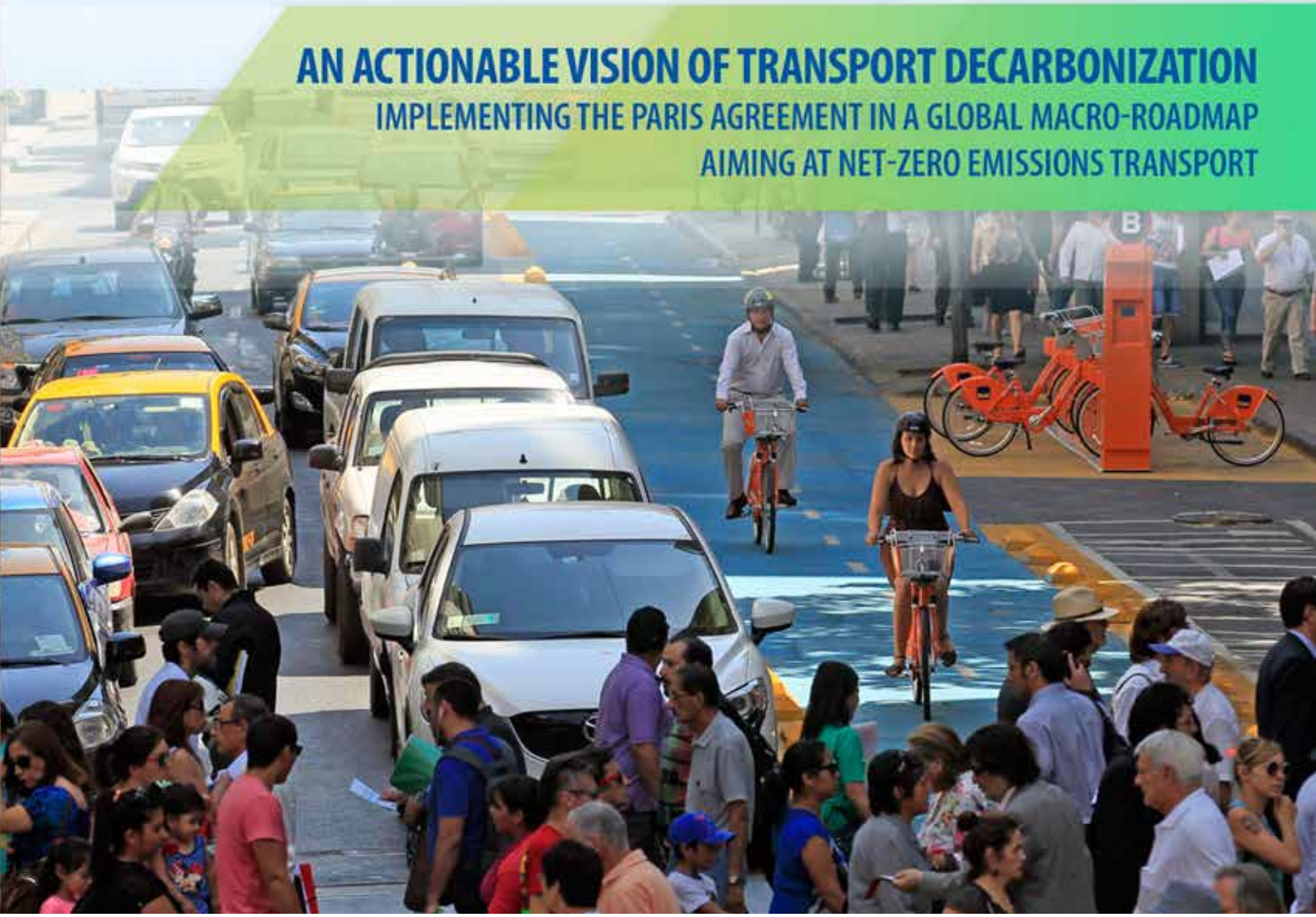
PARIS PROCESS
ON MOBILITY AND CLIMATE

AN ACTIONABLE VISION OF TRANSPORT DECARBONIZATION

IMPLEMENTING THE PARIS AGREEMENT IN A GLOBAL MACRO-ROADMAP AIMING AT NET-ZERO EMISSIONS TRANSPORT



PARIS2015
COP21·CMP11

MARRAKECH
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Consultation Draft
February 2017

This updated version of the Global Macro-Roadmap takes into account the discussion at COP22 and is prepared for a second round of consultations.

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List of Abbreviations

2DS	Two-Degree Celsius Scenario
BAU	Business-As-Usual
BRT	Bus Rapid Transit
CO2	Carbon Dioxide
COP22	The 22nd Session of the Conference of the Parties
ECF	European Cyclists' Federation
EVs	Electric Vehicles
FC	Fuel Cell
FfD	Addis Ababa Action Agenda "Financing for Development"
GCAA	Global Climate Action Agenda
GHG	Greenhouse Gas
HDVs	Heavy-Duty Vehicles
HLC	High Level Champions on Climate Change
ICAO	International Civil Aviation Organization
ICE	Internal Combustion Engines
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ITS	Intelligent Transport Systems
ITEM	International Transportation Energy Modelling
ITF	International Transport Forum
LDCs	Least Developed Countries
LDVs	Light-Duty Vehicles
LEZ	Low Emission Zones
LNG	Liquefied Natural Gas
LPAA	Lima Paris Action Agenda
LT	Light Trucks
MCB	Michelin Challenge Bibendum
MYC	Mobilise Your City
NDCs	Nationally Determined Contributions
OECD	Organisation for Economic Co-operation and Development
PCs	Private Cars
PPMC	Paris Process for Mobility and Climate
SDGs	Sustainable Development Goals
SIE	Société d'Investissements Energétiques - Morocco
SLoCaT	Partnership on Sustainable, Low Carbon Transport
SUMPs	Sustainable Urban Mobility Plans
TEM	Transport Expert Meeting
UEMI	Urban Electric Mobility Vehicles Initiative
UITP	International Association of Public Transport
ULEZs	Ultra Low Emission Zones
UNEP	United Nations Environment Program
w2w	Well-to-Wheel (emissions)
WBCSD	World Business Council for Sustainable Development
WCA	World Cycling Alliance
WEF	World Economic Forum
WTO	World Trade Organization
ZEV	Zero Emission Vehicles
ZEZ/ZEC	Zero Emission Zones and Cities


BRT the first choice
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I. The need for a bold action plan to implement the Paris Agreement on Climate Change for Transport

A. New challenging frontier for the Transport sector

1. Three recent major international agreements outline a "new frontier" for sustainable development and climate change, thereby putting a stronger pressure on all human activity sectors, including Transport:

- The 2030 Agenda for Sustainable Development, adopted in New York September 2015;
- The Paris Agreement on climate change, adopted at COP21 in Paris December 2015;
- The New Urban Agenda, the outcome document of the Habitat III conference, adopted in Quito, October 2016, to guide sustainable urban transport over the next 20 years.

2. The agreed UN 2030 Agenda for Sustainable Development and Habitat III´s New Urban Agenda call for improvements in access to opportunities and services that will require a large increase in transport infrastructures and services. Both agreements on sustainable development emphasize the increasing importance of social and environmental sustainability in all efforts to promote economic development and eradication of poverty.

3. The Paris Agreement on climate change sets an overall long-term direction for climate change policy; it sends a clear message to all economic sectors that there is need for disruptive change, as incremental approaches will be insufficient to achieve the necessary reductions in greenhouse gas (GHG) emissions, in line with the ambitious target of limiting temperature increases *('well below 2°C above pre-industrial levels, and to aim for a temperature increase of not more than 1.5°C')*. Therefore, each sector of human activity, including the Transport sector, must define its course of action whilst taking into account:

- a decarbonization timeline of 2050-2060 for the most developed, and 2060-2080 for less developed economies;
- the development and implementation of a transformation pathway that acknowledges the specific characteristics imposed by transport specific industrial investment and innovation cycles, that run from 5 to 40 years;
- the need to adapt transport systems and services to the demands of a changing climate;
- the synergies in public policy required to promote the changes in behavior and the clear market signals necessary for a disruptive transition towards a net-zero emission economy;
- the key role to be played by the financial community in funding the decarbonization process.

4. Change of this magnitude and transformative nature in the transport sector can only be achieved through combined action from all stakeholders (public and private) covering all segments of the transport sector.

5. The entire sector (mobility of people and transportation of goods) accounts for approximately 25% of CO2 emissions from the burning of fossil fuels, and 15% of anthropogenic GHG emissions. The transport sector at the global level is still growing, with experts forecasting a potential doubling of transportation activity by 2050, resulting in a business-as-usual (BAU) emissions scenario of about 12-13 Gt per year by 2050. This trend is driven by economic development and demographic growth, particularly in cities (already accounting for 75% of carbon emissions), with an additional 2-3 billion urban dwellers by 2050.

6. The challenge therefore is daunting: catering to a fast increasing demand for mobility and transport, drastically cutting GHG emissions and supporting social and economic development.

Transport as part of a net-zero emission economy

7. For the Transport sector, the goal is to largely decarbonize and move from 7.7 Gt emissions/year down to 3 or 2 Gt by mid-century. Transport will be part of a "net-zero emission" economy, in which remaining emissions from specific sectors will need to be sequestered or off-set through other means. Investing in GHG sequestration/removal solutions though R&D and implementation of proven solutions must start now. Peaking as soon as possible in GHG emissions is key and, while a lot of people still think of capture and storage or removal as a (primarily) long-term, post-2050 mitigation approach, research into such technologies must be intensified now, to allow much faster deployment at scale than 2050.

8. The transformation of the transport sector will have to be largely completed between 2060 (economically most advanced areas) and 2080 (other parts of the world). All modes of transport (road, railway, aircraft, maritime, rivers, transport for people and goods) will need to be part of the global systemic transformation involving new consumption patterns and behavioral changes, major technological innovations, the emergence of new mobility ecosystems, and the creation of new business models. Such a change, both in scope and urgency, calls for unprecedented immediate and coordinated mobilization of all Transport sector players, public and private, including policy makers, economic and corporate players, and the full participation of civil society. The Transport sector alone cannot realize such ambitious action and so will need to gain the full cooperation of other sectors that interact with it, especially the Energy sector and Urban development.

B. Time to take action

9. Transport has been established as one of the thematic areas under the Global Climate Action Agenda (GCAA), formerly the Lima Paris Action Agenda (LPAA); the discussions on transport within the GCAA have been facilitated since COP21 by the Paris Process on Mobility and Climate (PPMC) , in close interaction with the French Government (COP21 Presidency) and the Moroccan Government (COP22 Presidency), as well as the Moroccan Energy Investment Company (SIE). Acting together as the GCAA Transport team, they have made strides in building a genuine "Low-carbon Transport community", and making a start in the setting of an agenda for structural, long-term change in the sector.

