RESEARCH BRIEF

PARIS PROCESS ON MOBILITY AND CLIMATE

Partnership on Sustainable Low Carbon Transport

Renewable energy and transport - Decarbonising Fuel in the Transport Sector

Overview

The transport sector now accounts for about 23% (7.3 Gt) of annual global energy-related CO2 emissions (32 Gt). This is a significant rise (about 120%) from 3.3 Gt/year during the 1970s, and to achieve a two-degree scenario (2DS)[1], CO2 emissions from transport would need to decline to 5.7 Gt annually. By 2015, global road transport CO_2 emissions should have already peaked in order to achieve a 2DS, but this is not likely to happen under current trends. Non-OECD countries are expected to experience continued growth in motorization and travel demand (i.e. private vehicle motorization index[2] for non-OECD countries could increase by about 7 times from 2000 levels by 2050). Oil is expected to remain the dominant transport fuel in the coming years, and thus must be offset by a rapid decarbonisation of fuels and scaling up of renewable energy in the transport sector.

Current Trends

At present the transport sector is the least diversified energy end use sector. Globally, about 50% of renewable energy (Figure 1) is used in the residential, commercial and public sectors. In 2013, only about 3.5% of renewable energy was consumed in transport sector globally (with about 10% of renewable energy consumed in the transport sector in OECD countries).

[1] The two-degree scenario (2DS) involves putting in place an emissions trajectory which would result in at least a 50% chance of limiting average global temperature increase to 2°C.
[2] Private vehicles for 1000 people, ETP 2015 Data Visualisation

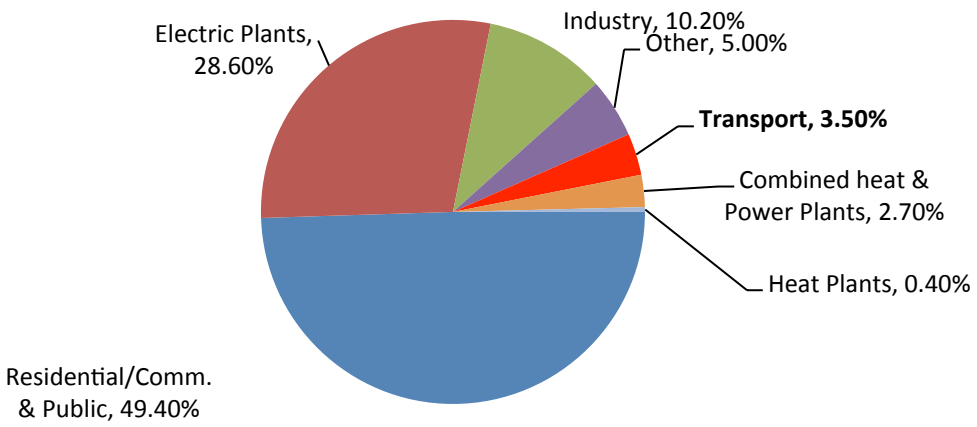

Figure 1 Current Renewable Energy use in Different Sectors (IEA, 2015)

Globally about 93% of the transport sector is driven by oil, with biofuels still meeting only 2% of road transport fuel demand (mostly in Brazil, the United States and the European Union) and natural gas contributing to only about 1% of total transport fuel use. Between 1990 to 2013, in many non-OECD countries (and especially in Asian countries), petroleum based fuels share in total transport fuel has actually increased (Figure 2) in spite of initiation of pro-active policies for decarbonising transport fuels (especially through biofuels). Biofuel blend mandates are currently in place in at least 33 countries, including 31 national mandates and 26 state/provincial mandates; five years ago, the figures were roughly the same, with 31 national mandates and 29 state/provincial mandates. While a number of countries strengthened existing biofuel blend mandates in 2014, the debate over the sustainability of first-generation biofuels continues, and thus, such policies are showing mixed progress.[3]

