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PARIS PROCESS
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Partnership on Sustainable Low Carbon Transport

ANALYSIS ON NATIONAL TRANSPORT SECTOR EMISSION TRENDS 1990 - 2012

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CORNIE HUIZENGA
KARL PEET
SUDHIR GOTA

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TRANSfer

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List of Abbreviations

2DS	Two-degree Celsius scenario
ASI	Avoid-Shift-Improve
BAU	Business-as-usual
BRT	Bus Rapid Transit
CO_2	Carbon dioxide
COP	Conference of the Parties
GDP	Gross Domestic Product
GHG	Green House Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GSR	Global Status Report
Gt	Giga tons
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
INDCs	Intended Nationally-Determined Contributions
kT	Kilo tons
LCA	Lifecycle Assessments
LGV	Light Goods Vehicle
LPAA	Lima-Paris Action Agenda
LPG	Liquid petroleum gas
NAMA	Nationally Appropriate Mitigation Action
MCB	Michelin Challenge Bibendum
MRT	Mass Rapid Transit
MRV	Measurement, reporting and verification
MT	Mega tons
NCs	National communications
OECD	Organisation for Economic Co-operation and Development
PPMC	The Paris Process on Mobility and Climate
SLCPs	Short-lived climate pollutants
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar

Introduction

The latest estimates from the International Energy Agency (IEA) indicate that the transport sector contributed nearly 23% of global CO_2 emissions from fuel combustion in 2012. [1]Transport, with an average annual growth rate of 2.0% from 1990-2012, is among the fastest growing sectors of CO_2 emissions from fuel combustion, as shown in Table 1.

CO_2 Emissions from Transport (Mt CO_2)	1990	4580
	2000	5736
	2008	6784
	2012	7187
Annual Transport Emissions Growth Rate (%)	1990-2000	2.3
	2000-2008	2.1
	2008-2012	1.5

Table 1: Total Emissions from Transport and Average Growth Rates

Thus, tracking emissions trends in the transport sector (in the context of economy-wide emissions) is an essential step in defining possible transport components of Intended Nationally Determined Contributions (INDCs) from UNFCCC parties, and in helping to determine required contributions from transport to establish and achieve national and global mitigation targets. Yet,tracking global averages is of limited use to countries who are developing their INDCs to support the upcoming COP21 meeting in Paris, and therefore we must have a clearer understanding of transport emissions trends and differentiation atnational levels to take effective actions to reduce global transport sector emissions and achieve an IPCC-recommended 2-degree scenario (2DS).

Thus, to inform the discussion on the contribution of transport to CO_2 emissions and also the role that transport should play in mitigation strategies – in particular,INDCs –the Partnership on Sustainable Low Carbon Transport (SLoCaT) has developed theSLoCaT Analysis of Transport Emission Trends to illustrate national and regional trends in three areas: (1) transport sector share of emissions relative to total emissions from fuel combustion, (2) growth of transport sector emissions, and (3) absolute and per-capita emissions from transport, as normalized by a number of key variables.

Transport Sector Emissions Share

According to 2012 IEA data, transport was the largest energy consuming sector in 40% of countries worldwide, and in most remaining countries, transport is the second largest energy consuming sector. 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%, and the share of countries exceeding the global average is increasing over time.The share of countries in which transport accounted for more than 30% of emissions from fuel combustion rose from 34% in 1990 to 47% in 2012, as shown in Figure 1.At the same time,the share of countries in which transport accounted for less than 10% of emissions from fuel combustion decreased from 14% in 1990 to 5% in 2012.

1 2014, CO_2 Emissions from Fuel Combustion Highlights (2014 edition), Figure 9. Accessed May 15, 2015.
2 Primary data are derived from (1) IEA, CO_2 emissions from fuel combustion (2014 and previous years), (2) the 2014 edition of World Development Indicators, and (3) UNFCCC information on Annex-I and non-Annex I countries and emission pledges