10. COP22 (November 2016) in Marrakech, Morocco, came after a series of 2015-2016 international discussions and workgroups that, beyond New York, Paris and Quito, sent multiple converging signals showing public and private actors' intent to use powerful levers (policy – technological – financial) to drive large-scale and coordinated action to achieve sustainable development while addressing global warming. This was reflected in discussions in the 2016 G20 and G7 meetings in China and Japan, which both saw a strong emphasis on the concept of sustainable infrastructure. The prioritization of providing funding for climate action (e.g. through the Green Climate Fund), the strong global partnership of the Addis Ababa Action Agenda "Financing for Development" (FfD) to underpin implementation of the 2030 Agenda´s sustainable development goals (SDGs), and the Innovation Mission launched at COP21 to significantly enhance global investment capacity in R&D towards a shift to renewable energy, are further indications of the willingness to trigger transformational change.

11. The GCAA Transport team, on behalf of the numerous transport stakeholders that it represents, acknowledges this progress at international level and proposes a process to develop a framework for action on transport and climate change for the coming decades. As a countdown from the *2050*[+]decarbonization horizon set by the Paris Agreement, this framework for action, hinges on three main actions:

1. *Plan for mid/long-term disruptions towards a systemic transformation of the Transport sector (2020-2050*[+]*):*
   - bring together all relevant stakeholders (public and private sector, think tanks) around a sound Global Macro-Roadmap. We understand the Global Macro-Roadmap to be a process as well as a document that can serve as a reference or compass to set the course towards the long-term climate goals agreed in the Paris Agreement, enabling each actor to develop its own positioning and work out its contribution in line with the overall directions set by the Global Macro-Roadmap, without being prescriptive in terms of the details of actions taken to realize such directions.
2. *Taking the short term decisions on which the success of the Paris Agreement ultimately depends on (2016-2020):*
   - recommend urgent measures (Quick Wins) to public authorities and private sector stakeholders to kick-start the transformation of the Transport sector;
   - contribute towards strengthening of existing Nationally Determined Contributions (NDCs) and support them to raise the required ambition level in 2020, inspired by the directions set in the Global Macro-Roadmap.
3. *Leveraging existing GCAA Transport Initiatives and encouraging new ones:*
   - strengthen GCAA Transport Initiatives[2], improve their governance, and help them to scale up by linking more directly to action by Parties;
   - promote the emergence of new Initiatives to address those areas of action that have yet to be worked out by the Transport sector.

12. In sum, the recent adoption of the 2030 Sustainable Development Goals (SDGs) and the signing of the Paris Agreement on climate change have set, for us all, clearer long-term goals to improve human well-being, and have added a new level of urgency to implementing long-sought but little-realized steps toward these ends. Crucially, NDCs

1 The Paris Process on Mobility and Climate (PPMC) is a joint initiative of Michelin Challenge Bibendum (MCB) and the Partnership on Sustainable, Low Carbon Transport (SLoCaT). It brings together well over 150 organizations, networks and initiatives that support ambitious, transformative action on transport and climate change. Read more at www.ppmc-transport.org.

2 This concerns a series of initiatives taken by non-State actors to promote action on transport and climate change in different transport sub-sectors. For details see: http://www.ppmc-transport.org/transportinitiatives/

provide an instrument that can be used to drive national climate action. The first generation of NDCs presented in 2015, prior to COP21, lack in ambition and do not have time frames which enable the planning of a comprehensive transformation of the Transport sector towards net-zero emission which will be required by 2050 and beyond. This is why the GCAA Transport team proposes the development of a decarbonization Global Macro-Roadmap as described below.

II. A Global Macro-Roadmap to decarbonize transport by 2050+

13. We propose the development of a Roadmap through a phased action process, covering a 2020-2050+ timeline and thereby covering both short as well as mid- to long-term actions.

14. This Roadmap aims to give a realistic (technically feasible) vision, with an operational focus for each segment of the Transport sector (people and freight; road, railway, aviation, waterborne; urban and rural). It is driven by new sustainable and inclusive growth opportunities called for by the SDGs. It assumes the development of new technologies and business models as levers of growth and transformation of the Transport sector. Such change will not come at the same pace in all sub-sectors and regions of the world, and therefore the emphasis is on a phased and regionally specific approach.

15. Being part of a wider sustainable development agenda, it is key that the Roadmap, in addition to being climate relevant, emphasizes the equity dimension of sustainable transport. It will take an overarching look across the Transport sector as a whole – and focus on the broad deployment of appropriate low carbon transport solutions for passengers and freight "in the context of sustainable development and efforts to eradicate poverty" (Paris Agreement, Article 2).

16. The Roadmap will focus on identifying a balanced package of actions taking into account the main sustainable transport paradigm which combines ***Avoid*** (reduce unnecessary travel through e.g. land use planning or logistics redesign and halting counterproductive regulation that incentivizes travel by individual motorized vehicles), ***Shift*** (shift movement of goods and people to the most efficient modes, by scaling up good practices) and ***Improve*** (improve environmental performance of fuels and powertrains, intermodality and transport management). Successful implementation of Avoid-Shift-Improve measures at large scale will be enabled by new, (shared) mobility solutions and supportive enabling institutional, regulatory, and financial mechanisms. The aim is to ensure that ALL the required policies AND technologies are included in a single, comprehensive, sustainable development sensitive, Transport sector Roadmap taking account of different geographic and economic circumstances.

17. The development of the Roadmap will include prioritization of actions based on an assessment of mitigation potential, whilst also taking into account cost effectiveness, broader sustainable development impacts, and political acceptability.

18. The Roadmap brings together a lot of work being done at the technological, modal, national and regional levels into a single vision for the global Transport sector along eight priority areas. This Global Macro-Roadmap is a tentative common framework for a transformative ambition and must be regarded as a work in progress to be completed and enriched; the basic elements have been presented and positively received in various public and private arenas. It needs to be furthermore confronted to the views of state and non-state actors, experts, and other stakeholders from various sub-sectors and regions.

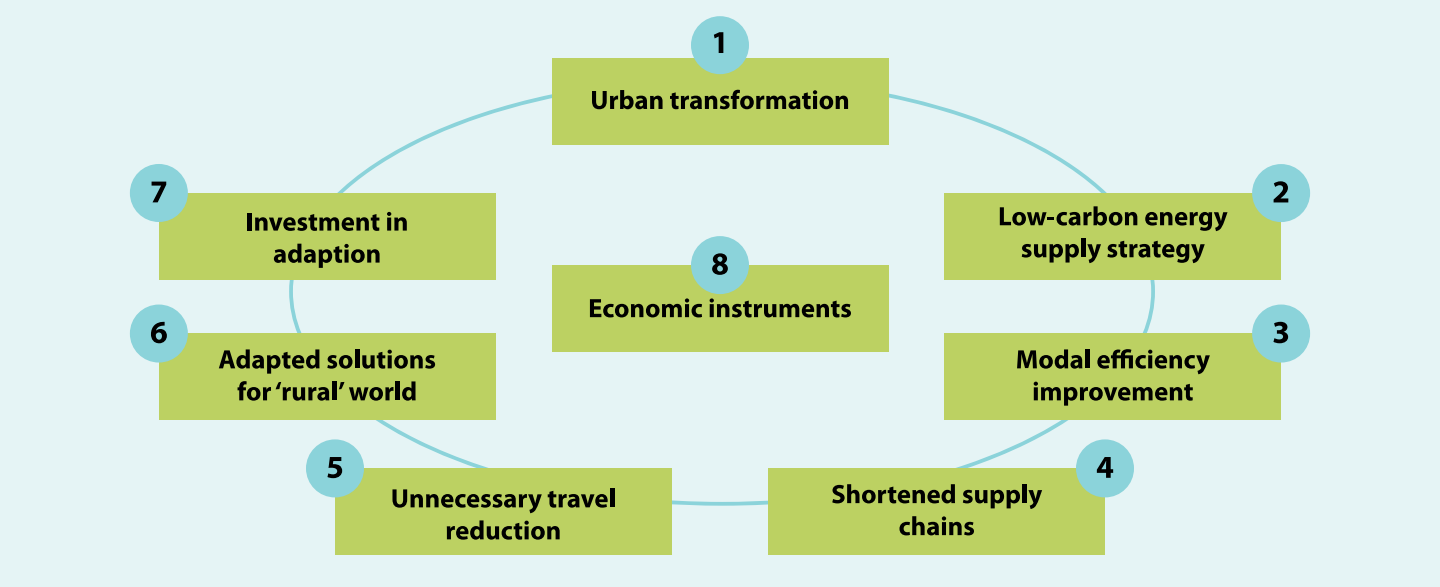


Figure 1 - Global Macro-Roadmap: 8 Priorities

Component 1: Urban transformation – Leverage aspiration for healthier, inclusive lifestyles and efficient prosperous cities to drive Urban Transport decarbonization

19. The fight against climate change will be won or lost in cities. The goal for the Transport community is modern efficient cities with no pollution, with inclusive mobility of people and freight. In densely populated areas, the mitigation of climate change will be closely linked to fulfilling the growing aspiration of people to breathe clean air. As the urban population is expected to increase by 2-3 billion people between now and 2050, urban planning is a key tool in realizing higher density, mixed land-use cities. This

should help to ensure that a greater amount of trips are made by walking or cycling. Offering more attractive mass transit solutions will help to limit the growth of individual car ownership and use and promote greater equity in access to economic opportunities and essential services. Cities should lead in the rapid scaling up of electric mobility, both for private and public transport, and following the lead of a growing number of cities, fossil fuel powered transport can be the exception, rather than the rule, from 2030 onwards in cities in the developed world. This applies both to passenger and urban freight.

20. Useful experience has been gained in the transformation of urban transport through local access regulations (e.g. Low Emission Zones), targeting both air quality improvements and congestion reduction in selected areas. This has been done often through a combination of local road charging, regulation (access restrictions for more polluting vehicles, based on emission standards), improvement in mass transit systems, promotion of pedestrian areas, and bus and cycling lanes.

21. The first publicized LEZ was in Tokyo (2003), with very visible results today. Several European cities and others followed suit. But fossil fuels and internal combustion engines (buses, trucks, passenger cars) continue to dominate transport in such cities. Moving ultimately towards Zero Emission Zones and Cities (ZEZs/ZECs, for both air pollutants and GHGs) can be accelerated through an intermediate step: Ultra Low Emission Zones (ULEZ, soon thereafter to be extended to ULECities, thus including suburbs) in which emission control measures, shifting individual travel to clean public transport and greater prioritization of walking and cycling is combined with seamlessly connected (Intelligent Transport Systems ITS/ICT) other modes, to ensure optimal inter-modality between public and private modes of transport. This is to be accompanied by a phasing out of internal combustion engines (ICE) vehicles. It will also require modifications in land use to minimize unwanted travel. London announced in 2014, after reviewing the benefits of the LEZ it introduced in 2008, the decision to move to a ULEZ in 2020.

