic characteristics and mitigation potential within the transport sector. For example, under a 2DS, transport emissions are set to decrease by 37% in OECD Europe and by 86% in Non-OECD Asian countries from 2010 levels by 2030 (Figure 6).

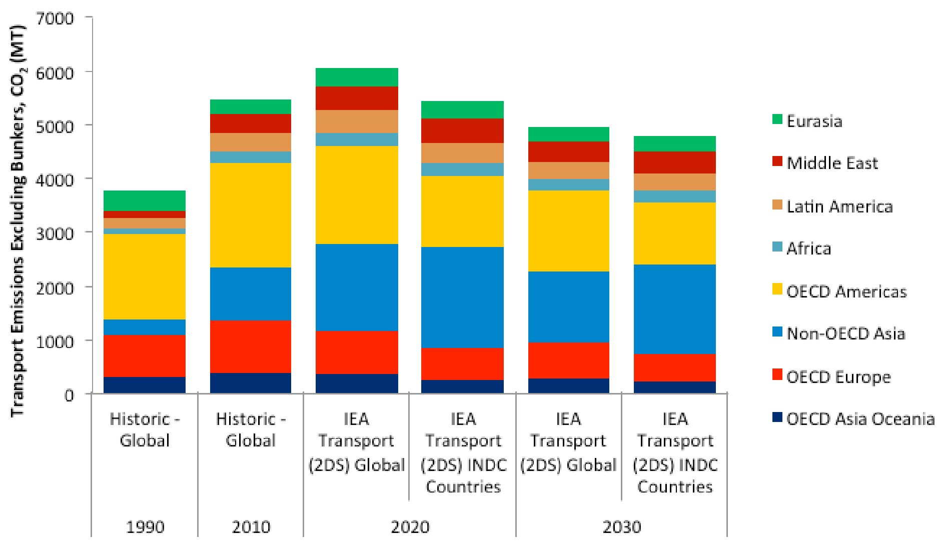


Figure 6: Transport 2DS Scenario Emissions 1990 – 2030 by Region

Under the 2DS scenario, the 2030 transport share in total economy-wide emissions is about 16%,[21] which is very close to the current global share of 15% in 2010.[22] This implies that in order to reach 2DS scenario, transport emission share within economy-wide emissions should not increase significantly (i.e. transport sector would need to restrict emissions at a similar rate as other sectors).

Energy Agency (2015). CO2 Emissions From Fuel Combustion Highlights 2015. Available online at http://www.iea.org/publications/freepublications/publication/co2-emissions-from-fuel-combustion-highlights-2015.html

20 Neglecting international aviation and maritime emissions. International Energy Agency (2012). World Energy Outlook 2012, Paris. Available online at: http://www.worldenergyoutlook.org/weo2012/

21 When compared with economy-wide 2DS requirements as indicated in United Nations Environment Programme (UNEP) (2015).The Emission Gap Report 2015-Executive Summary. Available online at: http://uneplive.unep.org/theme/index/13#indcs

22 Considering 2010 global GHG emissions excluding land-Use change and forestry (MtCO2e) as 42968 MT. CAIT Climate Data Explorer (2015). Washington, DC: World Resources Institute. Available online at: http://cait.wri.org.

B. Business-as-usual Scenario

1. Description

BAU projections forecast emissions on an assumption that no additional low carbon policy actions are adopted and they are estimated assuming continuation of transport sector investment's to keep the existing transport capacity operational for full length of analysis. This scenario takes into account economic forecasts but does not envisage shifting transport related investments to more low carbon modes. The global average BAU scenario is considered by combining results from several models as reviewed in the Fifth Assessment Report (AR5) of Working Group III of the Intergovernmental Panel on Climate Change (IPCC)[23] and other estimates such as IEA 6DS[24] and ICCT-Roadmap.[25]

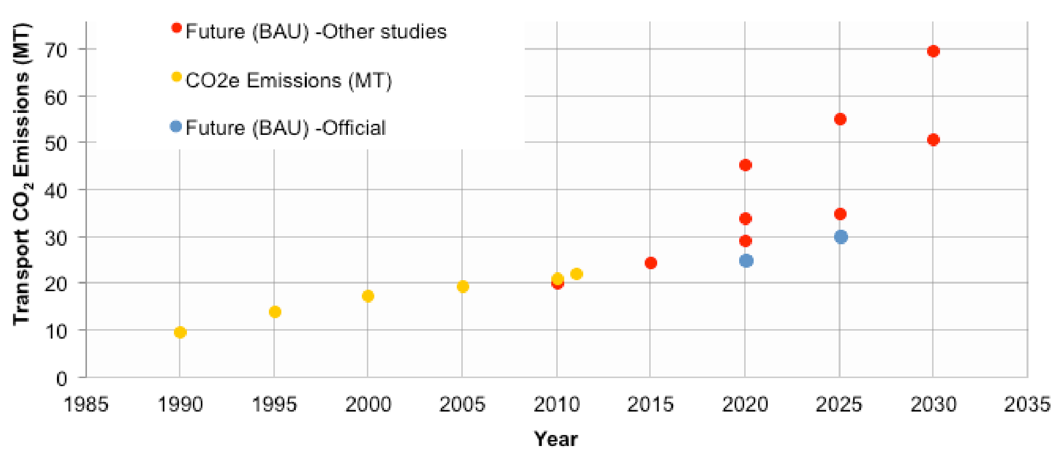
This study develops country specific BAU projections for 138 countries with INDC commitments based on INDC submissions till 1st November 2015. These countries constitute about 80%, 82% and 88% of 2010, 2020 and 2030 global transport BAU emissions, respectively. Of 138 countries considered in the analysis, BAU estimates are derived from external studies for 62 countries which represent 77% of global transport CO2 emissions (Box 1 illustrates Tier I fact sheet from Chile). For the other 72 countries, where country specific BAU estimates are not available, sketch BAU projections are provided (via Tier II fact sheets) based on certain assumptions. The detailed methodology and the list of countries with type of BAU projection is provided in the Annex I and II.

Box-1: Chile BAU Projection

In Chile, transport sector contributes 23% to total national GHG emissions. Between 1990 to 2010, GHG emissions from all sectors combined increased by 84% where as transport sector grew at 138% over the same period. Projections established in national communication for transport sector suggests a growth of 44% between 2010 to 2025 (Chile. Second National Communication of Chile) with transport emissions growing to 30 MT by 2025. However, estimates by World Bank (Partnership for Market Readiness, Activity 4: Study on the Chilean National Situation), University of California, Davis (O'Ryan, Raúl and Thomas S. Turrentine (2000) Greenhouse Gas Emissions in the Transport Sector 2000-2020: Case Study for Chile. Institute of Transportation Studies, University of California, Davis) and PROGEA (National Energy Strategy 2012-2030, Chile) projects transport emissions to reach about 50 to 70 MT by 2030 which are higher than the official estimates. The variation in BAU projections in different studies is mainly due to different assumptions regarding socio-economic characteristics, travel demand and behaviour and due to utilization of different emission models.

Considering the BAU projections by 2020 and 2030 vary within the range of 29-45 MT and 50 to 70 MT respectively, the average BAU transport emission trajectory is considered to reach 35 MT by 2020 and 60 MT by 2030.

Figure 1 Transport 2DS Scenario Emissions 1990 – 2030 by Region



CHILE - TRANSPORT GHG EMISSIONS

23 Intergovernmental Panel on Climate Change (IPCC) (2014). Fifth Assessment Report (AR5) of Working Group III - The IPCC AR5 Scenarios Database. Available online at: http://www.iiasa.ac.at/web/home/research/researchPrograms/Energy/IPCC_AR5_Database.html

24 International Energy Agency (2012). Energy Technology Perspectives 2012 Pathways to a Clean Energy System, Paris. Available online at: https://www.iea.org/publications/freepublications/publication/ETP2012_free.pdf

25 The International Council on Clean Transportation (2012). Global Transportation Energy and Climate Roadmap, Washington DC. Available online at: http://www.theicct.org/sites/default/files/publications/ICCT%20Roadmap%20Energy%20Report.pdf

2. Findings

Global BAU average emission projections and its comparison with global 2DS is provided in Figure 7. Estimates suggest that by 2020 and 2030, respectively, global annual transport emissions could increase to 7.9 and 9.3 Gt of CO_2 i.e. an increase of about 23% and 41% above global 2DS[26].

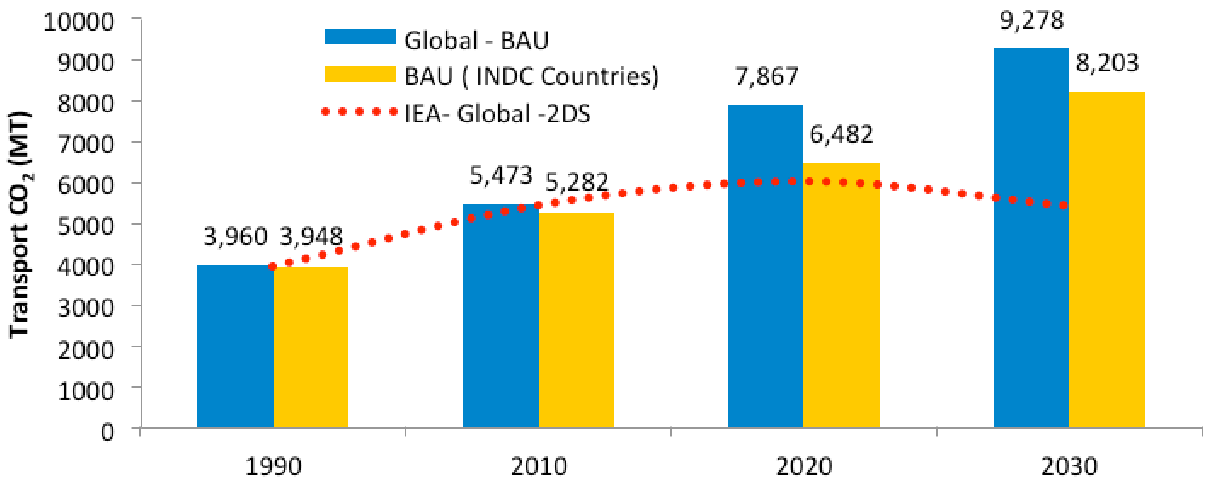


Figure 7: Transport BAU Growth for Global & INDC Countries

The BAU projection for the INDC countries (i.e. for 138 countries) indicates that emissions from the transport sector could grow to 8.2 billion tons of CO2 (55% increase from 2010) by 2030 (Figure 8). This implies that the detailed country specific bottom-up approach to building a BAU scenario for INDC countries confirms the global BAU scenario, that was drawn up making use of a more limited set of global sources.

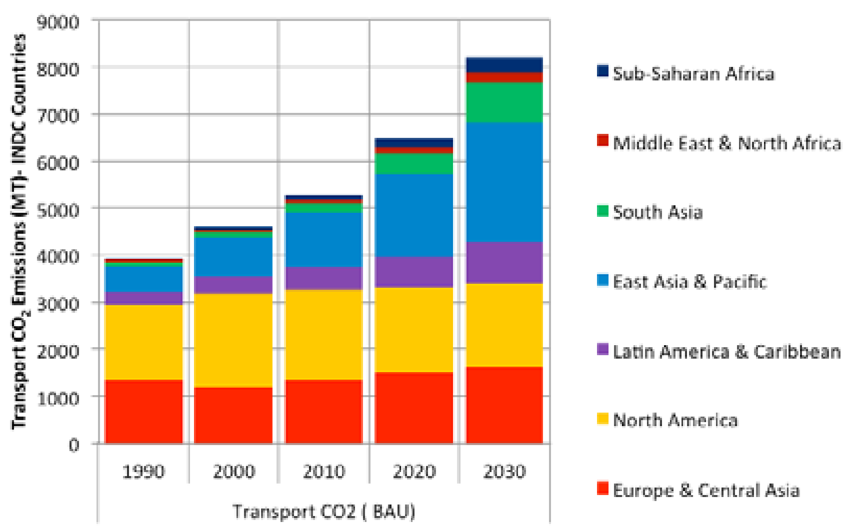


Figure 8: Transport BAU Emissions Projections for Different Regions (INDC Countries) 1990 - 2030

The majority of the transport sector emissions growth would be concentrated in developing countries in Asia, the Middle East and North Africa and Sub-Saharan Africa. In the BAU scenario, the emission share of Europe & Central Asia and North America is set to decrease from 62% in 2010 to 42% in 2030.

The BAU increase in transport emissions in INDC countries is about 55% which is slightly higher than the economy-wide emission increase (excluding land use) of about 49% from 2010 to 2030.[27]

26 These estimates do not consider international aviation and maritime emissions i.e. deducting 1 Gt from 6.5 Gt in 2030. International Energy Agency (2012). World Energy Outlook 2012. Paris. Available online at: http://www.worldenergyoutlook.org/weo2012/

27 Economy-wide projections are from the United Nations Environment Programme (UNEP) (2015).The Emission Gap Report 2015-Executive Summary. Available online at: http://uneplive.unep.org/theme/index/13#indcs

In developing countries i.e. middle and low income countries, emissions from the transport sector are set to grow at a higher intensity (2-4 times) than economy-wide emissions.[28] Figure 9 shows this higher increase in transport sector emissions when compared with economy-wide emissions. For example, South Asia and Sub-Saharan Africa show highest intensity of transport emissions growth with increases of 367% and 216% from 2010 to 2030. (However, for economy-wide emissions the increase in South Asia and Sub-Saharan Africa is only 118% and 79%). Generally, as income grows, the economic structure shifts from agriculture to industry to services, which increases transport's share of total economy-wide emissions. In developed economies, especially Annex I countries, economy-wide and transport sector emissions are projected to increase modestly with transport sector emissions growing more slowly than economy-wide emissions[29].

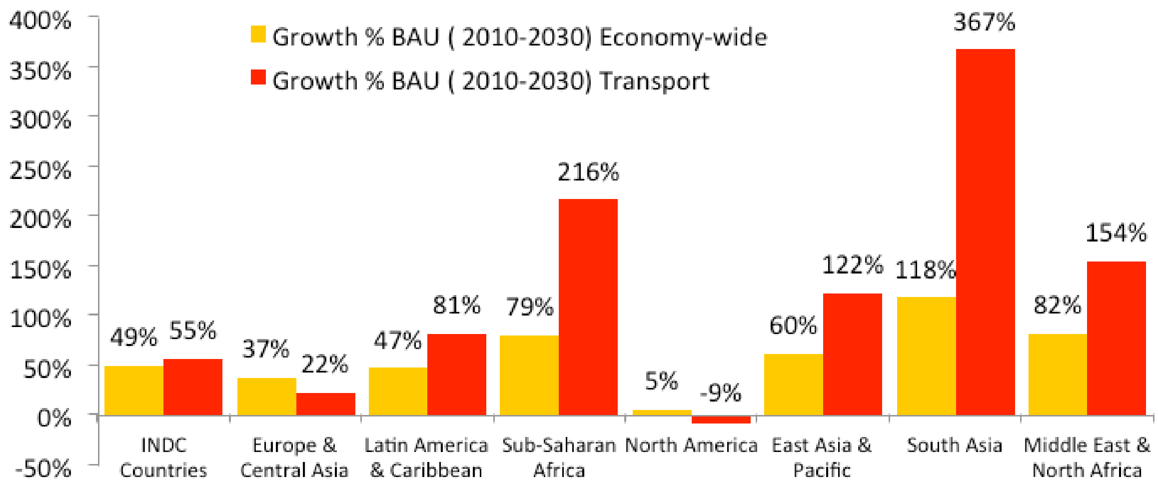


Figure 9: Economy-wide & Transport BAU Emissions Growth for Different Regions 2010-2030

The current share of transport in total economy-wide emissions is about 14% for the 138 countries included in this report. However, there is significant variation in transport emission share based on income levels. Generally, as the countries become richer, the transport emission share in total economy-wide emissions increases as transport sector grows more intensely than other sectors (Figure 8).[30]

28 It is important to note that regional and sectoral differences in contributions to global emissions could conceal even larger differences among individual countries and thus it is important to keep track of individual country and sectoral contribution. SLoCaT has developed National-Level Transport Emissions Factsheets which provide (historical and future) transport sector contribution to economy-wide emissions for 138 countries. Partnership on Sustainable Low Carbon Transport (2015). Transport GHG Emissions Database: National-level Transport Emissions Factsheets. Shanghai. Available online at: http://www.slocat.net/docs/1518

29 it is interesting to note that transport sector currently accounts for about a quarter of EU GHG emissions. While in other sectors, GHG emissions have been decreasing, in the transport domain they have risen by as much as 30% over the past 25 years. However, future projections reveal that transport sector could grow lower than economy-wide emissions from 2010 to 2030. This could be due to high intensity of actions already undertaken in the transport sector when compared to other sectors and due to peak travel where the demand for passenger travel reaching saturation in OECD countries.

