Partnership on Sustainable Low Carbon Transport (SloCaT) Review of World Energy Outlook Special Report on Energy and Climate Change

IEA's recently-published report " Energy and Climate Change - World Energy Outlook Special Report" provides a first assessment of the impact of Intended Nationally Determined Contributions (INDCs), which represent committed national climate pledges including in the energy sector. The transport sector makes a significant contribution to emissions within the energy sector: a recent SLoCaT analysis reveals that the transport sector is the largest energy-consuming sector in 40% of countries worldwide, and in most remaining countries, transport is the second-largest energy-consuming sector. The transport sector now accounts for more than one-fifth (7.3 Gt) of global energy-related CO2 emissions (32 Gt), a significant rise from 3.3 Gt/year during the 1970s.

The IEA report highlights the following three Scenarios and their potential impact on energy consumption and CO2 emissions from the energy sector:

1. INDC Scenario - This Scenario considers INDCs submitted to the UNFCCC Secretariat by May 14, 2015, which represent countries accounting for about 34% of global energy-related emissions. In addition, it also includes likely forthcoming commitments by major economies like China and India.
2. Bridge Scenario – The Bridge Scenario considers policies and actions that may be necessary to deliver a peak in global energy-related emissions by 2020. IEA assumes that peaking of emissions can be achieved by currently proven technologies and policies, without changing the economic and development prospects of any region.
3. 450 Scenario - This Scenario considers policies and investments necessary to serve the internationally adopted goal to limit the rise in long-term average global temperature to 2 °C (with a likelihood of around 50%). This Scenario is more ambitious than the Bridge Scenario and it considers additional policies and investments.

This review note from SLoCaT summarizes some of the key observations offered by IEA and their implications for the transport sector.

1. Emissions Scenarios Relative to 2°C Target

Implementing current INDC pledges will not be sufficient to limite the rise in temperature below 2°C. If energy sector carbon mitigation efforts are not enhanced after 2030, the emissions path established by the INDC Scenario would be consistent with an average temperature increase of around 2.6 °C by 2100 and 3.5 °C after 2200. Thus, the current energy sector related proposals among INDCs are not sufficient and need radical improvements. IEA predicts that the largest contribution to global GHG abatement in the energy sector comes from energy efficiency, which is responsible for 49% of the savings in 2030.

Figure 1 highlights the cross-sectoral energy demand variation across different Scenarios. In the transport sector under the INDC Scenario, transport energy consumption annual growth must be reduced from 2.1% in 1990-2013 to 1.2% in 2013 to 2030. Under the Bridge Scenario and the 450 Scenario, this future annual growth in energy consumption needs to be further reduced to 0.8% and 0.7%, respectively for the transport sector. In all cases the transport sector, together with the buildings sector is targetted for the largest reductions in growth.