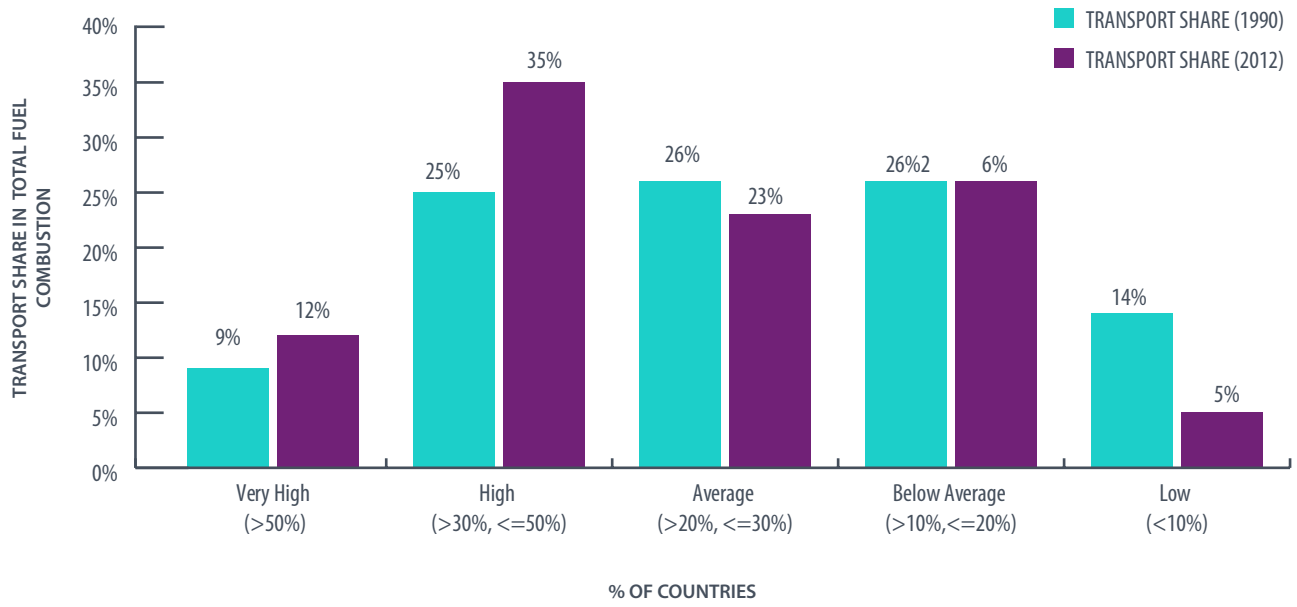

Figure 1 Transport Share in Total Fuel Combustion Distribution

These 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 emissions from fuel consumption. Since current investment choices in transport infrastructure and technology can lock in countries to either a fossil fuel dependent or low-carbon pathway for the next 30 to 50 years, it is essential that such trends be reversed by incorporating low carbon transport in national pre-2020 mitigation strategies andsector-specific INDC reduction targets, which are expected to guide post 2020 mitigation action.

Furthermore, transport emission shares in non-Annex I countries (relative to Annex I countries)increased from 24% in 1990 to 45% in 2012,due to high growth in transport activity in non-Annex I countries coupled with slower growth in transport activity in Annex I countries, as well as possible greater deployment of emission reducing measures(e.g. fuel economy standards), in these countries, as shown inFigure 2.It is expected that by 2016 or 2017 transport emissions from non-Annex I ocuntries will be larger than those from Annex I countries.This trend suggests that there is an urgent need for non – Annex I countries to take on action on transport and climate change. It also offers Annex I Parties an opportunity to provide necessary financial support and technology transfer to help non-Annex I countries adopt low carbon pathways earlier in the development process, to make emissions reductions from transport more economical and more conducive to achieving broader development goals.

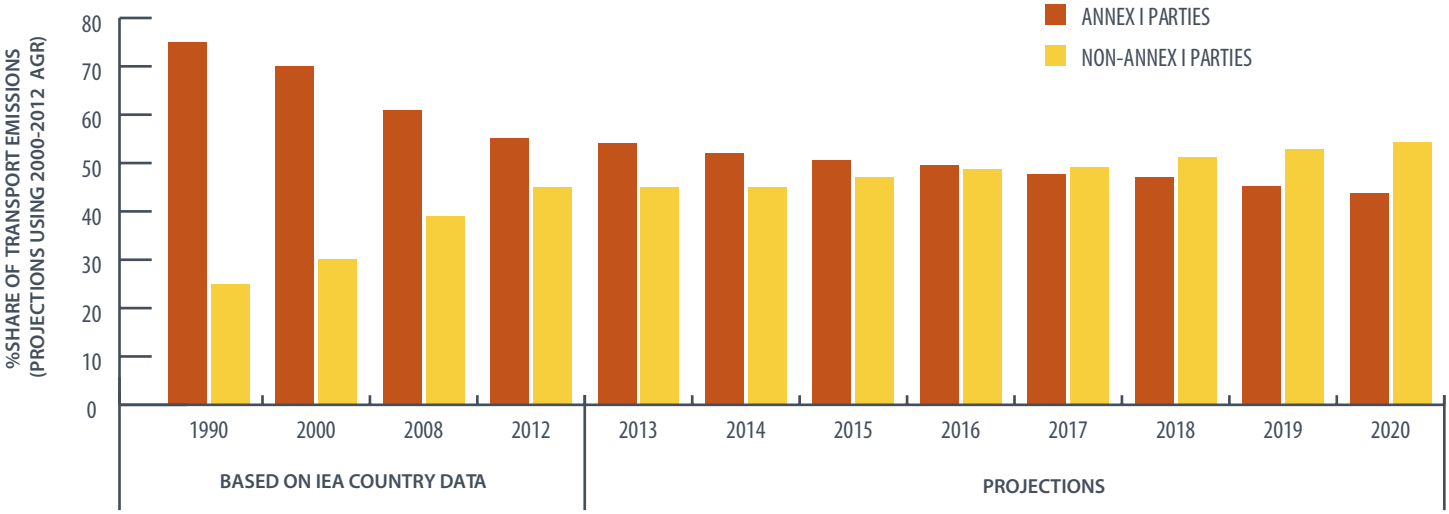

Figure 2 Transport Emissions Share of Annex I and non-Annex I countries

Individual non-Annex I countries with a high share of transport emissions relative to total emissions include Togo (77%), Congo (75%), Mozambique (72%), Benin (70%), and Costa Rica (70%), underscoring that increased attention to reducing transport sector emissions in these countries could yield significant reductions in overall national emissions.

Transport Sector Emissions Growth

Table 2 illustrates transport sector emissions growth from 1990 to 2012, reflecting reduced growth rates among Annex I countries (which averaged 0.5% during this period),and steadily rising growth rates among non-Annex I countries (which averaged 4.8%). This further underscores the fact that developed economies have an opportunity to share good practices to help ensure that emerging economies are able to meet low emissions targets.

	Transport CO_2 Mt CO_2				Annual Growth Rate (%)		
	1990	2000	2008	2012	1990-2000	2000-2008	2008-2012
Annex I Parties	2990	3369	3493	3377	1.2	0.5	-0.8
Non-Annex I Parties	970	1527	2203	2730	4.6	4.7	5.5

Table 2: Average Annual Growth of Transport CO_2 Emissions

Figure 3 illustrates the considerable, persistent differences among countries in terms of annual average growth in transport CO_2 emissions. While about half of countries worldwide have experienced either high or very high growth (i.e. more than 3% or 5%, respectively), in the 1990-2012 period, it is important to note that from 2008-2012, 33% of countries worldwide experienced either zero or negative growth.