22. A first key step and Quick Win will be to massively increase the number of LEZs (backed up by supportive measures on public transport, walking and cycling) in the next couple of years, for cities above 100 000 inhabitants. Following this, cities across the world need to join London in its effort to create ULEZ. To pursue the goal of 100% transport-related-emission-free cities by 2060, front-running cities would have to turn to Zero Emission Zones (which implies greatly reduced individual motorized transport and electric or plug-in hybrid systems only for remaining passenger transport as well as urban freight, in combination with smart door-to door solutions, and various sharing systems) by 2030.

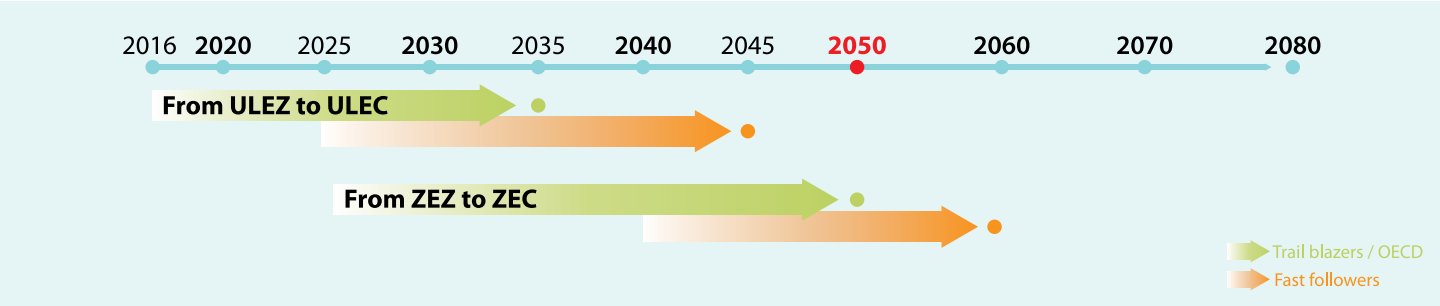


Figure 2 - Component 1: Urban Transformation

23. This would not only spark a sizeable and positive transformation of life in cities (e.g. reduced congestion, greater equity in access, lower air pollution) but would also create the scaling-up conditions needed to develop huge business opportunities, to allow cities to remain engines of growth and trim down the cost of change to society because of lower health costs as well as avoided congestion.

24. Ideally, deciding to make the change within 10, maximum 15 years (2020-2035), would pave the way to easier standardization, synergism in best practice exchanges, and favorable joint procurement conditions for e.g. electric busses. Managing such a transformation within and across countries would not only require municipal government decisions, but also national coordination and intergovernmental harmonization. To plan and implement the transformation of urban transport, the Transport community will need to work in much closer and effective manner with the Urban development community. This should extend from urban planning, financing, environmental planning and safety considerations.

Component 2: Low-carbon energy supply strategy

25. A three pronged low-carbon energy for transport strategy, including a) decarbonize power generation through renewables; b) develop a clean hydrogen industry; and c) ensure a sustainable bio- or synthetic-fuel supply) – together with improved energy efficiency (described under component 3) is a key part for the transformation of the Transport sector.

26. Low carbon (in many cases renewable-energy based) electricity is a necessity to allow the roll-out of e-drive vehicles at scale, while eliminating the emissions of GHGs and air pollutants.

27. The transition to a renewables-based energy supply needs to be supported by storage and local generation systems (batteries, supercaps, fuel cells) and by smart grids to optimize energy needs and flows. A specific requirement for scaled e-mobility is the ability of the energy infrastructures to recharge batteries quickly. If all of this would take place, this would allow for medium- and long-distance travel by electric vehicles, which would expand e-mobility beyond the current urban focus.

28. The International Energy Agency says that decarbonized power production (~20 gCO_2/kWh) is possible by 2050 in the OECD countries. Developing countries are likely to take longer (~2070), but some are already changing rapidly. To initiate momentum to low-carbon power generation, countries that are above 400-600g CO_2/kWh need to embrace a shift in their primary energy mix without delay.

29. Immediate steps are required as well on the production of second generation, sustainable bio-fuels and synthetic (non-fossil-fuel-derived) liquid fuels. The use of these sustainable fuels is required especially by the aviation sector to be able to make its contribution towards the decarbonization of transport from 2030-2035 onwards. Depending on the production volumes that can be realized, other transport modes, especially boats and possibly trucks and trains, can also be powered by such sustainable fuels albeit in the case of trucks and trains, on a smaller scale. The use of agro-fuels for passenger cars is expected to remain limited to niche-markets with proven sustainability on a life-cycle basis (e.g. Brazil with-fuels produced from sugarcane waste).

30. There is agreement that significant clean hydrogen production will need to be part of future medium to longer term energy supply; this would be by 2030 and beyond. The latest studies show that to be economically and ecologically relevant, hydrogen must be produced from renewable sources and preferably be made available locally.

31. So far the Transport sector has acknowledged the importance of a low carbon energy supply, but has not really acted in concert with the Energy sector to map out the steps to be taken to ensure the timely available supply of of low-carbon energy for the sector. Although transport is one of the largest end-users of energy, the Energy sector is only recently starting to get in touch with the Transport sector to draft joint approaches. There is a growing urgency to develop joint pathways for the production of renewable sources of energy and their deployment in transport.

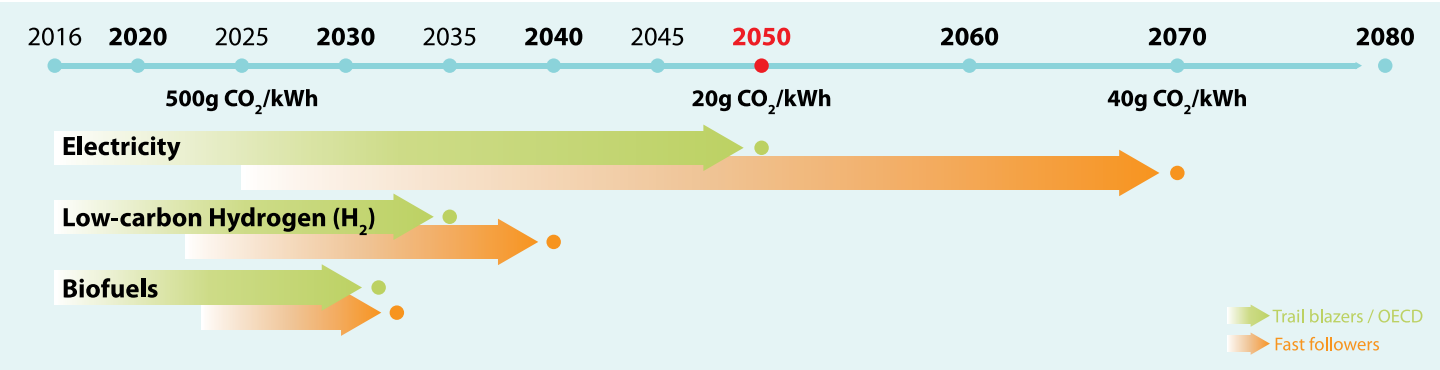


Figure 3 - Component 2: Low-carbon energy supply strategy

Component 3: Improve modal and system efficiencies

3-a/ Drive down energy consumption and emissions of new light duty vehicles (LDVs). Hybridize and electrify a growing part of the passenger and freight transport fleet

32. Estimates are that under a Business as Usual scenario without any measures to reduce the demand for individualized motorized mobility, there could be around 2 billion light vehicles on the road by mid-century. In combination with measures to reduce such demand, described in other components of the Roadmap, drastic energy consumption reductions are therefore necessary. Technologically, such ambitious improvements in energy efficiency are feasible.

33. Today, in real world driving conditions, the fleet-average "well-to-wheel" (w2w) emissions of private cars (PC) and light trucks (LT) world-wide is around 200 gCO_2/km (closer to 170 gCO_2/km in Europe). The technical feasibility of reducing this to 50 gCO_2/km is now well established, and it is understood that further reductions to 25 gCO_2/km are feasible as well. "2 liter" (~50 gCO_2/km, tailpipe) and even "1 liter" (~25 gCO_2/km, tailpipe) prototypes are already publicized by car manufacturers. Reaching 50 gCO_2/km w2w on average for new vehicles in 2040, in real world conditions, is technically achievable i.e. almost achievable with conventional technologies - provided in particular that vehicles become lighter, with crash avoidance systems – and it is clearly achievable with hybrid/electric solutions and sustainable bio- or synthetic fuels.

34. For entire fleets to be at 50 gCO_2/km w2w by 2050+ will require retrofit regulations to be enacted and/or fast rotation scenarios (e.g. sharing to keep vehicles fewer years on the road)to become routine. Moving further down to an average of 25gCO_2/km w2w will require a massive development of electric drive systems, including plug-in hybrids, battery vehicles with or without range extenders (ICEs or fuel cells (FC)), very light ICE vehicles with energy recovery and sustainable liquid fuels, FC vehicles. This is achievable around 2050 (in most advanced areas) with the proper infrastructure investments and the right experience curve. Common standards will be needed to enable a quick and decisive move towards electrification of transport.

35. Moving down to 15gCO_2/km w2w will require an almost complete shift to e-mobility with electricity and/or hydrogen produced through almost zero carbon techniques. Scaling up of vehicles meeting these emission requirements should be heavily incentivized to get a sizeable market by 2030+ and ensure significant "close-to-zero" emission fleets by 2060. Several countries, or sub-national entities, are putting in place increasingly ambitious mandates to promote the use of e-mobility and, in some cases, to ban the use of ICEs (either both for gasoline and diesel, or only the latter).

36. The transformation of the vehicle manufacturing industry has implications for the current industrial structure and linked to that the labor market. To ensure the required political support for such a transformation, it is key to have a better understanding of the winners and the losers of such a transformation and what policy measures can be taken to address the issues of the losers.

3-b/ Curb GHG emissions of Heavy Duty Vehicles (HDVs)

37. Heavy trucks are key in regional and long distance freight transport and, despite necessary expanded action to shift towards more waterborne and rail transport of goods, roads will continue to play an important role in freight transport, with under a Business as Usual scenario an increase in numbers of trucks.

38. As trade will grow in the coming decades and the world population benefits from more consumer goods, cities, states, and nations must make a drastic effort geared at reducing the pollution and energy consumption of trucks. Scaling up of improving energy efficiency will take time and thus, transformation of this sector should begin early in the next decade. The pace of change will be faster provided that the freight and the logistics sector can be brought aboard as partners and if they see the financial benefits of drastically reducing GHG and air pollution emissions through the reduced use of fuel and more efficient operations including greater use of ITS and connected modes (see component 4).