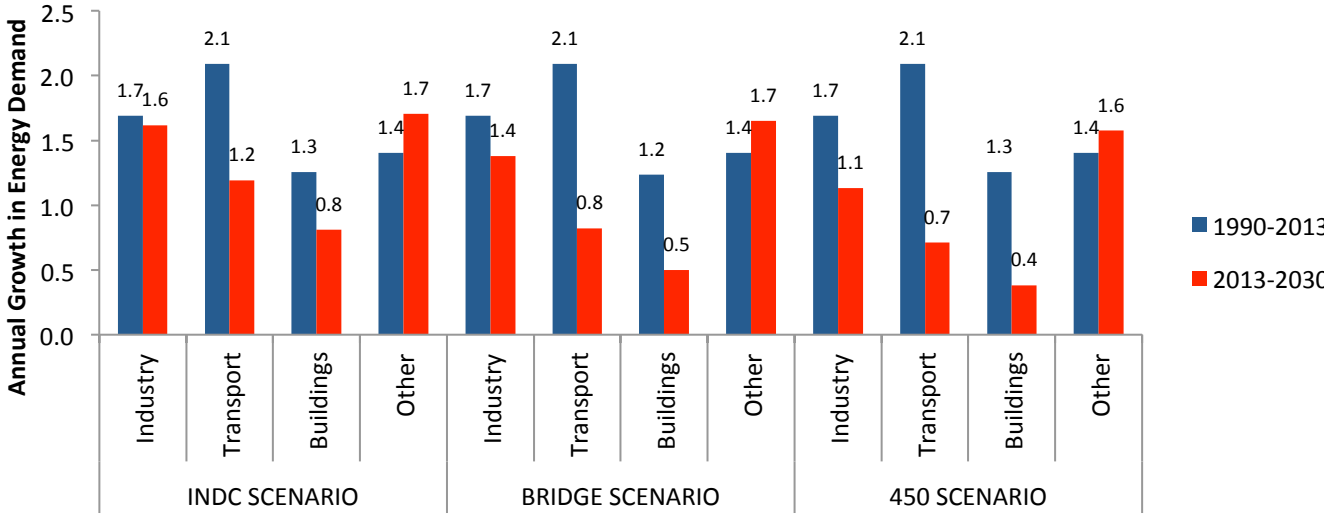

Figure 1: Growth in Energy Demand under Three IEA Scenarios

2. Growth in Transport CO_2 Emissions in OECD and NON-OECD Countries

The current OECD share in total transport CO2 emissions is 55%, with the higher share in transport emissions is due to higher travel activity in OECD countries; however, transport CO2 emissions in non-OECD countries are quickly catching up. A recent SLoCaT analysis indicates that about half of countries worldwide have experienced either high or very high growth (i.e. more than 3% or 5%, respectively) in transport emissions in the 1990-2012 period, with growth higher in non-OECD countries than in OECD countries. It has been estimated that in within next two years, non-OECD countries will emit more than half of the world's transport CO2 emissions.

The IEA analysis indicates that even with implementation of stringent policies and investments, high growth in non-OECD countries could continue in the future. In the Bridge Scenario, to achieve a peak in global energy-related emissions by 2020, annual growth in global transport emissions between 2013-2030 must be lowered by at least 4 times compared to 1990-2013. In OECD economies, transport CO2 emissions could be reduced to an annual growth of -1.6% with existing technologies and at no additional societal costs, and in non-OECD countries, transport CO2 emissions could be restricted to 2.1% annual growth, as shown in Figure 2. Thus, the intensity of growth in developing countries could be reduced by 50% of its growth over past two decades.

