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Mitigation benefits and co-benefits of policies, practices and actions for enhancing mitigation ambition and options for supporting their implementation: the social and economic value of carbon and the promotion of efficient public transport and energy efficiency of vehicles

Technical paper by the secretariat

Summary

This technical paper compiles information on mitigation benefits and co-benefits of policies, practices and actions for enhancing mitigation ambition, with a focus on two thematic areas: the social and economic value of carbon and the promotion of efficient public transport and energy efficiency of vehicles. It also compiles information on support for the implementation of such policies, practices and actions in those thematic areas. Information for the update was gathered at the two technical expert meetings that took place in May 2016 in Bonn, Germany, during the forty-fourth sessions of the subsidiary bodies, as well as from the relevant literature on the implementation of policy options.

This technical paper has two annexes, which contain policy option tables and information on activities undertaken by international, multilateral and bilateral organizations in the two thematic areas presented in this paper.

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Contents

I. Background

A. Mandate

1. This updated technical paper focuses on mitigation benefits and co-benefits of policies, practices and actions for enhancing mitigation ambition and options for supporting their implementation in the two thematic areas identified by Parties during the technical examination process (TEP) and recommended by the high-level champions appointed by the Presidents of the twenty-first session of the Conference of the Parties (COP) and the President Designate of COP 22. The topics were chosen on the basis of Parties' views expressed at COP 21 and earlier in 2015, during the negotiations on ways and options for enhancing mitigation ambition in the pre-2020 period. The coverage of the two thematic areas in this paper does not indicate priority over other important mitigation sectors presented in the previous technical papers published in 2014 and 2015 within the TEP.[1]

2. This technical paper has been prepared by the secretariat as one of the key outcomes of the TEP on mitigation (TEP-M) as per the mandate contained in paragraph 111(b) of decision 1/CP.21. The target audience of the paper comprises Parties, non-Party stakeholders, international expert organizations and multilateral initiatives supporting the realization of climate mitigation goals articulated in the Paris Agreement.

3. In accordance with decision 1/CP.21, this technical paper contains information drawn from the discussions held at the two most recent technical expert meetings (TEMs) on mitigation, held on 20 and 23 May 2016 in Bonn, Germany, and organized by the Subsidiary Body for Implementation (SBI) and the Subsidiary Body for Scientific and Technological Advice (SBSTA).[2] The topics of those TEMs were: (1) the social and economic value of carbon and concrete tools based on a reference value of carbon to inform investment decisions, re-evaluate risks and incentivize early action; and (2) shifting to more efficient public transport and increasing the energy efficiency of vehicles. The paper also contains information drawn from the TEM presentations and summaries, relevant submissions from Parties and observer organizations and other relevant sources.

B. Objectives

4. The objective of this technical paper is to compile information on mitigation policies, practices and technologies for: (1) recognizing and utilizing the social and economic value of carbon; and (2) scaling up low-carbon transport, with a focus on public transport and the energy efficiency of vehicles. The paper presents policy options and good practices that can enable ambitious pre-2020 action and support key mitigation and sustainable development goals. It highlights examples of leadership and success as well as lessons learned from action undertaken around the world. The policy options and good practices presented are intended to support countries and jurisdictions in addressing climate challenges, replicating solutions and reducing and eliminating barriers in order to bring crucial climate and sustainable development goals to fruition.

5. Through the TEP and the dissemination of this technical paper, the secretariat seeks to support Parties and non-Party stakeholders in designing and implementing effective

[1] The previous technical papers, published in 2014 and 2015 (FCCC/TP/2014/3 and Add.1, FCCC/TP/2014/13 and Add.1–4 and FCCC/TP/2015/4, Add.1–2) are available at <http://climateaction2020.unfccc.int/tp/>. This technical paper does not supersede the previous ones but rather builds on the findings, information and options for enhancing mitigation ambition contained therein.

[2] Detailed information on the TEMs, including the summaries by the facilitators, is available at <http://climateaction2020.unfccc.int/tep/technical-expert-meetings/>.

policies, particularly in the aforementioned technical areas discussed at the TEMs (see para. 3 above). While the paper focuses on the pre-2020 period in line with the mandate for the TEP, the policies presented can support both near- and long-term climate and development objectives. Such actions and policies will lead to increased ambition over time and the achievement of the critical climate mitigation goals articulated in the Paris Agreement.

6. The information presented in this technical paper does not imply that there is consensus among Parties on any of the issues or options covered in the relevant submissions and at the TEMs. Rather, it provides an overview of the discussions that took place at the TEMs and additional literature relating to the mandate for the paper.

C. Structure

7. Chapter I of the paper contains background information on the mandate for and objectives and structure of the paper. Chapter II presents the main findings, detailing high-level trends, policies, practices and actions in relation to: (1) recognizing and utilizing the social and economic value of carbon; and (2) catalysing low-carbon transport in the context of crucial sustainable development goals. Chapters III and IV present policy options, approaches and good practices in relation to recognizing and utilizing the social and economic value of carbon to support mitigation and scaling up low-carbon transport, with a focus on public transport systems and the energy efficiency of vehicles. The information in those chapters is also collated in the policy option tables contained in the annexes. Chapter V discusses initiatives, options and ways to mobilize means of support for accelerated implementation through the subsidiary bodies within the TEP, institutions under the Convention and multilateral, regional and bilateral development institutions. Chapter VI concludes the paper with a description of possible next steps to accelerate policy implementation in the pre-2020 period.

8. Annex I presents policy option tables that collate information from this paper on policies and good practices to support: (1) recognition of the social and economic value of carbon; and (2) shifting to more efficient public transport and increasing the energy efficiency of vehicles. They include a number of leading examples of effective policy design and implementation in those two areas at the country and jurisdictional levels. Building on the information contained in chapter V, annex II presents a more comprehensive list of multilateral, regional and bilateral initiatives supporting activities related to the social and economic value of carbon and low-carbon public transport.

II. Main findings

9. Urgent and transformative action is required to meet key climate goals set out in the Paris Agreement. Nationally determined contributions (NDCs) together with robust low-emission development strategies or similar climate plans can provide a strong foundation for catalytic action. However, the NDCs submitted so far by Parties are insufficient, in aggregate, to achieve the goal of holding the average global temperature rise below 2 °C above pre-industrial levels, let alone the more ambitious 1.5 °C goal articulated in the Paris Agreement. Therefore, it is critical for Parties to significantly increase the mitigation ambition of their NDCs, beginning in the pre-2020 period.[3]

10. Scaled-up near-term pre-2020 action in the policy areas presented in this paper, namely, recognizing the social and economic value of carbon and encouraging the shift to more efficient public transport and increasing the energy efficiency of vehicles, along with other key policy areas, will be critical in meeting the climate mitigation goals set out in the

[3] FCCC/CP/2015/7.

Paris Agreement. Such action should be strongly and clearly connected to implementation needs in the post-2020 period and ensure increased ambition over time.

11. Pre-2020 climate action is driven by the national commitments to reach the United Nations Sustainable Development Goals (SDGs), which provide a critical foundation for transformational climate action at the national and subnational levels. In particular, development-driven climate action can enable social, economic and environmental co-benefits such as improved health, safety and well-being, increased energy security, innovation and job creation, and improved air quality, biodiversity and climate resilience. Robust assessment of the developmental impacts of the proposed climate policies can allow for prioritization and decision-making that will maximize sustainable development outcomes and positive climate impacts.