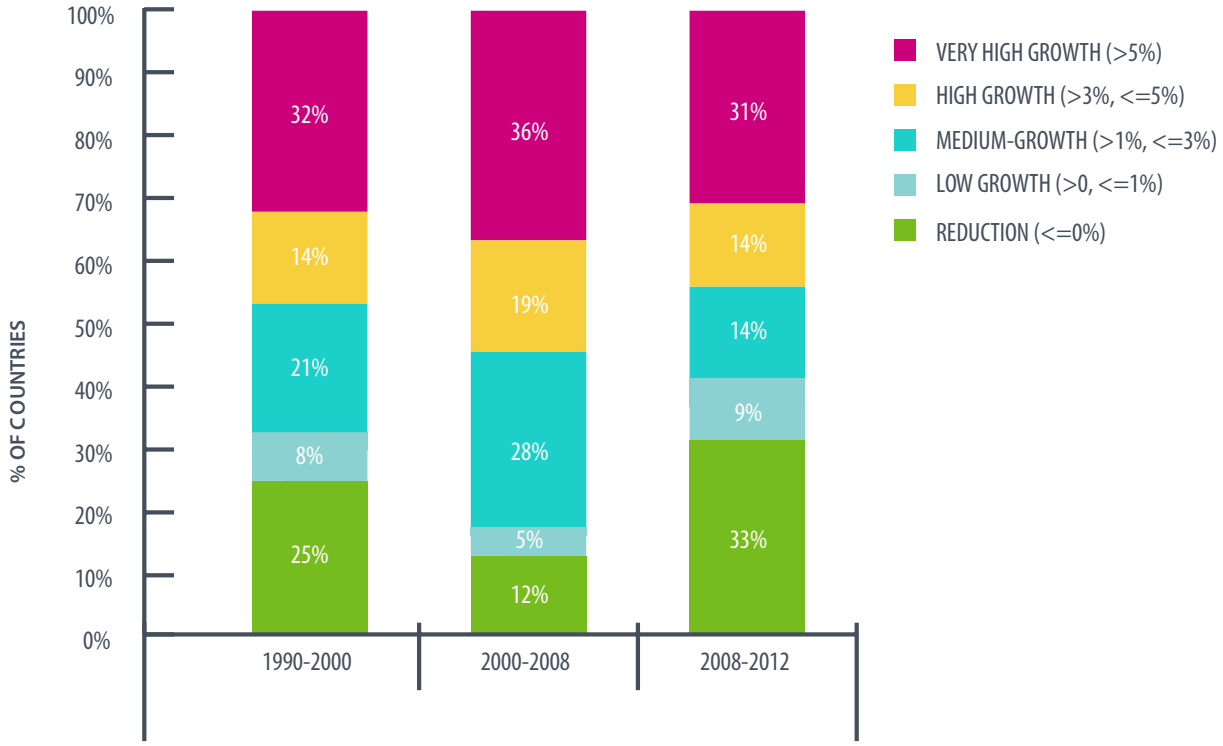

Figure 3: Differentiation in Transport Growth Rates among Individual Countries

At a regional level, transport CO_2 annual growth rates largely follow a split betweenAnnex 1 and non-Annex 1 countries, as shown in Figure 4. Growth rates of EU-28 and OECD Americas, which were largely similar for 1990-2000 started to differ for 2000-2008 and show a marked difference for 2008-2012 (i.e.the EU-28 showssubstantial negative growth (-2.2%) while OECD Americas shows a very marginal decrease (-0.2%). Regional groupings within the non-Annex 1 countries show much greater variation (albeit all positive growth), with the fastest growth at a regional level in China(if considered as a separate region).

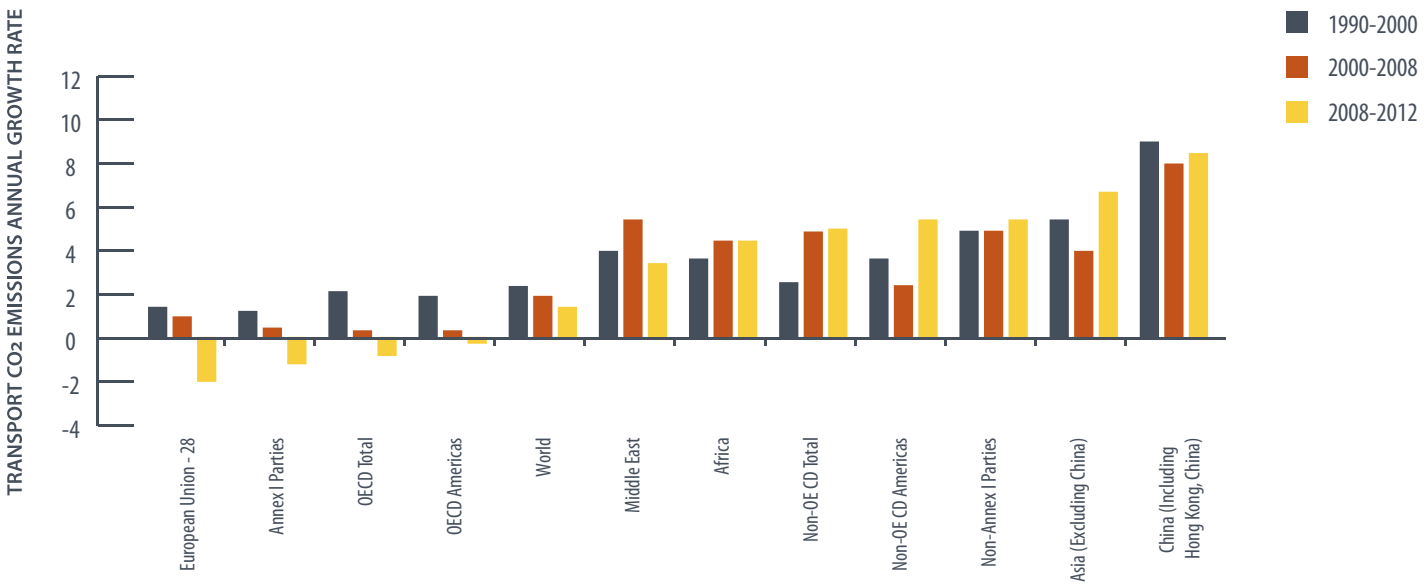

Figure 4 Transport CO_2 Emissions Growth Across Regions

A review of individual countries shows that individual states with the highest transport emissions growth between 1990 to 2012 were Benin (15.0%), Viet Nam (10.0%), Qatar (9.4%), Angola (9.4%), and Tanzania (9.1%), highlighting a substantial need and opportunity to further define mitigation strategies in the transport sector..