30 As economies shift from agriculture to industry to service, both the magnitude of transport CO_2 emissions and its share in economy-wide emissions rise.

For example, in 2010, the average transport emission share in total economy-wide emissions in low, middle, and high income countries analysed in this report were 3%, 8%, and 22%, respectively. Due to existing and already agreed upon low carbon policies, the transport emission share in high income economies, would decrease by 2030 when compared with 2010 levels. In middle- and low-income countries (mostly non-Annex I countries), the transport emission share under the BAU scenario will increase significantly by 2030 when compared with 2010 levels (Figure 10).

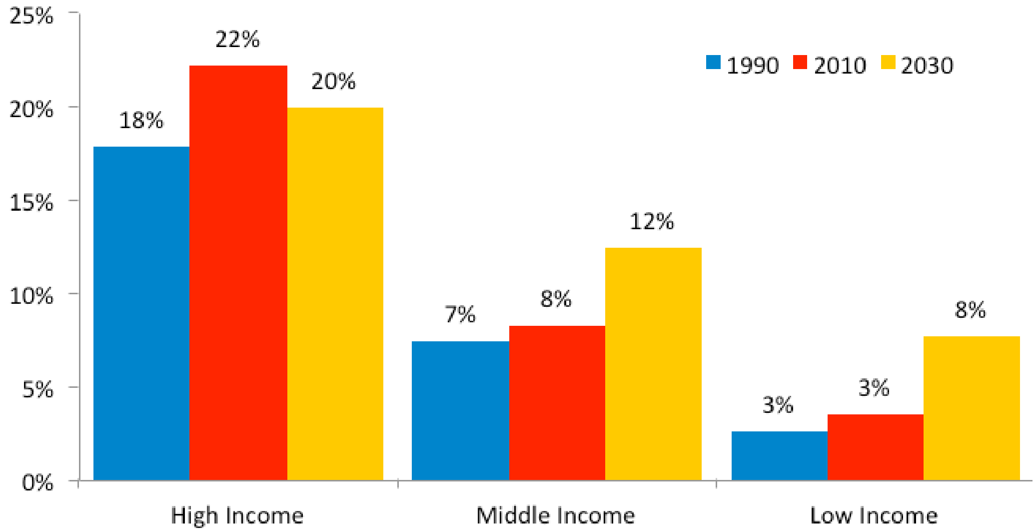


Figure 10: Transport Emission Share in Economy-wide Emissions, 1990-2030

The average emission intensity of transport CO2 emissions with gross domestic product (GDP) for the countries with INDC commitments was 0.16 kg of CO2 per dollar of GDP in 1990 and this decreased by 58% to 0.06 kg of CO2 per dollar of GDP in 2010. Future projections reveal that by 2030, the emission intensity would further decrease by 46% to 0.04 kg of CO2 per dollar of GDP (vs. 2010) without undertaking any additional low carbon efforts within the transport sector (Figure 11).

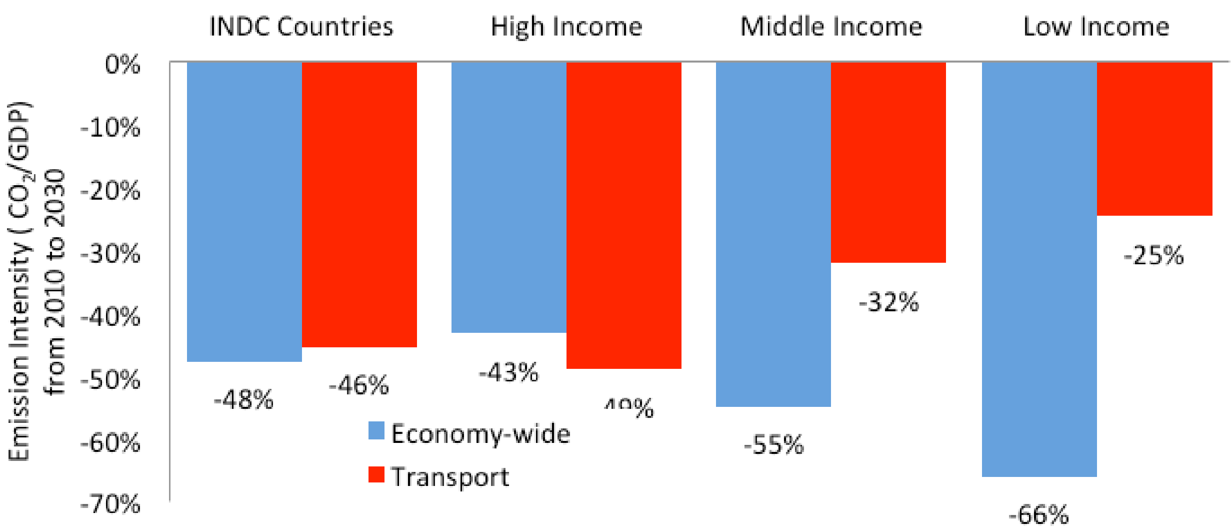


Figure 11: BAU Transport Emission Intensity with GDP Growth (2010 - 2030)

The decrease in emission intensity in transport sector closely follows the economy-wide GDP emission intensity; i.e. a decrease of 60% and 48% between 1990 to 2010 and 2010 to 2030. It is noteworthy that transport-related emission intensity reductions in high level income countries are considerably more favourable than in middle- and especially low-income countries when compared to economy-wide emission reduction intensities. This indicates a weak decoupling of emissions with GDP (i.e. when emission growth is lower than economic growth).

However, as indicated there is a significant variation among different typology of countries. High income economies reduce the emission intensity at a much faster rate when compared with low and middle income economies. They also reduce transport emission intensity at a much higher rate when compared with economy-wide emissions. In a BAU scenario, however, the developing economies (i.e. middle-and low-income economies) reduce economy-wide emissions at a much faster rate when compared with transport sector emissions. This emission intensity behaviour replicates transport emission share characteristics between developed and developing economies described earlier (i.e. an increase in transport emission share in developing countries, and a reduction in emission share in developed economies).

There is a significant variation as well in transport emissions per capita in different income level countries, as shown in Figure 12. For developed economies i.e. high income countries, 2010 transport emissions per capita were 2.8 to 3 tonnes/capita. However, in the developing countries it varied from 0.1 to 0.4 tonnes/capita.

The average transport emissions per capita under the BAU scenario are expected to increase at a much higher rate from 2010 to 2030 when compared with 1990 to 2010. For example, for 138 countries with INDC emission targets, the 1990 to 2010 increase was only 5% but the expected increase from 2010 to 2030 is 31%. In high income economies the transport CO2 per capita decreases modestly from 2010 to 2030 (4% reduction). This is compensated however by large increases of 125% compared to 2030 in middle-income countries and 167% in low-income countries.

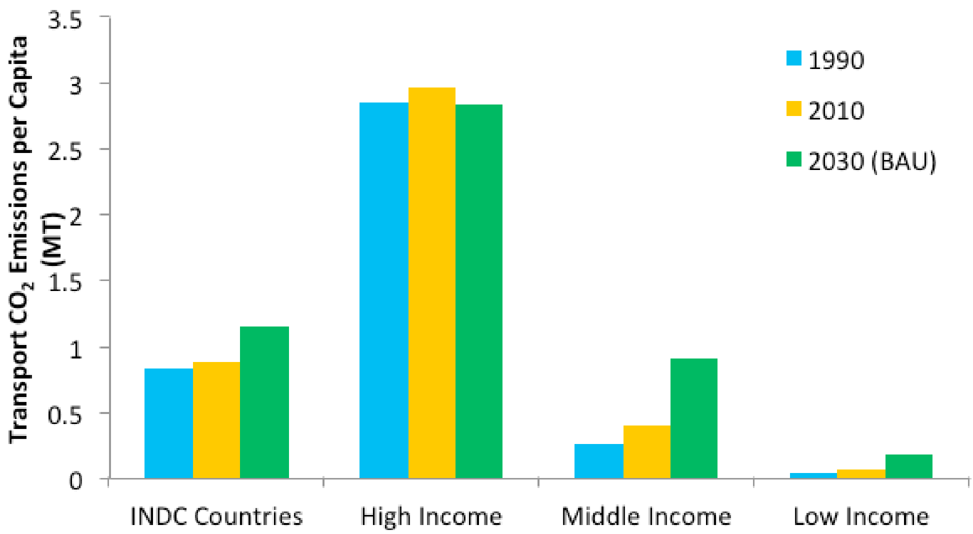


Figure 12: Transport Emission per Capita (BAU) by Income Level, 1990-2030[31]

31 SLoCaT Partnership analysis based on data collected for 138 countries studied in the report and from 350+ mitigation potential studies underpinning analysis in this report (see Annex IV).

3. Comparison to 2DS

Different estimates suggest an economy-wide emission gap of 15-20 billion tonnes by 2030 between BAU and 2DS scenario.[32] The global share of transport in this economy-wide emission gap at 2030 is about 19% to 26%.[33] This underscores the importance of transport sector engagement in economy-wide mitigation efforts.

Figure 13 shows the comparison of BAU scenario of INDC countries with the 2DS scenario[34] i.e. an emission gap in 2030 of about 3.4 Gt (i.e. a gap of 42%).

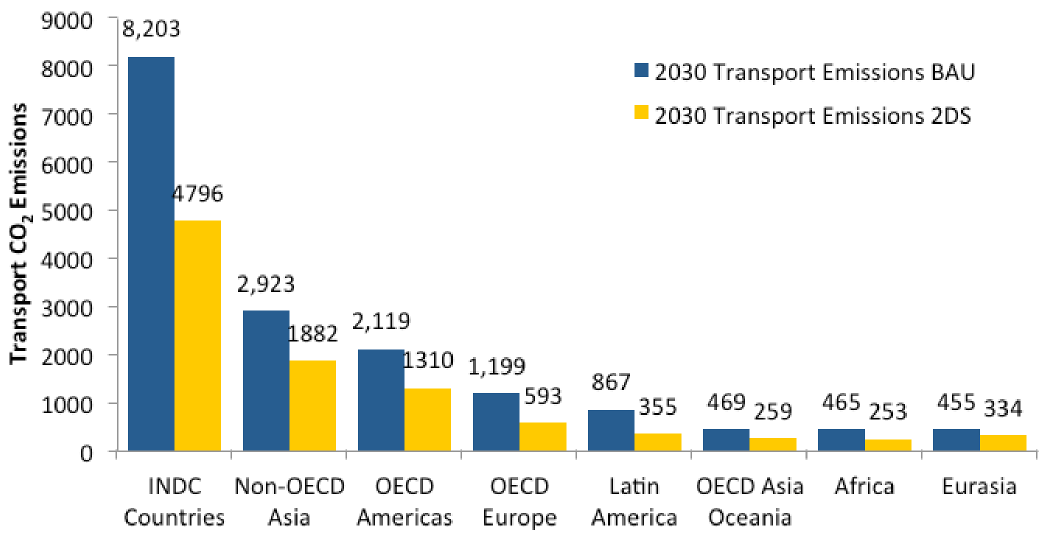


Figure 13: Transport BAU and 2DS Scenario Emissions in 2030

C. Low Carbon Scenario

1.Description

The Low Carbon Scenario (LCS) considers significant additional policy measures and investments in low carbon modes which allows the transport sector to deviate from the BAU emission trajectory. Low carbon measures include a combination of 'Avoid' strategies, which reduce the need to travel (e.g. transport demand management); 'Shift' strategies, which move transport trips to more efficient modes (e.g. public transport improvements or mode shift for freight); and 'Improve' strategies, which increase the efficiency of existing trips (e.g. fuel economy standards). This scenario may include different policy options either in combination or in isolation as determined based on several factors such as local priorities, costs, marginal abatement cost curves, benefits and co-benefits.

The LCS emissions in this study are a bottom-up scenario reflecting local priorities. The scenario is aggregated using low carbon measures that are proposed to be implemented or investigated for implementation in individual countries after considering a combination of local development needs and priorities, costs, co-benefits and multi-criteria assessment.

Of the 138 countries considered in the analysis, LCS estimates for 62 countries are derived after detailed literature survey from more than 350 studies (Box 2 illustrates an example from Chile in which two studies were considered to derive an average low carbon scenario). Attempts were made to identify at least two to three low carbon studies per country and then the LCS projections were averaged (simple average).[35]

32 United Nations Environment Programme (UNEP) (2015).The Emission Gap Report 2015-Executive Summary. Available online at: http://uneplive.unep.org/theme/index/13#indcs

33 Considering economy-wide BAU emissions of 57,000 to 62,000 MT from overview in United Nations Environment Programme (UNEP).2015.The Emission Gap Report 2015-Executive Summary. Available online at: http://uneplive.unep.org/theme/index/13#indcs

34 Comparisons with 2DS are made on the basis of recalculated 2DS taking into account that analysis is for 138 countries only (excluding international aviation and maritime emissions).

35 It is important to note that for each particular country, LCS projections from different studies and sources can vary significantly due to a number of factors (e.g. methodology, socio-economic projections, type and source of data, and differing intensity, timeline and magnitude of policies modelled).

Box 2: Typology of Low Carbon Transport Policy Measures

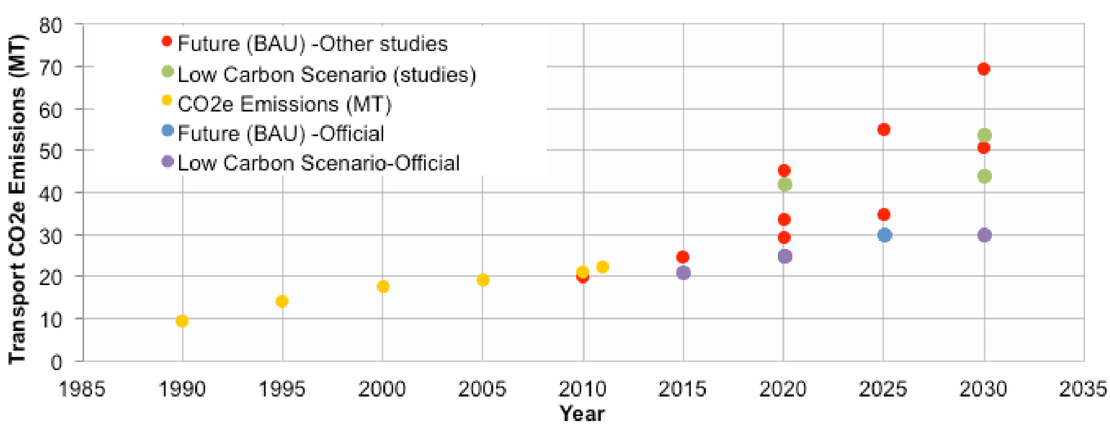
Low carbon scenario for the transport sector should ideally be a balanced combination of 'Avoid-Shift-Improve' strategies applicable uniformly across passenger and freight movement. These strategies include avoiding unnecessary motorized trips, reducing the lengths of trips, shifting motorised trips to low-carbon modes, and improving the carbon intensity of modes of transport. The analysis of mitigation potential underpinning the LCS specifically assessed all three components Avoid, Shift and Improve.

However, countries in their stated policies often still rely heavily on the technological improvement strategies to reduce carbon emissions resulting in suboptimal mitigation capability. For example, 128 INDCs submitted till November 1st 2015 propose about 216 transport mitigation measures of which nearly 64% of measures are of "improve" category or related to technological and fuel improvement. Further, mitigation actions in INDCs are heavily skewed towards passenger transport, while, freight which is almost as important in terms of CO2 was considered in a much smaller number of INDCs.

Box 3 : Chile Low Carbon Scenario

Two major studies have considered implementation impact of enhanced low carbon transport policies in Chile. Mitigation analysis carried out in Chile by World Bank (Partnership for Market Readiness, Activity 4: Study on the Chilean National Situation) establishes that transportation and industry and mining sectors have the highest expected energy consumption growth rates during the 2010-2020. In the mitigation analysis, interventions considered range from technological solutions such as use of hybrid vehicles, aerodynamic improvements and renovation of the fleet to behavioral changes such as eco-driving, reducing the use of cars by promoting public transportation, expansion of subway systems, and increasing the fee on parking and tolls.

A total of forty one mitigation measures were considered in Energy, Transportation, Industry, Forestry and Commercial, Public and Residential sectors based on the national target of 20% deviation below the "Business as Usual" emissions growth trajectory by 2020.



The University of California, Davis (O'Ryan, Raúl and Thomas S. Turrentine (2000) Greenhouse Gas Emissions in the Transport Sector: Case Study for Chile. Institute of Transportation Studies, University of California, Davis) has considered the mitigation impacts of 'Constant Urban Public Transport Share,' 'Improved Passenger Train Transport,' 'Intensive Use of Natural Gas' and other measures to derive low carbon estimates for Chile. Considering the variation in policy packages modeled under the low carbon scenario in these two studies, the estimates vary significantly among each other i.e. from 30-54 MT by 2030 with an average reduction of 43 MT (i.e. 29% reduction from average BAU).