12. Several governments and private sector institutions have taken action to support policies aimed at carbon pricing and are already using the social and economic value of carbon to support the design and implementation of policies, regulations, economic instruments, targets and projects that align with key climate and sustainable development goals.[4] Already, approximately 40 nations and over 20 subnational and regional jurisdictions, representing almost a quarter of global greenhouse gas (GHG) emissions, have implemented carbon pricing approaches, particularly carbon markets, carbon taxes and incentives.[5]

13. There is sufficient evidence to suggest that in order to ensure effective carbon pricing policies, there needs to be wide coverage across carbon-intensive sectors and sufficiently high prices to affect investment decisions. Yet, in the member countries of the Organisation for Economic Co-operation and Development (OECD) and in Brazil, the Russian Federation, India, Indonesia, China and South Africa (referred to as BRIICS countries), it was found that still 60 per cent of carbon dioxide (CO_2) emissions from energy use are subject to no tax, and that only 10 per cent of emissions from energy use are taxed at EUR 30/t CO_2 or above.

14. Market-based and regulatory approaches and policies that implement carbon pricing, such as carbon markets, carbon taxes and incentives, as well as fossil fuel subsidy reform can provide a strong economic signal to support low-carbon development. Such policies and regulations can enable the mobilization of finance and inform operational decisions to support diverse climate actions, such as switching fuel from coal to natural gas, renewable energy (RE) deployment, adoption of energy efficiency measures and the use of low-carbon technologies in industry. As an important sign of progress, the Group of Seven (G7) put forward a pledge in May 2016 to end most fossil fuel subsidies by 2025.[6]

15. Recognizing and utilizing the social and economic value of carbon is an innovative approach to supporting positive carbon pricing as it allows worldwide damages associated with climate change in the future to be accounted for within the design of various climate-related policies and projects launched now. The economic and social value of carbon can then inform the design of mitigation actions aligned with adaptation, health and other crucial sustainable development co-benefits.

16. Low-carbon transport continues to be a crucial area of focus in supporting scaled-up mitigation action. To support emission reductions in the sector, many countries included low-carbon public transport actions in their NDCs.

[4] OECD. *Effective Carbon Rates on Energy: OECD and Selected Partner Economies*. Available at <https://www.oecd.org/tax/tax-policy/effective-carbon-rates-on-energy.pdf>.

[5] World Bank. *State and Trends of Carbon Pricing.* Available at <http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2015/09/21/090224b0830f0f31/2_0/Rendered/PDF/State0and0trends0of0carbon0pricing02015.pdf>.

[6] Mathiesen K. 2016. G7 nations pledge to end fossil fuel subsidies by 2025. *The Guardian*. Available at <https://www.theguardian.com/environment/2016/may/27/g7-nations-pledge-to-end-fossil-fuel-subsidies-by-2025>.

17. Progress has been made in supporting both public transport and the energy efficiency of vehicles in the last few decades. Particularly from 2000 to 2014, the energy intensity of the transport sector at the global level saw an average annual reduction of 1.8 per cent.[7] Building on that trend, countries and jurisdictions around the world are designing and implementing effective policies and actions to enable low-carbon transport. In particular, multimodal transport systems, mass transit (e.g. bus rapid transit (BRT) and rail), non-motorized transport and ride-sharing programmes, supported by and integrated into high-level sustainable transport policy frameworks, are enabling low-carbon development. The actions focused on public transport are often coupled with efficiency and clean fuel programmes such as fuel efficiency standards,[8] electric vehicle (EV) deployment programmes, biofuel and natural gas mandates and hydrogen programmes, among many others. As a whole, action for low-carbon transport can play an important role in reaching key climate goals.

18. To further support recognizing and utilizing the social and economic value of carbon to inform policies and projects, greater attention and support could be given to facilitating coordination across actors at the regional and national levels, particularly ministries of environment and finance. Technical cooperation at the global level could also allow for collaborative assessment and global consensus-building around the social and economic value of carbon.

19. Several valuable actions can be taken to support the scaling up of low-carbon transport. In particular, three areas of collaboration could be pursued at the global level: building a common global framework and goals, developing a sustainable low-carbon transport road map and implementing quick-win solutions to encourage short-term action and to kick-start transformation. These areas of focus would bring together governments, non-state actors and other non-Party stakeholders to enable comprehensive action and support.

20. The subsidiary bodies and institutions under the Convention, multilateral initiatives and non-governmental stakeholders are playing a highly valuable role in supporting finance, technology transfer and capacity-building to enable low-carbon transport and recognition of the social and economic value of carbon. Building on successful collaborative efforts, there is a need to scale up support across those areas to catalyse further action and enable a low-carbon future.

21. TEP-M will continue to enable discussion and action related to the social and economic value of carbon, low-carbon transport and climate action more broadly. To build on and improve the process going forward, the following actions are proposed: enabling further regional dialogue, engagement and action; ongoing sharing of replicable success stories; focusing on approaches to improving support mechanisms; improving the TEMs through several practical actions and continuing to support the momentum of the Lima–Paris Action Agenda (LPAA) and promote the Road Map for Global Climate Action in order to provide a strong foundation for accelerated policy implementation in the pre-2020 period.[9] The road map will serve as a steering document for action in the areas presented in this paper and across the climate landscape.

[7] Renewable Energy Policy Network for the 21st Century (REN21). *Renewables 2016. Global Status Report*. Available at <http://www.ren21.net/wp-content/uploads/2016/06/GSR_2016_Full_Report_REN21.pdf>; and World Energy Council. *Energy Efficiency Indicators database.* Available at <https://www.wec-indicators.enerdata.eu/>.

[8] It should be noted that fuel efficiency standards now cover 70 per cent of the global passenger car market and have had a large impact on emission levels to date.

[9] UNFCCC. *Road Map for Global Climate Action*. Available at <http://newsroom.unfccc.int/media/658505/high-level-champions-climate-action-roadmap.pdf>.

III. Policies, practices and actions recognizing the social and economic value of carbon

A. Mitigation benefits and co-benefits associated with the social and economic value of carbon

22. Over the last decade, many countries have taken action to support policies aimed at carbon pricing and the use of the social and economic value of carbon. Parties acknowledged in paragraph 108 of decision 1/CP.21 the importance of and increasing emphasis on understanding the economic and social value of carbon and the use thereof to inform the design of mitigation actions aligned with adaptation, health and sustainable development co-benefits. Early and transformative mitigation action is required to achieve critical climate mitigation goals supported by the international community, in particular those enshrined in the Paris Agreement.

23. Such action could not only assist with achieving critical mitigation goals, but also lead to cost savings by avoiding long-term damages associated with GHG emissions, which can be represented by the social and economic value of carbon. Articulating those cost savings, as well as other important co-benefits of climate action, can provide a strong impetus to expand and raise the ambition of immediate mitigation action under the NDCs and other mechanisms.[10] Further, delaying near-term action will lead to significant increases in overall mitigation costs over time.[11]

24. A carbon price gives an economic signal to emitting entities to discontinue their polluting activity, to reduce emissions or to continue polluting and compensate for it. The carbon price can be reflected in terms of estimated costs of emission reductions or the social and economic value of carbon. In contrast to the well-established term of the social and economic cost of carbon as a traditional way of reflecting carbon pricing, the social and economic value of carbon represents positive carbon pricing.

25. The social and economic value of carbon can be represented as the net present value of future worldwide damages (often up to 100 years in the future or longer) avoided by removing or preventing an additional tonne of CO_2 emissions at a certain point in time.[12] Examples of avoided damages include changes in agricultural productivity, health impacts and damage to property associated with floods, storms or other climate-related events.[13, 14] It is intended to comprehensively represent damages resulting from climate change, but it is unlikely that all damages are represented within estimates of the social and economic value of carbon.[15] The social and economic value of carbon can serve as a benchmark or reference value to assess the impacts and effectiveness of low-carbon policies and actions

[10] TEM on the social and economic value of carbon. Summary by the facilitator Mr. Alfredo Sirkis (Brazil). Available at <http://climateaction2020.unfccc.int/tep/technical-expert-meetings/>.

[11] OECD. *OECD Environmental Outlook to 2050*. Pre-release version. Available at <https://www.oecd.org/env/cc/49082173.pdf>.