Crucially, Figure 5indicates that growth in transport emissions can be decoupled to some extent from economic growth.Annex I Parties in particular have limited transport emissions growth to well below GDP growth rates, and even non-Annex I Parties have also kept transport growth below GDP growth over this 12-year period (albeit by a much narrower margin, due to recently rising growth rates among many non-Annex I Parties). While transport growth continues to lead GDP growth in Africa, the Middle East, and the developing Americas, emerging economies in Asia have demonstrated measured success in achieving economic growth while limiting transport emissions during the 1990-2012 period.

Figure 5: Regional Growth in GDP and Transport Emissions

In the case of Annex I countries, the decoupling effect is growing stronger through the three time frames indicated, while in the case of non-Annex 1 countries, there is no similar progression, and the decoupling effect becomes weaker over time, to the point at which it is virtually non-existent for 2008-2012, as shown in Figure 6, though it is important to note variations within the Annex I and non-Annex I countries, as shown in Figure 7 and Figure 8 below.

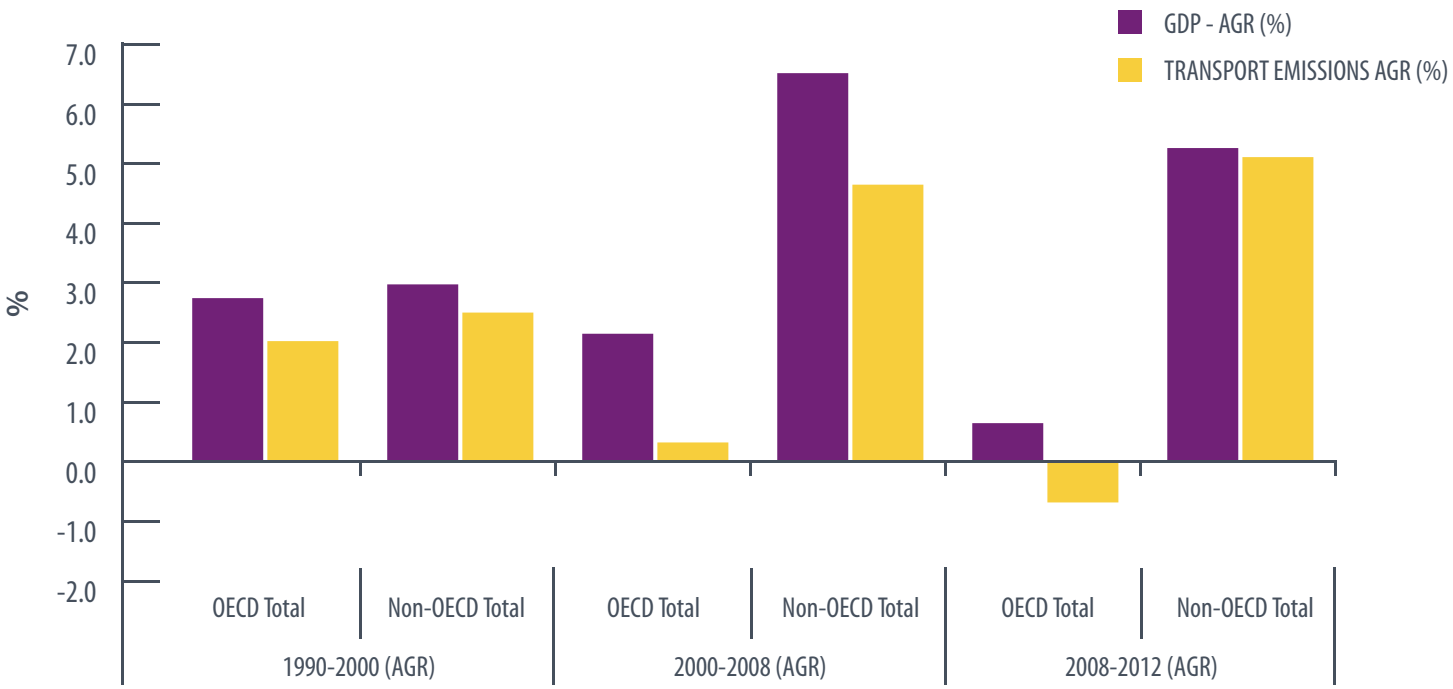

Figure 6: Transport CO_2 Emissions Growth Relative to GDP Growth

Annex I countries like Sweden, UK and Germany have reduced transport CO_2 emissions growth relative to GDP growth,with transport CO_2 emissions remaining at or below 1990 levels, and GDP growing at annual rates of 1-3% (as represented by downward slopes in Figure 7). By contrast, Annex I countries like the Czech Republic, Croatia and Portugal show an increased coupling of transport emissions with economic growth, with transport emissions increasing from 1.6 to 3.8% andGDP rising only from 0.3 to 1.8% from 1990 to 2012.