For rest of the countries, where estimates are not available (totalling 76 countries), sketch LCS projections are provided (via Tier II fact sheets) based on assumptions. The detailed methodology and the list of Tier II countries for which we relied on this type of LCS projection is provided in Annex I.

2. Findings

Figure 14 highlights transport emissions growth from 2010 to 2030 under the BAU and LCS for different regions. LCS projections for the 138 countries with INDC emission targets indicate a potential decrease of transport emissions growth to 6.2 GT of CO2 by 2030 (i.e. a decrease of 24% from BAU)

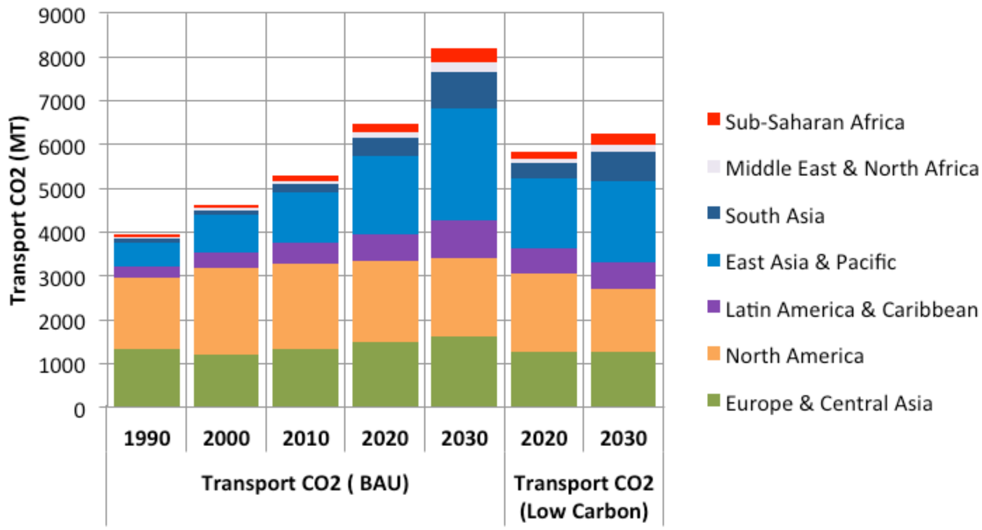


Figure 14: Transport Emissions Growth in Low Carbon Scenario Compared to BAU for Different Regions 1990 - 2030

In INDC countries, the annual growth in transport emissions could be reduced from a total of 8 GT to 6 GT (i.e. 2% growth in BAU to 0.8%) (Figure 15). In developed countries, there is likely to be a net decrease in emissions due to implementation of low carbon policies.

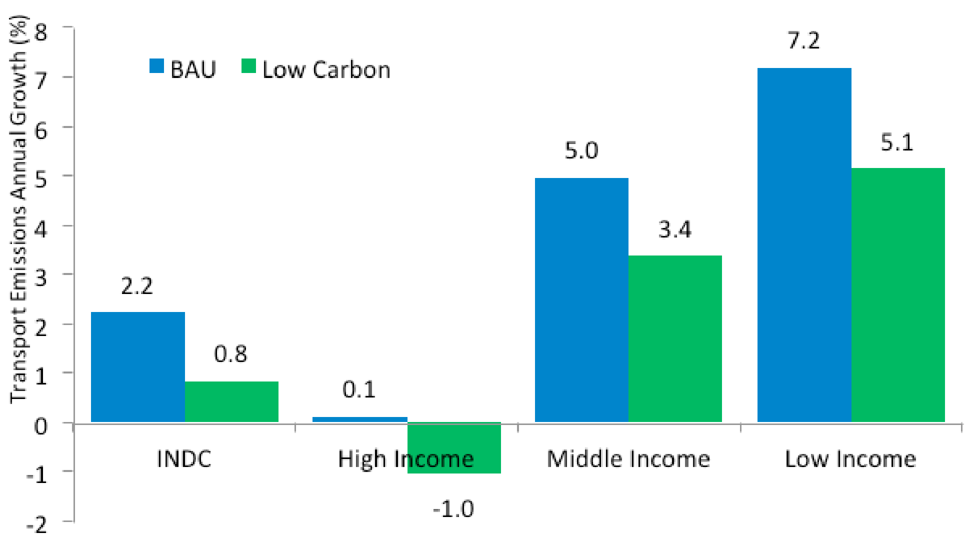


Figure 15: Transport Emission Annual Growth in BAU and LCS (2010-2030)

The transport sector LCS projections reveal that by 2030, the linkage of emission intensity with GDP could decrease by 59% which is much higher when compared to emission intensity decrease in BAU scenario (46%) (Figure 16).

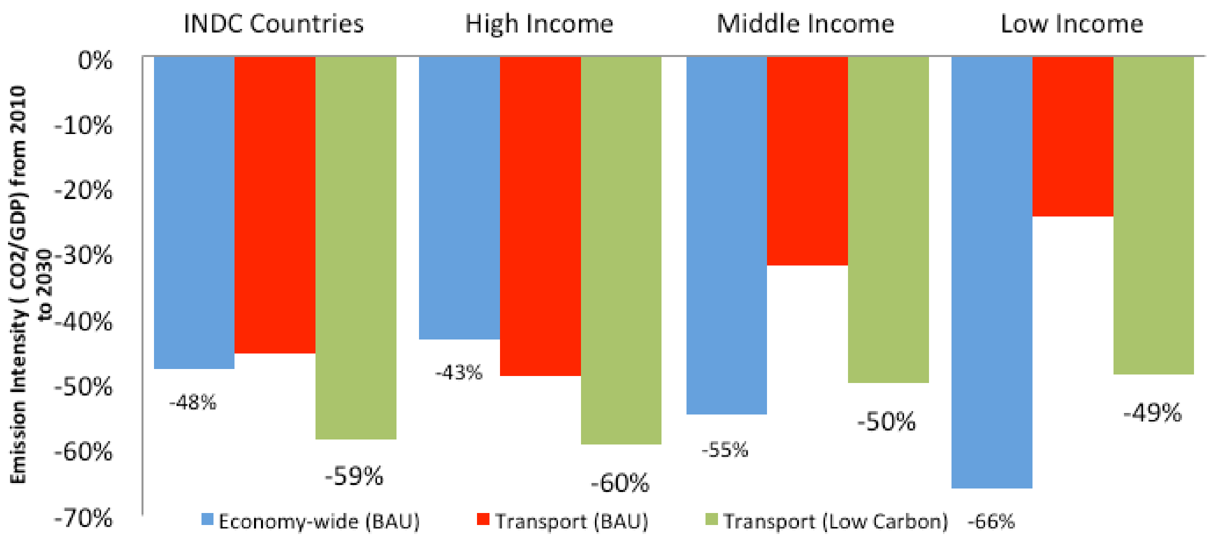


Figure 16: Transport Emission Intensity Growth and GDP Growth, 2010 - 2030

Under the low carbon scenario, high income economies reduce their emission intensity at a slightly higher rate when compared with low and middle income economies. However, the developing economies i.e. middle and low income economies reduce transport emission intensity at a lower rate under low carbon scenario when compared with economy-wide emission intensity reduction under BAU. It should be noted that differences between the middle and low income countries and high income countries are smaller in the case of the LCS than was observed in the BAU case. Differences still occur due to continued high intensity of growth in transport sector when compared with economy-wide emissions under BAU.

For the 138 countries with INDC emission reduction targets, the 2010 transport emissions per capita was 0.88 tons/capita. With implementation of low carbon policies, by 2030 global transport emissions per capita could be restricted to 2010 levels. However, there is a significant variation in transport CO2/capita growth among different typology of countries (Figure 17). In high income economies, the transport CO2 per capita decreases from 2010 to 2030 by 24% while it would still increase in middle and low income countries (66%-88%). This would, in developing countries, with low carbon transport policies, cut the transport CO2/capita BAU growth in half.

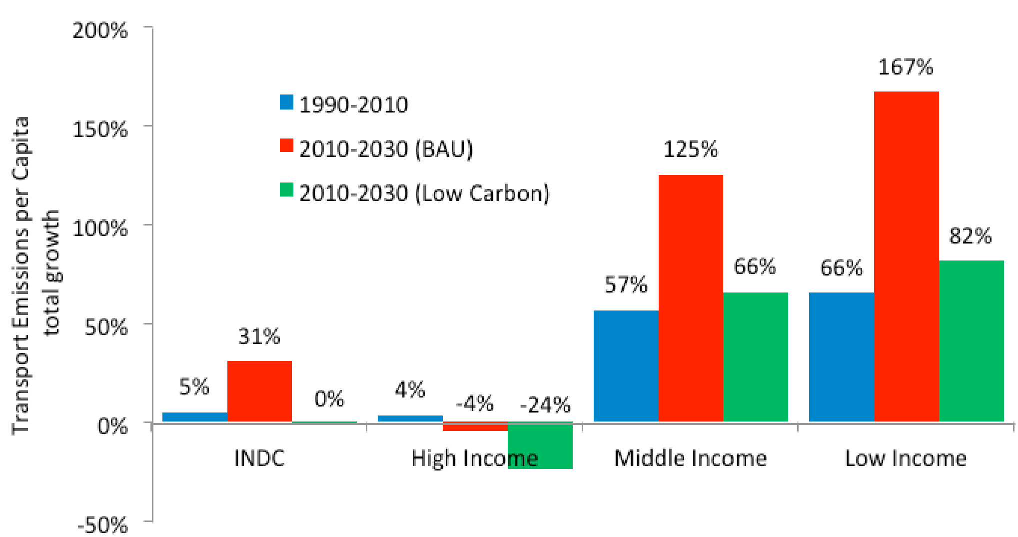


Figure 17: Transport CO2/Capita for BAU and LCS, 1990 - 2030

3. Comparison to 2DS

With implementation of the low carbon scenario, the BAU emission gap of 3.4 Billion tons with 2DS scenario (41%) could be reduced to just about 1.5 billion tons of CO2 i.e. a gap of 23%. Figure 18 shows the distribution of this emission gap across regions.

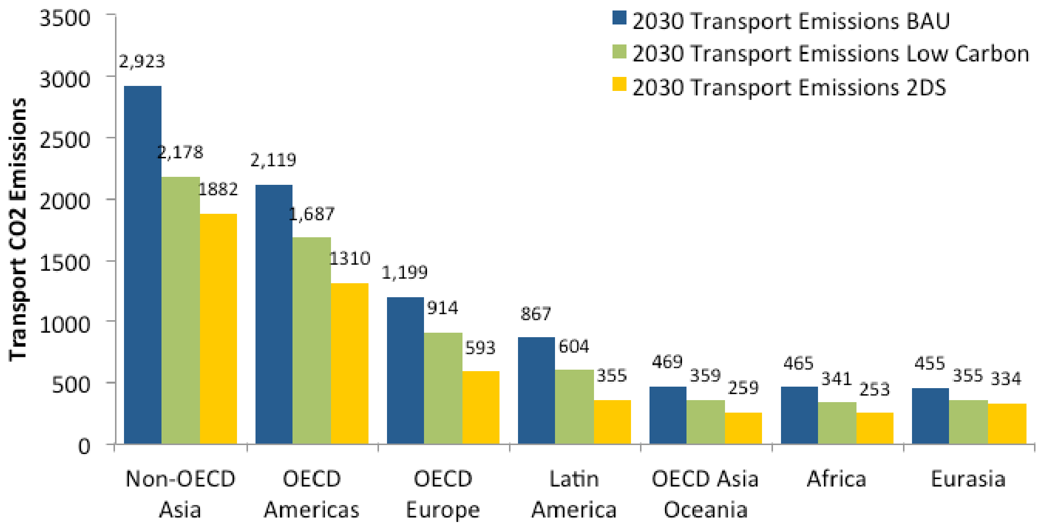


Figure 18: 2030 Transport CO2 Emission Projections for Different Scenarios

In the calculation of the emission gap between LCS and the 2DS described above the LCS was derived by simple averaging of the different low carbon estimates for individual studies after literature review of more than 350 studies. An alternative approach of calculating the emission gap assumes a more aggressive low carbon scenario ('aggressive LCS'), which considers higher impact low carbon measures (instead of average impact low carbon measures) in available mitigation studies for individual countries, which are collated and aggregated globally.

It is important to note that this scenario is not developed by adding individual impacts of different studies for a specific country but by selecting only those studies which show the highest intensity of mitigation (or in other words, lowest 2030 transport CO2 emissions and aggregated globally). This is an hypothetical scenario and may not be practical for assessing 2030 impact, as these studies are largely from the period 2005 to 2010, and already assume high deviation in emissions by 2015 (Figure 19).

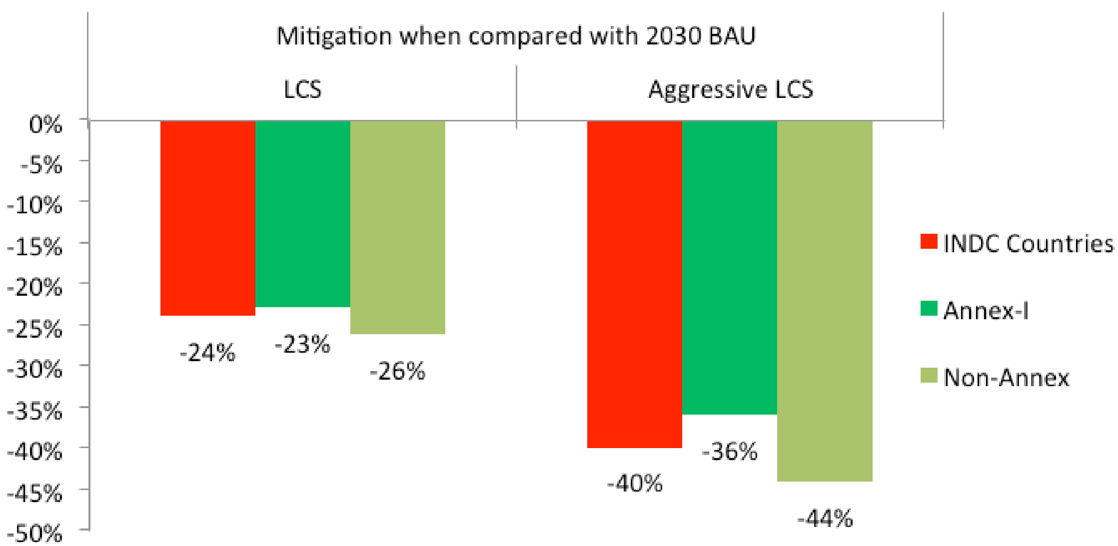


Figure 19: Impact of LCS and Aggressive LCS Implementation vs. BAU, 2020 and 2030

For the 138 INDC countries, by 2030, when compared with the BAU, the 24% reduction under the LCS increases to 40% under the aggressive LCS. For non-Annex I countries, the impact is higher when compared to Annex I countries (i.e. 44% vs. 36%, respectively).

With aggressive low carbon transport policies, the projected 2030 BAU and LCS emission gaps of 3.4 and 1.5 billion tons could be completely eliminated (Figure 20).

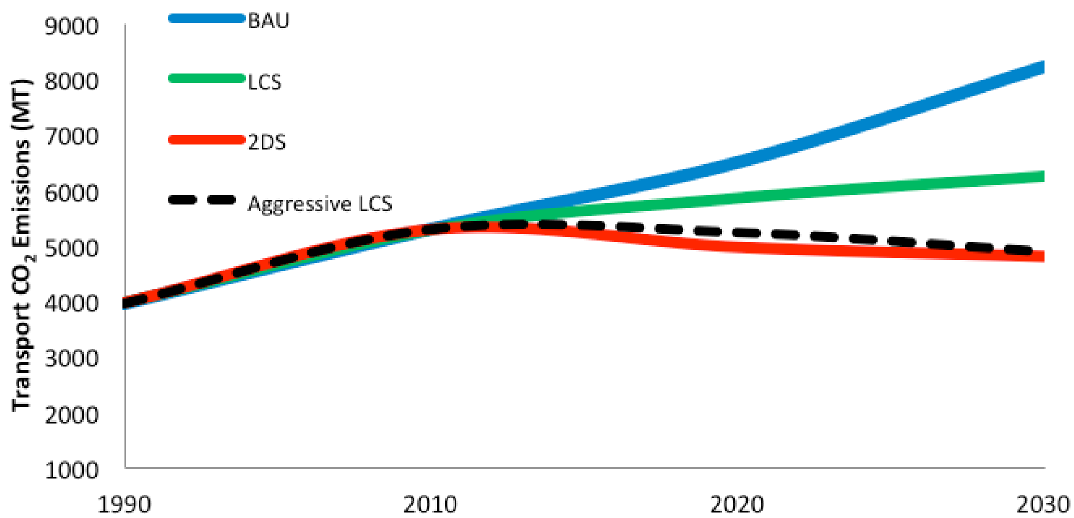


Figure 20: Comparison of BAU, 2DS and LCS 1990 - 2030[36]

This assumes that an aggressive LCS appears to be in line with a recent IEA analysis.[37] Indicating that in OECD economies, transport CO2 emissions can be reduced to an annual growth of -1.6% and in non-OECD countries, transport CO_2 emissions can be restricted to an annual growth of 2.1% with existing technologies and at no additional societal costs. This closely matches with aggressive LCS estimates in this study.