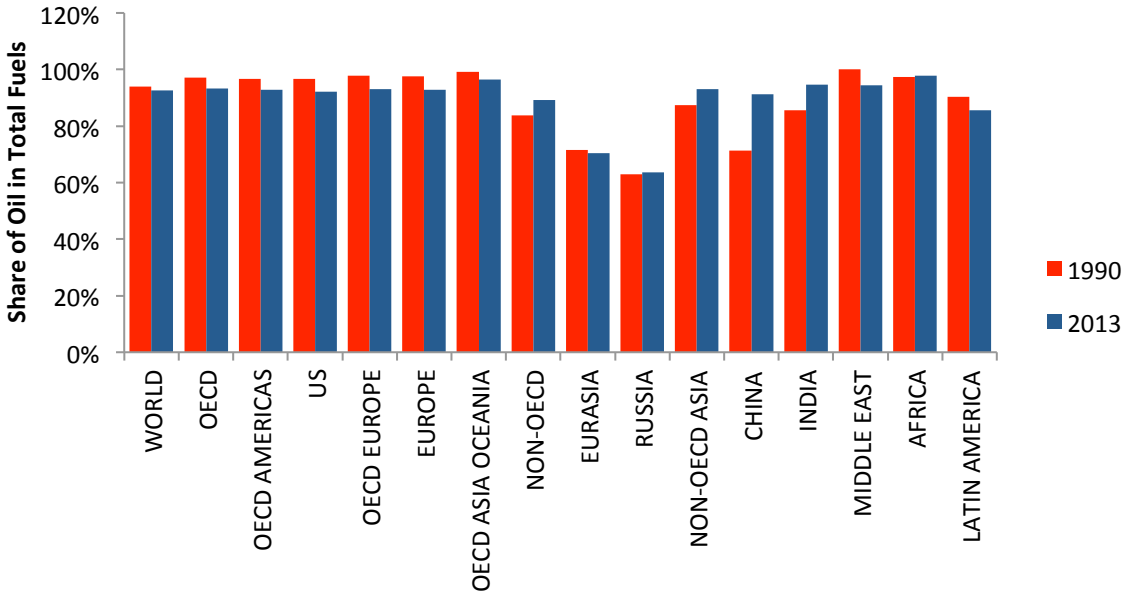

Figure 2 Share of Oil in Transport Sector (IEA,2015)

[3] REN21 Renewables Global Status Reports, 2011 and 2015. http://www.ren21.net/Portals/0/documents/Resources/GSR2011_FINAL.pdf; http://www.ren21.net/wp-content/uploads/2015/07/GSR2015_KeyFindings_lowres.pdf

From 2000 to 2012, biofuel consumption within the transport sector has seen a six-fold increase globally. During the same period, natural gas use in transport modes (excluding pipelines) has experienced a tenfold increase[4]. In both cases, however, these increases are measured from a very low baseline, and thus these fuels still make up an insignificant share of total global fuel consumption. Furthermore, policies to strengthen the potential linkage between electric vehicles and renewable energy have also received little focus on a global scale.[5]

For global energy-related emissions to peak latest by 2020, IEA estimates that the share of petroleum-based fuels among transport fuels needs to be decreased from 94% to 87% between 1990 and 2030. In OECD and non-OECD countries, respectively, the penetration of low carbon fuels could potentially reach 82% and 87% by 2030. This transition could be made by considering currently proven technologies, without changing the economic and development prospects of any region[6]. However, policies in support of decarbonisation of fuel would need to be intensified, as IEA projections[7] reveal that even with current policies in support of decarbonization of fuel, there will still be a gap of 2% to 27% (with an average gap of 12%) by 2035 (Figure 3).

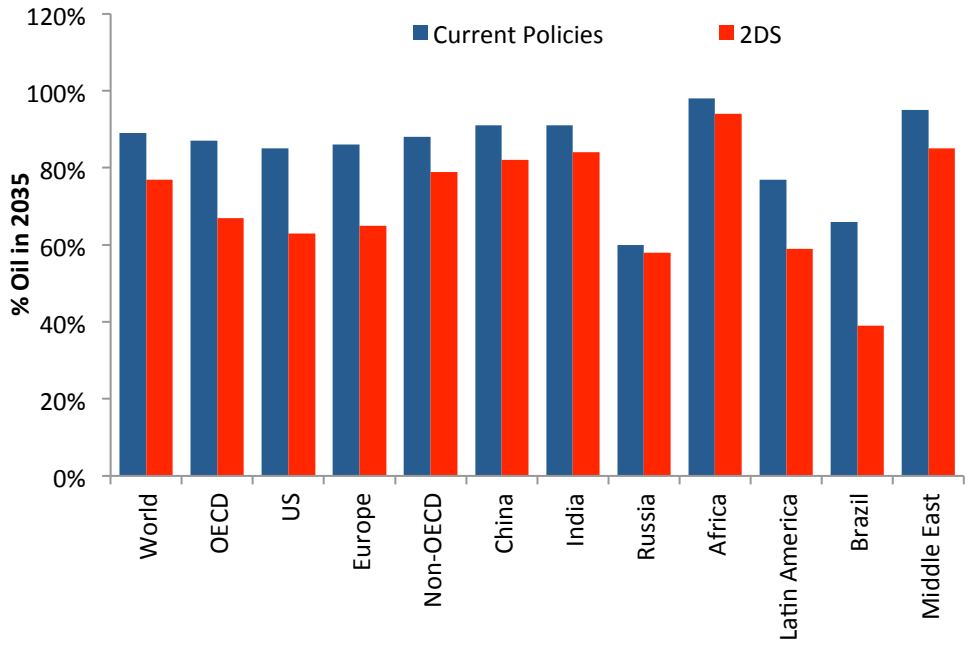

Figure 3 Share of Oil in Transport in 2035 Under Current Policies and 2DS Scenario (IEA,2012)

Required Policies

Achieving needed increases in renewable energy in the transport sector will require implementing a set of concerted strategies.