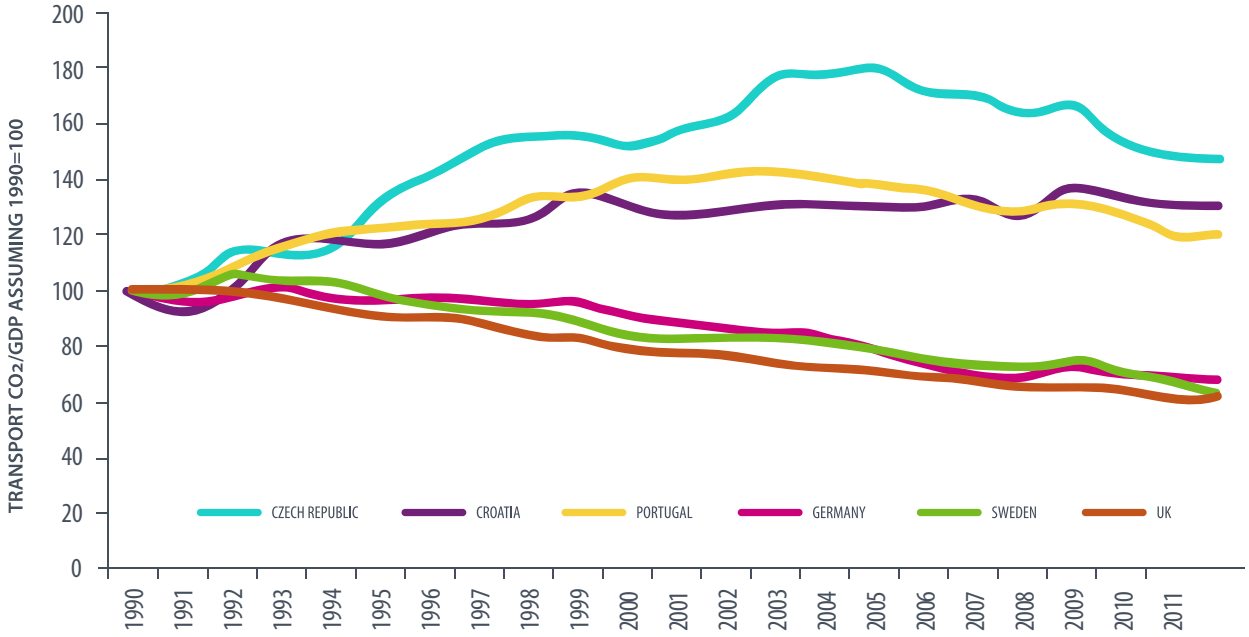

Figure 7: Transport Emissions/GDP Growth among Selected Annex I Parties

Among non-Annex I countries, the prevailing trend is towardan increased coupling of transport emissions with economic growth (e.g. VietNam, Paraguay and Indonesia), although there are also examples of non-Annex I countries which have managed to reduce growth in transport emissions relative to economic growth (e.g. Colombia, Argentina and Mongolia), as shown in Figure 8. However, in the latter three countries, the transport sector is still growing faster than other sectors relative to sector-wide CO_2 emissions from fuel combustion.

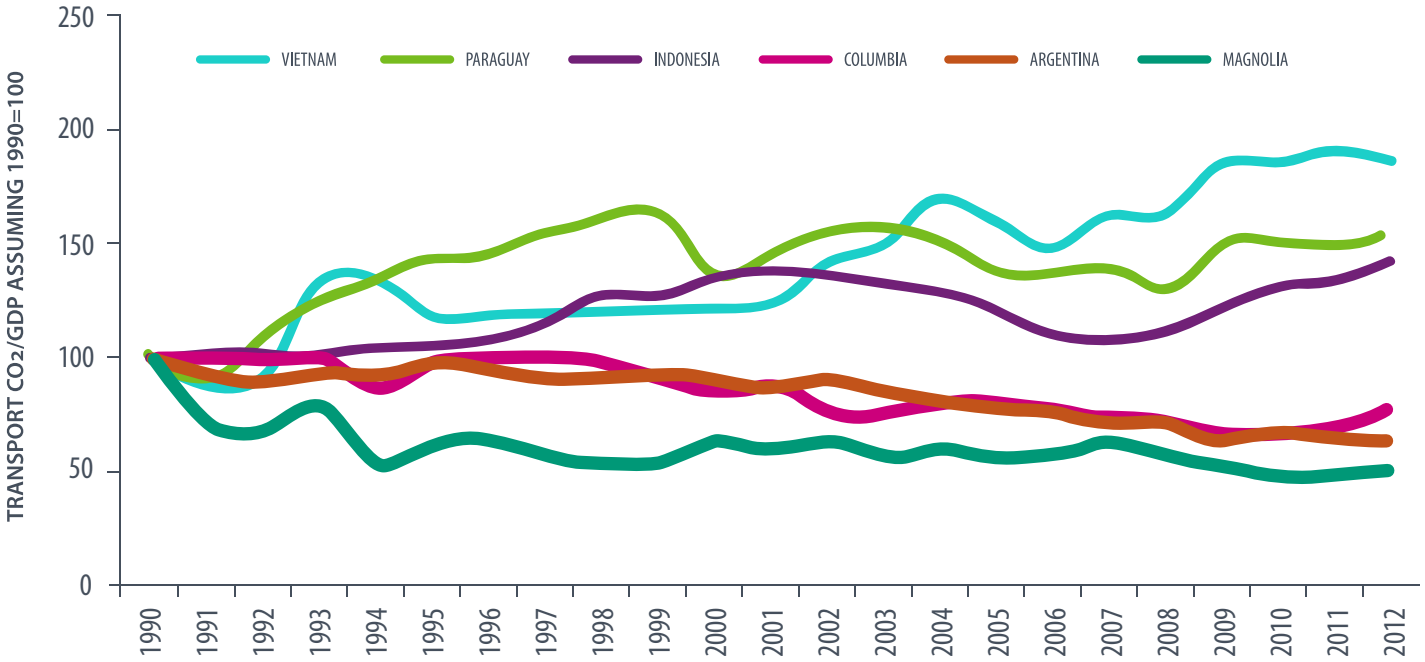

Figure 8: Transport Emissions/GDP Growth among Selected non-Annex I Parties

Globally, nearly 82% of transport emissions are generated from countries (both developed and developing) which have committed to official (conditional or unconditional) economy-wide emission reduction targets (whether absolute or as a reduction in energy intensity) under the UNFCCC process[3]. While transport growth rates in Annex I countries with targets have reduced over the years, for non-Annex I countries with targets, transport emission growth rates have actually increased over the 2008-2012 period, as shown in Figure 9. Considering the high intensity of energy consumption within the transport sector and its potential future growth, it is essential that transport sector mitigation strategies play an central role in strengthening the reduction pledges of these and other countries.