36 In this figure BAU, 2DS and LCS are generated by linear interpolation of 2010, 2020 and 2030 values and thus many scenarios show peak of emissions at 2010, which is just a representation and unrealistic.

37 International Energy Agency (2015). World Energy Outlook Special Report. Paris. Available online at: https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf

D. The 2030 Estimated Transport Emission Targets in INDCs

1. Description

Intended Nationally-Determined Contributions (INDCs) are policy based documents to communicate to the United Nations Framework Convention on Climate Change (UNFCCC) secretariat country-level strategies to reduce carbon emissions and increase resilience for the post-2020 period[38]. These country specific documents acknowledge that each country faces a unique set of circumstances influencing reduction strategies, including socio-economic development patterns, historic emission trajectories, and varying financing requirements. The information provided in INDCs may include quantifiable information on base years, time frames and/or periods of implementation, scope and coverage assumptions and methodological approaches to mitigation and adaptation actions for the period between 2020 and 2030. INDCs represent a unique opportunity to increase bold mitigation and adaptation measures in transport and other sectors, as for the first time in history, countries are communicating their intended actions to reduce emissions and increase resilience on sectoral scales in the context of the UNFCCC system.

Investigations carried out by various institutions point to an economy wide emission gap (11-16 billion tons) between the 2DS scenario and the committed INDCs by 2030[39] (See box 4). It is clear that given the significant emission gap between the current policies, INDCs and 2DS scenario, more sustained effort is required from countries to stay within a 2DS.

Box 4 – Economy-wide Mitigation Ambition INDCs

As of November 1, 2015, 128 INDCs covering 155 countries had been submitted, which represent about 87% of economy-wide global greenhouse gas emission.[40]

A recent analysis of INDCs by different institutions project emissions gaps of 11-16 GT by 2030.

	INDCs Considered	Study	Finding	Emission Gap (CO2e by 2030)
1	INDCs submitted as of 31 August	PBL[41]	INDCs submitted to date could reduce emissions by 3.5 to 4.0 billion tons by 2030, compared to the level under current policies.	15-16 GT
2	INDCs submitted as of 15 October	IEA[42]	The cumulative effect of implementing all INDCs submitted by mid-October would lead to an average global temperature increase of around 2.7°C by 2100, which falls short of the "major course correction necessary" to stay below an average global temperature rise of 2°C.	N/A
3	INDCs submitted as of 1 October	Climate Action Tracker[43]	The INDC process has led to a significant improvement in promised action compared to earlier pledges of action and informal announcements. However, If fully implemented, the submitted INDCs for 2025 and 2030 are projected to lead to a warming of around 2.7°C by 2100.	11-13 GT
4	INDCs submitted as of 1 October	UNFCCC[44]	The implementation of the communicated INDCs is estimated to result in aggregate global mission levels of 56.7 (53.1 to 58.6) Gt CO2 eq in 2030	15 GT
5	INDCs submitted as of 1 October	UNEP[45]	Full implementation of unconditional INDCs results in emission level estimates in 2030 that are most consistent with scenarios that limit global average temperature increase to below 3.5 °C (range: 3 - 4 °C) by 2100 with a greater than 66 % chance.	12 GT

38 United Nations Framework Convention on Climate Change (2015). INDCs as communicated by Parties. Available online at: http://unfccc.int/focus/indc_portal/items/8766.php
39 United Nations Environment Programme (UNEP) (2015).The Emission Gap Report 2015-Executive Summary. Available online at: http://uneplive.unep.org/theme/index/13#indcs
40 CAIT Climate Data Explorer (2015). Washington, DC: World Resources Institute. Available online at: http://cait.wri.org.
41 PBL Netherlands Environmental Assessment Agency (2015). PBL Climate Pledge INDC tool. Available online at: http://infographics.pbl.nl/indc/
42 International Energy Agency (2015). World Energy Outlook Special Briefing for COP21. Paris. Available online at: https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf
43 Climate Action Tracker (2015). Emissions Gap - How close are INDCs to 2 and 1.5°C pathways? Available online at: http://climateactiontracker.org/assets/publications/CAT_global_temperature_update_October_2015.pdf
44 United Nations Framework Convention on Climate Change (2015). Synthesis report on the aggregate effect of the intended nationally determined contributions. Available online at: http://unfccc.int/resource/docs/2015/cop21/eng/07.pdf
45 United Nations Environment Programme (UNEP) (2015).The Emission Gap Report 2015-Executive Summary. Available online at: http://uneplive.unep.org/theme/index/13#indcs

To determine the impact of INDC implementation at sector level either the economy-wide targets need to be sub-allocated to different sectors or impact of actions in different sectors needs to be aggregated to determine the progression towards the committed target. It is generally assumed that all sectors, including the transport sector, need to provide significant contributions based on their capabilities and requirements. This study provides information to help understand the potential contribution of the transport sector through the INDC process. Understanding the mitigation ambition of the transport sector in the first generation of the INDCs is also important since the level of ambition in INDCs are to be 'ratcheted up' in subsequent time frames.[46] The LCS described in the previous section is especially relevant in that context.

Among the INDCs submitted till date, 95% identify explicitly or implicitly transport sector as a mitigation source. About 63% of INDCs propose (general or specific) transport sector mitigation measures. However, only about 10 % of INDCs have proposed a transport sector emission reduction target and about 9% and 15% of INDCs include estimates of country-level BAU projections and transport mitigation potential estimates. Clearly, while the transport sector is rightfully considered as a major mitigation source, the magnitude of emission reductions from transport sector and its potential contribution to economy-wide mitigation has generally not been well-elaborated.

The INDC 2030 targets established by most countries are generally economy-wide and not sector specific. Further, they are often not represented as a single unconditional value, but as a single conditional value or a range of values (based on the provision of external funding or other factors).[47] For this analysis, the most stringent commitment made by the country is considered as their ambition towards post 2020 commitment.

In order to measure progress and compare emission reduction efforts, the economy-wide targets are translated to transport sector using transport share in economy-wide emissions. The shares are considered for 1990, 2010 and 2030 to serve as three diverse baselines for INDC targets. Using these shares, the economy-wide mitigation target is translated to transport sector assuming that the transport sector will provide a proportional contribution to emission reduction targets relative to its share in total emissions (at 1990, 2010 or 2030). The main purpose of using three different transport INDC targets is to assess the relative impact of a changing share of transport emissions compared to overall emissions. [48]

It is acknowledged that the approach of proportional allocation of transport emissions neglects magnitude of mitigation capability and costs and benefits involved in emission reductions. It is clear that different sectors have different cost-effective approaches to reducing GHG emissions, and allocation of emission reduction targets to different sectors is often based on a combination of factors - local priority, cost effectiveness, future magnitude of growth and co-benefits. Different countries may prioritize different sectors for achieving national emission reductions.

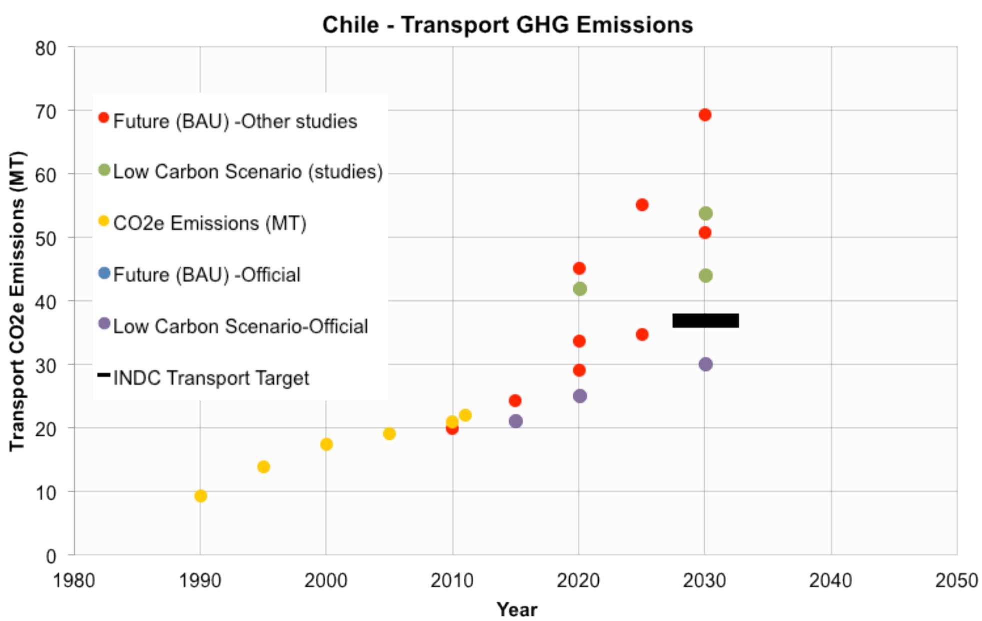
However, until now the information required to calculate transport targets based on a cost based approach is not available for the majority of countries. Based on a recent investigation of INDCs, only 8% of countries had assessed marginal abatement costs, co-benefits or costs and benefits for deriving mitigation strategies within transport sector. There is a great diversity and magnitude of transport modes and since transport is a derived demand, there is great degree of variation in consumer response to policies and the application of economic instruments. Further, there exists little information on vehicles, usage, fuel, or CO2 emissions per kilometre in developing countries and owing to the difficulty to understand and estimate "a priori" the factors affecting travel behaviour, fuel consumption and travel behaviour.[49]

46 With re-evaluation intervals (e.g. 5- or 10-year periods) still under discussion within the UNFCCC process.
47 United Nations Framework Convention on Climate Change (2015). Quantified economy-wide emission reduction targets by developed country Parties to the Convention: assumptions, conditions, commonalities and differences in approaches and comparison of the level of emission reduction efforts. Available online at: http://unfccc.int/resource/docs/2013/tp/07.pdf
48 As indicated the relative share of transport emissions is expected to go up between 1990 and 2030.
49 The transport sector has received less attention than other sectors in climate finance due to this complexity.

These shortcomings in information have guided the choice for the proportional allocation of emissions to arrive at the INDC related transport targets. While sub-optimal it does allow an assessment at global level to understand the potential role of transport sector in achieving the INDC economy-wide mitigation target. The case of Chile (Box 5) indicates that the approach of proportional allocation of transport emissions resulted in a relative conservative estimate of transport related INDC target compared to LCS related emission estimates for the transport sector.

Box 5 - Chile INDC Target

Chile in its recent Intended Nationally Determined Contribution (Contribution Nacional Tentativa De Chile (INDC) Para El Acuerdo Climatico Paris 2015) has included two emission mitigation targets for 2030. The unconditional target is a 30% reduction of GHG emissions-intensity of GDP below 2007 levels by 2030 and the conditional target (conditional on international financial support in the form of grants) is a 35–45% reduction of GHG emissions-intensity of GDP compared to 2007 by 2030. Chile has indicated that transport sector will be an important sector in economy-wide mitigation. However, it has not allocated any mitigation targets to transport sector nor it has identified low carbon policies required to be implemented. The figure shows a comparison of various BAU, LCS estimates with an estimated transport sector INDC target considering its 2010 emission share within economy-wide emissions. Baed on the analysis, it is clear that the estimated INDC transport target is less ambitious than the LCS related estimates and that the INDC target is therefor a relative conservative estimate transport sector can contribute much higher than its share in 2010 economy-wide emissions.



2. Findings

The three different INDC transport emission targets derived for Annex I and non-Annex I countries are shown in Figure 21. For the 138 INDC countries included in the analysis, there is a variation of about 20-30% depending upon the transport share utilized (1990, 2010 and 2030). However, the variation is significantly higher (50% in non-Annex I between targets derived using 2030 and 1990 share) in developing countries when compared with developed countries (2% in Annex I).

In developed economies, the transport share in economy-wide emissions is understood to be fairly uniform from 1990 to 2030. However, in developing countries due to structural shift in economy, the transport sector emission share in economy-wide emissions are projected to increase significantly over 1990 to 2030 period and due to this change, the transport sector target derived using different shares leads to much higher variation. Using 1990 share of transport to translate economy-wide emission target to transport sector will result in a target which is significantly lower than targets derived using 2010 and 2030 share.

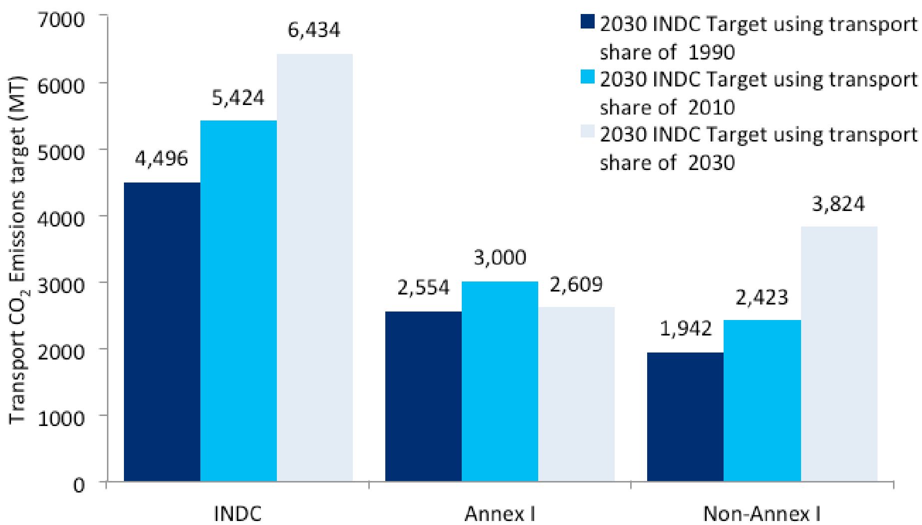


Figure 21: 2030 Estimated Transport Emission Target in INDCs (using 1990, 2010 and 2030 share)

Figure 22 shows the comparison of INDC targets with BAU and LCS projections for countries of different income categories. In the high income countries, the estimated INDC targets are very close to the LCS (i.e. the transport sector has a realistic chance of providing significant contribution to economy-wide reductions if current INDC pledges are implemented); thus the share of transport contributions could be in proportion to its share of economy-wide emissions. However, in developing countries (middle- and low-income) there is likely to be a significant gap between INDC transport sector target and LCS, depending upon the assumptions used.[50] Current INDC commitments translated to the transport sector assuming 2030 share is closest to the LCS scenario.

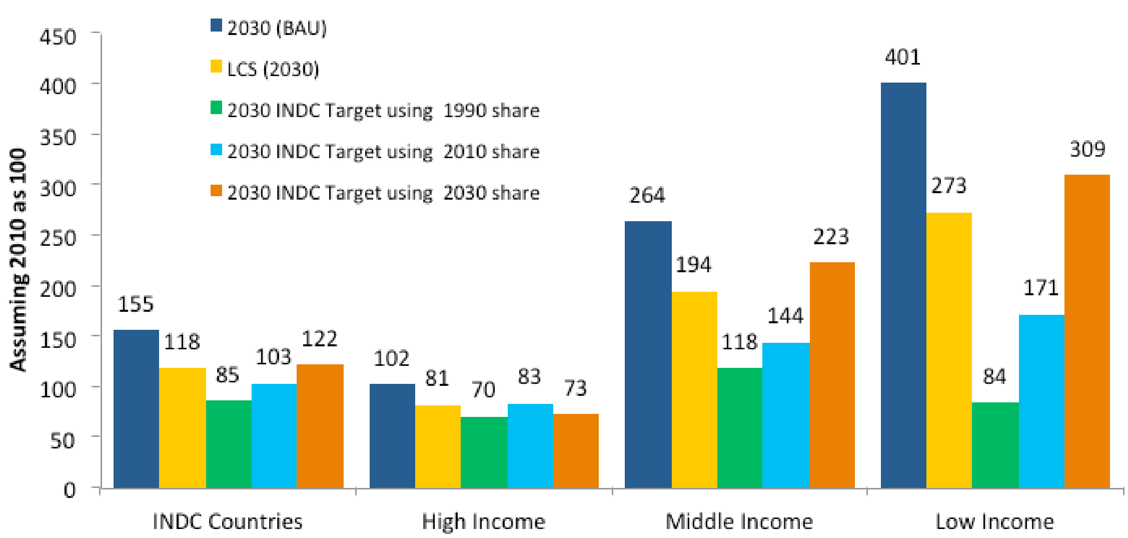


Figure 22: Transport Emission Growth under Different Scenarios, 2010 – 2030

50 It should be noted that high-income countries will continue to dominate low- and middle-income countries in per capita transport emissions in 2030, as shown in Figure 12.