[12] Presentation made by the OECD at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/scene_setting_oecd_simon.pdf>.

[13] Parry ML, Canziani OF, Palutikof JP, van der Linden PJ and Hanson CE (eds.). 2007. Consideration of costs and damages avoided and/or benefits gained. *In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Available at <https://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch18s18-4-2.html>.

[14] Center for Strategic and International Studies (CSIS). *What is the Social Cost of Carbon?* Available at: <https://www.csis.org/analysis/what-social-cost-carbon>.

[15] Presentation made by the United States of America at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_us_epa_shouse.pdf>.

within the public and private sectors. The social and economic value of carbon can also play a key role in ensuring the stringency of climate policies to support ambitious mitigation action.

26. As an important area of focus based on the social and economic value of carbon, positive carbon pricing is an approach to providing real financial assets in exchange for mitigation actions. Thus, positive carbon pricing could serve as an investment tool and stimulate the climate finance needed to support the attainment of the 2 °C goal. Positive carbon pricing could be used as a financial mechanism to reward early mitigation actions that go beyond established climate targets.[16] In addition, government certificates, based on the social and economic value of carbon, could be designed to finance mitigation projects. Implementation of positive carbon pricing could be complementary to other economic instruments, such as carbon markets.

27. Furthermore, the frameworks and infrastructure already established for carbon markets could be leveraged to support the development and implementation of worldwide positive carbon pricing. As an example, the verification and certification processes under the clean development mechanism could support the implementation and compensation of mitigation actions that are additional and avoid double counting.[17] Positive carbon pricing could also allow for an increased role of institutional investors, the public sector and development banks in supporting low-carbon action and long-term financial sustainability.

B. Utilizing the social and economic value of carbon

28. Applying a social and economic value of carbon can enable the internalization of co-benefits, re-evaluation of risks, design of effective economic instruments and informed investment decisions to move from climate potential to action. On a practical level, national and subnational governments, the private sector and non-governmental organizations (NGOs) can use the social and economic value of carbon in many ways, as described below.

29. **Evaluating long-term objectives and targets of climate policy**: utilizing the social and economic value of carbon can support policymakers in assessing the potential of high-level climate policies to meet key objectives and targets related to mitigation, resilience and sustainable development goals, including improved health and quality of life, job creation and environmental diversity. However, it is important to set additional objectives and targets beyond reducing GHG emissions to monitor and evaluate whether other policy goals are being met. Targets should be established on the basis of specific goals and matched to certain policies. For example, if one of the goals of the climate policy is to increase the use of RE, targets could cover MW RE installed, kW RE generated or consumed, the amount of investment in RE projects, RE-related jobs created, and the reduction of pollution and GHG emissions.

30. **Developing economic instruments such as market-based instruments, subsidies, taxes and guarantees on low-emission investments**: the social and economic value of carbon and related carbon pricing methods can inform the effective design of economic instruments to support low-carbon development, including carbon markets, carbon taxes, fossil fuel subsidy reform and guarantees on low-emission investments.

31. **Designing regulations through comprehensive cost–benefit and policy impact analysis**: estimations of the social and economic value of carbon can be used to assess potential impacts of climate-related regulations and policies and support their effective

[16] As footnote 10 above.

[17] Presentation made by the Centre d'Etudes Prospectives et d'Information Internationale at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/06_cepii_etienne.pdf>.

design. In evaluating the social and economic value of carbon it is critical to use appropriate discount rates[18] to address model and calculated value uncertainties. As one notable benefit, using a social and economic value of carbon can allow for consistency across regulatory assessments within a country or jurisdiction (see box 1).

Box 1
The United States of America's social cost of carbon

The United States of America developed an estimated social cost of carbon that has supported at least 75 regulatory actions and impact analyses through quantification of the costs and benefits of increasing or reducing emissions. Challenges have been experienced in relation to the use of discount rates and other modelling uncertainties. As a result, the United States is applying multiple discount rates in deriving the social cost of carbon used for regulatory and policy assessments. Importantly, using the social cost of carbon has allowed for consistency in supporting policy and regulatory appraisal processes to enable low-carbon development. The United States Environmental Protection Agency has also developed an estimated social cost of methane to support the analysis of the impact of methane regulations.

Sources: (1) Presentation made by the United States of America at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_us_epa_shouse.pdf>; (2) White House Office of Management and Budget. 2010–2015. *Social Cost of Carbon.* Available at <https://www.whitehouse.gov/omb/oira/social-cost-of-carbon>; and (3) United States Environmental Protection Agency. *The Social Cost of Carbon.* Available at <http://www.epa.gov/climatechange/EPAactivities/economics/scc.html>.

32. **Appraising projects and assessing costs and benefits related to the social and economic value of carbon**: several public and private institutions are applying a social and economic value of carbon or carbon pricing to inform project appraisals and planning in order to: prepare for future climate policies and regulations; support economic opportunities associated with reducing GHG emissions; and raise the confidence of investors that climate risks within project portfolios are being considered and addressed. An internal carbon price can also support the development of long-term business strategies and communication to investors in relation to the benefits of investment decisions. Currently, over 1,000 companies use or are considering using social and economic values of carbon or carbon pricing to inform their business operations.[19] Shadow pricing, internal prices and internal fees are three standard methods used by the private sector to reflect climate considerations in business operations (see figure 1).

[18] A discount rate is defined by OECD as "an interest rate used to convert a future income stream to its present value"; see <https://stats.oecd.org/glossary/detail.asp?ID=643>.

[19] Presentation made by the Carbon Disclosure Project at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/03_cdp_sara.pdf>.

Figure 1
Applications, strategies and impacts of standard carbon pricing approaches to reflect climate considerations in business operations

	Shadow Price	Internal Price	Internal Fee
	Future emissions	Current emissions	Current emissions
Application	Risk analysis of future projects/capital investments	Applied directly to business unit	Charges each business unit
Strategy	Integration into strategic planning	Integrated into every-day operations	Generates revenue for green investments
Impacts	Develop competitive advantage	Sparks innovation (design, processes, sourcing)	Increase access to clean energy & technologies

Source: Presentation made by the Carbon Disclosure Project at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/03_cdp_sara.pdf>.

Note: The shadow price is a hypothetical or assumed cost of carbon for emissions developed by institutions to assess possible investments. Ranges of shadow prices can be developed to test sensitivities and impacts of potential external carbon prices on investments. Internal fees as well as carbon taxes or trading programmes can be developed internally within a company to formally support emission reduction targets. In contrast to explicit carbon prices, implicit prices are calculated on the basis of a company's expenses to reduce emissions (e.g. cost per Mt CO_2 eq).

33. In addition to private sector applications, development banks and institutions can utilize the social and economic value of carbon and carbon pricing to inform investments in low-carbon projects. Figure 2 provides examples of the use of carbon pricing approaches to inform different types of project and investment funded by the European Bank for Reconstruction and Development.

Figure 2
Roles and use of carbon pricing for project development and appraisal

Situation	Example	Potential carbon price information sources
Regulation (e.g. ETS, tax or implicit like feed-in tariffs): Carbon price scenarios to be taken into account in the feasibility study and sensitivity analysis	Energy efficiency investment in an industrial installation under the EU ETS or K-ETS	- Published (historic) carbon pricing from exchanges - Reviews by carbon market analysts - Market models - Analysis of anticipated regulatory changes (e.g. ETS reform)
Carbon price can be expected due to **anticipated regulations**.	Energy efficiency investment in the power sector in a Partnership for Market Readiness (PMR) country considering an emissions trading scheme.	- Market models / abatement cost curve analysis - Policy mapping and review
Application of policy to **recognise carbon and other pollutant externalities** (if no carbon pricing is available, or such pricing is perceived to be distorted)	Using a shadow price for carbon emissions in the cost / benefit analysis e.g. through levelised cost of energy (LCOE).	- Social cost of carbon / shadow price studies - Comparison with peers and studies
Design of a **donor grant co-funding** project sponsoring the uptake of low carbon technologies, whilst ensuring effectiveness	Financing instrument in Slovakia where level of grant co-finance is calibrated on the basis of the anticipated emission reductions times a crediting period times an pre-agreed cost of carbon.	- Social cost of carbon studies - Anticipated carbon price development (if applicable) - Investment barrier analysis

Source: Presentation made by the European Bank for Reconstruction and Development at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/02_ebrd_jan_willem.pdf>.