First, policies that are currently in place should be fully implemented. For example, in 1992 the United States Energy Policy Act established the goal of having “alternative fuels” replace at least 10% of oil in transport by 2000 and 30% by 2010. However, by 2013 oil remained dominant with a 92% market share[8]. For example, in 2003 India established an indicative target of 20% blending of bio-fuels (i.e.

[4] IEA, Renewables Information (2015 edition)
[5] http://www.ren21.net/wp-content/uploads/2015/07/GSR2015_KeyFindings_lowres.pdf
[6] Energy and Climate Change - World Energy Outlook Special Report
[7] IEA - World Energy Outlook 2012
[8] An Alternative Transportation Fuels Update: A Case Study of the Developing E85 Industry

bio-diesel and bio-ethanol) by 2017 and an intermediate target of 5% blending of bio-fuels by 2010/11;[9] however, India's ambitious plan of producing sufficient biodiesel is failing to meet even 5% blending with diesel due to unavailability of sufficient feedstock and pricing issues[10]. And in many countries, targets for EV shares of new registrations have fallen far short of the mark; for example, in Germany, a commitment to achieve an EV share of 20 percent of new registrations by 2020 appears overly optimistic, based an EV share of less than one percent in 2014.

Second, additional policies must be put into place to increase the diversification of the transport energy mix. Figure 4 illustrates current and projected fuel trends for passenger and freight transport. IEA believes that to reach a 2DS scenario, sales of electric vehicles (EVs), which currently constitute less than 1% of car sales worldwide[11], will need to exceed 40% of total passenger car sales by 2040, and biofuels will need to support more than 10% of road transport fuel demand, 11% of shipping energy demand and 33% of aviation sector fuel demand by 2040. Natural gas is also important as a road transport fuel in some markets, but it cannot deliver the long-term decarbonisation required, as it is still a carbon based fuel[12]. However, natural gas may be important for cutting CO2 emissions from heavy-duty vehicles (HDVs) where potential application of electrification appears to be more limited[13].

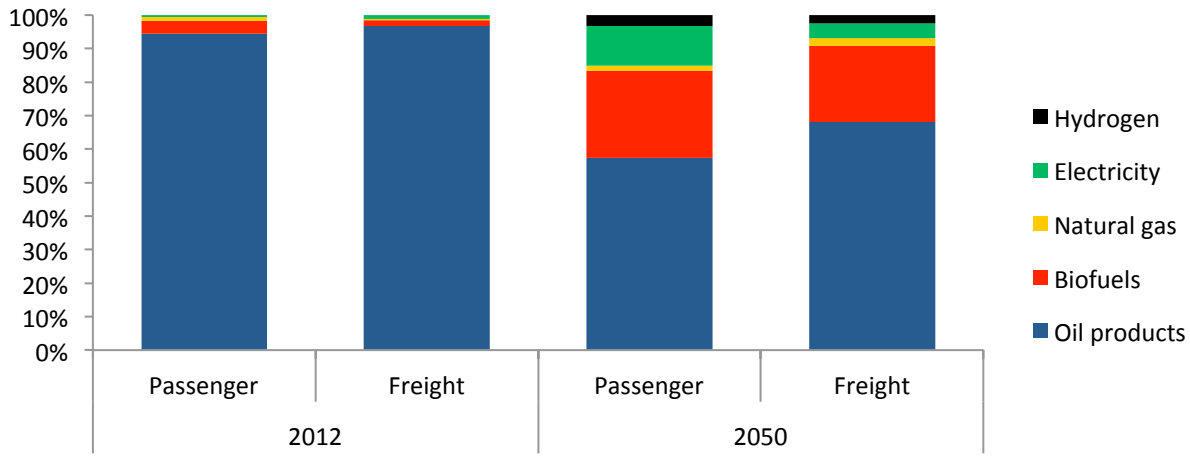

Figure 4 Current and Projected Fuel Diversity for Passenger and Freight Transport

Brazil provides a good example of diversification of the energy end use sector[14]. In 2004, the IEA predicted that by 2020, alternative fuels could contribute about 14% of Brazil's transport energy consumption by 2020[15]; however, current estimates reveal that alternative fuels could contribute almost double that share (i.e. about 27% of transport energy consumption) by 2020[16]. Over 85% of all light-duty vehicles (LDVs) currently sold in Brazil use flex-fuel technology (i.e. running on a