39. Assuming that thanks to all possible technical improvements [drag reduction, weight decrease, engine efficiency, hybridization, lower carbon fuels (e.g. CH4, biofuels)], the emissions per t.km (ton x kilometer) would

decrease by a rate of progress close to the one observed for cars, whilst realistically integrating the necessity of a longer timeframe, one could assume that by 2050, on average a heavy truck currently emitting around 850 gCO_2/km could on average emit around or less than 300 gCO_2/km.

40. Tighter fuel economy standards for trucks are a must as part of the transformation strategy, and a system of standards of increasing stringency needs to be put in place as soon as possible. Moving down below 100 gCO_2/km on average is likely to be a post-2060 goal, and would most likely require clean hydrogen, second/third generation biofuels, and e-motorways (for which initial testing is underway).

41. Quickest progress in decarbonizing freight transport can be made in urban areas, where there is already a substantive body of experience with the use of e-trucks (both Medium and Heavy Duty). Several cities have indicated that zero-emission urban freight systems can be in place by 2030.

3-c/ Continue electrifying and improving energy efficiency of rail

42. Rail-based means of transport is used for moving large number of people (subways, light-rail and trams in the case of cities and trains, sometimes High Speed, in the case of inter-city travel) and freight (mostly trains). The Roadmap at other places (e.g. component 1 for urban transport and component 4 and 5) is making the case for shifting the transportation of goods and people to rail-based modes.

43. A greater use of electricity (generated from renewable sources) and efficiency measures are required for all forms of rail transport. Urban rail infrastructure and services are already largely electrified, and in the future these can be made mandatory. The emphasis here should be on the source of electricity. The degree of electrification of long distance rail varies between countries. Intermediate targets should be set for expanding the percentage of rail systems operated in part, or in full, on electricity. Linked to this, long-distance rail also needs to consider the source of electricity and, where possible, follow the example of the Netherlands, which since the beginning of 2017 operate a fully renewable energy powered rail network.

44. The rail sector had prior to COP21 committed to an industry-wide initiative with a series of milestones in terms of CO_2 emission reductions:

- 50% reduction in CO_2 emissions from train operations by 2030, and 75% reduction by 2050 (specific average CO_2 relative to a 1990 base line – ie. reduction of emissions per passenger/km + ton/km)
- 50% reduction in energy consumption from train operations by 2030, and 60% reduction by 2050 (specific final energy relative to 1990 baseline).

45. These milestones can serve as the basis for a modified rail specific roadmap that takes into account the increased ambition of the Paris Agreement to limit temperature increase to 'well below 2°C'.

3-d/ Manage the two key technical transitions for aviation: sustainable low-carbon kerosene and hybrids

46. The International Civil Aviation Organization (ICAO) agreement to reach carbon neutral growth by 2020 is a remarkable short term objective, and is in line with the general understanding that transport emissions should peak at latest by the early 2020's. Then, aiming at reducing by 2050 net CO_2 emissions to 50% of what they were in 2005 (through technology, improved operations, better infrastructure management and global market-based measures -- primarily offsetting) can be hailed as an encouraging move – but needs to be elaborated with detailed plans and viable business models. However, this may still not prove to be enough for the overall transport sector to be in line with the Paris objective of a "net-zero emission economy", especially if the enhanced harmfulness of high altitude GHG emissions is confirmed.

47. Sustainable low-carbon kerosenes (bio or synthetic) for jet engines, complemented by fuel cells for on-board operations, are solutions currently being favored and actively developed in parallel to the advancement of all the energy efficiency tools in aircraft operations and traffic. By 2035, this transition should be completed worldwide. Technology should then be advanced enough to embark on the second transition: hybrids (taking off with liquid fuels, cruising on electric power). A clear phasing of progress in the aviation sector must be crafted, with associated emission regulations

agreed at international or national level reflecting established institutional mandates. Action on aviation will need to be a combination of measures agreed under ICAO in the case of international aviation and through the UNFCCC in the case of domestic aviation (e.g. through NDCs and long-term emission reduction strategies).

48. Excellent progress is being made already with the carbon accreditation of airports, with a growing number of carbon neutral airports in terms of day-to-day operations. As a next step it is also important to consider the role of airports as mobility hubs. Guided by the actions indicated in other components of the Roadmap, efforts are needed to make them "clean mobility hubs".

3-e / Electrify river and coastal shipping and scale-up the role of wind-energy and sustainable bio-or-synthetic fuels in long-haul shipping, complementing greater use of Liquefied Natural Gas (LNG)

49. Because shipping can operate at low speed, it does not require huge power in comparison to other transport means. Still, shipping is at present almost completely fossil fuel powered; however for relatively short distances, fuel cells and locally produced hydrogen appear to be promising solutions, all the more as space availability, weight, and fears of hydrogen leaks are lesser issues for such open air applications. Various electric powered ships (river and coastal) are currently being tested, with positive results. Scaling up needs to be incentivized through supportive public policy.

50. Long-haul shipping can benefit also from the use of wind, through ingenious sail designs, which is also a potential part (but still largely overlooked) of the solution to reduce emissions from shipping. Second and third generation more sustainable biofuels, once produced at scale (see component 2) can complement, somewhere around 2030, LNG, which will be for the next 15 years the main alternative solution to fossil fuel powered ships.

51. As in the case of aviation there will be a need for a transparent and predictable long-term emissions pathway for the international and domestic shipping sector, based on which a system of standards will need to be put in place sooner rather than later. The international part of standard setting will need to be done through the International Maritime Organization, while the UNFCCC (through NDCs and long term emission reduction strategies) can address emissions from domestic shipping.

52. It is expected that improved operational measures (e.g. trimming, route optimization, vessel operation, shore power etc.) will have a significant role to play in bringing down emissions from shipping.

3-f/ Improve Transport system efficiency through greater intermodality, door-to-door solutions, and sharing applications

53. The efficiency of transportation systems and thereby energy use and associated GHG emissions is determined in part by types of modes of transport used and their respective efficiency. Beyond the modal optimization described in the previous sections, rapid improvements in smart intermodality can bring considerable benefits in terms of lowering GHG emissions in the Transport sector.

54. ITS and ICT development and deployment must be accelerated to ensure efficient, seamless travel both for people and transport of goods. Seamless intermodality between existing modes (public and private) can help to

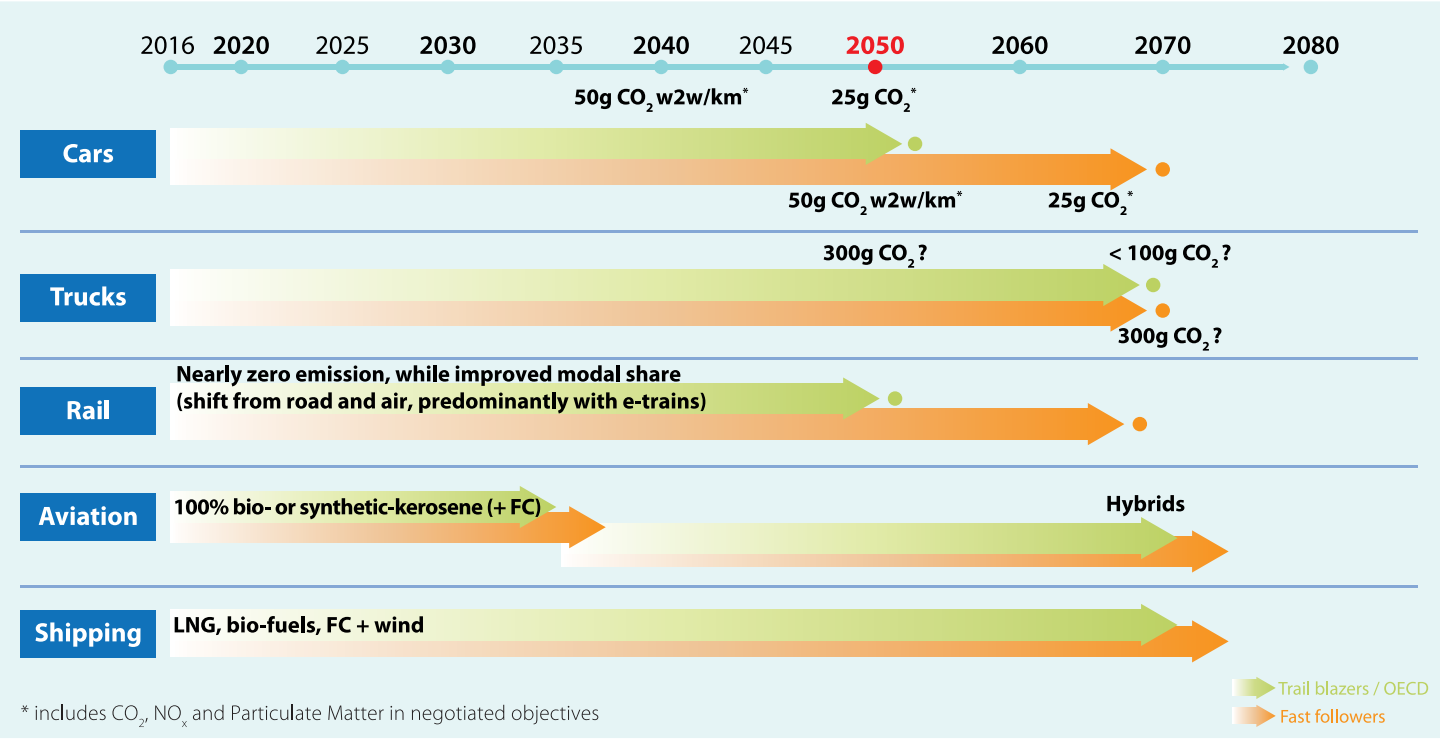


Figure 4 - Component 3: Modal efficiency improvement

increase the modal share of public transport by offering door-to-door solutions in the case of passenger mobility. Urban freight delivery systems based on urban distribution, and logistics systems with last mile delivery through electric or bike based solutions, can reduce emissions from freight transport.

55. It is believed that the use of shared services and (fully or partially) autonomous vehicles is the key to door-to-door solutions and decreased individual car ownership in cities.

56. The move towards greater intermodality and shared use of vehicles, including autonomous vehicles is an area where new business models are especially relevant. Such business models promoting efficient, real time, personalized solutions (e.g. Uber, Blablacar, car clubs) must be encouraged (with the proper set of regulations to ensure social fairness). It is key for them to be linked with public transport systems rather than replacing them, as can be seen in some cases due to a lack of local and national policies favoring (in some cases forcing) the coordination of various modal development agencies and their programs to maximize equitable accessibility and system efficiency.

57. If implemented properly, intermodality can be a key step towards solving the problems of an urban mobility model relying too much today on individual car ownership.