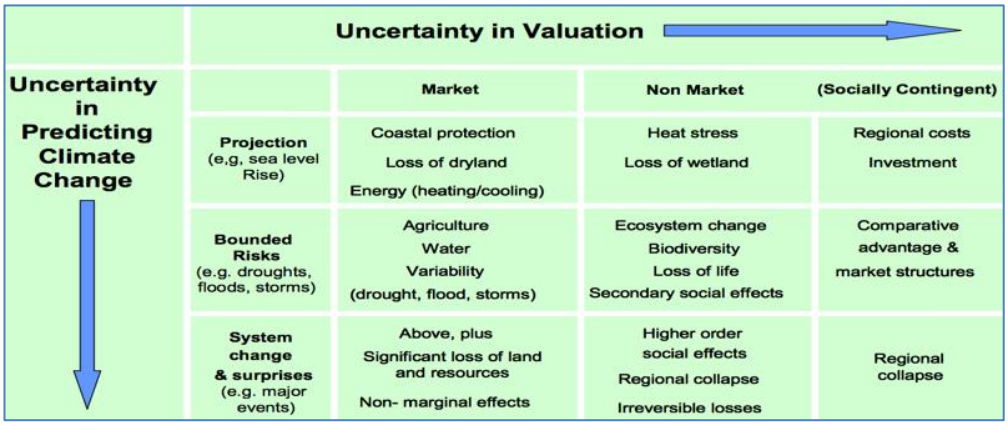
Abbreviations: ETS = emissions trading system, EU ETS= European Union Emissions Trading System, K-ETS = Korea Emissions Trading System.

34. Good practices and replicable models exist in relation to utilizing a social and economic value of carbon to support the practical action areas. Those good practices and examples demonstrate how to address the technical and non-technical challenges in utilizing the social and economic value of carbon and can support the implementation of various climate actions.

35. **Convening stakeholders**: stakeholders are critical to informing efforts to estimate and apply a social and economic value of carbon and to build support more broadly. Workshops and meetings can be held to educate stakeholders on the social and economic value of carbon and to receive input and feedback on approaches, methodologies and application.

36. **Addressing uncertainties**: many frameworks for the social and economic value of carbon do not consider the full picture of potential climate impacts and risks. Further, uncertainty around impacts and risks is an important consideration in developing estimates. Potential risks and related uncertainties associated with the social and economic value of carbon are presented in figure 3.

Figure 3
Risk matrix for the social and economic value of carbon



Source: Organisation for Economic Co-operation and Development. *The Social Cost of Carbon.* Watkiss P. Available at <https://www.oecd.org/env/cc/37321411.pdf>.

37. To address uncertainties related to the social and economic value of carbon, the following actions, put forward by OECD International Transport Forum (ITF), can be considered:

(a) Additional information on long-term impacts that may have a high level of uncertainty can be provided;

(b) Risk-adjusted discount rates, scenario analysis and/or scenario testing can be applied to assessments to address risk uncertainty issues;

(c) Additional and distinct uncertainty assessments can provide a more comprehensive view of the impacts of uncertainty in relation to the costs and benefits of policies, projects and investments.

38. **Establishing key parameters**: effectively establishing key parameters is a critical step in evaluating the social and economic value of carbon, as parameters will greatly influence estimates. Key parameters include discount rate applied, time-horizon and equity weighting for different regions. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change noted that "an appropriate social risk-free discount rate for consumption is between one and three times the anticipated growth rate in real per capita consumption (medium confidence)". OECD found that using a declining discount rate over

time, combined with sensitivity analysis, can be an effective approach to estimating the social and economic value of carbon. Policymakers and practitioners can also consider using multiple discount rates to address model and calculated value uncertainties.[20]

39. **Supporting consistency**: the social and economic value of carbon can be used to inform multiple policies and/or projects within a government or institution to support consistency. This can allow for improved efficiency in assessment processes and clearer communication of approach and policy or project decisions.

40. **Building capacity**: to support the appraisal of low-carbon projects, the private sector has identified the need to build capacity within companies to estimate an internal carbon price and to set appropriate project boundaries. There is also a need within the finance, investment and donor community for further education on carbon pricing and estimates of the social and economic value of carbon. Finally, within governments and the public sector, there is also a need to build capacity to estimate the social and economic value of carbon, collect and develop reliable, accurate and standardized data and apply estimates consistently to support regulatory decision-making and policymaking.

C. Economic and fiscal instruments related to carbon pricing

41. Market-based and regulatory approaches and policies (such as carbon markets, carbon taxes, fossil fuel subsidy reforms and positive carbon pricing) can provide a strong economic signal to support low-carbon development. Such policies and regulations can enable the mobilization of finance and inform operational decisions to support diverse climate actions, such as fuel switching from coal to natural gas, RE deployment, adoption of energy efficiency measures and innovation and use of low-carbon technologies in industry.[21]

42. Carbon pricing is an important mechanism to promote early mitigation action, leverage finance and support key economic, social and environmental co-benefits. While the social and economic value of carbon represents the long-term damages avoided by preventing the release of 1 t CO_2 emissions into the atmosphere, a carbon price reflects the amount that emitters must pay to emit a certain amount of CO_2. Governments and stakeholders use various methods and inputs to establish a carbon price, such as current estimated costs to mitigate CO_2 emissions or the social and economic value of carbon as a reference level.

43. The World Bank estimated the combined value of carbon pricing instruments worldwide at USD 50 billion in 2015. However, further action is needed, as half a trillion United States dollars is invested annually in fossil fuel production and consumption.[22] Current carbon pricing instruments are not providing clear enough market signals to drive investments towards less carbon-intensive technologies. A large part of the lack of clarity of market signals is due to fossil fuel subsidies that shield producers from market price fluctuations and end users from fossil fuel costs that match their consumption.

44. To ensure effective carbon pricing policies, there needs to be wide coverage across carbon-intensive sectors and sufficiently high prices to affect investment decisions. For example, in OECD and BRIICS countries it was found that still 60 per cent of CO_2 emissions from energy use are subject to no tax, and that only 10 per cent of emissions from energy use are taxed at EUR 30/t CO_2 or above.[23]

[20] OECD. *The Social Cost of Carbon.* Watkiss P. Available at <https://www.oecd.org/env/cc/37321411.pdf>.