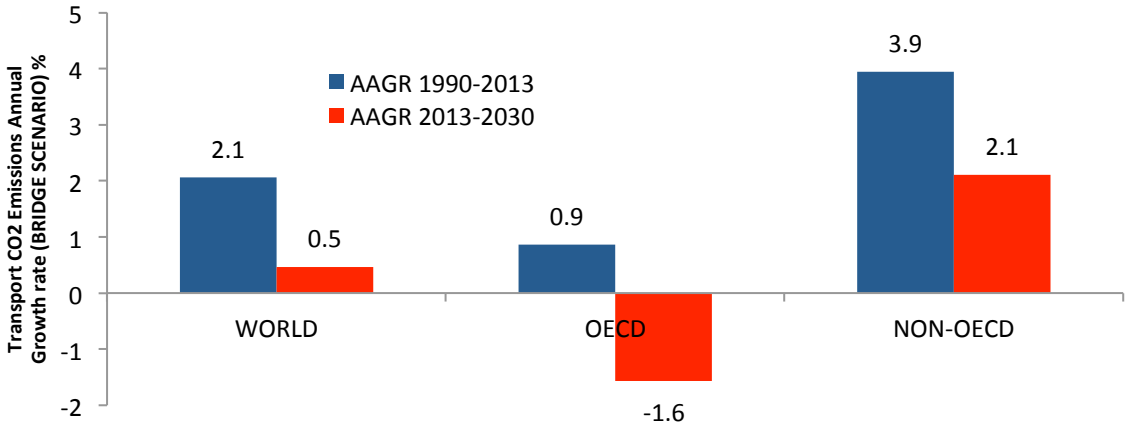

Figure 2: Transport Emissions Growth Rates under Bridge Scenario

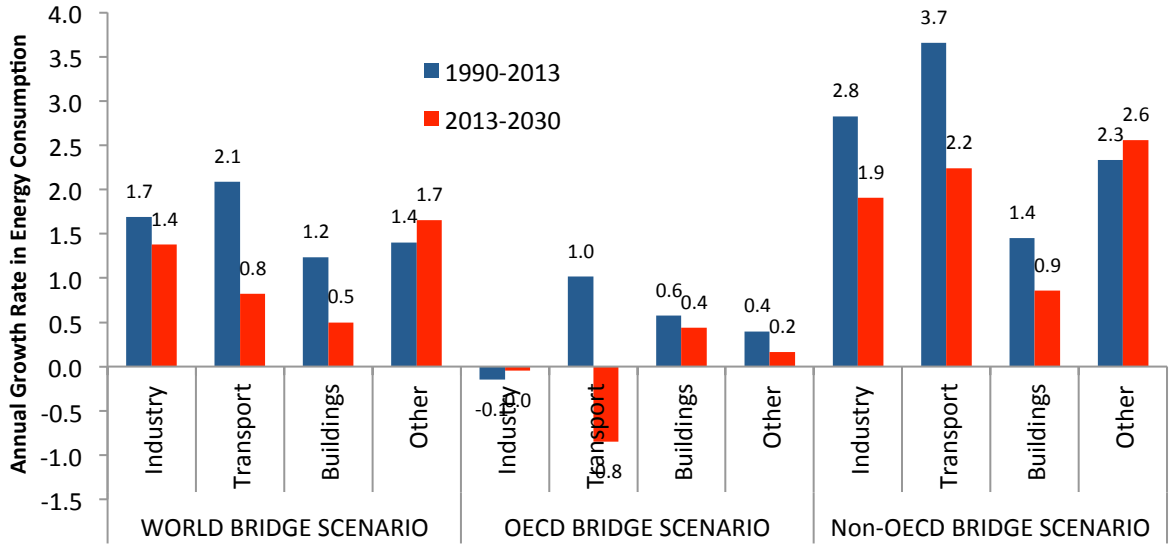

Figure 3: Annual Growth Rate in Energy Consumption

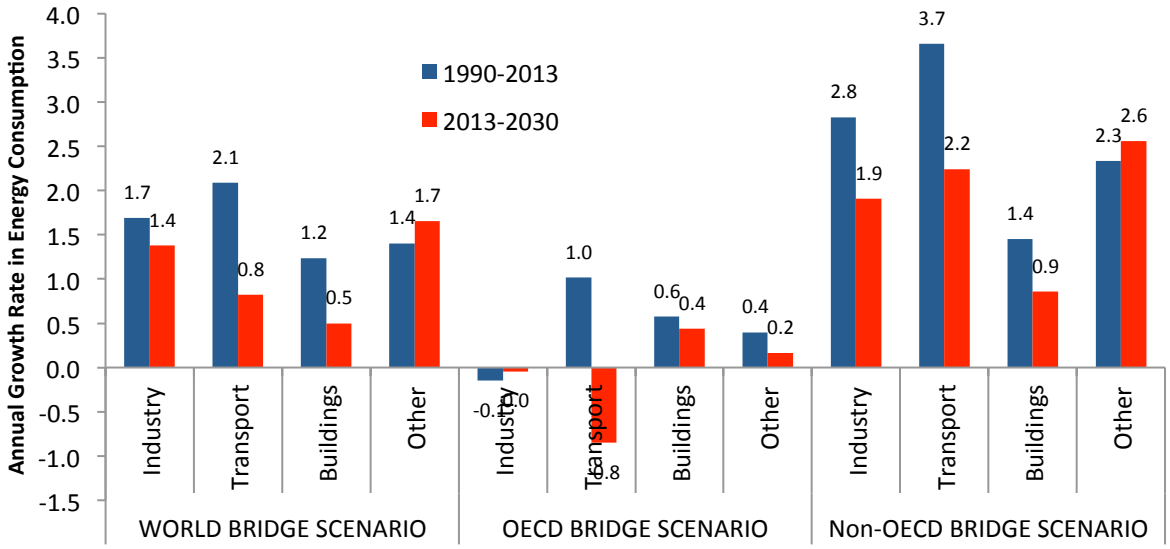

Figure 3 shows that in both OECD and non-OECD economies, the transport sector grew more intensively when compared with other sectors between 1990 to 2013. However, over 2013 to 2030, in OECD countries, the transport sector has the potential to provide the highest intensity of reductions. In non-OECD countries, the mitigation efforts in the transport sector could be comparable to other sectors in the Bridge Scenario.

3. Growth in Transport CO_2 Emissions across Countries and Regions

In the Bridge Scenario, transport emissions are projected to peak in 2020 and not to increase further in the period 2020 to 2030. As shown in Figure 4, among non-OECD countries, India is projected to have the highest intensity of emission growth at 5%; in comparison, Latin America and Russia with aggressive policies could reduce the intensity of transport emissions growth to only 0.3%. In China, the largest reduction in intensity of transport emissions growth is possible, with a projected reduction from 10.2% from 1990-2013 to 2.7% from 2013-2030.