58. System efficiency also plays a key role in long-distance freight transport. Increasing load factors, improving railway effectiveness, densifying networks, reducing down time for freight, facilitating border crossing, successfully competing with airlines on mid-distance regional travel, using clean electricity, and so on, all are key to increasing system efficiency for non-urban freight transport. Particular attention and support is needed for transit corridors.

Component 4: De-fragment and shorten supply chains to manage freight Transport emissions

59. Trade continues to increase, and the linked growth in freight movements is potentially huge. Therefore, above and beyond promoting lower-carbon transport means, more fundamental steps are to be taken towards rationalizing supply chains and reducing overall transport distances. For business and the logistics sector this can mean:

- (re)-localizing and/or optimizing purchasing choices, redefining supplying schemes;
- de-fragmenting certain operations (e.g. semi-finished products manufactured in different places and then assembled elsewhere);
- more collaboration e.g. logistics centers, data, final delivery;
- simplifying and streamlining distribution circuits.

60. The "fourth industrial revolution" and "factory 4.0" developments must address the critical topic of modal shift and overall reduction of mileage.

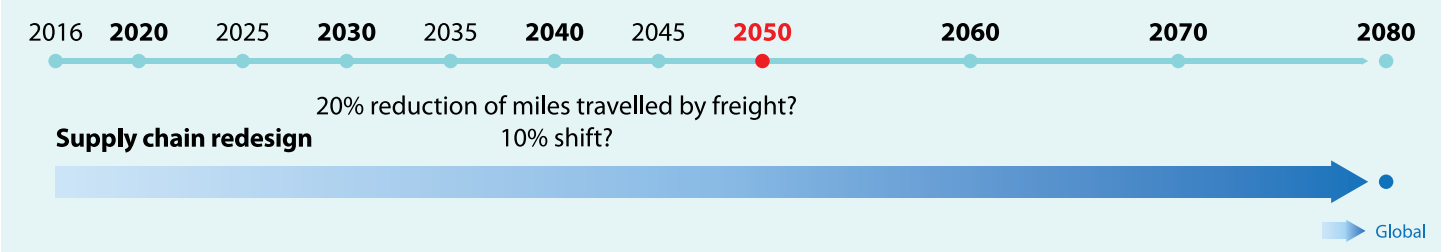


Figure 5 - Component 4: Shortened supply chains

61. The current economy and world trade have been built on relatively inexpensive transport systems, that don´t reflect the full costs to society. Many national regulations, based on protectionist or other grounds, hinder the efficient use of resources e.g. transport assets (more than a third of trucks in the world move empty).

62. Transforming transportation towards a net-zero emission economy requires that trade policy should be increasingly based on environmentally-led paradigms, and the success of such policies should specifically address GHG impacts. This is an area which is today overlooked by both governments and business. It must become a more urgent priority for companies, the Word Trade Organization (WTO) and countries.

63. It is through the re-design of supply chains and enabling policies that in the coming two decades a decrease (20%?) of miles travelled by freight could be achieved without loss of overall industrial production.

Component 5: Avoiding vehicle kilometers for commuting, shopping and accessing services

64. There is considerable potential to reduce regular daily travel both through alternatives to job-related commuting, on-line shopping or remote access to educational and other community based services.

65. Commuting represents a sizeable share of an individual's use of transport, it contributes towards congestion and is often at the expense of family and private life and at the same time costing organizations a significant amount of labor time and budget. Alternatives (like work-at-home, telework, telecommuting, remote office centers) exist and have proved their relevance, at least for a certain percentage of time and, although growing, are still representing a tiny proportion of human work worldwide. Addressing work practices and commuting in an effective manner calls, however, for more direct and structured coordination between transport planners and Human Resource development managers.

66. Likewise, the growing use of on-line shopping and access to educational and various services have reduced the need for travel.

67. Together, these alternatives to travel can provide dividends in environmental benefits, better health, time saved for family and/or private activities, better availability for work, cash savings for more gratifying expenditures as well as reduction in transport related GHGs. A greater use of electronic services, home services (e.g health care), home delivery can help to ensure better local provision of basic services and needs and, in some cases, connect disadvantaged areas to jobs and economic opportunities (see also component 6).

68. If it turns out to be feasible to considerably reduce these types of travel, this opens the door for other types of travel demand reduction measures in other travel modes. Combined with measures on land-use planning, car-pooling, developments with regard to shared, automated, and connected vehicles, electric vehicles (EVs) and more, these practices and new technologies could reduce the amount of vehicle kilometers travelled significantly. Would a 50% reduction in Vehicle Kilometers Traveled be unrealistic by 2040 if taken as a shared objective?

Component 6: Provide low-carbon solutions for the rural (non-urban) populations

69. Even though most key transformations in the Transport sector over the next 50-60 years will be driven by cities, or by changing travel between cities, a successful transition will necessarily need to involve rural areas as well.

70. There is currently a large unmet demand for mobility of people and goods which is holding back the economic and social development of many rural areas, especially in the developing world. The 2030 Sustainable Development Agenda therefore rightfully calls for improvements in rural access through an expansion of transport infrastructure and services.

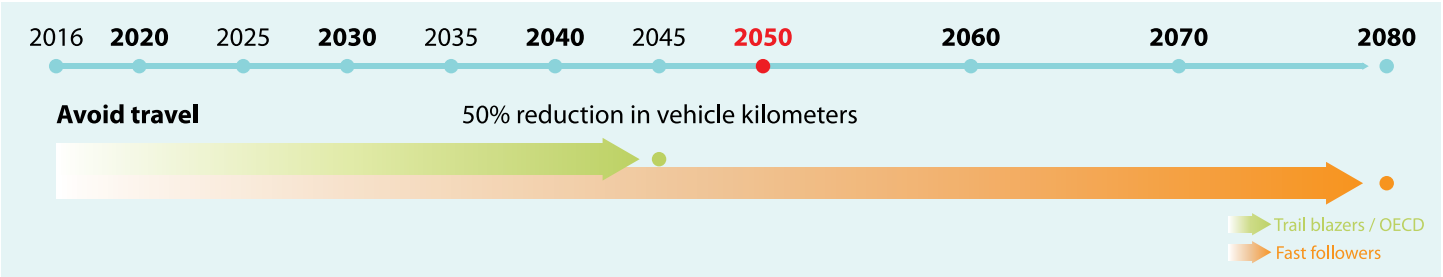


Figure 6 - Component 5: Unnecessary travel reduction

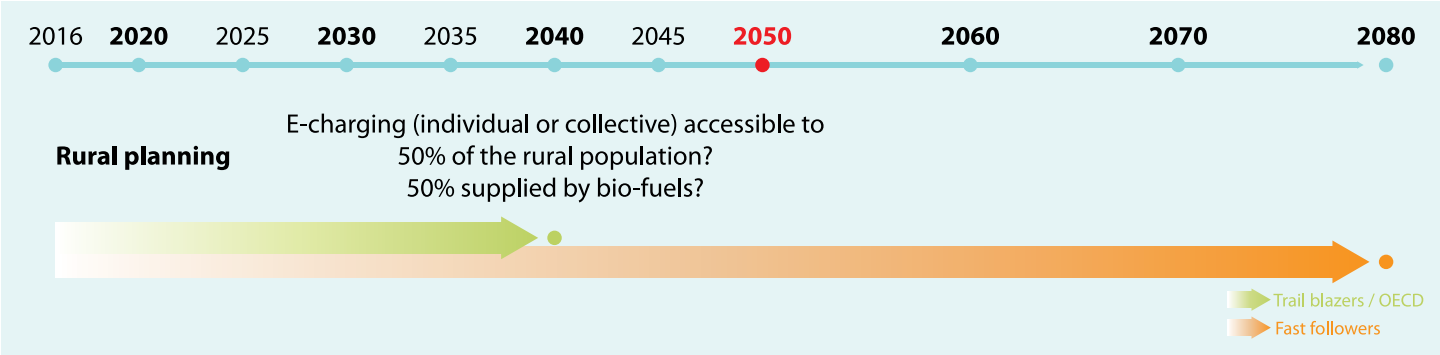


Figure 7 - Component 6: Adopted solutions for 'rural' world

71. The design of medium- to long-term low-carbon solutions for the rural population is guided by a number of relevant megatrends:

- Continued migration from rural to urban areas, which should not be taken as fatality and be somehow kept under reasonable limits;
- Accelerated deployment of decentralized renewable energy production and improved energy storage facilities;
- Roll out of fast internet across rural areas;
- Increased disposable incomes because of greater productivity.

72. Together these trends will provide rural areas with a more diverse range of transport options, which increasingly can be expected to operate making use of renewable energy sources. The relative short distances involved, combined with decentralized renewable electricity supplies make it likely that e-mobility can become a significant mode of transport, both for freight and passengers by 2030. The strong tradition of sharing transport positions rural areas well for shared mobility applications adapted to them.

73. Rural populations can benefit greatly from enhanced distant access to a wide range of services, e.g. market information, administrative and health services as well as online shopping. All of which would reduce the need for travel.

Component 7: Accelerate action on adaptation in Transport sector

74. Adaptation in the transport sector is necessary for both developed and developing countries. Crucially, sustainable passenger and freight transport systems must adapt to climate change to maintain reliability and increase market share, in order to achieve their full mitigation potential. Transport systems worldwide are vulnerable to the increasing impacts of a changing climate and this increases the potential for catastrophic impacts. Resilient transport is important in disaster recovery. Transport systems and services are already being severely disrupted by climate related events with an ever-growing number of incidents in both the developed and developing world. The systemic nature of transport means that disruption in one mode can severely impact another.

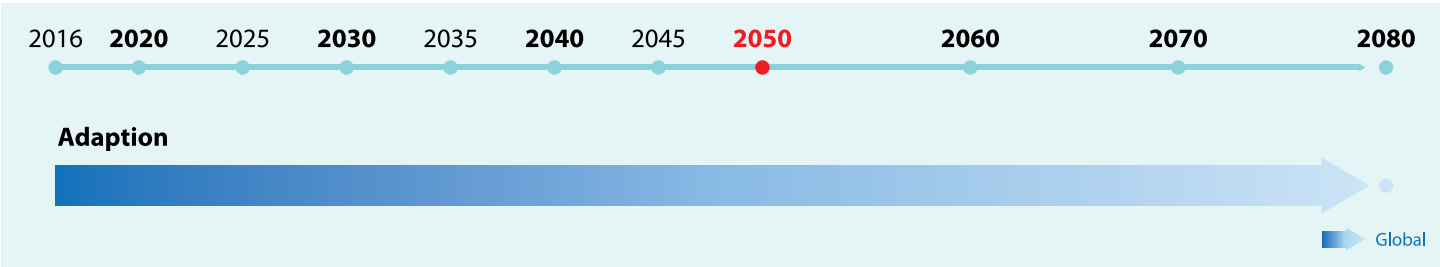


Figure 8 - Component 7: Investment in adaptation

75. Transport services provide access to jobs, goods and services and are essential for agricultural, industrial and commercial activities. Disruptions to transport services have a direct impact on the economy and social well-being of communities. Left unmanaged, climate change will

significantly affect the operational, financial, environmental and social performance of Transport. In addition, climate change presents a significant risk for global transport infrastructure investments, estimated globally at $1.4 trillion to $2.1 trillion per year.