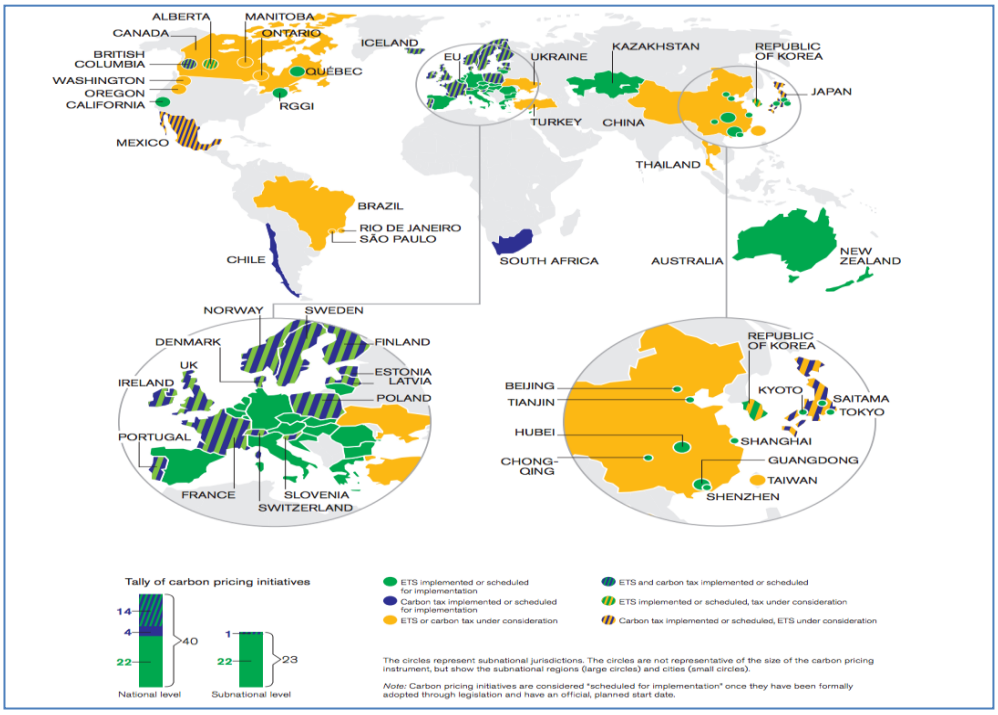
[21] As footnote 10 above.

[22] Presentation made by OECD at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/scene_setting_oecd_simon.pdf>.

[23] As footnote 5 above.

45. Various economic instruments can be used to place a monetary value on carbon (e.g. a carbon price) to support GHG emission reductions. Globally, approximately 40 nations and over 20 subnational and regional jurisdictions, representing almost a quarter of global GHG emissions, have implemented carbon pricing approaches, particularly carbon markets, emissions trading schemes and carbon taxes.[24] The carbon pricing policies cover approximately half of the total emissions of those countries and jurisdictions (see figure 4 and box 2).[25]

Figure 4
Summary map of existing, emerging and proposed regional, national and subnational carbon pricing initiatives



Source: World Bank and ECOFYS. *Carbon Pricing Watch 2016.* Available at <http://hdl.handle.net/10986/24288>.
Abbreviation: ETS = emissions trading scheme.

Box 2
Supporting diverse carbon pricing approaches in Canada

Canada is leading and supporting low-carbon development action at the national and subnational levels. In particular, it is supporting diverse approaches to enabling carbon pricing based on unique economic, policy and climate objectives and targets in various provinces. For example, British Colombia currently has a carbon tax that covers 70–75 per cent of its emissions, Quebec has a cap-and-trade system that is linked to the American State of California, Ontario is planning to launch a cap-and-trade system in 2017 and Alberta has a carbon pricing scheme for transportation and heating fuels. Currently, 90 per cent of Canadians live in provinces (including Manitoba) with carbon pricing mechanisms in place.

[24] As footnote 4 above.
[25] World Bank and ECOFYS. *Carbon Pricing Watch 2016.* Available at <http://hdl.handle.net/10986/24288>.

At the national level, Canada is a member of the high-level Carbon Pricing Panel, with a goal to "increase explicit carbon pricing to 25 per cent by 2020 and 50 per cent by 2030" and is collaborating with the Carbon Pricing Leadership Forum to catalyse and support private sector action. Canada has also developed a portal for engagement with stakeholders on various climate issues, including carbon pricing (<http://letstalkclimateaction.ca>). Each of these important activities will feed into a broader pan-Canadian framework on clean growth and climate change that is planned for development

Source: Presentation made by Canada at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/04_canada_katherine.pdf>.

46. High-level good practices to support carbon pricing adapted from the World Bank "FASTER" principles for successful carbon pricing are highlighted below.[26] Based on successes and challenges around the world, these high-level good practices for carbon pricing are followed by descriptions and good practices of specific carbon pricing economic instruments: carbon taxes and carbon markets.[27]

47. **Ensuring fairness and equitable outcomes**: carbon pricing mechanisms integrate a 'polluter pays' framework and can be designed to carefully assess and ensure equitability across cost and benefit allocations, with a particular emphasis on lessening burdens on vulnerable populations. For instance, complementary policies and approaches (e.g. transfers of revenue through rebates and reductions in other taxes, indexing assistance programmes to inflation, etc.) can support improved outcomes for poor households.[28]

48. **Integration with broader climate strategies and action**: carbon pricing can be one critical element of a broader climate action framework that can include actions such as collecting data, establishing GHG emission inventories, assessing broader policy portfolios in relation to mitigation and development impacts, designing monitoring and evaluation strategies and implementing policies. Policy packages can be designed within these broader frameworks to ensure comprehensive and complementary outcomes. At the same time, non-conducive policies can be reformed, such as fossil fuel subsidies, to enable maximum effectiveness of policy action and investment.

49. **Ensuring a stable and transparent policy framework** with increased ambition over time is critical for the success of carbon pricing mechanisms and broader climate action. Effective climate policy frameworks can send a clear signal to investors to support climate action. Further, strong engagement with stakeholders in designing and implementing policies effectively and clear tracking and communication of carbon pricing and other policy outcomes to stakeholders are important elements of effective climate frameworks.

50. Providing tools and knowledge for market actors to assess costs and benefits and to determine the most effective action is an important area of support. To lessen costs, carbon pricing administrative processes can build on and be integrated with similar policy frameworks (e.g. tax policy frameworks). Finally, revenues from carbon pricing can also support further benefits to society through reinvestment and/or transfer on the basis of unique local circumstances and priorities. While expanding the comprehensiveness of

[26] OECD/World Bank. *The FASTER Principles for Successful Carbon Pricing: An Approach Based on Initial Experience.* Available at <https://www.oecd.org/environment/tools-evaluation/FASTER-carbon-pricing.pdf>.

[27] The New Climate Economy 2015. Available at <http://newclimateeconomy.report/2015/misc/downloads/>.

[28] Morris DF and Munnings C. *Designing a Fair Carbon Tax*. Resources for the Future. Available at <http://www.rff.org/research/publications/designing-fair-carbon-tax>.

carbon pricing instruments to consider other emissions and sectors over time is ideal, it is important to consider the full costs of administration and monitoring.[29]

51. **Aligning with environmental objectives**: carbon pricing can support several other environmental goals (e.g. improvement of local air quality) and these goals can inform effective policy design. High-level goals can be established at the beginning of the policy development process to inform overall design (see box 3).[30]

Box 3
France's proposal to increase taxes on coal-fired power plants

Building on other low-carbon development actions and leadership in the country, an advisory committee of the French Government recommended an increase in taxation of coal-fired power plants on the basis of emissions. The recommendation is expected to be included in France's next budget law, to be adopted in November 2016. Other recommendations that could complement the carbon tax include increased stringency of emission standards for coal-fired power plants and floor and ceiling prices, along with an auction system, for the European Union Emissions Trading System.

Source: Reuters. *French carbon pricing committee proposes tax on coal-fired power.* Available at <http://uk.reuters.com/article/france-carbon-pricing-idUKL8N19X4SM>.

1. Carbon taxes

52. A carbon tax is applied to carbon-intensive production processes and services to ensure that those responsible for carbon emissions pay an allocation for the associated externalities (e.g. the social costs). Carbon taxes are calculated on the basis of estimates of GHG emissions and are applied in a similar way to other taxes, such as value added taxes. Often applied through a tax based on the carbon content of fuel, carbon taxes provide a mechanism to support reductions in GHG emissions.

53. The high-level best practices for carbon pricing highlighted above are critical in supporting the effective design of carbon taxes. Building on those elements, best practices specific to carbon taxes are highlighted below.