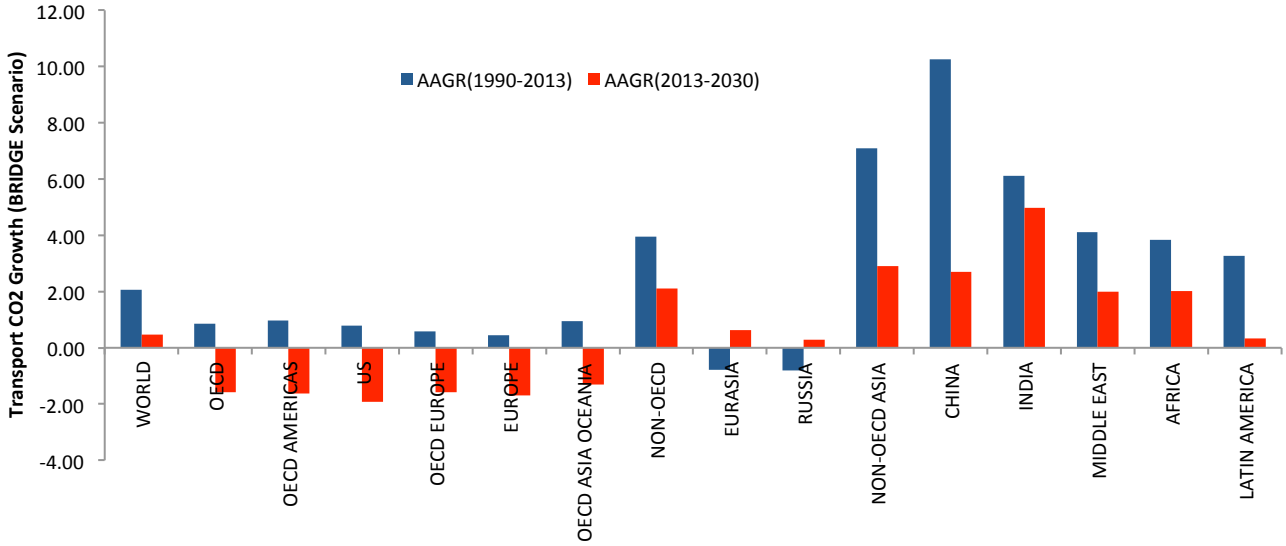

Figure 4: Transport CO2 Growth under Bridge Scenario

It is interesting to note the difference in annual growth in transport sector energy consumption relative to CO2 emissions in OECD and non-OECD countries. Figure 5 shows that in OECD countries, the transport energy consumption and transport CO2 emissions annual growth rates are -0.8 and -1.6% respectively, which is mainly due to relatively higher penetration of low carbon fuels in OECD countries, while in non-OECD countries, transport energy consumption and CO2 emissions are 2.2 and 2.1%, indicating relative higher carbon content fuels in these countries when compared with OECD countries.