[9] India's National Policy on Bio-fuels, 2003
[10] India Biofuels Annual 2013
[11] In recent years electric cars have received a great deal of attention, but globally electric bikes and scooters dominate electric cars sales by a wide margin, with around 350 e-bikes or scooters are sold for every 1 electric car purchase. About 112,000 electric cars were sold worldwide in 2013. By comparison something in the region of 40 million e-bikes or scooters were sold worldwide in 2013. In China, there are more electric bikes and scooters than the total number of cars on the road. The global pattern for sales of e-bikes and scooters in 2013 has China in first place, at about 32 million, followed by Europe at 1.8 million, and Japan at 440,000. The U.S. had sales of an estimated 185,000 e-bikes.
[12] Energy and Climate Change - World Energy Outlook Special Report
[13] The Contribution of Natural Gas Vehicles to Sustainable Transport
[14] Brazil's national ethanol programme, ProAlcool, was launched in response to the oil crises in the 1970s.
[15] IEA-World Energy Outlook 2004
[16] IEA-World Energy outlook 2012

combination of gasoline and ethanol), and by 2020, over 80% of the Brazilian automobile fleet should be capable of running on pure ethanol, a four-fold increase from the current 20% share[17].

Third, the market attractiveness of policies in favour of decarbonising fuel depends upon the removal of fossil fuel subsidies[18], as current fossil-fuel alternatives are likely to remain uncompetitive in market segments with subsidized fuels[19]. Current subsidy arrangements for oil in transport not only obscure the direct costs of producing and distributing fuels, they also neglectd the costs incurred by negative externalities, and thus give unfair advantage to oil over cleaner fuels[20]. Further, refueling infrastructure costs and implementation timeframes can also pose significant barriers to the transition to a more diversified fuel economy. Finally, current low oil prices – even without subsidies – pose a major obstacle to overcoming the current cost of biofuels, and thus the transport sector could also benefit from a low carbon transition in other sectors to help make biofuels more cost competitive.

Lifecycle Assessments

In order to establish a more level playing field for alternative fuels, it is essential to carry out life-cycle assessments (LCAs) for varying fuel types. In order to compare performance of different fuels, all emissions associated with fuel production, distribution, and combustion must be considered.

There are significant uncertainties corresponding to modelling choice of system boundaries, direct and indirect impacts, and other assumptions. For example, direct GHG emissions from biofuels could be about 30-90% lower per kilometer traveled when compared to gasoline and diesel fuel; however, for some biofuels, considering emissions from land-use changes could lead to higher emissions when compared with gasoline or diesel fuel. It is also important to consider rebound effects due to alternative fuel subsidies. For example, if the difference in GHG emissions factors between an alternative fuel and the prevailing fossil fuel is less than the expected rebound effect, then promoting the alternative fuel will result in a net increase in GHG emissions, despite its relative efficiency[21].

Increasing electrification of transport is one of the main entry points for increasing renewable energy in the sector; however, for electric vehicles, it is important to consider how electricity is generated (and in addition, to consider the proximity of these emissions to populated areas). For example, considering the GHG intensity of a typical coal-based power plant is about 1gCO2/MWh at the outlet for a battery-electric vehicle with efficiency of 200 Wh/km, this would equate to vehicle emissions of about 200 gCO2e/km, which is higher than for a hybrid light duty vehicle[22]. Figure 5 shows the variation in grid emission factors for different countries[23]. Countries that have large hydropower capacity (e.g. Costa Rica, Colombia or Brazil) will have relatively clean electricity while countries with coal based electricity generation will produce electricity with higher embedded CO2 emissions (e.g. South Africa, Serbia).

[17] UNEP- Brazil's Developing Automotive Fuel Economy Policy
[18] Energy and Climate Change - World Energy Outlook Special Report
[19] BP 2014, Energy Outlook 2035
[20] Guiding Principles for Driving Sustainability in Transportation
[21] Sims R., R. Schaeffer, F. Creutzig, X. Cruz-Núñez, M. D'Agosto, D. Dimitriu, M. J. Figueroa Meza, L. Fulton, S. Kobayashi, O. Lah, A. McKinnon, P. Newman, M. Ouyang, J. J. Schauer, D. Sperling, and G. Tiwari, 2014: Transport. *Climate Change 2014: Mitigation of Climate Change*.
[22] Wang M, GREET1_2012 model. Argonne National Laboratory.
[23] IGES database of Grid Emission factors