54. **Determine the carbon tax payers**: determination of the payers of a carbon tax (i.e. where the tax falls within the energy supply chain) will be unique to individual countries and jurisdictions. However, reducing the number of entities taxed can reduce administrative costs. The Center for Climate and Energy Solutions found that a downstream tax would potentially have to fall on millions of users, increasing the likelihood that the scope of the programme would be more limited with higher aggregate and administrative costs.[31] Within this context, carbon taxes may be most cost-effectively applied to upstream energy suppliers rather than at the midstream (e.g. utilities) or downstream (e.g. households and energy-using businesses) levels. Detailed analysis should be undertaken to determine the appropriate carbon tax payer model within different national and subnational contexts.

55. **Establish the tax rate**: several options exist to inform the establishment of a carbon tax rate and the options chosen will be unique to individual circumstances (see box 4). Two common options include: setting the rate on the basis of the social and economic value of carbon and aligning the rate with specific emission or revenue goals using economic modelling. In both cases, the tax rate can be evaluated and increased over time in relation to marginal climate damages and/or broader emission and development goals. Other subsidies

[29] Center for Climate and Energy Solutions (C2ES). *Options and Considerations for a Federal Carbon Tax.* Available at <http://www.c2es.org/publications/options-considerations-federal-carbon-tax>.

[30] As footnote 26 above.

[31] World Bank. *Pricing Carbon.* Available at <http://www.worldbank.org/en/programs/pricing-carbon>.

for fossil fuels and/or low-carbon technologies should also be taken into account when considering a carbon tax rate.[32]

Box 4
Portugal's carbon tax and funding for low-carbon transport

In 2015 Portugal introduced a green fiscal reform that includes a carbon tax for sectors that are not included in the European Union Emissions Trading System (EU ETS). The tax is expected to provide EUR 95 million in funding for low-carbon transportation actions, including bicycle and car sharing programmes and electric vehicles as well as forestry and biodiversity initiatives. The carbon tax applies to sectors not covered by the EU ETS.

Sources: Organisation for Economic Co-operation and Development (OECD). *Climate Change Mitigation: Policies and Progress*. Available at <http://dx.doi.org/10.1787/9789264238787-en>; and Moreira da Silva. Presentation at the meeting on the Green Growth in Portugal, OECD Headquarters. 3 February 2015.

56. **Evaluate and adjust over time**: a robust plan for monitoring and evaluating the impacts on carbon tax on emissions and development goals provides a solid basis for ongoing improvements. Several methodologies can be used to assess impacts. Evaluation of impacts can inform the tax level and other policy adjustments over time. The impacts of carbon tax revenue reinvestment programmes (e.g. in low-carbon infrastructure projects) can also be assessed to communicate benefits and inform policy direction over time.

57. **Reduce costs**: in some cases, countries and jurisdictions can leverage already existing monitoring, reporting and evaluation systems and other administrative processes to reduce costs associated with carbon taxes. For example, measurement, reporting and verification (MRV) systems for reporting on air pollution can be used to identify entities that may be subject to a carbon tax. Such MRV systems may already be supported by well-defined administrative procedures for data collection, thus reducing the administrative burden and costs.

2. Carbon markets or emissions trading schemes

58. Carbon markets or emissions trading schemes (ETSs) provide tradable allowances of emissions to incentivize market-based emission reductions. An increasing number of carbon markets or ETSs are being implemented globally on the basis of international experience. Market reforms are also continually under way around the world.[33] For example, given an overabundance of emission allowances and subsequent low allowance prices that are insufficient for effectively driving investment decisions, the European Union Emissions Trading System has undertaken reforms to temporarily postpone the auctioning of 900 million allowances until 2019 as well as introduce a market stability reserve.[34] The Government of the Republic of Korea has also been considering adjustments to address concerns about allowance allocations and prices.[35] Figure 5 presents allowance prices in selected ETS markets from 2015 to 2016.

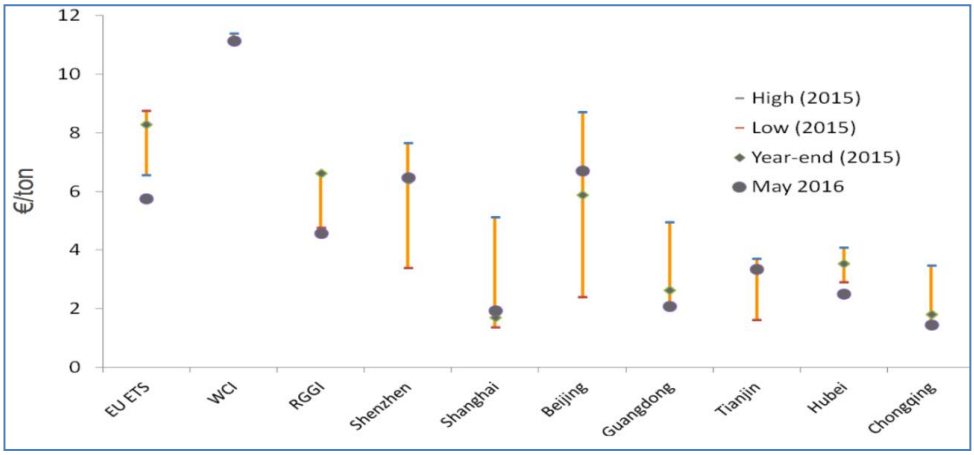
[32] Sumner J, Bird L and Smith H. *Carbon Taxes: A Review of Experience and Policy Design Considerations*. National Renewable Energy Laboratory (NREL). Available at <http://www.nrel.gov/docs/fy10osti/47312.pdf>.

[33] Presentation made by Thomson Reuters Point Carbon at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_thomson_reuters__frank_melum.pdf>.

[34] European Commission. Climate Action. *Structural Reform of the EU ETS.* Available at: <http://ec.europa.eu/clima/policies/ets/reform/index_en.htm>.

[35] Reklev S. 2016. Analysis: Korea's ETS may be long, and looming reforms could bring even more supply. *Carbon Pulse*. Available at <http://carbon-pulse.com/18573/>.

Figure 5
Allowance prices in selected emissions trading markets in 2015 and 2016



Source: Presentation made by Thomson Reuters Point Carbon at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_thomson_reuters__frank_melum.pdf>.

Abbreviations: EU ETS = European Union Emissions Trading System, RGGI = regional greenhouse gas initiative, WCI = western climate initiative.

59. Building on the good practices in carbon pricing overall highlighted above, good practices specific to ETS design and implementation are described below. They are adapted from an International Carbon Action Partnership and World Bank publication as well as other key resources.[36,37,38] While good practices are useful for designing carbon markets, specific design elements will be highly influenced by unique national and jurisdictional circumstances related to high-level goals and objectives, economic factors and other considerations.

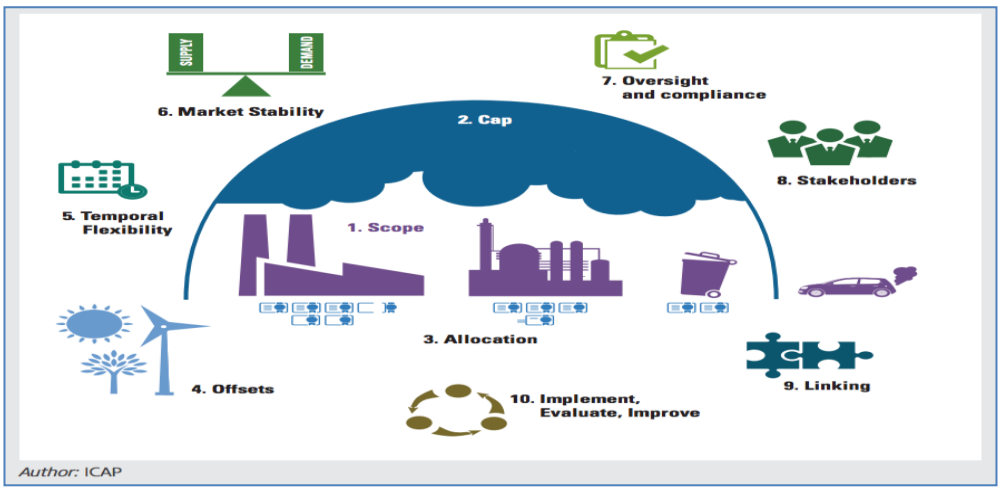
60. **Design an effective ETS planning and implementation process**: several steps are important in designing an effective ETS, ranging from scoping emissions and sectors covered to designing caps, engaging stakeholders and implementing, evaluating and ensuring compliance, among many others (see figure 6).