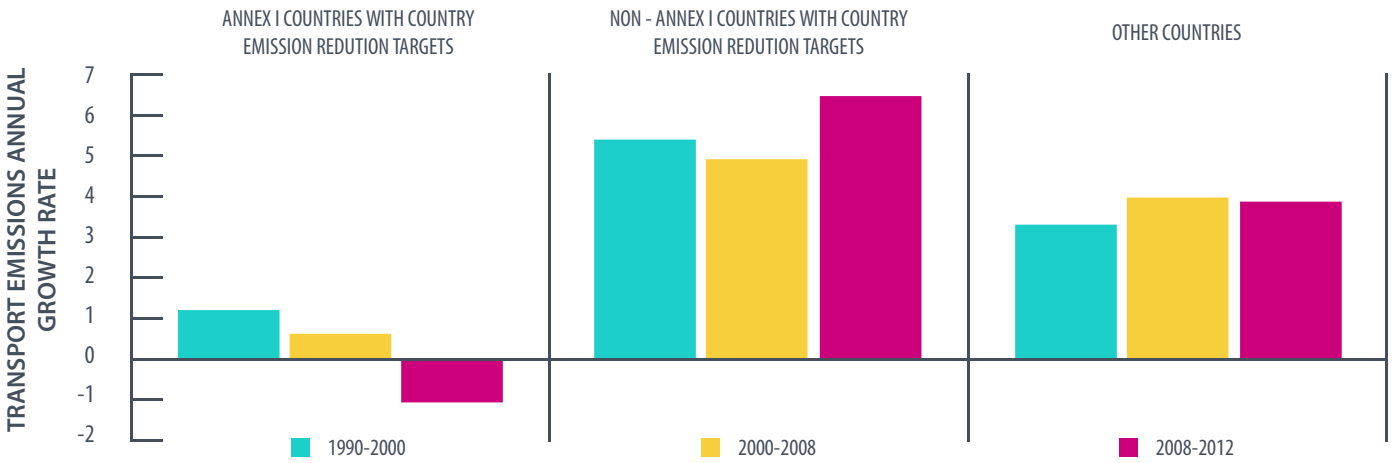

Figure 9: Growth in Transport Emissions among Countries with Reduction Targets

Transport Sector Absolute and Per-Capita Emissions

Figure 10ranks countries according to absolute CO_2 emissions from transport. Although the United States topped the rankings for both 1990 and 2012, this figure underscores changing growth trends for transport emissions, with many developing countries emerging as large emitters in transport sector (e.g. China, India, Brazil, Mexico, Indonesia) and several European countries (e.g. France, Italy and United Kingdom) dropping out of the top 10 out largest transport related emitters in absolute terms.

3 http://unfccc.int/meetings/copenhagen_dec_2009/items/5264.php, http://www.c2es.org/international/history-international-negotiations/2020-targets

Furthermore, the top 10 transport CO_2 emitters in 2012 contributed to 53% of total global transport CO_2 emissions. This suggests the need to significantly reduce transport sector emissions amongthese large emitters, while ensuring that emerging economies take steps to decouple transport sector emissions from economic growth in order to avoid risingfurther in the rankings. Figure 10ranks countries according to absolute CO_2 emissions from transport. Although the United States topped the rankings for both 1990 and 2012, this figure underscores changing growth trends for transport emissions, with many developing countries emerging as large emitters in transport sector (e.g. China, India, Brazil, Mexico, Indonesia) and several European countries (e.g. France, Italy and United Kingdom) dropping out of the top 10 out largest transport related emitters in absolute terms. Furthermore, the top 10 transport CO_2 emitters in 2012 contributed to 53% of total global transport CO_2 emissions. This suggests the need to significantly reduce transport sector emissions amongthese large emitters, while ensuring that emerging economies take steps to decouple transport sector emissions from economic growth in order to avoid risingfurther in the rankings.