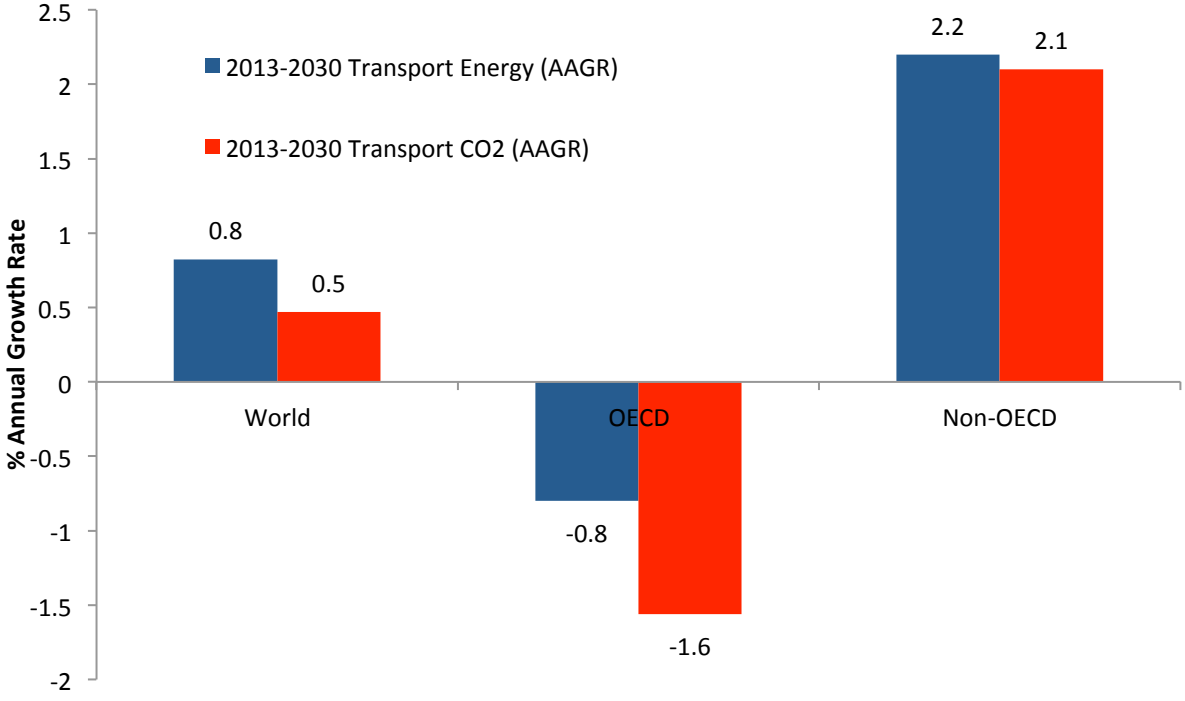

Figure 5: Annual Growth Rates in Transport Energy and Transport CO2

4. Decarbonization of Fuel

Countries across the world have not yet managed to overcome technical and market barriers in order to accelerate the transition to low-carbon fuel. Currently, 93% of the transport sector is driven by oil, and biofuels still meet only 2% of road transport fuel demand (mostly in Brazil, the United States and the European Union). Between 1990 to 2013, in many Non-OECD countries especially Asian countries, oil share in total transport fuel increased (Figure 6).

In the Bridge Scenario, the share of oil among fuels could be decreased from 94% to 87% between 1990 and 2030. In OECD and non-OECD countries, respectively, the penetration of low carbon fuel could potentially reach 82% and 87% by 2030. Figure 6 highlights the diversity of decarbonisation of fuel trends across different regions. IEA predicts that to reach the 450 Scenario outcome (i.e. 2°C), sales of electric vehicles (EVs), which currently constitute less than 1% of car sales worldwide, should exceed 40% of total passenger car sales by 2040.

The use of biofuels (primarily in the road and aviation sectors) more than doubles in the 450 Scenario when compared with the Bridge Scenario, thus providing more than 10% of road transport fuel demand and 33% of aviation sector fuel demand by 2040. However, if fuel subsidies are not removed and if the current period of low oil prices persist, the relative attractiveness of alternative transport fuels will be reduced.

IEA suggests that natural gas as a road transport fuel is important in some markets, but it cannot deliver the long-term decarbonisation that is required in the transport sector as it is still a carbon based fuel[1].

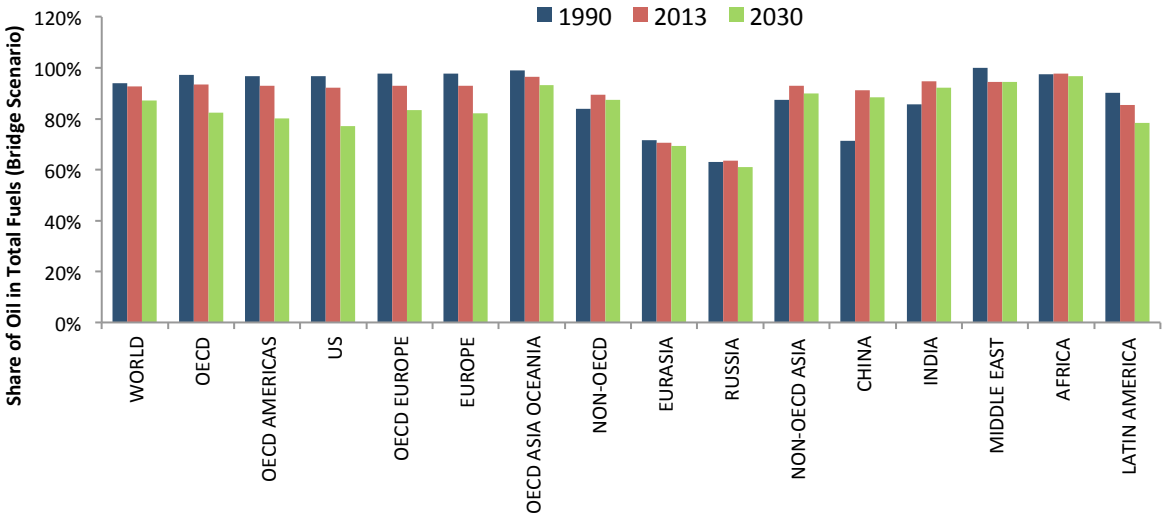

Figure 6: Share of Oil in Total Fuels (Bridge Scenario)