Box 6: Countries with Transport Targets

Of 138 countries considered in the analysis, 12 countries have explicitly stated their transport sector emission targets.[51] In majority of these countries (9 out of 12), the LCS scenario is very close to the actual transport emission reduction targets (less than 20% variation). This clearly establishes that countries often rely on LCS scenario to identify and establish transport sector's contribution to economy-wide emissions. For some countries like Bangladesh, Gabon and Seychelles the transport targets established using 2030 share are closer to the actual targets than the LCS scenario. Among the countries analyzed, only Burkina Faso has established its transport emission reduction target which is very close to its current emission share in economy-wide emissions.

Country	Transport emissions in MT				
	2030 LCS	Actual 2030 INDC Transport target	Transport Emission Target based on share of		
			1990	2010	2030
Bangladesh	13.91	21.92	3.77	26.11	21.92
Burkina Faso	4.01	2.91	-	2.79	5.66
Côte d'Ivoire	4.47	4.47	1.17	2.34	4.59
Dominica	0.08	0.06	0.03	0.04	0.04
Ethiopia	19.00	16.00	2.13	4.83	9.43
Gabon	2.00	2.32	0.58	1.02	2.18
Grenada	0.09	0.08	-	0.06	0.06
Japan	144.00	163.00	197.23	188.72	162.27
Marshall Islands	0.01	0.01	0.00	0.01	0.01
Republic of Moldova	1.81	2.00	0.79	1.05	2.79
Seychelles	0.17	0.16	-	0.05	0.16
Trinidad and Tobago	4.15	3.94	3.53	3.67	4.79

3. Comparison to 2DS

Among the three potential INDC transport sector targets, the target derived using 1990 share is closest to 2DS for the 138 INDC countries analysed. This runs counter to the current emission trajectories as well as INDC targets based on 2010 and 2030 share, which put transport well below the 2DS. Based on this it is clear that it will not be possible to reach a 2DS within the transport sector by 2030 based on measures proposed in current INDCs. Thus, all currently investigated and planned LCS measures must be implemented to provide an optimal contribution to INDCs and serve as a foundation to close the emissions gap.

51 D.R. Congo has provided only the urban transport emission reduction target and hence not included in above table.

IV. Conclusions

The report has assessed a BAU scenario, as well as two hypothetical variants of LCS (average and aggressive) based on available mitigation potential studies, and three different variations of INDC transport related targets. Table 1 provides an overview of the impacts of the different scenarios versus a 2DS.

Table 1: Emissions Gap under Various Scenarios for INDC Countries

Scenario	2030 Projected Transport Emissions (Billion Tons)	Transport Emissions Gap with 2DS at 2030 (Billion Tons)
2DS (threshold)	4.8	-
BAU	8.2	3.4
LCS	6.2	1.4
Aggressive LCS	4.9	0.1
INDC (1990)	4.5	-0.3
INDC (2010)	5.4	0.6
INDC (2030)	6.4	1.6

It is only in the case of a 2030 INDC target using 1990 share of transport emissions or an aggressive application of the LCS that transport emissions would either approach or exceed the 2DS, and both of these cases may not be realistic by 2030 for different reasons. As could be expected based on a general economy wide analysis of INDCs and their mitigation targets, the transport sector related targets developed under the analysis are generally also not ambitious enough.

The outcome of the analysis is cause for concern. If the scenarios described in this document would materialize it means that the transport sector would be not well placed in terms of making its long term (2050 and 2100) contribution to the 2DS. Investments would have been made up to 2030 that would lock in emission patterns that, at least for the medium term, are not compatible with the 2DS. This will require in the short and medium much deeper reductions from other sectors which may not be possible or cost effective, thus substantially increasing the difficulty of an economy wide transitioning to a 2DS pathway.

To address the emission gap low carbon policies (incorporating 'Avoid,' 'Shift,' and 'Improve' strategies) must be scaled up and accelerated to approach a 2DS within the transport sector (e.g. Manage the demand for travel through land-use planning and pricing; promote modal shift to low(er) carbon transport modes; implementing strict fuel economy standards and pricing to leapfrog technologies; promoting electrification and renewables in road transport.

Such a more forceful implementation of low carbon policies (both in scope and intensity), would position the transport sector better to reach 2DS requirements, if not by 2030 then beyond.

This study apart from estimating mitigation potential in the transport sector also intended to contribute to methodology development on national level transport emission scenario development. Policy is made at the country level and it is therefore important to have a country specific knowledge base. The analysis of 350+ studies and the development of 138 country fact sheets is an important contribution to the development a country specific transport emission scenario approach.

The desktop review of more than 350 mitigation potential studies indicated that BAU and LCS projections were available for less than half of the countries considered in this analysis. Only a fraction of countries have specified transport emission targets and estimated marginal abatement cost curves or quantified co-benefits for transport mitigation strategies. Thus, there is an urgent need to build capacity to improve data collection efforts, enhance cooperation among peer countries, and introduce more rigorous methodologies to more accurately determine transport sector emissions projections and mitigation potential, in order to drive national strategies and global policies to contribute toward a 2DS.

ANNEXES

Annex- I - Countries Considered in the Analysis with Methodology Type

Sl.No	Country/Region	Analysis Type	BAU Projection	Low Carbon Projections
1	Afghanistan	Tier II	SLoCaT Projections	SLoCaT Projections
2	Albania	Tier II	SLoCaT Projections	SLoCaT Projections
3	Algeria	Tier II	SLoCaT Projections	SLoCaT Projections
4	Argentina	Tier I	Multiple Sources	Multiple Sources
5	Armenia	Tier II	SLoCaT Projections	SLoCaT Projections
6	Australia	Tier I	Multiple Sources	Multiple Sources
7	Austria	Tier I	Multiple Sources	Multiple Sources
8	Azerbaijan	Tier II	SLoCaT Projections	SLoCaT Projections
9	Bangladesh	Tier I	Multiple Sources	Multiple Sources
10	Barbados	Tier II	SLoCaT Projections	SLoCaT Projections
11	Belarus	Tier II	SLoCaT Projections	SLoCaT Projections
12	Belgium	Tier I	Multiple Sources	Multiple Sources
13	Benin	Tier II	SLoCaT Projections	SLoCaT Projections
14	Bhutan	Tier II	SLoCaT Projections	SLoCaT Projections
15	Bosnia and Herzegovina	Tier II	SLoCaT Projections	SLoCaT Projections
16	Botswana	Tier II	SLoCaT Projections	SLoCaT Projections
17	Brazil	Tier I	Multiple Sources	Multiple Sources
18	Bulgaria	Tier I	Multiple Sources	Multiple Sources
19	Burkina Faso	Tier II	SLoCaT Projections	SLoCaT Projections
20	Burundi	Tier II	SLoCaT Projections	SLoCaT Projections
21	Cabo Verde	Tier II	SLoCaT Projections	SLoCaT Projections
22	Cambodia	Tier I	Multiple Sources	Multiple Sources
23	Cameroon	Tier II	SLoCaT Projections	SLoCaT Projections
24	Canada	Tier I	Multiple Sources	Multiple Sources
25	Central African Region	Tier II	SLoCaT Projections	SLoCaT Projections
26	Chad	Tier II	SLoCaT Projections	SLoCaT Projections
27	Chile	Tier I	Multiple Sources	Multiple Sources
28	China	Tier I	Multiple Sources	Multiple Sources
29	Colombia	Tier I	Multiple Sources	Multiple Sources
30	Comorros	Tier II	SLoCaT Projections	SLoCaT Projections
31	Congo	Tier II	SLoCaT Projections	SLoCaT Projections
32	Costa Rica	Tier I	Multiple Sources	Multiple Sources
33	Cote d'Ivoire	Tier II	SLoCaT Projections	SLoCaT Projections
34	Croatia	Tier I	Multiple Sources	Multiple Sources
35	Cyprus	Tier I	Multiple Sources	Multiple Sources
36	Czech republic	Tier I	Multiple Sources	Multiple Sources
37	D.R.Congo	Tier II	SLoCaT Projections	SLoCaT Projections
38	Denmark	Tier I	Multiple Sources	Multiple Sources
39	Djibouti	Tier II	SLoCaT Projections	SLoCaT Projections
40	Dominica	Tier II	SLoCaT Projections	SLoCaT Projections

Sl.No	Country/Region	Analysis Type	BAU Projection	Low Carbon Projections
41	Dominican Republic	Tier II	SLoCaT Projections	SLoCaT Projections
42	Ecuador	Tier II	SLoCaT Projections	SLoCaT Projections
43	Equatorial Guinea	Tier II	SLoCaT Projections	SLoCaT Projections
44	Eritrea	Tier II	SLoCaT Projections	SLoCaT Projections
45	Estonia	Tier I	Multiple Sources	Multiple Sources
46	Ethiopia	Tier II	SLoCaT Projections	SLoCaT Projections
47	Finland	Tier I	Multiple Sources	Multiple Sources
48	France	Tier I	Multiple Sources	Multiple Sources
49	Gabon	Tier II	SLoCaT Projections	SLoCaT Projections
50	Gambia	Tier II	SLoCaT Projections	SLoCaT Projections
51	Georgia	Tier II	SLoCaT Projections	SLoCaT Projections
52	Germany	Tier I	Multiple Sources	Multiple Sources
53	Ghana	Tier II	SLoCaT Projections	SLoCaT Projections
54	Greece	Tier I	Multiple Sources	Multiple Sources
55	Grenada	Tier II	SLoCaT Projections	SLoCaT Projections
56	Guatemala	Tier II	SLoCaT Projections	SLoCaT Projections
57	Guinea	Tier II	SLoCaT Projections	SLoCaT Projections
58	Guyana	Tier II	SLoCaT Projections	SLoCaT Projections
59	Haiti	Tier II	SLoCaT Projections	SLoCaT Projections
60	Honduras	Tier II	SLoCaT Projections	SLoCaT Projections
61	Hungary	Tier I	Multiple Sources	Multiple Sources
62	Iceland	Tier I	Multiple Sources	Multiple Sources
63	India	Tier I	Multiple Sources	Multiple Sources
64	Indonesia	Tier I	Multiple Sources	Multiple Sources
65	Ireland	Tier I	Multiple Sources	Multiple Sources
66	Israel	Tier I	Multiple Sources	Multiple Sources
67	Italy	Tier I	Multiple Sources	Multiple Sources
68	Japan	Tier I	Multiple Sources	Multiple Sources
69	Jordan	Tier II	SLoCaT Projections	SLoCaT Projections
70	Kazakhstan	Tier I	Multiple Sources	Multiple Sources
71	Kenya	Tier I	Multiple Sources	Multiple Sources
72	Kenya	Tier II	SLoCaT Projections	SLoCaT Projections
73	Kiribati	Tier II	SLoCaT Projections	SLoCaT Projections
74	Kyrgyzstan	Tier II	SLoCaT Projections	SLoCaT Projections
75	Laos	Tier I	Multiple Sources	Multiple Sources
76	Latvia	Tier I	Multiple Sources	Multiple Sources
77	Lebanon	Tier II	SLoCaT Projections	SLoCaT Projections
78	Lesotho	Tier II	SLoCaT Projections	SLoCaT Projections
79	Liberia	Tier II	SLoCaT Projections	SLoCaT Projections
80	Liechtenstein	Tier II	SLoCaT Projections	SLoCaT Projections
81	Lithuania	Tier I	Multiple Sources	Multiple Sources
82	Luxembourg	Tier I	Multiple Sources	Multiple Sources
83	Madagascar	Tier II	SLoCaT Projections	SLoCaT Projections
84	Maldives	Tier II	SLoCaT Projections	SLoCaT Projections
85	Malta	Tier I	Multiple Sources	Multiple Sources

Sl.No	Country/Region	Analysis Type	BAU Projection	Low Carbon Projections
86	Marshall Islands	Tier II	SLoCaT Projections	SLoCaT Projections
87	Mauritania	Tier II	SLoCaT Projections	SLoCaT Projections
88	Mauritius	Tier II	SLoCaT Projections	SLoCaT Projections
89	Mexico	Tier I	Multiple Sources	Multiple Sources
90	Monaco	Tier II	SLoCaT Projections	SLoCaT Projections
91	Mongolia	Tier II	SLoCaT Projections	SLoCaT Projections
92	Montenegro	Tier II	SLoCaT Projections	SLoCaT Projections
93	Morocco	Tier II	SLoCaT Projections	SLoCaT Projections
94	Mozambique	Tier II	SLoCaT Projections	SLoCaT Projections
95	Namibia	Tier II	SLoCaT Projections	SLoCaT Projections
96	Netherlands	Tier I	Multiple Sources	Multiple Sources
97	New Zealand	Tier I	Multiple Sources	Multiple Sources
98	Niger	Tier II	SLoCaT Projections	SLoCaT Projections
99	Norway	Tier I	Multiple Sources	Multiple Sources
100	Oman	Tier II	SLoCaT Projections	SLoCaT Projections
101	Paraguay	Tier II	SLoCaT Projections	SLoCaT Projections
102	Peru	Tier II	SLoCaT Projections	SLoCaT Projections
103	Philippines	Tier I	Multiple Sources	Multiple Sources
104	Poland	Tier I	Multiple Sources	Multiple Sources
105	Portugal	Tier I	Multiple Sources	Multiple Sources
106	Republic of Korea	Tier I	Multiple Sources	Multiple Sources
107	Republic of Macedonia	Tier II	SLoCaT Projections	SLoCaT Projections
108	Republic of Moldova	Tier II	SLoCaT Projections	SLoCaT Projections
109	Romania	Tier I	Multiple Sources	Multiple Sources
110	Russia	Tier I	Multiple Sources	Multiple Sources
111	Senegal	Tier II	SLoCaT Projections	SLoCaT Projections
112	Serbia	Tier II	SLoCaT Projections	SLoCaT Projections
113	Seychelles	Tier II	SLoCaT Projections	SLoCaT Projections
114	Singapore	Tier I	Multiple Sources	Multiple Sources
115	Slovakia	Tier I	Multiple Sources	Multiple Sources
116	Slovenia	Tier I	Multiple Sources	Multiple Sources
117	South Africa	Tier I	Multiple Sources	Multiple Sources
118	Spain	Tier I	Multiple Sources	Multiple Sources
119	Sri Lanka	Tier II	SLoCaT Projections	SLoCaT Projections
120	Sweden	Tier I	Multiple Sources	Multiple Sources
121	Switzerland	Tier I	Multiple Sources	Multiple Sources
122	Tajikistan	Tier II	SLoCaT Projections	SLoCaT Projections
123	Thailand	Tier I	Multiple Sources	Multiple Sources
124	Togo	Tier II	SLoCaT Projections	SLoCaT Projections
125	Trinidad and Tobago	Tier II	SLoCaT Projections	SLoCaT Projections
126	Tunisia	Tier I	Multiple Sources	Multiple Sources
127	Tunisia	Tier II	SLoCaT Projections	SLoCaT Projections
128	Turkey	Tier II	SLoCaT Projections	SLoCaT Projections
129	Uganda	Tier II	SLoCaT Projections	SLoCaT Projections
130	UK	Tier I	Multiple Sources	Multiple Sources

Sl.No	Country/Region	Analysis Type	BAU Projection	Low Carbon Projections
131	Ukraine	Tier I	Multiple Sources	Multiple Sources
132	United Republic of Tanzania	Tier II	SLoCaT Projections	SLoCaT Projections
133	Uruguay	Tier II	SLoCaT Projections	SLoCaT Projections
134	US	Tier I	Multiple Sources	Multiple Sources
135	Vanuatu	Tier II	SLoCaT Projections	SLoCaT Projections
136	VietNam	Tier I	Multiple Sources	Multiple Sources
137	Zambia	Tier II	SLoCaT Projections	SLoCaT Projections
138	Zimbabwe	Tier II	SLoCaT Projections	SLoCaT Projections

Annex - II - BAU and Low Carbon Emission Projection Methodology

This study is one of the most comprehensive attempts in aggregating transport CO2 bottom-up quantifications for BAU scenario and LCS. A detailed literature review was carried out from 350 studies[52] to extract detailed bottom-up projections for business-as-usual and low carbon scenario.[53] However, based on this review, BAU & LCS estimates were available for only 62 countries. For each of the 62 countries with detailed data, emission estimates for BAU and LCS from different studies were compiled to determine average values for 2020 and 2030. These estimates help generate 'Tier I' National-Level Transport Emissions Factsheet.