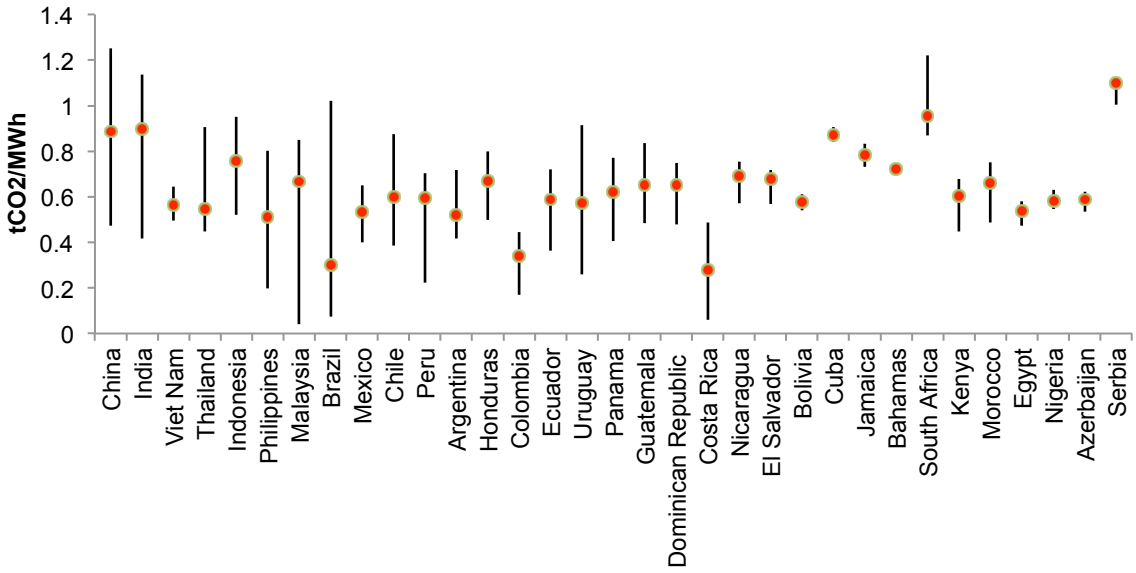

Figure 5 Grid Emission factors for Countries

The transport sector can benefit greatly from decarbonizing efforts in the electricity sector. IEA estimates that renewable energy could become the leading source of electricity by 2030 and the carbon intensity of the power sector is projected to improve by 30% during the same period[24]. This will be helped by more than 100 countries have established renewable energy targets over the last decade[25]. This expected improvement in carbon intensity of the power sector may justify the near-term rollout of electric vehicles, even if current LCAs yield negative results for electric vehicles.

National Climate Actions

Currently, Parties to the United Nations Framework Convention of Climate Change (UNFCCC) are working toward a new global climate change agreement which is to be negotiated by the end of 2015 and come into effect from 2020. Since the first Conference of the Parties (COP) in 1995, transport carbon emissions have risen by more than 40%. Intended Nationally Determined Contributions (INDCs) are poised to play an integral role in the negotiations leading up to COP21. Countries have been in the process of preparing their INDCs which will communicate country targets and strategies to reduce carbon emissions for the post-2020 period (i.e. including targets for the 2020-30 time frame and long-term GHG targets for 2050 and beyond). By mid-September 2015, 37 countries[26] had submitted their INDCs. Among all the measures prioritized within transport sector (Figure 6), decarbonising fuel had the highest priority among countries in INDCs submitted to date.

[24] Energy and Climate Change - World Energy Outlook Special Report
[25] IRENA (2015), 'Renewable Energy Target Setting'.
[26] Including one submission by the European Union representing 25 EU Member States.