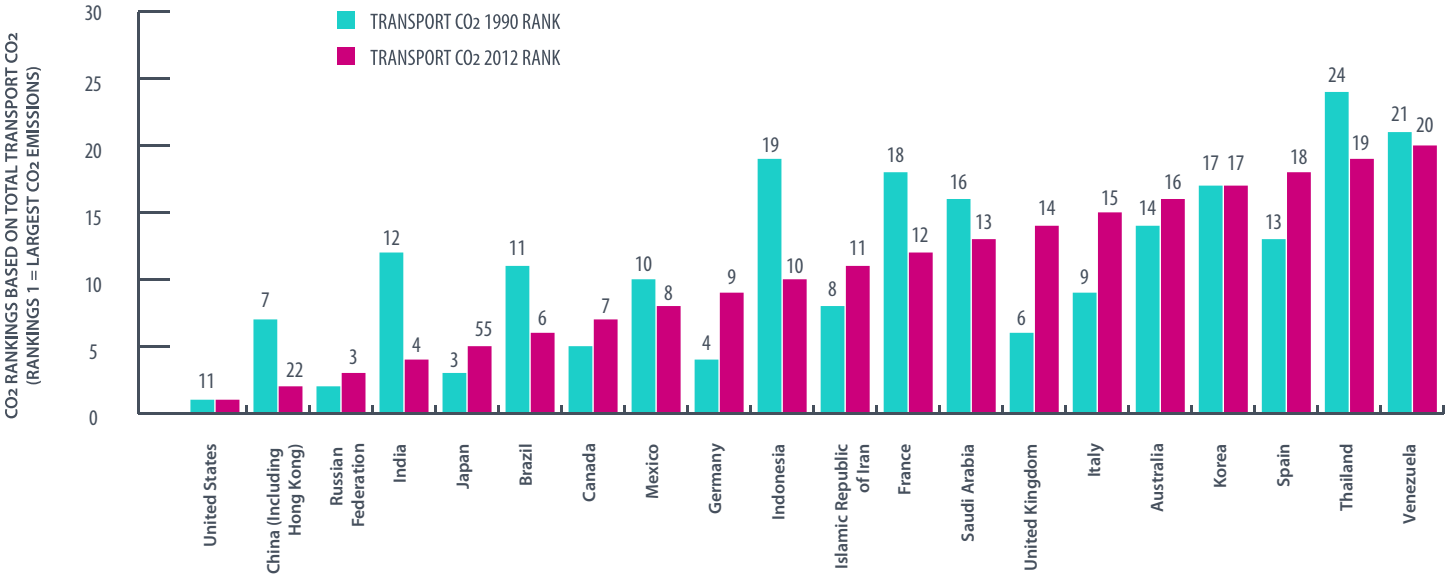

Figure 10: Country Rankings by Absolute Emissions from Transport

A similar ranking for per-capita transport emissionspaints a different landscape, which is largely dominated by auto-dependent developed countries (e.g. United States, Canada, Australia, New Zealand), and petroleum-rich states (e.g. Qatar, Saudi Arabia, Kuwait, Oman), as shown in Figure 11. This underscores the necessity for auto-dependent developed countries to accelerate and scale up low carbon transport pathways, and to make progress inpricing carbon and phasing out fossil fuel subsidiesto achieve the 2DS.

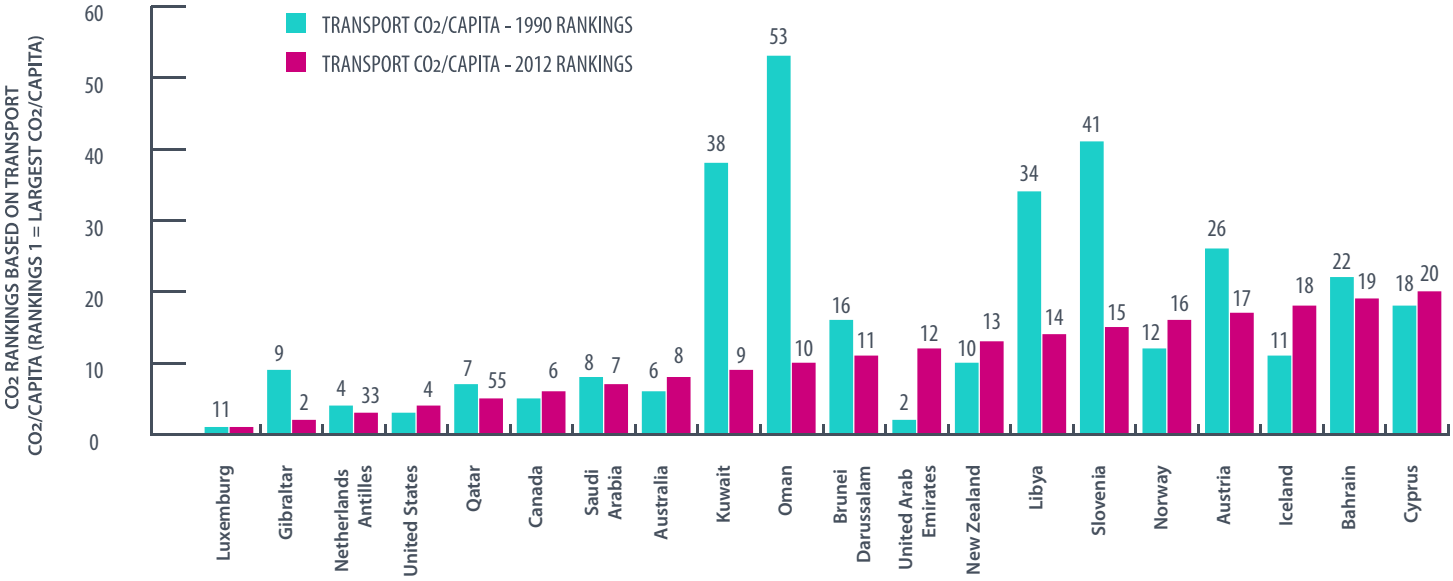

Figure 11: Country Rankings by Per Capita Emissions from Transport

Figure 12 shows the variation in transport CO_2 emissions growth relative tomotor fuel pricing . Countries which have consistently kept gasoline prices above US$1/liter over period 2000 to 2012 (e.g. Japan, Netherlands, Uruguay) show clear reductions in transport emissions growth, and countries with gasoline prices above US$0.7/liter (e.g. many OECD countries) show only a marginal increase in transport emissions growth. However, for countries that have kept gasoline prices artificially low due to fuel subsidies, transport CO_2 emissions have grown at a rapid rateduring the 2000-2012 period.