[36] Partnership for Market Readiness and International Carbon Action Partnership. *Emissions Trading in Practice: a Handbook on Design and Implementation*. Available at <https://openknowledge.worldbank.org/bitstream/handle/10986/23874/ETP.pdf?sequence=11&isAllowed=y>.

[37] World Bank. *10 Practical Steps to Create an Emissions Trading System*. Guigon P. Available at <http://blogs.worldbank.org/climatechange/10-practical-steps-create-emissions-trading-system>.

[38] Ellerman AD, Joskow PL and Harrison D Jr. *Emissions Trading in the U.S.: Experience, Lessons, and Considerations for Greenhouse Gases.* C2ES. Available at <http://www.c2es.org/publications/emissions-trading-us-experience-lessons-and-considerations-greenhouse-gases>.

Figure 6
Steps of an emissions trading scheme design and implementation process



Source: Partnership for Market Readiness and International Carbon Action Partnership. *Emissions Trading in Practice: a Handbook on Design and Implementation*. Available at <https://openknowledge.worldbank.org/bitstream/handle/10986/23874/ETP.pdf?sequence=11&isAllowed=y>.

61. **Support a robust framework**: to achieve GHG emission mitigation and other key development goals, an ETS can be supported by several actions, including: collecting and analysing GHG emissions data and other key economic and social data, developing a strong monitoring, reporting and evaluation framework (including a robust registry system), reducing carbon leakage through various actions, and ensuring a system that accurately accounts for carbon offsets, especially those that may enter from outside the ETS.

62. **Enable cost-effectiveness**: eTSs can be designed to allow for flexibility within the system that supports lower-cost abatement options. For example, an industry participant could decide to: (1) make improvements to their industrial processes or business practices to provide for lower emissions; (2) purchase additional allowances; or (3) pay a fee for non-compliance. This flexibility gives market participants several choices regarding how to fulfil their ETS requirements, allowing them to select the most cost-effective option, any of which will still go towards meeting the carbon cap (best practice is for the fee payment to be invested in low-carbon technologies). Further, effectively integrating ETSs with complementary policies within specific sectors can also support cost-effective outcomes. Linking ETSs may also improve cost-effectiveness as it increases the number of carbon abatement options.

63. **Design a predictable and transparent, yet flexible policy framework**: a predictable ETS policy framework that provides transparent information on system design, parameters and adjustment over time can support long-term investment mobilization. While flexibility is necessary to address changing climate conditions and evolving markets over time, changes to ETS frameworks and targets can be made transparently and predictably to reduce investor uncertainty (see box 5).

Box 5
Lessons learned from China's pilot emissions trading scheme

In the context of broader market-based policy reform, in 2011 China established a pilot emissions trading scheme (ETS) in seven provinces and municipalities. Having learned lessons from the pilot, a national ETS is expected to be in place by 2017. Several challenges, identified during the pilot phase, are being addressed to support

the establishment of the ETS. In particular, there is a need to improve and verify emissions data to support reliability, and to build institutional and human capacity to support the ETS framework and implementation at various levels and in various sectors. There is also a strong need to support coordination across authorities, sectors and relevant policy frameworks. Finally, planning for extensive legislative processes and ensuring financial resources to implement the ETS are critical elements to support effective design.

Source: Presentation made by China at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/03_china_duan.pdf>.

64. **Consider design features to link with other markets**: carbon markets in various jurisdictions can be designed with consistent features to allow for transactions and compliance across markets. Specific design features to support linkages will be dependent upon unique jurisdictional circumstances.[39,40,41] The regulators of each ETS would need to collaborate to ensure that the markets are compatible and also to analyse the implications of linkages. Design elements to be considered include sectoral scope and methodologies for allocating allowances, options for banking allowances, market interactions, including coherence of market stability mechanisms, and regulatory procedures.

3. Fossil fuel subsidy reform

65. Fossil fuel subsidies encourage investment in fossil fuel extraction, processing and consumption, whereas ETSs encourage investment away from intensive carbon use, and thus fossil fuel subsidies and ETSs are inherently at odds. In markets with fossil fuel subsidies, not only the real price of fossil fuel is obfuscated, but also the social and economic value of carbon (see box 6).

Box 6
Indonesia's fossil fuel subsidy reforms and need for social impact assessment

In 2015 Indonesia put in place reforms to phase out gasoline subsidies and to cap diesel fuel subsidies. As a result of the reform, subsidies were earmarked in the 2015 budget to make up more than 13 per cent of total government expenditure, but this has now been decreased to 1 per cent, equivalent to a USD 14 billion decrease in a single year. However, there is a need for further assessment of the social and economic impacts of fuel subsidy reforms on different portions of the Indonesian population (e.g. poor households) to inform ongoing efforts and actions to address equity issues.

Source: Organisation for Economic Co-operation and Development. *Climate Change Mitigation: Policies and Progress*. Available at <http://dx.doi.org/10.1787/9789264238787-en>.

66. The phase-out of fossil fuel subsidies could result in a 6–13 per cent reduction in GHG emissions by 2050.[42] In their NDCs, 13 countries articulated actions to support fossil fuel subsidy removal and related energy pricing actions. Further, by the end of 2015, more than 50 member countries of the Group of 20 (G20) and Asia-Pacific Economic Cooperation committed to fossil fuel subsidy reform and phase-out.[43] In addition, in 2015

[39] As footnote 36 above.
[40] As footnote 37 above.
[41] As footnote 38 above.
[42] Merrill L, Bassi AM, Bridle R and Christensen LT. *Tackling Fossil Fuel Subsidies and Climate Change: Levelling the Energy Playing Field*. Nordic Council of Ministers. Available at <http://dx.doi.org/10.6027/TN2015-575>.
[43] REN21. *Renewables 2016 Global Status Report*. Available at <http://www.ren21.net/wp-

the Friends of Fossil Fuel Subsidy Reform, a coalition of eight non-G20 countries, together with France and the United States of America sent out a communiqué calling on the international community to increase efforts to phase out fossil fuel subsidies.[44] As a sign of progress, since then the G7 has made a pledge to end most fossil fuel subsidies by 2025.[45]

67. Savings from fossil fuel subsidy reform offer a significant opportunity for reinvestment in low-carbon technologies such as RE, energy efficiency and low-carbon transportation options. Current low international oil prices could also provide a favourable opportunity for near-term action and reform.[46] On the basis of international experience, the following good practices, adapted from relevant literature, can support fossil fuel subsidy reform in the context of unique national circumstances.

68. **Consider timing, coordinate across entities and develop a detailed plan**: a country's political environment can have an impact on the ability of policymakers to implement fossil fuel subsidy reform, thus timing is a key consideration. Gradual reform can be an effective approach and allow for incremental action on various fuel subsidies over time. It is also critical to build support and coordination mechanisms across the government entities and sectors that will be involved and affected. Fossil fuel subsidy reform entails a number of key steps, including: engaging stakeholders and communicating with the public to build awareness, analysing reform options and timing for implementation, assessing impacts and mitigation options, implementing pricing reforms and mitigation actions, monitoring and evaluation, and improving over time. Each of these steps can be articulated in detailed reform plans based on unique country circumstances.