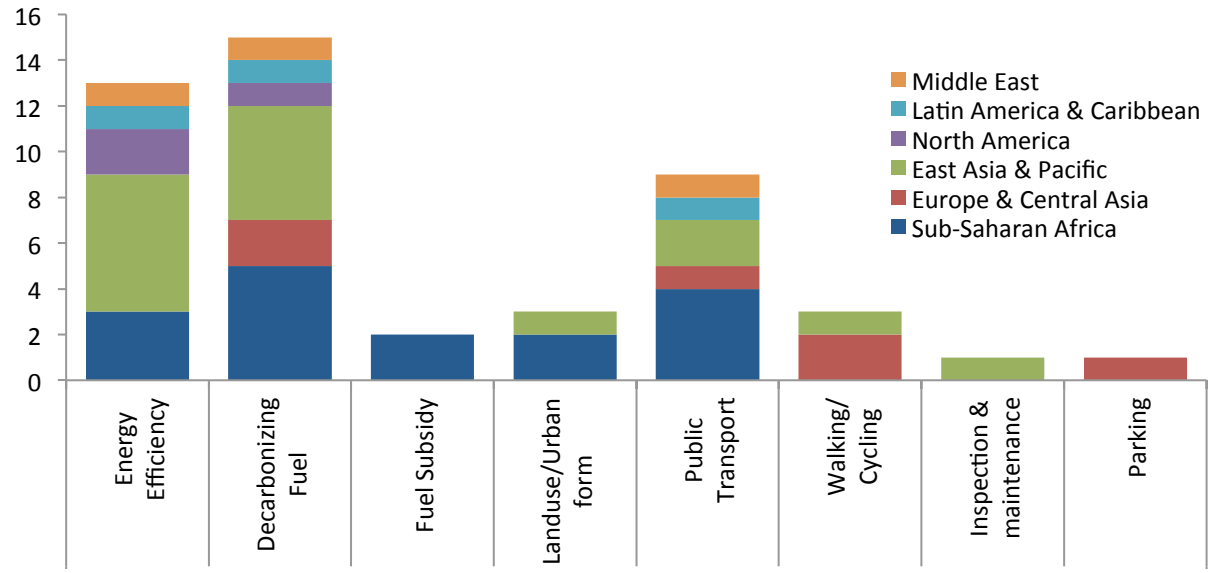

Figure 6 INDC's Prioritize Diversification of Transport Fuel Mix

Table 1 highlights some specific examples of post-2020 targets for decarbonising fuel within a number of existing INDCs:[27]

Table 1 Some Examples of Renewable Energy targets in INDC

Country	Renewable Energy Target	Transport Renewable Energy Measures
Algeria	27% of the national electricity production from renewable energy by 2030	Increased share of liquefied petroleum gas and natural gas consumption fuels between 2021 and 2030
Canada	To ban the construction of traditional coal-fired electricity generating units. These regulations will also lead to the phase-out of existing coal-fired electricity units without carbon capture and storage. Reduce GHG emissions from natural gas-fired electricity	Renewable fuels regulations require that gasoline contain an average 5% renewable fuel content and that most diesel fuel contain an average 2% content
China	Increase the share of non-fossil fuels in primary energy consumption to around 20%	Improve the quality of gasoline and to promote new types of alternative fuels
Jordan	Gradually increasing the share of renewable energy source (RES) to 32%	Facilitating the purchase of low emission vehicles and to scrap high polluting vehicles through the introduction of standards, incentives and legal means.
Morocco	Over 50% of installed electricity production capacity from renewable sources by 2025. Provide 42% of the installed electrical power from renewable sources, of which 14% is from solar energy, 14% is from wind energy and 14% is from hydraulic energy by 2020	Substantially increasing the use of natural gas, through infrastructure projects
Mongolia	Increase the share of renewable electricity capacity to 30% of total electricity generation capacity by 2030, from 7.6% in 2014	Increase the share of private hybrid road vehicles from approximately 6.5% in 2014 to approximately 13% by 2030.
Tunisia	Increase share of renewable energies in electricity production to 14% in 2020 and to 30% in 2030. Reduce carbon intensity in the energy sector by approximately 46 per cent compared to 2010	Renewable energy in transport is considered a part of energy sector

[27] UNFCCC, INDCs as communicated by Parties

While many countries have prioritized energy efficiency within the transport sector, the targets are not well defined in terms of the policy and implementation for the transport sector when compared with other sectors like electricity. **Error! Reference source not found.** provides examples from country targets for decarbonizing fuel in the transport sector based on REN21 Renewables 2015 Global Status Report (GSR) supplemented with data from other studies[28]. The majority of the countries in **Error! Reference source not found.** have established 2020 renewable energy targets; however, the impact of current policies (as shown in Figure 3 above) is not sufficient to deliver an IEA-targeted peak in global energy-related emissions by 2020.