Tier I National-level factsheets include the following components:

- Historical and future BAU growth trajectories in the transport sector, based on NCs and BURs;
- Available transport sector mitigation potential studies derived from modeling efforts by government agencies, development banks, and other research organizations; and
- A graphical representation of alternate emissions scenarios in the transport sector, which can help in determining an appropriate degree of mitigation ambition

These factsheets help identify how mitigation targets could be developed and improved for transport sector and could also help in future MRV activities.
Sample information contained in the national transport emissions fact sheets is illustrated in the below summary graph of key transport trends for Japan. Figure 1 shows that official transport emission target for 2030[54] could be easily reached under the low carbon transport scenario i.e. with additional implementation of low carbon transport policies and projects. However, under the BAU scenario, there could be significant gap between the baseline and transport emission target.

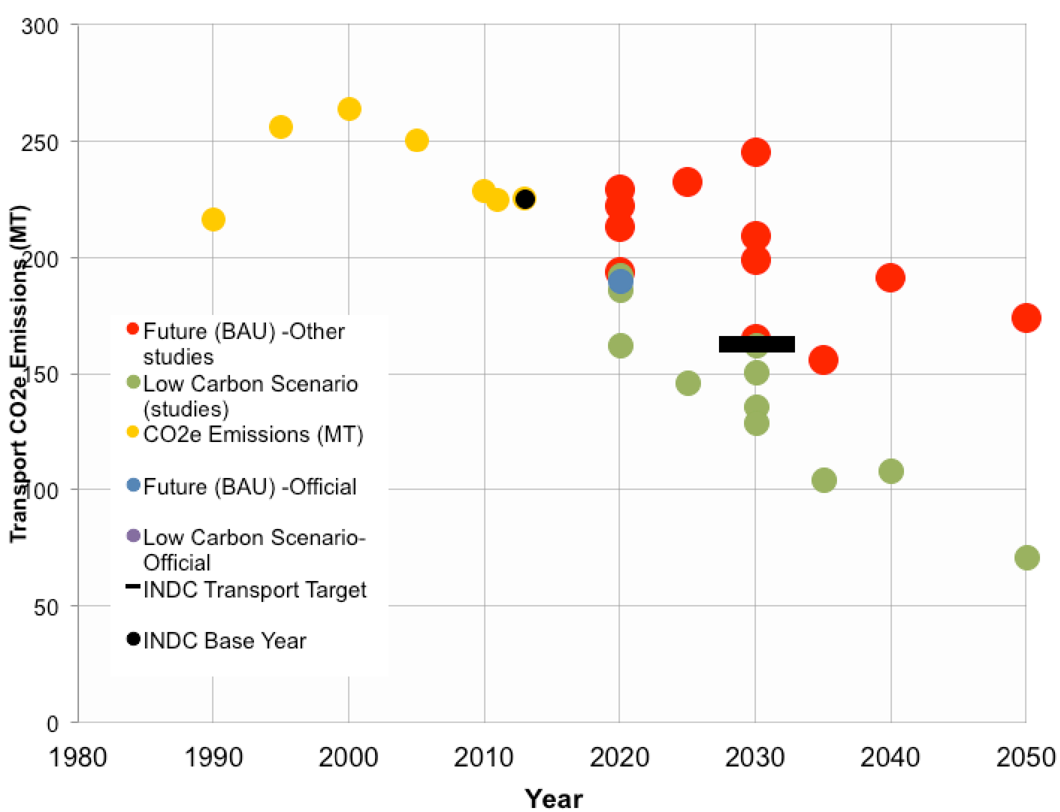


Figure 23: Japan Transport GHG Emissions (BAU and Low Carbon Estimates)

52 Country level references are included in Annex
53 This is about 80% of 2010 global transport emissions
54 United Nations Framework Convention on Climate Change. 2015. Submission of Japan's Intended Nationally Determined Contribution (INDC). Available online at : http://www4.unfccc.int/submissions/INDC/Published%20Documents/Japan/1/20150717_Japan's%20INDC.pdf

BAU forecasting and mitigation potential analyses required to support development of these national fact sheets are not available for all countries across the globe. In order to provide indicative estimates to fill data gaps in rest of the countries, insights from countries with existing estimates on BAU and low Carbon Scenario are used to interpolate and estimate the emission growth in transport sector for the remaining countries without detailed transport data. This analysis is used to develop 'Tier II' fact sheets. Tier II fact sheets include the following components:

- Historical and future BAU growth trajectories in the transport sector, based on NCs and BURs;
- A graphical representation of emissions scenarios in the transport sector, which can help in determining an appropriate degree of mitigation ambition

These sketch projections for BAU and LCS are carried out using the following approaches:

I. The first approach is to use a regression of transport CO2/capita and GDP/capita for all countries in 2012, which would allow calculation of transport CO2/capita for 2020 and 2030 using existing GDP/capita projections for these years using IMF data (Figure 24). The basic premise behind this regression is that economic growth has been accompanied by rising per-capita CO2 emissions from transport activity. But, this regression analysis does not consider the potential decoupling of emissions which has been observed especially over last few years in some OECD countries. Recent research has showed that in the case of Annex I countries, the decoupling effect grew stronger from 1990 to 2012, while in the case of non-Annex I countries, the decoupling effect became weaker over time, to the point at which it was virtually non-existent for 2008-2012. Thus, in the non-Annex I countries, the prevailing trend is toward a coupling of transport emissions with economic growth under a BAU scenario, which is indicative of Figure 21. Since the majority of countries where the projections and mitigation estimates are required are non-Annex I countries, in the absence of reliable estimates, these sketch projections could provide a reasonable approximation and could be further improved over time.

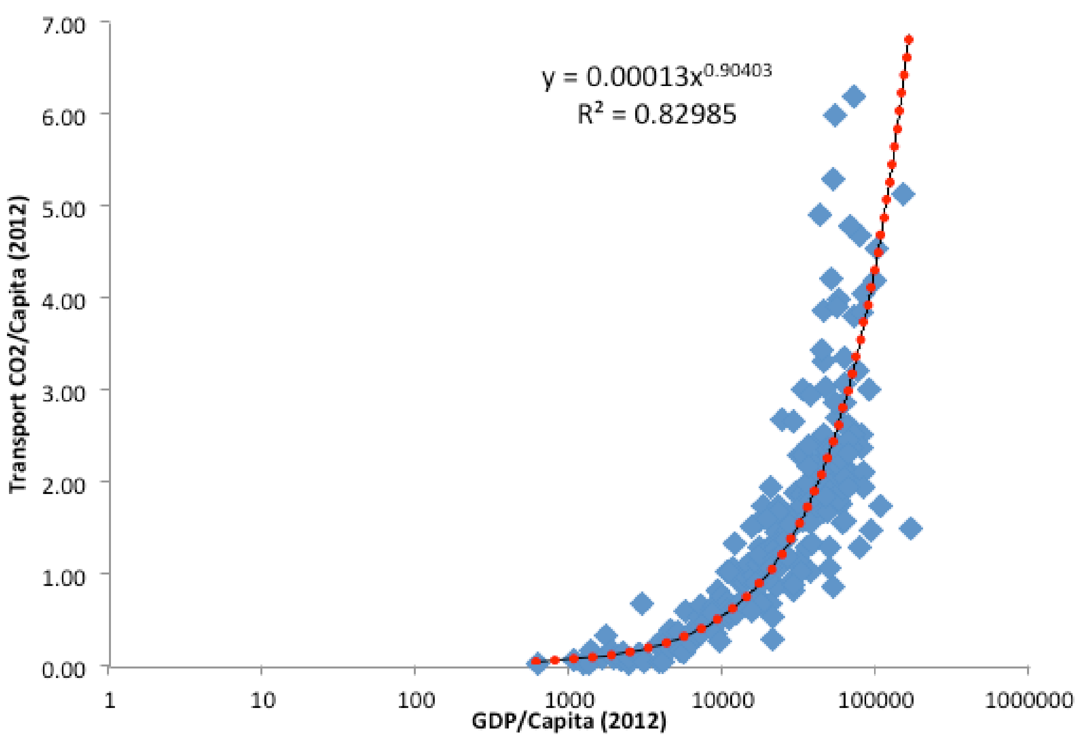


Figure 24: Correlation between GDP/Capita and Transport CO_2/Capita

II. The second approach is to extend historic annual growth rates of transport CO2 emissions between 2000 and 2012 to the years 2020 and 2030[55]. Some of the countries (particularly low and middle income countries such as Angola, Benin, Congo, Kyrgyzstan etc.) have double digit annual growth rates. Thus, in order to avoid overestimation, maximum transport annual emission growth rates are restricted to 6% which reflects the maximum growth scenario over 2010 to 2030.[56]

55 Partnership on Sustainable Low Carbon Transport. 2015. SLoCaT Analysis of Transport Emission Trends. Shanghai. Available online at: http://ppmc-cop21.org/slocat-analysis-of-transport-emission-trends/

56 This figure is based on a review of global transport CO2 assessment for different developing regions such as ASEAN, Non-OECD Asia, Latin American and Caribbean countries and Africa. The models considered were IEA projections WEO 2012, WEO 2015, ITPS-ASEAN, ICCT-Roadmap, GCAM, IMAGE, TIAM-ECN & AIM databases.

III. Using these two projections, simple average BAU estimates for 2020 and 2030 are determined. Annex I summarizes projections using the first two approaches for countries with detailed data, with the results showing that a majority of estimates are within an acceptable range (i.e. for 2020 and 2030, we get weighted average variation of about 0% and 16% between the average estimates and the BAU projections from different countries[57]). We consider this variation acceptable, as BAU projections from different studies and sources for a particular country can vary significantly due to a number of factors (e.g. definition of BAU, projection methodology, socio-economic projections, type and source of data, and differing intensity, timeline and magnitude of policies modelled).

IV. Average LCS for countries without any data are estimated through extrapolation based on average mitigation potential for 2020 and 2030 for countries with detailed data. An average mitigation share can be calculated for countries with detailed data by categorizing them into Annex I and non-Annex I countries, and then low carbon transport scenario emissions in 2020 and 2030 can be computed for countries without detailed data. Average mitigation values for 2020 and 2030 are shown in the following table, based on an analysis of 62 countries.

Table 2 Average Mitigation in Low Carbon Scenario in Transport Sector (relative to BAU)

Country	Mitigation at 2020	Mitigation at 2030
Annex I	-9.01%	-22.96%
Non-Annex I	-11.66%	-26.22%

V. These average mitigation values are uniformly applied to all countries to determine the cumulative bottom-up mitigation potential. Since each country will consider a different mix of policies, strategies and intensity of implementation considering its local priorities and costs based on its socio-economic characteristics and growth, transport development and current policies, it is acknowledged that assuming a single constant mitigation potential across several countries is a limitation. This limitation could be addressed in the future as more countries carry out detailed projections and mitigation studies, and as data quality improves from individual Parties. Based the methodological assumptions described above, the SLoCaT Partnership has produced Tier I and Tier II fact sheets for about 138 countries, as previously described.

57 In terms of a simple average, the variation in 2020 and 2030 is 6% and -8%%.%

Annex - III - Estimates on Transport emissions, GDP and Population

	Transport CO2 (MT) BAU			Transport CO2 (MT): Low Carbon (avg)		GDP GDP (Billion US$) based on purchasing-power-parity (PPP)		Population (In Thousands)	
	2010	2020	2030	2020	2030	2010	2030	2010	2030
Afghanistan	0.3	1	1	1	1	44	185	28398	43500
Albania	2.2	3	5	3	4	30	108	3150	3311
Algeria	33.3	47	84	42	62	467	1267	37063	48561
Argentina	41.3	54	72	52	55	789	1243	40374	46859
Armenia	1.3	2	3	2	2	17	40	2963	2970
Australia	83.6	101	115	92	85	927	2326	22404	28336
Austria	22.2	23	23	19	19	354	644	8402	9005
Azerbaijan	4.9	8	11	8	9	140	347	9095	10474
Bangladesh	8.4	12	26	8	14	392	2059	151125	185064
Barbados	0.2	0	0	0	0	4	8	280	306
Belarus	5.3	13	20	12	15	146	226	9491	8488
Belgium	27.1	24	24	21	18	441	779	10941	11664
Benin	3.1	4	7	3	5	15	64	9510	15507
Bhutan	0.2	0	0	0	0	4	26	717	898
Bosnia and Herzegovina	3.4	3	5	3	4	34	89	3846	3700
Botswana	2.0	3	5	2	3	25	77	1969	2348
Brazil	166.0	204	265	190	175	2800	5785	195210	222748
Bulgaria	8.0	12	14	12	13	112	221	7389	6213
Burkina Faso	1.0	2	7	2	4	22	101	15540	26564
Burundi	0.5	1	2	1	1	7	31	9233	16392
Cabo Verde	0.2	0	0	0	0	3	7	488	577
Cambodia	1.9	6	9	5	5	35	204	14365	19144
Cameroon	2.7	4	6	4	5	52	194	20624	33074
Canada	187.0	223	252	180	143	1362	2880	34126	40617
Central African Region	0.3	0	1	0	0	4	9	4350	6318
Chad	1.5	3	7	3	5	26	113	11721	20878
Chile	20.8	35	60	33	43	324	913	17151	19815
China	513.6	967	1501	925	1067	12256	53807	1359821	1453297
Colombia	21.6	34	46	32	40	502	1626	46445	57219
Comorros	0.1	0	0	0	0	1	3	683	1057
Congo	1.4	3	6	3	4	24	92	4112	6754
Costa Rica	4.5	5	6	4	4	58	185	4670	5760
Côte d'Ivoire	1.5	4	6	3	4	50	240	18977	29227
Croatia	6.0	6	6	5	5	87	147	4338	4015
Cyprus	2.3	3	3	3	3	37	62	1104	1306

	Transport CO2 (MT) BAU			Transport CO2 (MT): Low Carbon (avg)		GDP GDP (Billion US$) based on purchasing-power-parity (PPP)		Population (In Thousands)	
	2010	2020	2030	2020	2030	2010	2030	2010	2030
Czech republic	18.5	18	19	18	17	290	637	10554	11053
D.R.Congo	1.4	4	6	3	5			62191	103743
Denmark	13.2	14	14	13	12	232	477	5551	6009
Djbouti	0.1	0	1	0	0	2	8	834	1075
Dominica	0.1	0	0	0	0	1	2	71	77
Dominican Republic	4.9	8	12	7	9	110	309	10017	12219
Ecuador	15.2	18	31	16	23	137	434	15001	19649
Equatorial Guinea	0.2	1	1	1	1	23	14	696	1139
Eritrea	0.2	0	1	0	0	6	15	5741	9782
Estonia	2.2	3	3	2	2	28	78	1299	1212
Ethiopia	5.0	10	26	8	19	97	719	87095	137670
Finland	13.4	13.0	11.0	10.6	9.4	207	364	5368	5650
France	133.8	132	126	119	112	2358	3867	63231	69286
Gabon	0.5	1	3	1	2	28	141	1556	2382
Gambia	0.2	0	0	0	0	3	12	1681	3056
Georgia	2.1	4	6	4	6	26	85	4389	3953
Germany	155.0	196	186	143	119	3327	5124	83017	79552
Ghana	4.9	11	21	9	16	75	335	24263	35264
Greece	22.1	23	25	19	18	320	634	11110	10976
Grenada	0.1	0	0	0	0	1	2	105	107
Guatemala	5.6	8	12	7	9	96	283	14342	22566
Guinea	0.9	1	4	1	3	13	61	10876	17322
Guyana	1.0	1	1	1	1	4	14	786	853
Haiti	1.1	1	2	1	2	15	43	9896	12537
Honduras	3.0	4	6	3	4	32	88	7621	10811
Hungary	11.8	17	18	15	13	218	467	10015	9525
Iceland									
0.9	1	1	1	1	12	31	318	384	
India	161.5	400	794	315	669	5420	30519	1205625	1476378
Indonesia	105.8	158	261	113	207	2030	8276	240676	293482
Ireland	11.6	14	16	13	14	193	480	4468	5347
Israel	11.9	19	23	17	14	215	504	7420	9632
Italy	118.9	120	114	107	95	2124	2812	60509	61212
Japan	228.1	210	204	180	144	4294	5772	127353	120625
Jordan	5.2	8	14	7	11	70	212	6455	9355
Kazakhstan	19.8	20	24	19	19	304	896	15921	18573
Kenya	5.0	10	19	7	12	107	533	40909	66306
Kiribati	0.0	0	0	0	0	0	0	98	131