[1] This appears to contradict previous IEA findings @ http://www.iea.org/Textbase/npsum/MTGMR2013SUM.pdf and https://www.iea.org/publications/freepublications/publication/natural_gas_vehicles.pdf

5. Vehicle Fuel Efficiency

The latest review from IEA[2], suggests that over 2012 and 2013, global fuel economy of LDVs increased only at 1.6% due to growing car ownership in non-OECD countries without fuel economy targets (Figure 7). Under the Global Fuel Economy Initiative (GFEI), an annual improvement of 3.1% from a 2014 baseline is targeted for LDVs through 2030.

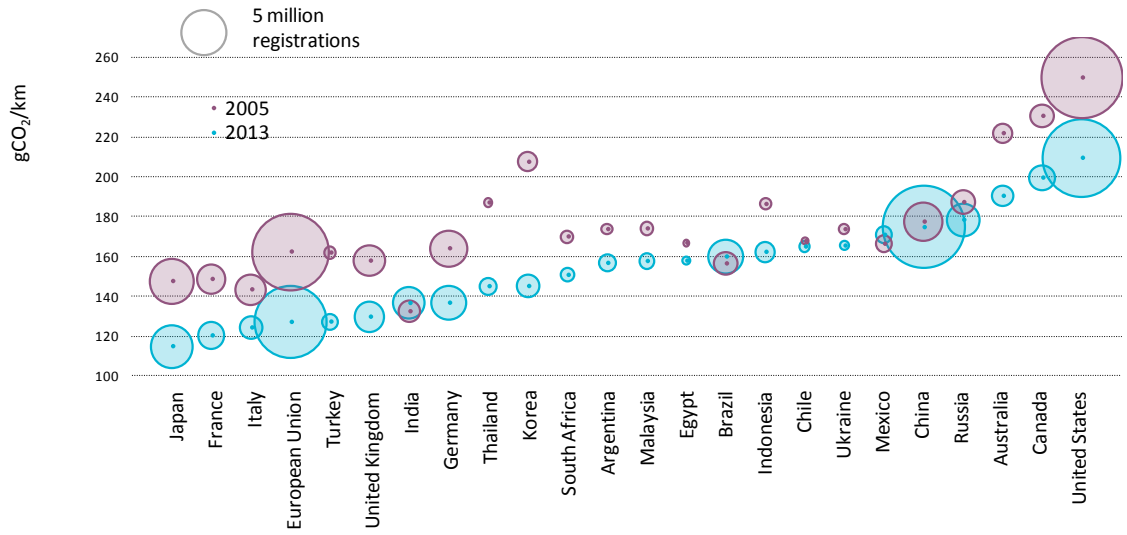

Figure 7 New PLDV tested fuel economy (IEA)

In order to achieve deep reductions in transport sector carbon emissions under the Bridge Scenario, progressive fuel economy standards need to be implemented so that global average fuel consumption for new light duty vehicles (LDVs) is reduced to around 4 litres per 100 km in 2030, a reduction of 50% relative to 2005. For new freight trucks, standards need to be adopted to achieve a 30% reduction in average vehicle fuel consumption per truck relative to current vehicle fuel efficiency. In order to achieve this, annual average increase in fuel economy (L/100km) must reach 2.7% for LDVs and 2.0% for heavy-duty vehicles (HDVs)(Figure 8).

IEA recommends that improving fuel efficiency of new vehicles must to go hand-in-hand with restrictions on use of vehicles above a certain age. For example, vehicles across Africa are often second-hand and one highly productive measure is to impose restrictions on aging vehicles as has been done in Angola, Botswana and Kenya.