Country	Target for Decarbonizing Transport Energy
Albania	10% of transport final energy demand by 2020
Austria	11.4% of transport final energy demand by 2020
Botswana	5% of biodiesel of total diesel consumption by 2016
Bulgaria	11% of transport final energy demand by 2020
Croatia	10% of transport final energy demand by 2020
Cyprus	4.9% of transport final energy demand by 2020
Czech Republic	10.8% of transport final energy demand by 2020
Denmark	10% of transport final energy demand by 2020
Estonia	2.7% of transport final energy demand by 2020
EU 28	10% of EU-wide transport final energy demand by 2020
Finland	20% of transport final energy demand by 2020
France	10.5% of transport final energy demand by 2020
Germany	20% of transport final energy demand by 2020
Greece	10.1% of transport final energy demand by 2020
Hungary	10% of transport final energy demand by 2020
India	20% blending of biofuels, both for bio-diesel and bio-ethanol by 2017
Indonesia	Biodiesel and ethanol consumption in the transportation sector increased to minimum of 25 % and 20% of total fuel consumption in the sector by 2025
Ireland	10% of transport final energy demand by 2020
Israel	to reduce the proportion of petroleum-based fuels in transportation between 2013 and 2025, to about 30% by 2020, and approximately 60% by 2025
Italy	10.1% transport final energy demand (2,899 ktoe) from biofuels by 2020
Japan	to increase the share of highly energy-efficient next-generation vehicles in the new car sales from 50% to 70% by 2030
Liberia	5% of total transport fuels from biofuels by 2015
Lithuania	10% of transport final energy demand by 2020
Luxembourg	10% of transport final energy demand by 2020
Malta	10.7% of transport final energy demand by 2020
Moldova	20% of transport final energy demand by 2020
Myanmar	8% of transport fuels using biofuels by 2020
Netherlands	10% of transport final energy demand by 2020
Poland	20% of transport final energy demand by 2020
Portugal	10% of transport final energy demand by 2020
Qatar	10% of transport final energy demand by 2020
Romania	10% of transport final energy demand by 2020
Slovakia	10% of transport final energy demand by 2020
Slovenia	10.5% of transport final energy demand by 2020
Spain	11.3% of transport final energy demand by 2020 (biodiesel),2,313 ktoe of ethanol by 2020, electricity - 4.7 GWh / year by 2020 (501 ktoe from renewable sources by 2020)

[28] Based on desk top research of country renewable policies and Global Climate Legislation Study

Srilanka	20% of transport final energy demand from biofuels by 2020
Sweden	Vehicle fleet that is independent from fossil fuels by 2030
Thailand	Ethanol - 9 million litres / day consumption by 2022, biodiesel - 6 million litres / day consumption by 2022 and advanced biofuels - 25 million litres / day production by 2022.
Uganda	2.2 billion litres of biofuels for transport by 2017
Ukraine	Use of alternative fuels to 20% of the total amount of fuel consumption in 2020
United Kingdom	5% of transport final energy demand by 2014; 10.3% by 2020
Vietnam	Use of compressed natural gas and liquefied gas in buses and taxis, with 20% of buses and taxis by 2020 (and by 80% by 2050)
Zimbabwe	10% of transport final energy demand by 2015

Table 2: National Targets for Decarbonising Fuel in the Transport sector

Conclusions

Future efforts on fuel decarbonisation in the transport sector are likely to be determined by the following three questions:

How fast do we need to decarbonize transport?

Decarbonizing the economy will require rapid transformation within the transport sector. It has been well established that decarbonizing the transport sector is likely to be more challenging than for other sectors, given the continuing growth in global demand, and the rapid increase in demand for faster transport modes in emerging economies[29]. Lack of progress to date in slowing growth of global transport emissions to meet IEAs requirement to peak transport emissions by 2020 to achieve a 2DS will require deeper emission reductions in the middle and longer term with high intensive transition to a more diversified transport energy sector.

Are countries picking up speed in decarbonizing transport?

As noted above, progress to date on transport energy decarbonisation is mixed, with early successes (e.g. adoption of flex-fuel vehicles in Brazil) offset by challenges (e.g. problems in meeting fuel blending mandates in India, EV uptake in Germany). Furthermore, more general progress on decarbonisation in OECD countries has been offset by increasing market shares for petroleum-based fuels in non-OECD countries (particularly in Asia). While existing national fuel blending mandates and inclusion of transport targets on renewable energy in INDCs raise hopes for transport energy decarbonisation in the long term, the proof is in the implementation, and the jury on these efforts is still out.

What additional steps must be taken to accelerate the energy transition in transport?

Scaling up and accelerating fuel decarbonisation in the transport sector will require concerted action and innovative practices in a number of key areas, including the following:

Technology and Innovation:

- Scale up technology transfer through the UNFCCC process (e.g. electric mobility, biofuel technologies) to expand North-South cooperation and accelerate adoption of sustainable approaches to fuel decarbonisation.
- Expand South-South cooperation to further development of biofuels to reduce carbon emissions while minimizing negative externalities (e.g. deforestation, monocultures).

[29] https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter8.pdf

- Accelerate research in efficient batteries and energy storage systems to reduce prices and increase range in electric vehicles.

Policy Instruments:

- Increase focus on policies promoting the linkage between electric vehicles and renewable energy, which have received little attention to date.[30]
- Consider expansion of biofuel blend mandates, as these numbers have remained relatively stable in recent years.[31]
- Further the phase-out of fossil fuel subsidies (i.e. 'negative' carbon pricing), building on recent advocacy and monitoring efforts from the Nordic Development Fund, GIZ and others.
- Implement 'positive' carbon pricing policies at local, national and global levels, based on successful demonstrations of transport carbon markets and applications of carbon taxes.