76. Climate change scenarios are uncertain and the severity of climate impacts also varies greatly with the geophysical risk exposure of individual locations, their resilience and adaptive capacity. Nevertheless, decisions on adaptation must be made today, especially with respect to long-lived transport infrastructure assets that have the potential to lock-in development patterns many decades. Pro-active adaptation can be a low/no-regret option in cases where project savings accrued over the infrastructure life-cycle offset the higher construction and operational costs of inaction. Decision making on adaptation, especially in the case of transport infrastructure and systems with a long lifetime, needs to consider flexible responses to a changing climate allowing for adaptive management.

77. The adaptation effort today is far from sufficient and a wise strategy calls for:

1. Raising the profile of adaptation in discussions on climate change and transport;
2. Promoting climate risk screening and vulnerability assessment of existing transport systems, services, and all new projects;
3. Adopting industry relevant technical standards to ensure transport infrastructures are climate resilient, with appropriate adaptive capacities to minimize future risk;
4. Leveraging additional climate finance to shift public and private investments towards resilient transport systems;
5. Integrating adaptation into project design, including through enhanced emergency preparedness;
6. Strengthening coordination across agencies (including funding, implementing, and operating agencies);
7. Building capacity at local, national and international levels on transport adaptation;
8. Co-operating with the broader adaptation community to integrate transport into adaptation programs and activities.

Component 8: Large scale deployment of economic instruments giving a value to carbon, and which catalyze the transformation of the Transport sector

78. Deep reforms of transport pricing are required to ensure that users pay a price which reflects the full marginal social costs of transport (e.g. noise, infrastructure, accidents, delays, as well as GHG emissions and air pollution etc.). This will ensure fair modal competition, stimulate innovation by allowing market forces to drive the transformation of transport.

79. One of the key outcomes of COP21 has been the strengthened resolve to adopt carbon pricing to promote action on climate change. In Paris it was argued that pricing CO_2 at around 50 $/ton could give a strong push to alternative energies and that pricing it at around 100 $/ton would make certain technologies like carbon capture and sequestration become economically viable. Discussions continue both on price levels/trajectories and ways to foster a level playing field. Putting a value on carbon --be it in the form of carbon tax or emissions trading e.g. by making transport part of carbon markets -- is a major lever to inform player decisions towards low carbon solutions. This new economic instrument, if implemented at scale, will provide much needed market signals and help generate income to be pumped back into the economy, preferably through

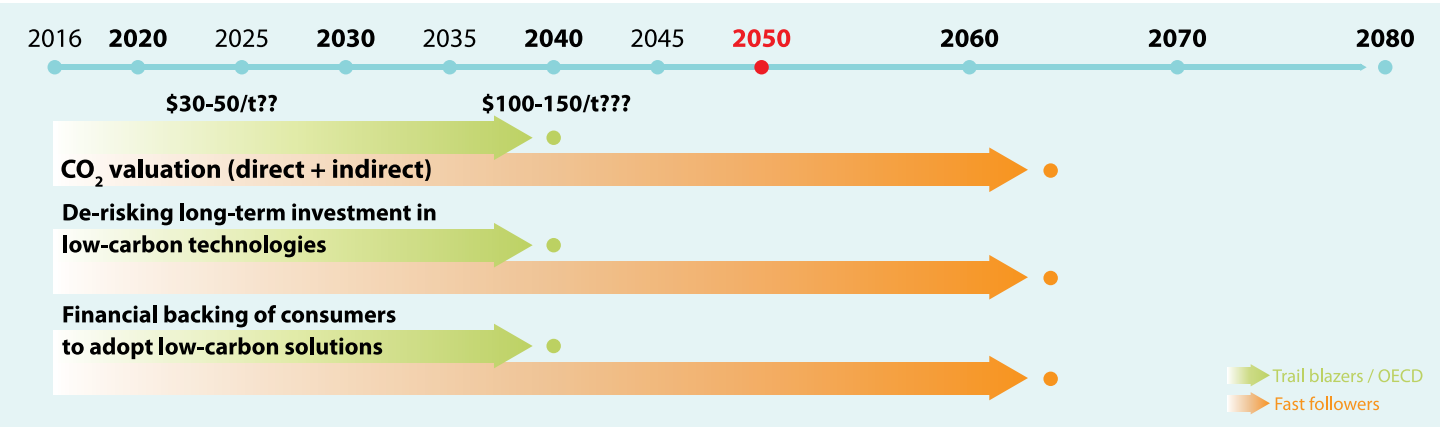


Figure 9 - Component 8: Economic instruments

sustainable transport related infrastructural investment, including public transport networks, and facilities for walking and cycling and new supportive ITS and ICT technologies.

80. Until now carbon pricing in the Transport sector has been poorly developed in comparison to other sectors, and additional efforts will have to be made to catch up. It is encouraging that a number of transport related companies have started to introduce an internal or shadow carbon price.

81. Carbon pricing, like other economic instruments, is important but needs to be combined with, rather than replace, regulatory approaches (for example fuel economy standards described in component 3).

82. Parties are invited to start working together with business and consumer associations on such a toolbox of economic instruments, to favor the transformation of the Transport sector. This will require business to be clearer about what it needs, and what it proposes in support of speeding up the transition. Political leadership will be necessary to unlock policy and regulation obstacles towards embracing transformative change.

83. Investments in new infrastructure, new technologies, and mass transit systems will have to be substantially increased, private money will need to be injected into areas traditionally managed by the public sector. Business models will have to evolve accordingly. To accomplish this, tools to de-risk long-term investments in low-carbon, and sustainable transport solutions have to be designed and deployed (e.g. shorter period amortization) to attract non-traditional investors in sustainable transport, e.g. insurance companies, pension funds and other institutional investors.

84. Climate finance, which constitutes a tiny share of the total financing need for transport, for both mitigation and adaptation purposes, should be used wisely – ideally to undertake the important upstream work to identify policies and investment opportunities, set standards and criteria, and only invest in, or be used for, key demonstration activities or path-changing activities e.g. the first rail line in a city. We advocate climate funds being used to help ensure that all transport funding (public and private) becomes more climate-oriented.

III. Way Forward

A. The Global Macro-Roadmap in the context of the UNFCCC process

85. There is widespread agreement that current ambition levels, both for climate change mitigation and adaptation fall well short of the targets set by the Paris Agreement on climate change. This was evident at the time of the adoption of the Paris Agreement and this will be addressed in the next year, as three critical timeframes for climate action emerged from discussions in the 2016 COP22 in Marrakech, Morocco: 2018, which will bring the first full facilitative dialogue to raise mitigation ambition in Nationally Determined Contributions (NDCs) and inform the ongoing global stocktakes; 2030, an essential medium-term deadline to assess results of action on both the Paris Agreement and the Sustainable Development Goals; and 2050, a longer-term deadline to achieve real progress toward sectoral decarbonization. Important in this context was the support, expressed in the Marrakech Action Proclamation[3] (MAP), for long-term emission reduction strategies that are in line with the long term climate targets set by the Paris Agreement.

86. At COP22, the centrality of NDCs was more firmly established, with profound implications for the Transport sector. In less than a year since COP21 in 2015, the "intended" contributions of INDCs have become solidified as NDCs, the main mechanism to communicate and implement the Paris Agreement. The main goals at present are how to operationalize strategies contained in current NDCs, and how

3 http://unfccc.int/files/meetings/marrakech_nov_2016/application/pdf/marrakech_action_proclamation.pdf

to take action by 2018 to scale up future iterations of NDCs, which will be supported by emerging political and technical initiatives like the NDC Partnership. At the same time, COP22 also saw the announcement of the first long-term emission reduction strategies, which describe long term (with a 2030-2050 timeframe) climate change objectives.

87. The manner in which the UNFCCC process is unfolding, with a strong focus on increased ambition level and acknowledgement of the need for long-term strategies provide the Transport sector with a well positioned platform to inform countries through the Global Macro-Roadmap on possible pathways to transform the transport sector and to scale up ambition.

88. Another key outcome of COP22, documented in the MAP, which gained unanimous support among Parties reinforces the irreversible momentum toward collective climate action, stating, "We, collectively, call on all non-state actors to join us for immediate and ambitious action and mobilization," offering a clear mandate to the Transport community. The complementary Marrakesh Partnership(MP-GCA launched by the High Level Champions on Climate Change)puts all climate action under one flag, by noting that "coalitions of thousands of cities, regions, companies and investors from across the world announced voluntary commitments to support the implementation of the ambitious climate action." This bodes well for further efforts on the Global Macro-Roadmap, which actively links action by State and non-State actors.

B. Development of the Global Macro-Roadmap

89. The Global Roadmap concept was presented first to the EU Informal Council of Ministers (Environment and Transport) in Amsterdam in April 2016, and received good support in particular from Germany, France, Netherlands, Austria, and the Czech Republic. China, Japan, Russia and the OECD expressed their interest when it was presented at the International Transport Forum in Leipzig (May 2016). Its compatibility with the IEA energy scenarios was also established in June 2016. Presentations were also made to the MCB Open Lab, ACEA, WEF. In October 2016, the Executive Council of the World Business Council for Sustainable Development (WBCSD) expressed its support for the concept and its will to foster business leadership in the transport transformation.

90. On-line consultations on the first draft of the Global Macro-Roadmap were conducted with members of the SLoCaT Partnership in early 2016 and two consultation meetings were conducted in March 2016 in Paris, and in May 2016 in Leipzig[4].

91. The Global Macro-Roadmap was also a central element in the Transport Showcase and Transport Dialogue, which the GCAA Transport team organized during COP 22 at the invitation of the two HLCs, as well as in the Round-table for Transport Ministers and the Round Table for Transport CEOs. Lastly, the wider sustainable Transport community discussed the relevance of Global Macro-Roadmap in the annual Transport Day organized by the PPMC on November 13th 2016 as part of COP22.

92. With the GCAA endorsement, immediately after COP22, efforts continued to speed up consensus and implementation, so that the GCAA Transport team proposes a 2017-2018 work program in support of the Global Macro-Roadmap which includes the following key steps in the coming years:

1. Mapping of other existing contributions to potentially enrich the Roadmap

93. The mapping of the existing modal, technology and regional Roadmaps will focus on identifying the gaps and already proposed short term priorities – in order to have a clear picture of the missing elements for a balanced, comprehensive, and global Roadmap for transport decarbonization. It will address:

- assessment of 12 global transportation/energy models identified and described in the International Transportation Energy Modelling (ITEM) Initiative;
- assessment of emerging decarbonization efforts at regional (EU), national (e.g. France, Germany

4 An ongoing overview of consultation efforts can be found at: www.ppmc-transport.org/global-road-map/consultation.

and Sweden as well as other countries that have expressed ambition to become carbon neutral or decarbonize their Transport sector) and local level (e.g. Helsinki and other cities that have expressed ambition to become carbon neutral).