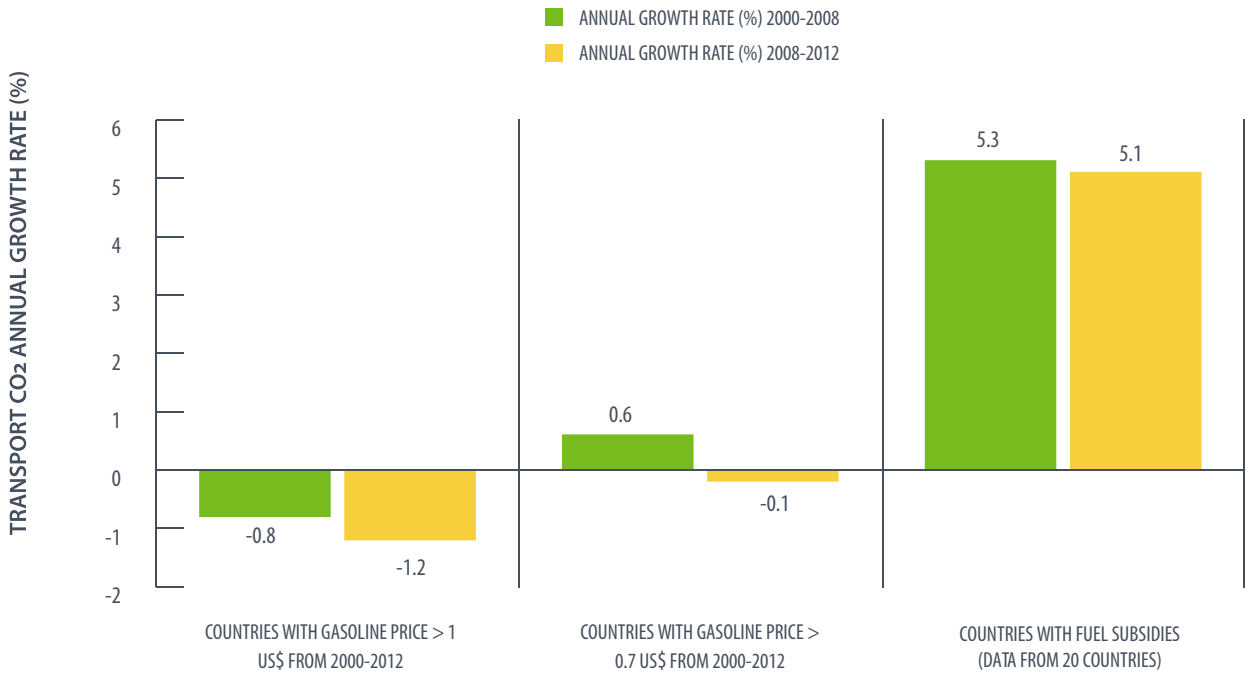

Figure 12: Transport Emissions Growth Relative to Fuel Prices

Average transport CO_2 emissions per capita in 2012 in non-Annex I countries amounted to only 18% of the average emissions per capitain AnnexI countries; however, the average annual growth rate in transport CO_2/capita in Non-Annex I countries from 1990-2012 was around 3%, while in Annex I countries it was around 0.1% during the same period, as shown in Figure 13.

Figure 13: Transport CO_2/Capita Growth Trends

4 Data extracted from 2014 edition of World Development Indicators, World Bank
5 we consider the period 2000 to 2012 by considering fuel prices for three years 2000,2008 and 2012.

It is also observed that per-capita transport CO_2 emissions in individual non-Annex I countries like Benin, Vietnam and China are growing at an explosive rate. It is notable that while China is in seventh position in terms of its transport emissions growth rate, it is third in transport emissions *per capita* growth rate (i.e. about 540% increase from 1990 levels).

Conclusions

Maximizing mitigation ambition requires optimizing contributions from transport, and the *SLoCaT Analysis of Transport Emission Trends* gives a broadpicture of trends in transport CO_2 emission share, growth, and absolute and per-capita emissions 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. A crucial observation within this analysis is the large differentiation among transport emissions trends between individual regions and countries, which underscores the necessity to taking a heterogeneous approach to tackling current and future transport sector emissions worldwide.

This variation among countries leads to a number of key implications for integrating transport in economy-wide emission strategies. First, a considerable number of countries will need to scale up transport mitigation strategies because transport contributes a large share of overall emissions. Second, transport emissions are growing faster than average fuel combustion related-CO_2, making it likely that it will become a more substantive problem in the future if not tackled in the near term. Third, many countries that currently have very low transport emissions per capitaare showing significant growth in this sector, and thus will have to take additional action to keep transport emissions in check in the coming decades. Fourth, a decoupling of transport emissions and economic growth is possible, as already demonstrated by many Annex I countries as well as a number of non-Annex I countries. Finally, there is a very clear linkage between fuel prices and transport CO_2 emissions, which emphasizes the need to phase out fossil fuel subsidies and initiate carbon pricing in the transport sector.

This analysis of historic trends can be complemented by a growing body of transport mitigation potential studies across a wide range of UNFCCC Parties, which can help to define a suitable set of transport sector implementation strategies.According to the IEA , a halving in GHG emissions from transport is projected to be feasible by 2050 and will be necessary to realize a 2DS, since cross-sectoral burden sharing is feasible only to a limited extent. The 2DS is estimated to represent cumulative investments of USD 445 trillion and represent a cumulative investment and operating saving of USD 70 trillion over 2010-2030; thus, Parties that incorporate low carbon strategies into national transport strategies can achieve not only emissions reductions and development benefits, but also financial gains.

To stay within an IPCC-recommended 2DS,Parties to the Convention must think critically about sectorial approaches in the process of defining INDCs that will allow them to raise pre-2020 ambition and establish post-2020 targets. In this context, bold transport strategies will be an essential element of raising ambition and meeting targets, and the analysis contained in the SLoCaT Analysis of Transport Emission Trends can contribute towards defining national strategies to maximize the mitigation potential of the transport sector.

Note: The SLoCaT Analysis of Transport Emission Trends is a work in progress. The SLoCaT Partnership is appealing to relevant organizations to provide comments and additions to this analysis. Please contact Karl Peet (karl.peet@slocatpartnership.org) for any revisions and input.

6 2013, International Energy Agency, "Global Land Transport Infrastructure Requirements: Estimating road and railway infrastructure and costs to 2050."
7 http://slocat.net/sites/default/files/u10/policy_brief_executive_summary.pdf

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