Financing:

- Create dedicated funding streams for sustainable transport (including transport fuel decarbonisation) during national processes for phasing out fossil fuel subsidies.
- Prioritise fuel decarbonisation in forthcoming sectoral strategies through the UNFCCC and the global process on Financing for Development (FfD).
- Monetize and capture co-benefits of decarbonizing fuel (e.g. reduced air pollution and health care costs) through enhanced market mechanisms.

Finally, it is essential to create expanded partnerships to accelerate the adoption of advanced fuel and vehicle technologies. This will require building multi-stakeholder partnerships that extend beyond core stakeholders and include a greater role for business, as well as leveraging global processes on climate change and sustainable development. Fortunately, there is growing collaboration in this area, as demonstrated by the following initatives.

The **Caring for Climate** initiative endeavors to mobilize a critical mass of business leaders to implement and recommend climate change solutions and policies. The initiative is jointly convened by the United Nations Global Compact, the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Environment Programme (UNEP). In recent years, Caring for Climate signatories have made progress in pursuing long-term strategies on energy efficiency and innovative low-carbon technologies throughout their value-chains. Caring for Climate's signatories include a number of representatives from the transport field, including the areas of passenger and freight transport (e.g. NY Metropolitan Transportation Authority, Korea Railroad Corporation, TNT Express), as well as manufacturers of automobiles and parts (e.g. PSA Peugeot Citroen, Hinopak Motors Limited). Thus this partnership has the potential to reduce current transport impacts and to incorporate other signatories in a range of transport sub-sectors.[32]

The **Michelin Challenge Bibendum (MCB)** event has convened major industry players of the sustainable mobility sector since 1998. More recently, MCB has created an ongoing approach called Open lab, which will continue to bring together actors from the transport sector to define and implement a shared vision of mobility.[33] MCB has joined forces with the Partnership on Sustainable Low Carbon Transport (SLoCaT) through the Paris Process on Mobility and Climate (PPMC), which was created to strengthen the voice of the sustainable transport community in the UNFCCC process, especially with a view to the upcoming Conference of Parties (COP21) in December 2015 in Paris.[34]

[30] http://www.ren21.net/wp-content/uploads/2015/07/GSR2015_KeyFindings_lowres.pdf
[31] http://www.ren21.net/wp-content/uploads/2015/07/GSR2015_KeyFindings_lowres.pdf
[32] http://caringforclimate.org/about/
[33] http://www.challengebibendum.com/index.php/Our-approach/our-mission
[34] http://ppmc-cop21.org/?page_id=103

CALSTART is a member-supported organization of more than 140 firms, fleets and agencies worldwide dedicated to supporting a growing high-tech, clean transportation industry to improve air quality, create jobs, and reduce carbon emissions. CALSTART provides services and consulting to spur advanced transportation technologies, fuels, systems and the industries that support them.[35] CALSTART's technology commercialization efforts encompass efficient vehicles, low-carbon fuels, and integrated mobility strategies.

Finally, the **Lima-Paris Action Agenda (LPAA)**[36] intends to contribute to closing the emissions gap by further increasing pre-2020 ambition to support the anticipated 2015 agreement at COP21, and to emphasize the need for greater action to strengthen resilience to climate impacts. Building upon the UN Secretary-General's Summit in September 2014 and subsequent fora, the LPAA is committed to scaling up cooperative climate initiatives to advance sustainable development and promote economic prosperity, which include the following two initiatives on electric mobility.[37]

The **Action Platform on Urban Electric Mobility (UEMI)** is an initiative to increase the market share of electric vehicles in cities to at least 30%, of all new vehicles (including cars and motorized 2-3 wheelers) sold on annual basis by 2030 while developing the enabling infrastructure for their effective use. Through increased use of electric mobility for passenger transport (both private and public) as well as freight transport (combined with measures to reduce transport demand and increase use of public and non-motorized transport) the initiative aims to reduce CO2 emissions by 30% in urban areas by 2030.[38]

The California EPA-led International **Zero-Emission Vehicle Alliance** aims to accelerate adoption of zero-emission vehicles (ZEVs) (including electric vehicles, plug-in hybrids and fuel-cell vehicles); support the achievement of national, urban and regional, and city climate change commitments through scaling up of ZEVs; and foster collaboration on policies to promote the advancement of investment and innovations required to achieve ZEV targets.[39]

[35] http://www.calstart.org/About-us/Who-We-Are.aspx
[36] http://newsroom.unfccc.int/lpaa/
[37] http://newsroom.unfccc.int/lpaa/transport/
[38] http://slocat.net/climatesummit
[39] http://www.calepa.ca.gov/PressRoom/Releases/2015/Alliance.htm