2. Assessment of mitigation potential

94. The assessment of mitigation potential will have two focusses:

- **By transport sub-sector (passenger – freight; land – aviation – shipping):** Assess the mitigation potential of different policies and measures in priority specific Transport sectors and sub-sectors.
- **Geographic (developed – emerging – least developed economies):** Quantify degree of transformational-change at global level to achieve Transport sector decarbonization by second half of century.

95. We will quantify emission gaps in different regions and the potential for the Global Roadmap to bridge this gap. The focus of analysis will be on regional levels, since the necessary data is not yet currently available for individual countries. This work will take advantage of the transportation mitigation potential database developed by the SLoCaT Partnership, now consisting of over 400 mitigation potential studies (i.e. academic studies of mitigation potential at national levels).

3. Prioritizing Roadmap elements

96. Based on the drivers of change/policy gaps, the national and regional analysis and the assessment of mitigation potential (but also taking into account cost effectiveness, broader sustainable development impacts and political acceptability), we will:

i. finalize the short and long-term priorities globally
ii. determine regional/national priorities for action.

97. As part of the second point, we expect to make a substantive start with the development of regionally specific versions of the Global Macro-Roadmap for Africa, Europe and Latin America in 2017 and in 2018 for Asia.

4. Roadmap Validation

98. Using a diverse panel of external general transport and development policy/academic experts, we will improve and validate the methodology and Roadmap before finalization. This is in effect a quality control/ assurance step. The panel of independent experts will be engaged to provide comments and ideas during the preparation of the Roadmap – this is to guarantee validity and quality of the work done before the document is published.

99. Extensive consultations will also be conducted with sub-sector and technology experts in support of each of the eight components of the Roadmap.

5. Building Support for Global Macro-Roadmap

100. This will require building consensus and supportamongst key stakeholder groups,with emphasis on government and private sector.

Developed economies in Europe and USA:

101. Consensus building can be aligned with ongoing consultation efforts in the International Transport Forum (ITF), the Transport Research Board in the USA and relevant national processes. More specifically it is proposed to present and discuss the Roadmap at:

- UNFCCC May meeting in Bonn;
- ITF Leipzig, May 2017;
- Relevant G20 and EU meetings.

Transitional and Developing economies in Africa, Asia and Latin America:

102. In part use can be made of relevant ongoing transport policy processes, but additional dedicated efforts will also be made through the organization in 2017-2018 of dedicated consultation workshops in Africa, Asia, and Latin America.The participants of these consultation workshops will be national and local government officials, thought leaders on sustainable transport, business, consumers, and other stakeholders. It is proposed to organize these events, where possible, back to


Picture by Alex Proimos

back with other large scale Climate Change and/or Sustainable Transport events. Discussions are ongoing with the UNFCCC Secretariat on how these workshops can fit in with regular consultations on the implementation of the different elements of the Paris Agreement, especially the implementation of current NDCs, the preparation of the next generation of NDCs, and the development of Low Greenhouse Gas Emissions Strategies.

Political leadership:

103. It is essential to move the Global Macro-Roadmap process forward, such political leadership is best provided by countries or sub-national entities that have committed themselves to decarbonization or ambitious action that later on could result in it.

Private sector engagement:

104. Engaging the private sectoris also crucial for the necessary transformation of the Transport sector through providing investment, delivering services and developing new solutions. Consultation with the private sector will make use of the momentum established through the Transport CEO Roundtable in COP22 in Marrakech and will be initially focused on representative bodies for the private sector including the WBCSD, the WEF and We Mean Business, who all have expressed support for the Roadmap process and its overall directions.

C. Embedding the Global Macro-Roadmap in broader Sustainable Transport

IV. Conclusion

108. The Paris Agreement on Climate Change, together with other international agreements on sustainable development, present the Transport sector with compelling reasons to accelerate transformative action. Such action needs to cater to an increasing need for mobility and transport, whilst drastically cutting GHG emissions, and improving the wider social and economic sustainability of human activities.

109. Decision makers in the public and private sectors need guidance to prepare the ambitious policies required to implement the long term climate targets set by the Paris Agreement. The pathway laid out in this plan of action does not guarantee that these ambitious objectives will be met, but they do present the Transport sector with a well-structured way forward. This can help present public and private stakeholders with relevant guidance to make timely and well-founded policy and investment decisions to the development of a sustainable "net-zero emission" Transport sector.

105. As stated before decarbonization of transport, albeit a key pre-requisite for meeting the targets set by the Paris Agreement, is not the ultimate objective of the work by the Paris Process on Mobility and Climate. Climate change is one of the 17 SDGs and as such it is important to recall the role that transport has to play in the realization of Sustainable Development. Its essential role is to provide equitable access to economic opportunities and essential services, and to enable business to generate growth, and to provide livelihood to society at large, in support of Poverty alleviation and Sustainable Development.

106. In this regard a successful development and implementation of the Global Macro-Roadmap on transport decarbonization is, in addition to the realization of the SDGs and the Paris Agreement, also a direct contribution to the New Urban Agenda and other relevant global and regional agreements on sustainable development.

107. This Global Macro-Roadmap links up with wider efforts on sustainable transport, through its role in the new emerging Sustainable Mobility for All initiative (SUM4ALL), which brings together relevant global processes on sustainable development and climate change in an integrated sustainable transport narrative. An important part of the SUM4ALL Initiative is a global tracking framework that sets ambitious targets on sustainable transport, including a "Green Goal" on transport, climate change and air pollution. The Global Macro-Roadmap intends to present a pathway for the realization of the "Green Goal" of SUM4ALL.

Annex

110. The development of the Global Macro-Roadmap on the decarbonization of transport can benefit from the efforts by the PPMC to develop a series of Quick Wins on transport, sustainable development and climate change and to convene a series of multi-stakeholder Initiatives on low-carbon transport.

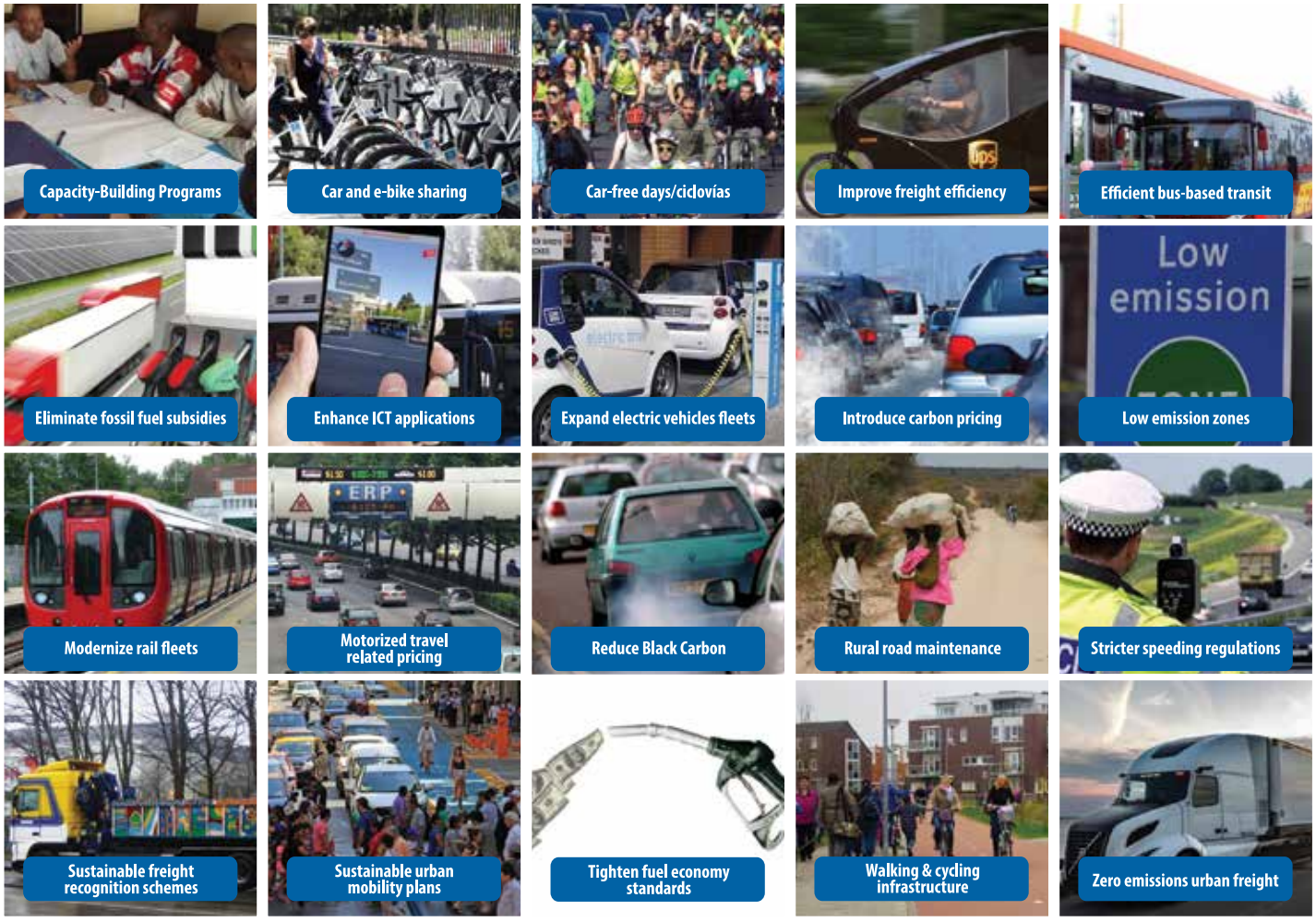
A. Quick Wins on Transport, Sustainable Development and Climate Change to initiate immediate disruptive action

111. Ambitious medium to long-term action on the transformation of the Transport sector needs to be supported by immediate bold and ambitious action that will kick-start the transformation in the desired Roadmap directions, and limit the lock-in effects of a high-carbon BAU scenario. This is key to promote pre-2020 mitigation actions and, in the case of the Transport sector, help ensure that emissions peak in the very early 2020s.

112. Accordingly, a set of twenty pre-2020 actions[5] are proposed for full-scale implementation over the next years, in line with the Global Macro-Roadmap towards genuine systemic transformation of the Transport sector, and support all components of the Roadmap with exception of components 2 on sustainable low carbon production and 7 on adaptation. They touch upon all transportation modes under what is a resolutely multimodal approach targeting the worst externalities, in both people's mobility and freight transport. They are attuned to regional concerns, they include all change drivers (new technologies, new behaviors) and they underpin new value creation and business models.