	Transport CO2 (MT) BAU			Transport CO2 (MT): Low Carbon (avg)		GDP GDP (Billion US$) based on purchasing-power-parity (PPP)		Population (In Thousands)	
	2010	2020	2030	2020	2030	2010	2030	2010	2030
Kyrgyzstan	2.4	4	5	3	3	15	55	5334	6871
Laos	1.4	4	5	3	4	24	140	6396	8806
Latvia	3.3	3	4	3	3	38	111	2091	1856
Lebanon	5.0	6	8	5	6	70	179	4341	5172
Lesotho	0.3	1	1	1	1	5	20	2009	2419
Liberia	0.2	0	1	0	1	3	17	3958	6395
Liechtenstein	0.1	0	0	0	0			36	41
Lithuania	4.6	6	7	6	6	63	191	3068	2817
Luxembourg	6.4	7	8	7	7	45	80	508	637
Madagascar	1.6	3	6	3	4	29	98	21080	36000
Maldives	0.3	1	2	1	1	4	13	326	436
Malta	0.6	1	1	1	1	12	29	425	437
Marshall Islands	0.0	0	0	0	0	0	0	52	58
Mauritania	0.7	1	3	1	2	13	57	3609	5640
Mauritius	0.9	1	2	1	1	19	55	1231	1288
Mexico	166.0	220	286	200	190	1842	5058	117886	143663
Monaco	0.0	0	0	0	0			37	44
Mongolia	1.4	3	5	3	4	20	106	2713	3388
Montenegro	0.7	1	1	1	1	8	19	620	608
Morocco	13.5	21	37	18	27	202	780	31642	39190
Mozambique	1.7	3	8	3	6	22	166	23967	38876
Myanmar	2.3	8	15	7	11	178	1137	51931	58698
Namibia	1.8	2	4	2	3	19	93	2179	3042
Nepal	2.3	3	5	3	4	53	180	26846	32853
Netherlands	35.0	38	36	30	25	745	1392	16615	17269
New Zealand	13.8	17	18	16	15	135	323	4368	5208
Niger	1.0	2	6	2	4	14	89	15894	34513
Norway	15.1	25	27	19	17	301	588	4891	5838
Oman	8.3	12	21	11	16	124	225	2803	4920
Paraguay	4.3	5	8	5	6	44	141	6460	8693
Peru	16.3	27	46	24	34	282	960	29263	36514
Phillipines	21.0	44	77	35	43	519	2248	93444	127797
Poland	48.1	50	58	47	50	801	2220	38199	37448
Portugal	18.7	20	21	17	16	281	461	10590	10433
Republic of Korea	84.6	116	132	100	115	1445	4080	48454	52190
Republic of Macedonia	1.3	2	2	2	2			2102	2069
Republic of Moldova	1.0	1	2	1	2	14	35	3573	3066

	Transport CO2 (MT) BAU			Transport CO2 (MT): Low Carbon (avg)		GDP GDP (Billion US$) based on purchasing-power-parity (PPP)		Population (In Thousands)	
	2010	2020	2030	2020	2030	2010	2030	2010	2030
Republic of Serbia	6.3	8	13	7	10	117	235	9647	8582
Romania	14.3	19	22	18	17	346	979	21861	20232
Russia	228.4	223	243	191	199	3046	4883	143618	133556
Senegal	2.0	3	6	3	4	28	110	12951	21856
Seychelles	0.1	0	0	0	0	2	5	91	98
Singapore	7.0	10	10	8	6	359	1081	5079	6578
Slovakia	6.7	7	9	7	7	132	328	5433	5396
Slovenia	5.3	6	6	5	5	58	109	2054	2086
South Africa	47.6	80	114	72	85	609	1181	51452	58096
Spain	91.9	106	126	95	101	1490	3001	46182	48235
Srilanka	6.8	9	11	8	8	156	797	20759	23271
Sweden	20.0	22	21	21	19	394	868	9382	10691
Switzerland	16.4	17	14	16	12	415	871	7831	9477
Tajikistan	0.3	1	2	1	2	16	62	7627	11407
Thailand	55.4	77	106	56	75	823	2368	66402	67554
Togo	0.9	1	3	1	2	8	33	6306	10015
Trinidad and Tobago	3.1	4	6	3	4	39	68	1328	1308
Tunisia	6.0	14	25	8	19	110	327	10632	12561
Turkey	44.0	85	129	75	95	1168	3393	72138	86825
Uganda	3.9	7	16	7	12	61	269	33987	63388
Ukraine	40.0	45	64	33	38	355	760	46050	39842
United Kingdom	120.8	127	142	116	95	2226	4228	62066	68631
United Republic of Tanzania	3.0	8	17	7	12	96	522	44973	79354
Uruguay	3.0	4	6	4	5	55	156	3372	3581
US	1763.7	1619	1521	1600	1311	15084	35342	312247	362629
Vanuatu	0.0	0	0	0	0	1	1	236	352
Vietnam	31.8	56	93	53	59	391	1645	89047	101830
Zambia	1.4	2	3	2	2	45	226	13217	24957
Zimbabwe	1.2	2	3	2	2	20	80	13077	20292

Annex - IV - Sources for Estimating BAU and Low Carbon Scenarios

Sl.No	Country	Study
1	Global	"Pathways to Deep Decarbonization", Sustainable Development Solutions Network (SDSN)and Institute for Sustainable Development and International Relations (IDDRI)
2	Global	"World Energy Outlook 2008", IEA
3	Global	"World Energy Outlook 2012", IEA
4	Global	E. Kriegler, M. Tavoni, T. Aboumahboub, G. Luderer, K. Calvin, G. De Maere, V. Krey, K. Riahi, H. Rosler, M. Schaeffer, D. van Vuuren (2013): What does the 2C target imply for a global climate agreement in 2020? The LIMITS study on Durban Platform scenarios, Climate Change Economics 4(4), doi: 10.1142/S2010007813400083
5	Global	Energy Technology Perspectives 2015,IEA
6	Global	Global transportation energy and climate roadmap, 2012, ICCT
7	Global	International Monetary Fund, World Economic Outlook Database, April 2015
8	Global	Michael A. Replogle and Lew Fulton, "A Global High Shift Scenario: Impacts And Potential For More Public Transport, Walking, And Cycling With Lower Car Use", ITDP & UC Davis
9	Global	The PBL Climate Pledge INDC tool, 2015, PBL Netherlands Environmental Assessment Agency
10	Global	The Pledge Pipeline, UNEP DTU, 2015
11	Global	Trends in global CO2 emissions; 2014 Report - EDGAR, EC-JRC and PBL Netherlands Environmental Assessment Agency
12	Global	UNEP 2013. The Emissions Gap Report 2014. United Nations Environment Programme (UNEP), Nairobi
13	Global	UNEP 2015. The Sixth Emissions Gap Report 2015. United Nations Environment Programme (UNEP), Nairobi
14	Global	UNFCCC 2015, Synthesis report on the aggregate effect of INDCs
15	Global	UNFCCC National Inventory Submissions for Annex I countries, National Communications for Annex I & non-Annex I countries, Biennial Reports (Annex I) & Biennial Update Reports (non-Annex I)
16	Global	UNFCCC, "Intended Nationally Determined Contributions (INDCs)"
17	Global	United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, CD-ROM Edition.
18	Global	World Energy Outlook Special Report 2015: Energy and Climate Change,2015, IEA
19	Global	WRI, CAIT 2.0. 2015. CAIT Projections Beta. Washington, DC: World Resources Institute
20	Afghanistan	The Intended Nationally Determined Contribution of the Afghanistan under the UNFCCC
21	Albania	The Intended Nationally Determined Contribution of the Albania under the UNFCCC
22	Algeria	The Intended Nationally Determined Contribution of the Algeria under the UNFCCC
23	Andorra	The Intended Nationally Determined Contribution of the Andorra under the UNFCCC

Sl.No	Country	Study
24	Antigua and Barbuda	The Intended Nationally Determined Contribution of the Antigua and Barbuda under the UNFCCC
25	Argentina	CLIMACAP Project
26	Argentina	Economics of Green House Gas Limitations
27	Argentina	Second Comunicación Nacional de la República Argentina a la Convención Marco de las Naciones Unidas sobre Cambio Climático
28	Argentina	The Intended Nationally Determined Contribution of the Argentina under the UNFCCC
29	Armenia	The Intended Nationally Determined Contribution of the Armenia under the UNFCCC
30	Armenia	Third National Communication on Climate Change
31	ASEAN	The Study for Long-Term Transport Action Plan for ASEAN (LPA Project), 2014, Institution for Transport Policy Study (ITPS)
32	Asia	ADB & DFID "Energy Efficiency and Climate Change considerations for on road transport in Asia" 2006
33	Asia	Economics of Reducing Greenhouse Gas Emissions in South Asia - Options and Costs
34	Asia	Lee Schipper et al. "Transport and Carbon Dioxide Emissions: Forecasts, Options Analysis, and Evaluation", ADB
35	Australia	Australia's emissions outlook
36	Australia	Australia's Sixth National Communication on Climate Change
37	Australia	Estimating the Emission Reduction Potential of Australian Transport
38	Australia	Greenhouse gas emissions from Australian transport: Projections to 2020
39	Australia	The Intended Nationally Determined Contribution of the Australia under the UNFCCC
40	Austria	Austria's Sixth National Communication
41	Austria	First Biennial Report
42	Azerbaijan	The Intended Nationally Determined Contribution of the Azerbaijan under the UNFCCC
43	Bangladesh	Bangladesh's second National Communication
44	Bangladesh	The Intended Nationally Determined Contribution of the Bangladesh under the UNFCCC
45	Barbados	The Intended Nationally Determined Contribution of the Barbados under the UNFCCC
46	Barbados	UNEP, Green Economy Scoping Study
47	Belarus	Belarus Sixth National Communication
48	Belarus	First Biennial Report
49	Belarus	The Intended Nationally Determined Contribution of the Belarus under the UNFCCC
50	Belgium	Belgium Sixth National Communication
51	Belgium	First Biennial Report
52	Belgium	Pathways to World Class Energy efficiency in Belgium
53	Belgium	Scenarios for a Low Carbon Belgium by 2050
54	Belize	The Intended Nationally Determined Contribution of the Belize under the UNFCCC

Sl.No	Country	Study
55	Benin	The Intended Nationally Determined Contribution of the Benin under the UNFCCC
56	Bhutan	The Intended Nationally Determined Contribution of the Bhutan under the UNFCCC
57	Bolivia	The Intended Nationally Determined Contribution of the Bolivia under the UNFCCC
58	Bosnia and Herzegovina	The Intended Nationally Determined Contribution of the Bosnia and Herzegovina under the UNFCCC
59	Botswana	The Intended Nationally Determined Contribution of the Botswana under the UNFCCC
60	Brazil	Brazil Low Carbon Country Case Study
61	Brazil	Brazil's Second National Communication
62	Brazil	Pathways for a Low Carbon Economy for Brazil
63	Brazil	The Intended Nationally Determined Contribution of the Brazil under the UNFCCC
64	Bulgaria	Bulgaria sixth National Communication
65	Bulgaria	First Biennial Report
66	Burkina Faso	The Intended Nationally Determined Contribution of the Burkina Faso under the UNFCCC
67	Burundi	The Intended Nationally Determined Contribution of the Burundi under the UNFCCC
68	Cabo Verde	The Intended Nationally Determined Contribution of the Cabo Verde under the UNFCCC
69	Cambodia	Cambodia's First National Communication
70	Cambodia	The Intended Nationally Determined Contribution of the Cambodia under the UNFCCC
71	Cameroon	The Intended Nationally Determined Contribution of the Cameroon under the UNFCCC
72	Canada	Achieving 2050 : A Carbon Pricing Policy for Canada
73	Canada	Canada's Sixth National Report on Climate Change
74	Canada	Getting to 2050: Canada's Transition to a Low-emission Future
75	Canada	The Intended Nationally Determined Contribution of the Canada under the UNFCCC
76	Central African Republic	The Intended Nationally Determined Contribution of the Central African Republic under the UNFCCC
77	Chad	The Intended Nationally Determined Contribution of the Chad under the UNFCCC
78	Chile	Chile Second National Communication
79	Chile	Greenhouse Gas Emissions in the Transport Sector 2000-2020: Case Study for Chile
80	Chile	PMR Market Readiness Proposal In Chile: Activity 4: Study On The Chilean National Situation
81	Chile	Programas de transporte: integrando los impactos del Cambio Climático
82	Chile	The Intended Nationally Determined Contribution of the Chile under the UNFCCC
83	China	Oil consumption and CO2 emissions in China's road transport: current status, future trends, and policy implications

Sl.No	Country	Study
84	China	Projection of Chinese Motor Vehicle Growth, Oil Demand, and CO 2 Emissions through 2050
85	China	Second National Communication on Climate Change of The People's Republic of China
86	China	The Intended Nationally Determined Contribution of the China under the UNFCCC
87	Colombia	Colombia Second National Communication
88	Colombia	CTF Colombia
89	Colombia	The Intended Nationally Determined Contribution of the Colombia under the UNFCCC
90	Comoros	The Intended Nationally Determined Contribution of the Comoros under the UNFCCC
91	Congo	The Intended Nationally Determined Contribution of the Congo under the UNFCCC
92	Costa Rica	Costa Rica Market Readiness Proposal (MRP) Partnership for Market Readiness Final Report
93	Costa Rica	The Intended Nationally Determined Contribution of the Costa Rica under the UNFCCC
94	Costa Rica	Third National Communication of Costa Rica
95	Croatia	Croatia Sixth National Communication
96	Croatia	First Biennial Report
97	Croatia	Possible development of the Croatian energy sector by 2050 in the view of carbon dioxide emission reductions
98	Cyprus	Cyprus Sixth National Communication
99	Cyprus	First Biennial Report
100	Czech republic	Czech Sixth National Communication
101	Czech republic	First Biennial Report
102	D.R. Congo	The Intended Nationally Determined Contribution of the D.R. Congo under the UNFCCC
103	Denmark	Danish Greenhouse Gas Reduction Scenarios for 2020 and 2050
104	Denmark	Denmark Sixth National Communication
105	Denmark	First Biennial Report
106	Djibouti	The Intended Nationally Determined Contribution of the Djibouti under the UNFCCC
107	Dominica	The Intended Nationally Determined Contribution of the Dominica under the UNFCCC
108	Dominican Republic	Second National Communication on Climate Change of Dominican Republic
109	Dominican Republic	The Intended Nationally Determined Contribution of the Dominican Republic under the UNFCCC
110	Ecuador	The Intended Nationally Determined Contribution of the Ecuador under the UNFCCC
111	Equatorial Guinea	The Intended Nationally Determined Contribution of the Equatorial Guinea under the UNFCCC
112	Eritrea	The Intended Nationally Determined Contribution of the Eritrea under the UNFCCC

Sl.No	Country	Study
113	Estonia	Long-term energy scenarios for Estonia, Scenarios for 2030 and 2050
114	Estonia	Estonia's opportunities to move Competitive Low Carbon in the direction of the economy in 2050
115	Estonia	Estonia's Sixth National Communication
116	Estonia	First Biennial Report
117	Ethiopia	The Intended Nationally Determined Contribution of the Ethiopia under the UNFCCC
118	European Union	European Gas Forum, "Reducing Transport CO2 Emissions in the EU Transport Sector 2050", 2012
119	European Union	EU Sixth National Communication
120	European Union	European Commission, "Energy Roadmap 2050", 2011
121	European Union	Greenhouse gas emission trends and projections in Europe 2011 - Tracking progress towards Kyoto and 2020 targets
122	European Union	Ian Skinner (AEA Associate) Huib van Essen (CE Delft) Richard Smokers (TNO) Nikolas Hill (AEA) "EU Transport GHG: Routes to 2050? - Towards the decarbonisation of the EU's transport sector by 2050", 2010
123	European Union	Long-term outlook of energy use and CO2 emissions from transport in Central and Eastern Europe
124	European Union	Road to 2030: how EU vehicle efficiency standards help member states meet climate targets
125	European Union	The Intended Nationally Determined Contribution of the European Union under the UNFCCC
126	European Union	Wolfgang Schade, Nicki Helfrich & Anja Peters, "A Transport Scenario for Europe Until 2050 in a 2-Degree World",2010
127	Finland	Finlands sixth national communication
128	Finland	First Biennial Report
129	Finland	Impact Assessment of the EU's 2030 climate and energy policies for Finland
130	Finland	Low Carbon Finland 2050
131	France	First Biennial Report
132	France	Frances Sixth National Communication
133	France	Markal-Times assessment of long term CO2 emissions targets for France
134	France	Pathways 2020-2050 Towards a low-carbon economy in France
135	Gabon	Gabon Second communication of Gabon on climate change to the UNFCCC
136	Gabon	The Intended Nationally Determined Contribution of the Gabon under the UNFCCC
137	Gambia	The Intended Nationally Determined Contribution of the Gambia under the UNFCCC
138	Georgia	The Intended Nationally Determined Contribution of the Georgia under the UNFCCC
139	Germany	CO2 Emissions Reduction in the Transport Sector in Germany
140	Germany	First Biennial Report
141	Germany	Germanies Sixth National Communication
142	Ghana	The Intended Nationally Determined Contribution of the Ghana under the UNFCCC
143	Greece	A Low Carbon Vision for Greece in 2050
144	Greece	First Biennial Report