[2]IEA, International comparison of light-duty vehicle fuel economy: Evolution over 8 years from 2005 to 2013 & International Energy Agency (2015), Tracking Clean Energy Progress 2015, OECD/IEA, Paris, Accessed on 20 June, 2015

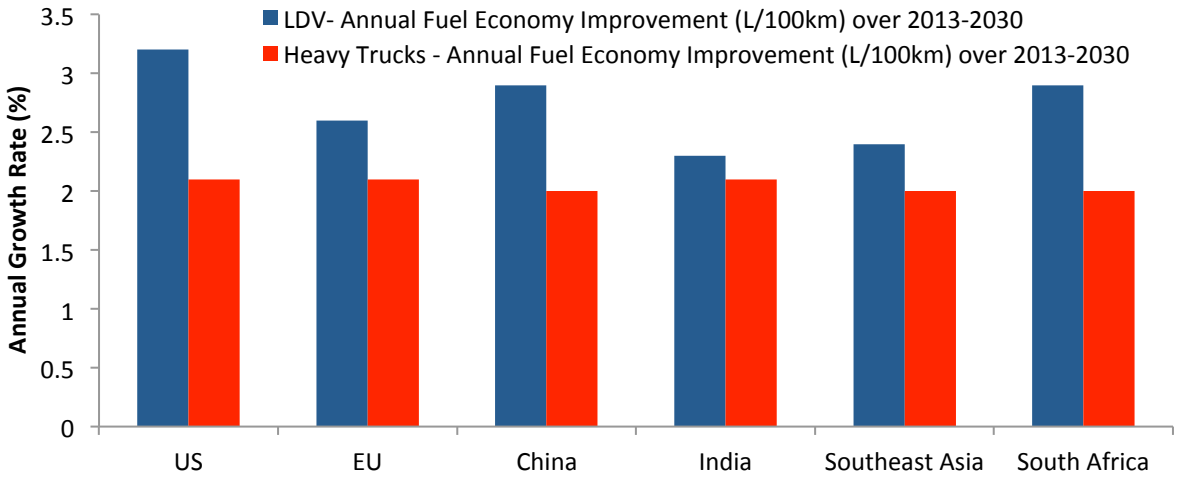

Figure 8: Annual Growth Rate of LDVs and HDVs in Key National Markets

6. Fossil Fuel Subsidies

In order to improve energy efficiency under the Bridge Scenario, IEA considers complete elimination of fossil-fuel consumption subsidies in net importing countries within the next ten years, and in net exporting countries by 2030[3]. Under the Bridge Scenario, subsidy reform reduces GHG emissions by around 160 Mt CO2e in 2020 relative to the INDC Scenario. representing 13% of the total savings between the two scenarios. The earlier quoted SLoCaT analysis indicates that countries which have consistently kept gasoline prices above US$1/liter during the 2000-2012 period (e.g. Japan, Netherlands, Uruguay) show clear reductions in transport emissions growth, while for countries that have kept gasoline prices artificially low due to fuel subsidies, transport CO2 emissions have grown at a rapid rate during the 2000-2012 period (see Figure 9).

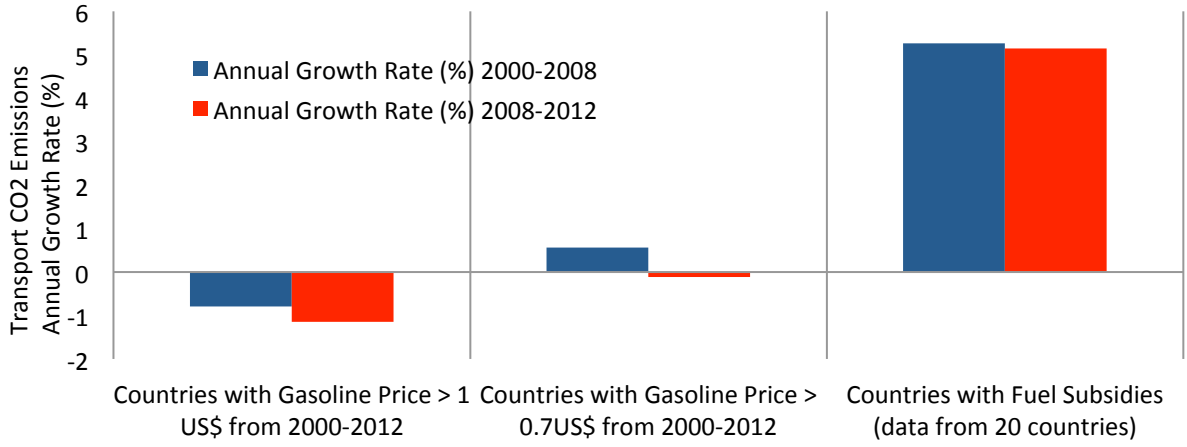

Figure 9: Transport Emissions Growth Rates Relative to Fuel Prices

[3] with the exception of Middle East

7. Avoid and Shift Measures

IEA suggests that the impact of 'avoid' (i.e. avoiding unnecessary transport trips) and 'shift' (i.e. shifting to more efficient modes) strategies in transport energy consumption and carbon emissions can be significant[4] and should thus be promoted across all countries. The study quotes that a 25% reduction in car and air travel in 2050 can reduce global energy use and CO2 emissions from transport by 20%[5]. The IEA's 2015 Energy Technology Perspectives shows that policies on avoid and shift can reduce global transport energy consumption and emissions **by 15% or more by the middle of this century in a stringent mitigation case**[6]. However, recent estimates from ITDP and UC Davis[7] indicate that by improving and expanding policies and investments on public transportation, walking and cycling, urban passenger transport emissions could be reduced 40% by 2050.