113. These pre-2020 actions span policy, regulatory and operational solutions for both human mobility and freight movement, thus providing a balanced toolbox to ramp up needed actions across transport themes and modes, and structuring efforts in three directions:

- Prompting decisions to expand the implementation of solutions which have already proven their efficiency at a smaller scale or with a less ambitious scope;
- Halting existing practices and/or regulations that run in directions opposite to what is required to set the global Transport sector on a lower-carbon trajectory;
- Initiating without delay, and at relatively low cost, actions or decisions preparatory to full implementation of a global decarbonization Roadmap.



5 http://www.ppmc-transport.org/quick-win-actions/

114. It is essential to stress that Quick Wins are not stand-alone solutions; they are principally pre-2020 steps towards the implementation of the decarbonization Roadmap. Therefore, implementing a full-blown transformation will require scaling up proven no-regret actions without delay, with some of the ensuing benefits arriving pre-2020 and others post-2020.

115. These Quick Wins have been selected through inputs from a broad set of transport experts and other stakeholders, and have been evaluated through multifaceted impact analysis. These actions have the potential to contribute toward reducing GHG emissions, thereby moderating climate impacts, while at the same time providing key development co-benefits such as improved access, increased efficiency, and enhanced safety. While the Quick Wins enumerated here are mitigation-focused, it is acknowledged that continued consultations will be needed to identify Quick Wins on adaptation in discussions leading up to COP23.

116. While both public and private sectors have key roles to play in the implementation of these Quick Wins, the respective responsibility will vary per Quick Win and might also differ by region. An important next step is the development of enabling public policies in support of these Quick Wins, and raising awareness in the private sector as to how it can take part in, and benefit from, the implementation of the Quick Wins.

Quick Wins	**Associated Roadmap Components**
Operational and Capacity Solutions	
• Expand city transport official training programs to build local capacity for sustainable transport in primary and secondary cities.	Component 1
• Formulate Sustainable Urban Mobility Plans (SUMPs) in primary and secondary cities.	Component 1
• Modernize ageing rail fleets and traction systems to increase efficiency.	Component 3
• Ramp up charging infrastructure to encourage expansion of electric vehicle fleets in primary and secondary cities.	Component 3
Freight Transport	
• Expand sustainable freight recognition schemes to reward proactive carriers and shippers.	Component 4
• Implement zero-emission (last-mile) urban freight through e-mobility and cycling solutions.	Component 3
• Improve freight efficiency (e.g. reduce empty load running by freight trucks) through route optimization, asset sharing between companies, and increased use of ICT/ITS solutions.	Component 4
• Invest in rural road maintenance and modern supply chains to reduce global food loss and waste.	Component 6
Passenger Transport	
• Expand car and (e-)bike sharing systems in primary and secondary cities.	Component 1 and 3
• Increase quality, availability, reliability, frequency, and efficiency of train/bus-based transit.	Component 1
• Provide and improve walking and cycling infrastructure (e.g. connected walking paths, protected cycle lanes), reallocating road space where necessary.	Component 1
Technical and Regulatory solutions	
• Accelerate deployment of tighter fuel quality standards to reduce emissions of black carbon and other short-lived climate pollutants.	Component 2 and 3
• Expand use of ICT/ITS applications for real-time travel information and route planning for walking, cycling, public transport and car sharing.	Component 4 and 5
• Legislate and enforce stricter speeding regulations by operational and technical means to reduce emissions and road crashes.	Component 1 and 5
• Tighten fuel economy standards for passenger and freight vehicles towards 2040-2050 objectives.	Component 3
Policy/Pricing Solutions	
• Accelerate global phase-out of fossil fuel subsidies	Component 8
• Implement (ultra-) low emission zones.	Component 8
• Introduce carbon pricing for the Transport sector where (sub-) national carbon markets currently exist or are under development.	Component 8
• Introduce car-free days and ciclovías (temporary street closures to encourage cycling and walking) in primary and secondary cities to build support for longer-term policies.	Component 1
• Introduce and scale up pricing for motorized travel options (e.g. congestion/road charging, parking pricing) in primary and secondary cities.	Component 8

Table 1 - Quick Wins on Transport, Sustainable Development and Climate Change to initiate immediate disruptive action

6 http://www.ppmc-transport.org/transportinitiatives/

B. Role of Transport Initiatives under the GCAA in supporting the Global Macro-Roadmap and Quick Wins

117. COP21 decided to appoint two High Level Champions (HLC) to *"facilitate through strengthened high-level engagement in the period 2016–2020 the successful execution of existing efforts and the scaling-up and introduction of new or strengthened voluntary efforts, Initiatives, and coalitions".*

118. The Partnership on Sustainable, Low Carbon Transport (SLoCaT) and the PPMC have helped, since early in 2015, to facilitate the development of 15 Initiatives by non-stateactors in the transport sector[6]. Their engagement was inspired by the call to action by Secretary General Ban Ki-moon in September 2014, and followed up by the 'Action Agenda' under the aegis of two HLCs, which since COP22 is now the Marrakech Partnership on Global Climate Action (MP-GCA).

119. There are as of February 2017, 15 Initiatives, which include both passenger and freight transport and touch on all Transport sectors and modes: from roads to rail, from air to waterborne transport, and from motorized vehicles to cycling. They address both mitigation of, and adaptation to, climate change. Collectively these Initiatives represent hundreds of partners and they bring together cities, regions, development organizations, the private sector, and civil society. The Initiatives contribute to all components of the Avoid-Shift-Improve approach and some of them actively support the principle of co-modality.

120. Collectively these Initiatives, if widely supported by state-and non-state actors and implemented at scale, can reduce the carbon footprint of an estimated half of all the passenger and freight trips made by 2025. Actions such as these can contribute to substantive savings associated with a shift to low carbon transport. The IEA estimated that these could be as high as US$70 trillion by 2050 (as less money would need to be invested in vehicles, fuel, and transport infrastructure), thus reflecting the strong economic case for climate action in the Transport sector.

121. These Initiatives can play an important role in the development and implementation of the Global Macro-Roadmap's components, as illustrated below:

	Urban Transformation	Low-Carbon Energy Supply	Modal Efficiency / Intermodality	Supply Chain Efficiency	Unnecessary Travel Reduction	Rural Areas	Adaptation	Economic Instruments
Airport Carbon Accreditation	✓		✓	✓				
Aviation's Climate Action Takes Off			✓	✓				
C40 Cities Clean Bus Declaration of Intent	✓		✓		✓			
Global Fuel Economy Initiative	✓		✓			✓		
Global Green Freight Action Plan			✓	✓		✓		
ITS for the Climate	✓		✓	✓	✓	✓	✓	
Low Carbon Road and Road Transport Initiative (LC2RTI)			✓			✓	✓	
Mobilise Your City (MYC)	✓		✓	✓	✓		✓	
Navigating A Changing Climate			✓	✓			✓	
UIC Low-Carbon Sustainable Rail Transport Challenge			✓	✓		✓	✓	
UITP Declaration on Climate Leadership	✓		✓			✓		
Urban Electric Mobility Vehicles Initiative (UEMI)	✓		✓	✓				
World Cycling Alliance (WCA) and European Cyclists' Federation (ECF) Commitment	✓		✓	✓			✓	
Worldwide Taxis4 Smart Cities Initiative	✓		✓					
ZEV Alliance	✓		✓	✓		✓		

Weak linkage | Medium linkage | Strong linkage

Table 2 - Role of Transport Initiatives under the GCAA in supporting the Global Macro-Roadmap and Quick Wins

122. It is apparent that the GCAA Transport Initiatives are especially relevant when it comes to the components focused on improving modal efficiency and urban transport. It is clear however that the geographic outreach of several Initiatives must be broadened. To take the Initiatives to scale, business and Parties will need to reinforce their support for the Initiatives. There are two key areas of the Roadmap that are largely being ignored by the current Transport Initiatives. Current Initiatives do have a focus on Energy, however, this is mostly about efficiency or promoting alternative fuel sources, and there are no Initiatives that have a clear focus on the changing of energy supply which will be required in the context of transformative action. Therefore, either the Transport sector should encourage the development of such Initiatives, or work much closer with relevant Energy sector Initiatives.

123. The other area where there is an urgent need for new, innovative Initiatives is the area of economic transition. Current Transport Initiatives acknowledge the importance of enabling economic instruments,but do not undertake dedicated activities in this area. It is suggested that there is probably scope to strengthen such components within the existing Initiatives, but this is also an area where there is scope for new Initiatives or closer cooperation with other thematic areas. Upcoming COP meetings in Bonn (2017) and Poland (2018) provide opportunities to launch a strong call to action to fill the gaps, and a clear action plan on the further development of the MP-GCA will be of help in this respect.

124. The Transport Initiatives also have direct relevance for the Quick Wins. For rapid implementation and broad scalability, a Quick Win must have the support of one or more champion organizations or Initiatives; in this respect, the GCAA Transport Initiatives are good catalysts for the proposed Quick Wins. These Initiatives are intended to accelerate pre-2020 action by sub-national and non-state actors, and thus are a natural springboard for promoting the Quick Wins at local levels, where the bulk of implementation takes place.

125. For example, some Initiatives are helpful in supporting *a range of Quick Wins:*

- *Global Green Freight Action Plan* ▸ All Freight Transport Quick Win actions.
- *MobiliseYourCity* ▸ All urban-focused Passenger and Freight Transport Quick Win actions; 'Formulate Sustainable Urban Mobility Plans in primary and secondary cities'.
- *UITP Declaration on Climate Change Leadership* ▸ All public-transport focused Passenger Transport Quick Win actions.
- *ITS for the Climate* ▸ All Quick Win Technical Solutions.
- *World Cycling Alliance (WCA) and European Cyclists' Federation (ECF) Commitment* ▸ All cycling-focused Quick Win actions.

126. Other Initiatives are more relevant to Quick Wins on a one-to-one relationship:

- *Global Fuel Economy Initiative* ▸ 'Tighten fuel economy standards for passenger vehicles'.
- *C40 Clean Bus Declaration* ▸ 'Increase quality, availability, reliability, frequency, and efficiency of bus-based transit'.
- *UIC Low-Carbon Sustainable Rail Transport Challenge* ▸ 'Modernize ageing rail fleets and traction systems to increase efficiency'.
- *Urban Electric Mobility Vehicles Initiative (UEMI) and ZEV Alliance* ▸ 'Ramp up charging infrastructure to encourage expansion of electric vehicle fleets in primary and secondary cities'.

127. To strengthen the relevance of the Initiatives for the Global Macro-Roadmap and the Quick Wins process, it is important to enhance the outreach of the Initiatives to Parties. This will be key to help ensuring that Parties benefit optimally from the Initiatives in the development and implementation of the Global Roadmap and in the pre-2020 implementation of Quick Wins.

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