Sl.No	Country	Study
145	Greece	Greece Sixth National Communication
146	Greece	The Greek Energy System in 2050 GHG mitigation options
147	Grenada	The Intended Nationally Determined Contribution of the Grenada under the UNFCCC
148	Guatemala	The Intended Nationally Determined Contribution of the Guatemala under the UNFCCC
149	Guinea	The Intended Nationally Determined Contribution of the Guinea under the UNFCCC
150	Guinea Bissau	The Intended Nationally Determined Contribution of the Guinea Bissau under the UNFCCC
151	Guyana	Guyana Second National Communication to the United National Framework Convention on Climate Change
152	Guyana	The Intended Nationally Determined Contribution of the Guyana under the UNFCCC
153	Haiti	The Intended Nationally Determined Contribution of the Haiti under the UNFCCC
154	Honduras	The Intended Nationally Determined Contribution of the Honduras under the UNFCCC
155	Hungary	Development and implementation of a monitoring and assessment tool for CO2 emissions in inland transport to facilitate climate change mitigation - Hungary Case Study
156	Hungary	First Biennial Report
157	Hungary	Hungary's sixth National Communication
158	Iceland	First Biennial Report
159	Iceland	Iceland's sixth National Communication
160	Iceland	Life Cycle Assessment of Scenarios for the Icelandic Vehicle Fleet
161	Iceland	The Intended Nationally Determined Contribution of the Iceland under the UNFCCC
162	India	Expert Group on Low Carbon Strategies for Inclusive Growth
163	India	India: Options for Low-Carbon Development
164	India	ITPS-TERI-Low Carbon Study, 2010, ITPS
165	India	Second national communication to the United Nations Framework Convention on Climate Change - India
166	India	The Intended Nationally Determined Contribution of the India under the UNFCCC
167	India	Transport Emissions and India's Diesel Mystery - Comparing Top-Down and Bottom-Up Carbon Estimates, WRI, 2014
168	Indonesia	Indonesia second National Communication
169	Indonesia	Indonesia's greenhouse gas abatement cost curve Dewan Nasional Perubahan Iklim, Indonesia
170	Indonesia	The Intended Nationally Determined Contribution of the Indonesia under the UNFCCC
171	Iran	Irans Second National Communication
172	Ireland	First Biennial Report
173	Ireland	Ireland sixth National communication
174	Ireland	Ireland's Greenhouse Gas Emission Projections 2012-2030

Sl.No	Country	Study
175	Israel	Greenhouse gas abatement potential in Israel
176	Israel	Greenhouse Gas Emission Reductions Action Plan for the State of Israel
177	Israel	Israel second National Communication
178	Israel	The Intended Nationally Determined Contribution of the Israel under the UNFCCC
179	Italy	First Biennial Report
180	Italy	Italy Sixth national Communication
181	Italy	Strategies and technologies for a low carbon energy system: the Italian case
182	Ivory Coast	The Intended Nationally Determined Contribution of the Ivory Coast under the UNFCCC
183	Jamaica	Jamaica's second national communication
184	Japan	CASA-2030
185	Japan	Japan 2050 Low Carbon navigator
186	Japan	Japan Roadmaps towards Low-Carbon Societies (LCSs)
187	Japan	Japan's sixth Communication to the UNFCCC
188	Japan	The Intended Nationally Determined Contribution of the Japan under the UNFCCC
189	Jordan	The Intended Nationally Determined Contribution of the Jordan under the UNFCCC
190	Kazakhstan	First Biennial Report
191	Kazakhstan	Kazakhstan Sixth National Communication
192	Kazakhstan	The Intended Nationally Determined Contribution of the Kazakhstan under the UNFCCC
193	Kenya	The Intended Nationally Determined Contribution of the Kenya under the UNFCCC
194	Kiribati	The Intended Nationally Determined Contribution of the Kiribati under the UNFCCC
195	Kyrgyz Republic	The Kyrgyz Republic's Second National Communication to the united nations framework convention on climate change
196	Kyrgyzstan	The Intended Nationally Determined Contribution of the Kyrgyzstan under the UNFCCC
197	LAC	Lee Schipper, Deakin Elizabeth, CarolynMcAndrews, Lynn Scholl, Frick Trapenberg, Karen, "Considering climate change in Latin American and Caribbean urban transportation : concepts, applications, and cases", The World Bank, 2009
198	Lao PDR	The Intended Nationally Determined Contribution of the Lao PDR under the UNFCCC
199	Latvia	First Biennial Report
200	Latvia	Green Energy Strategy 2050 for Latvia: a Pathway towards a Low Carbon Society
201	Latvia	Latvia's Sixth National Communication
202	Lebanon	The Intended Nationally Determined Contribution of the Lebanon under the UNFCCC
203	Lesotho	The Intended Nationally Determined Contribution of the Lesotho under the UNFCCC
204	Liberia	The Intended Nationally Determined Contribution of the Liberia under the UNFCCC

Sl.No	Country	Study
205	Liechtenstein	First Biennial Report
206	Liechtenstein	Liechtenstein's Sixth National Communication
207	Liechtenstein	The Intended Nationally Determined Contribution of the Liechtenstein under the UNFCCC
208	Lithuania	First Biennial Report
209	Lithuania	Lithuanian Climate Change Management Policy
210	Lithuania	Lithuania's Sixth National Communication
211	Luxembourg	First Biennial Report
212	Luxembourg	Luxembourg's Sixth National Communication
213	Macedonia	The Intended Nationally Determined Contribution of the Macedonia under the UNFCCC
214	Madagascar	The Intended Nationally Determined Contribution of the Madagascar under the UNFCCC
215	Malawi	The Intended Nationally Determined Contribution of the Malawi under the UNFCCC
216	Maldives	Ministry of Environment and Energy, "Low Carbon Strategy for the Transport Sector"
217	Maldives	Ministry of Environment, Energy and water, "In-depth Technology Needs Assessment of Transport Sector"
218	Maldives	The Intended Nationally Determined Contribution of the Maldives under the UNFCCC
219	Mali	The Intended Nationally Determined Contribution of the Mali under the UNFCCC
220	Malta	First Biennial Report
221	Malta	Malta Sixth National Communication
222	Marshall Islands	The Intended Nationally Determined Contribution of the Marshall Islands under the UNFCCC
223	Mauritania	The Intended Nationally Determined Contribution of the Mauritania under the UNFCCC
224	Mauritius	Second National Communication
225	Mauritius	The Intended Nationally Determined Contribution of the Mauritius under the UNFCCC
226	Mexico	Mexico Fifth National Communication
227	Mexico	Mexico's Low Emission Development Program, "Update of Mexico's emissions baseline and mitigation portfolio 2011-2030" 2013
228	Mexico	The Intended Nationally Determined Contribution of the Mexico under the UNFCCC
229	Mexico	Todd M. Johnson, Claudio Alatorre, Zayra Romo & Feng Liu, "Low Carbon Development for Mexico", 2010, The World Bank
230	Monaco	First Biennial Report
231	Monaco	Monaco's Sixth National Communication
232	Monaco	The Intended Nationally Determined Contribution of the Monaco under the UNFCCC
233	Mongolia	The Intended Nationally Determined Contribution of the Mongolia under the UNFCCC

Sl.No	Country	Study
234	Montenegro	The Intended Nationally Determined Contribution of the Montenegro under the UNFCCC
235	Morocco	The Intended Nationally Determined Contribution of the Morocco under the UNFCCC
236	Mozambique	The Intended Nationally Determined Contribution of the Mozambique under the UNFCCC
237	Myanmar	The Intended Nationally Determined Contribution of the Myanmar under the UNFCCC
238	Namibia	The Intended Nationally Determined Contribution of the Namibia under the UNFCCC
239	Netherlands	A low Carbon Vision for the Netherlands in 2050
240	Netherlands	Energy Blueprint, Netherlands
241	Netherlands	First Biennial Report
242	Netherlands	GHG trends and projections-Netherlands
243	Netherlands	Netherlands energy outlook 2014
244	Netherlands	Netherlands sixth National Communication
245	Netherlands	Policy options for reducing CO_2 emissions from road transport
246	Netherlands	Sustainable Innovations in Road Transport : Assessing the Impact of New Technology on Energy and Emissions
247	New Zealand	First Biennial Report
248	New Zealand	Introduction to NZ Transport System and Related Issues
249	New Zealand	New Zealand Sixth National communication
250	New Zealand	NZ Energy Outlook 2011
251	New Zealand	NZ Energy strategy 2050
252	New Zealand	The Intended Nationally Determined Contribution of the New Zealand under the UNFCCC
253	Niger	The Intended Nationally Determined Contribution of the Niger under the UNFCCC
254	Norway	Climate Cure 2020
255	Norway	Knowledge base for low-carbon transition in Norway
256	Norway	Norway's path to sustainable transport
257	Norway	Norway's Sixth National Communication
258	Norway	The Intended Nationally Determined Contribution of the Norway under the UNFCCC
259	Oman	The Intended Nationally Determined Contribution of the Oman under the UNFCCC
260	Panama	Panama second national communication to the UNFCCC
261	Papua New Guinea	The Intended Nationally Determined Contribution of the Papua New Guinea under the UNFCCC
262	Paraguay	The Intended Nationally Determined Contribution of the Paraguay under the UNFCCC
263	Peru	Peru's National Communication
264	Peru	The Intended Nationally Determined Contribution of the Peru under the UNFCCC
265	Philippines	The Intended Nationally Determined Contribution of the Philippines under the UNFCCC

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266	Poland	2050. PL - The Journey To The Low Emissions Future
267	Poland	First Biennial Report
268	Poland	Poland's sixth national Communication
269	Poland	Transition to a Low-Emissions Economy in Poland
270	Portugal	Evaluation of the impacts of the introduction of alternative fuelled vehicles in the road transportation sector
271	Portugal	Marginal Coabatement Costs for the Portuguese Energy System
272	Portugal	Sixth National Communication of Portugal
273	Portugal	The Green Growth Commitment and The Green Taxation Reform
274	Republic of Korea	"Estimating GHG Emission Reductions in the Transport Sector Through a Bottom-Up Mitigation Model (MESSAGE) and Facilitating Use of the Scheme" ,2013, KOTI
275	Republic of Korea	Korea's third national communication under the United Nations Framework Convention on Climate Change
276	Republic of Korea	Kyungho Lee, "Confirmation of a Road Map to Reduce 30% National GHGs Emission: Expected Cost for 14 trillion Won by 2020". The Asia Economy, 12 July 2011. Available from www.asiae.co.kr/news/view.htm?sec=eco3&idxno=2011071209173541812
277	Republic of Korea	The Intended Nationally Determined Contribution of the Republic of Korea under the UNFCCC
278	Republic of Moldova	The Intended Nationally Determined Contribution of the Republic of Moldova under the UNFCCC
279	Republic of Serbia	The Intended Nationally Determined Contribution of the Republic of Serbia under the UNFCCC
280	Romania	Energy [r]evolution- a sustainable Romania energy outlook
281	Romania	First Biennial Report
282	Romania	Romania's Sixth National Communication
283	Russia	Pathways to an Energy and Carbon Efficient Russia
284	Russia	The Intended Nationally Determined Contribution of the Russia under the UNFCCC
285	Russia	Russian Sixth National Communication
286	Rwanda	The Intended Nationally Determined Contribution of the Rwanda under the UNFCCC
287	Samoa	The Intended Nationally Determined Contribution of the Samoa under the UNFCCC
288	San Marino	The Intended Nationally Determined Contribution of the San Marino under the UNFCCC
289	Sao Tome and Principe	The Intended Nationally Determined Contribution of the Sao Tome and Principe under the UNFCCC
290	Senegal	The Intended Nationally Determined Contribution of the Senegal under the UNFCCC
291	Seychelles	The Intended Nationally Determined Contribution of the Seychelles under the UNFCCC
292	Sierra Leone	The Intended Nationally Determined Contribution of the Sierra Leone under the UNFCCC
293	Singapore	First Biennial Report
294	Singapore	Singapore Third National communication

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295	Singapore	The Intended Nationally Determined Contribution of the Singapore under the UNFCCC
296	Slovakia	Energy Policies of IEA Countries The Slovak Republic - 2012 Review
297	Slovakia	First Biennial Report
298	Slovakia	Slovakia's Sixth national communication
299	Slovenia	First Biennial Report
300	Slovenia	Slovenia's Sixth national Communication
301	Solomon Islands	The Intended Nationally Determined Contribution of the Solomon Islands under the UNFCCC
302	South Africa	First Biennial Report
303	South Africa	Long Term Mitigation Scenarios for South Africa and Climate Change Policy Response
304	South Africa	South Africa's Second National Communication
305	South Africa	The Intended Nationally Determined Contribution of the South Africa under the UNFCCC
306	Spain	Spain - Sixth National Communication
307	Sri Lanka	The Intended Nationally Determined Contribution of the Sri Lanka under the UNFCCC
308	Swaziland	The Intended Nationally Determined Contribution of the Swaziland under the UNFCCC
309	Sweden	First Biennial Report
310	Sweden	Greenhouse gas abatement opportunities in Sweden
311	Sweden	Sweden's Sixth National Communication
312	Switzerland	Defining deep decarbonisation pathways for Switzerland: An economic evaluation based on the computable general equilibrium model GEMINI-E3
313	Switzerland	iTREN-2030 Integrated transport and energy baseline until 2030
314	Switzerland	Swiss Greenhouse Gas Cost Abatement Curve
315	Switzerland	Switzerland - Sixth national communication to the UNFCCC
316	Switzerland	Switzerland Energy Transition Scenarios – Development and Application of the Swiss TIMES Energy System Model (STEM)
317	Switzerland	The Intended Nationally Determined Contribution of the Switzerland under the UNFCCC
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323	Tunisia	The Intended Nationally Determined Contribution of the Tunisia under the UNFCCC
324	Turkey	The Intended Nationally Determined Contribution of the Turkey under the UNFCCC

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325	Turkmenistan	The Intended Nationally Determined Contribution of the Turkmenistan under the UNFCCC
326	Uganda	The Intended Nationally Determined Contribution of the Uganda under the UNFCCC
327	UK	Climate change and energy guidance-2050 pathways
328	UK	Fourth Carbon Budget Review – Technical Report
329	UK	Low carbon transport, A greener future
330	UK	The Carbon Plan: Delivering our low carbon future
331	Ukraine	2050: Greenhouse Gas Emissions Projections for Ukraine
332	Ukraine	First Biennial Report
333	Ukraine	The Intended Nationally Determined Contribution of the Ukraine under the UNFCCC
334	Ukraine	Ukraine's sixth National Communication
335	United Arab Emirates	The Intended Nationally Determined Contribution of the United Arab Emirates under the UNFCCC
336	United Kingdom	First Biennial Report
337	United Kingdom	UK's Sixth National Communication
338	United States	The Intended Nationally Determined Contribution of the United States under the UNFCCC
339	Uruguay	The Intended Nationally Determined Contribution of the Uruguay under the UNFCCC
340	US	Moving Cooler
341	US	Reducing GHG from US Transportation
342	US	Scenarios for Deep Reductions in Greenhouse Gas Emissions
343	US	U.S. Climate Action Report 2014
344	Vanuatu	The Intended Nationally Determined Contribution of the Vanuatu under the UNFCCC
345	Vietnam	"Low Carbon Society Scenarios", 2014, ISPONRE,KU,NIES,IGES & MHIR
346	Vietnam	First Biennial Report
347	Vietnam	International Study of Transport Systems in a Low Carbon Society: Southeast Asian Region, 2010, ITPS-Clean Air Asia
348	Vietnam	Nguyen Thai Hoa, Kei Gomi and Yuzuru Matsuoka, "Low Carbon Energy Scenario Development in Vietnam", 2014 4th International Conference on Future Environment and Energy
349	Vietnam	The Intended Nationally Determined Contribution of the Vietnam under the UNFCCC
350	Vietnam	Viet Nam's second national communication to the United Nations Framework Convention on Climate Change
351	Vietnam	World Bank, Vietnam 2030, Charting a Low Carbon Development Path for Vietnam
352	Zambia	Climate Change Mitigation in Southern Africa - Zambia Country Study
353	Zambia	The Intended Nationally Determined Contribution of the Zambia under the UNFCCC
354	Zimbabwe	The Intended Nationally Determined Contribution of the Zimbabwe under the UNFCCC

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