8. Emissions from International Aviation and Maritime Shipping

The international aviation and maritime sectors constitute 8% of global oil demand, and these sectors are growing rapidly. Continuous improvements have been achieved over the past decade through the efficiency of new aircraft and through slow steaming in the maritime sector. The International Civil Aviation Organization (ICAO) has put in place a voluntary 2% annual efficiency improvement target to 2050 and an aim for "carbon neutral growth" from 2020. The International Maritime Organization (IMO) has made the Energy Efficiency Design Index (EEDI) mandatory for new ships and the Ship Energy Efficiency Management Plan (EEMP) mandatory for all ships. The EEDI standards alone would result in a 30% improvement by 2025 (compared with the average efficiency of ships built between 2000 and 2010).

9. Energy Efficiency Investments

Under the INDC Scenario, IEA suggests a significant increase in energy efficiency investments across different sectors. Country-specific recommendations for transport sector to reach INDC targets include the following:

- United States: Efficiency investments in transport double over the period to 2025.
- European Union: Investment in end-use efficiency nearly triples to $150 billion in 2030, with improvements in transport efficiency accounting for more than half of the total.
- China: Efficiency investment in transport grows to more than double existing levels by 2030, driven by a huge increase in car sales, the efficiency of which improves over time.
- India: Two-thirds of efficiency-related investments are directed towards the transport sector, particularly cars, where efficiency improves by ~25% to 2030.

10. Monitoring of Transport Sector Decarbonisation

---

[4] In 2012 publication "Energy Technology Perspectives 2012 Pathways to a Clean Energy System" IEA had suggested that "Avoid/Shift case contribution to lowering GHG emissions is modest when low-carbon technologies are widely implemented"

[5] Cuenot, F., L. Fulton and J. Straub, J. (2012), "The Prospect for Modal Shifts in Passenger Transport Worldwide and Impacts on Energy Use and CO2", *Energy Policy*, Vol. 41, pp.98-106.

[6] IEA, Energy Technology Perspectives 2015 - Mobilising Innovation to Accelerate Climate Action,

[7] A Global High Shift Scenario: Impacts And Potential For More Public Transport, Walking, And Cycling With Lower Car Use, By Michael A. Replogle, Institute for Transportation and Development Policy & Lewis M. Fulton, University of California, Davis

In order to track transport sector decarbonisation, IEA recommends three high level indicators:

- New passenger cars: CO2 emissions per vehicle-kilometre (g CO2/v-km)
- Road freight vehicles: CO2 emissions per tonne-kilometre (g CO2/t-km)
- Carbon intensity of total transport fuel demand (t CO2/TOE)

Along with these proposed indicators, IEA recommends that countries build capacity to collect detailed data at the sectorial and sub-sectorial levels in order to better understand trends in national energy systems and to better inform policymaking.

Summary

With INDCs and national energy policies and plans proposed so far, the world's estimated remaining carbon budget consistent with a 50% chance of keeping the rise in temperature below 2 °C is consumed by around 2040 – eight months later than is projected in the absence of INDCs. Clearly, more sustained effort is required from countries to stay below the 2 °C climate limit.

In the transport sector, In the INDC scenario, energy consumption annual growth needs to be reduced by 50% of 1990-2013 growth. In the 450 scenario, IEA proposes to further reduce the transport energy consumption growth by 40% over 2013-2030. IEA estimates that majority of these reductions could be possible with existing technologies and with no additional cost to the society.

The transport sector grew more intensively when compared with other sectors over the last two decades. However, over 2013 to 2030, in OECD countries, the transport sector has the potential to provide the highest intensity of reductions. Clearly, all countries need to submit ambitious INDCs for COP21 and enhance priorities and investments on energy efficiency to peak global transport emissions by 2020. Thus, any attempt at limiting global average temperature rise to less than 2°C without significant mitigation contributions from the transport sector is infeasible.