69. **Establishing an effective pricing approach** could eliminate subsidies, allow for automatic reflection of international price changes, provide transparency and integrate an effective enforcement mechanism.

70. **Assess and address impacts**: robust technical assessment can be undertaken to understand the impacts of fossil fuel subsidy reform on various population groups and sectors. Assessments can be stakeholder driven to ensure all relevant impacts are considered and to build support for action. On the basis of impact assessment, several measures (e.g. provision of targeted assistance to specific companies or households, anti-inflationary policies, temporary tax reductions, etc.) can be considered to address impacts on certain groups.

71. **Support outreach and awareness**: communicating with the public and stakeholders is a critical aspect of fossil fuel subsidy reform. Detailed plans can be put in place to support communication and outreach on key topics and messages related to details of implementation and impacts and benefits of reform.

content/uploads/2016/06/GSR_2016_Full_Report_REN21.pdf>.

[44] Friends of Fossil Fuel Subsidy Reform. *Fossil Fuel Subsidy Reform and the Communiqué*. Briefing note. Available at <http://fffsr.org/wp-content/uploads/2015/07/ffrs-communique-briefing-note.pdf>.

[45] As footnote 6 above.

[46] Beaton C, Gerasimchuk I, Laan T, Lang K, Vis-Dunbar D and Wooders P. *A Guidebook to Fossil-Fuel Subsidy Reform.* International Institute for Sustainable Development. Available at <https://www.iisd.org/gsi/fossil-fuel-subsidies/guidebook>.

IV. Policies, practices and actions encouraging the shift to more efficient public transport and increasing the energy efficiency of vehicles

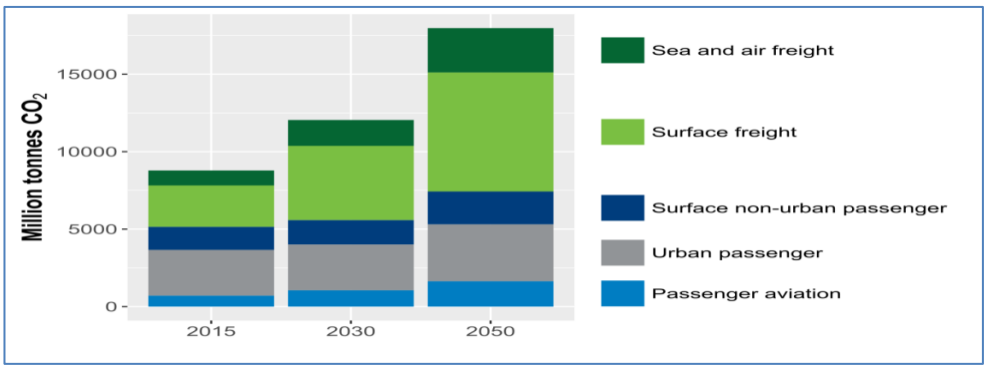
A. Drivers for ambitious mitigation policies, options and initiatives for the decarbonization of the public transport sector

72. The transport sector is a key enabler of economic growth and international trade, and demand for transport services continues to grow. Within this context, fossil fuel combustion by transport was responsible for 23 per cent of global CO_2 emissions in 2013.[47] As a promising trend, from 2000 to 2014 the global transport sector's energy intensity[48] decreased by 1.8 per cent annually on average, with the greatest decrease associated with the road transport sector. However, energy intensity in a few regions did remain nearly static, namely in the Middle East and Latin America.[49]

73. Under a 'business as usual' scenario, transport emissions are expected to grow to one third of global emissions by 2050, with a significant portion attributed to the urban passenger and surface freight sectors.[50] Notably, 38 per cent of global transport emission growth by 2050 is expected to occur in India, China and Latin America owing to rapid increases in urbanization and motorization rates.[51] More broadly, 97 per cent of emission increases in the sector by 2030 are expected to occur in developing countries.[52]

74. Emissions from the international aviation and maritime transport sectors are also forecast to increase and, if left unabated, could increase from 5 per cent of global CO_2 emissions in 2010 to at least 10 per cent by 2050.[53] Figure 7 presents estimated CO_2 emissions from transport subsectors in 2015, 2030 and 2050 under a 'business as usual' scenario.

Figure 7
Estimated carbon dioxide emissions from transport subsectors in 2015, 2030 and 2050



[47] International Energy Agency (IEA). *CO_2 Emissions from Fuel Combustion. Highlights.* Available at <https://www.iea.org/publications/freepublications/publication/CO2EmissionsFromFuelCombustionHighlights2015.pdf>.

[48] Defined by REN21 as the ratio of energy consumption for transport to gross domestic product.

[49] As footnote 43 above.

[50] The Global Fuel Economy Initiative website on cleaner more efficient vehicles. Available at <http://www.unep.org/transport/gfei/autotool/understanding_the_problem/Trends_and_scenarios.asp#emission>.

[51] Presentation made by OECD ITF at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_itf_jari_kauppila.pdf>.

[52] As footnote 50 above.

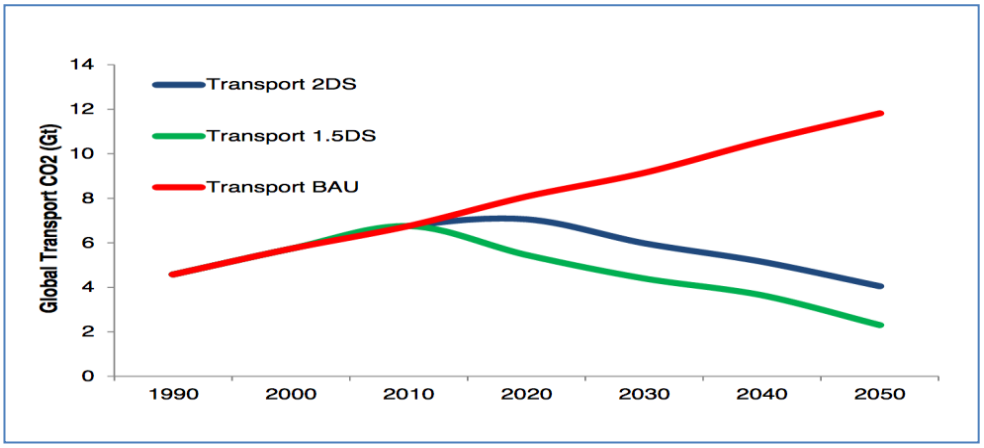
[53] As footnote 27 above.

Source: Presentation made by the International Transport Forum at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_itf_jari_kauppila.pdf>.

75. With two thirds of the world's population expected to live in urban areas by 2050, cities will play an important role in supporting the required low-carbon transformation in the transport sector. Currently, approximately 50 per cent of CO_2 emissions in the transport sector are attributed to urban transport; this figure could increase by 140 per cent by 2050 under a 'business as usual' scenario, with 90 per cent of those emissions occurring in developing and emerging economies. Critical policy actions to support public transport, mitigate urban sprawl and reflect externalities in pricing could reduce projected emission growth in the transport sector by 30–40 per cent.[54] Key actions to support integrated land use and multimodal sustainable transport planning and action within and between cities will be critical in enabling a low-carbon future.[55]

76. More ambitiously, a number of institutions and nations are working to fully decarbonize the transport sector by 2050 to support and align with calls from the international community to limit the average global temperature increase to 1.5 ºC. Transport sector CO_2 emission scenarios aligned with 'business as usual', 2 ºC and 1.5 ºC temperature rise scenarios are presented in figure 8.

Figure 8
Transport sector carbon dioxide emission scenarios to 2050



Source: Presentation made by the Partnership on Sustainable Low Carbon Transport at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/transport_tem_cornie_huisenga_ppmc.pdf>.

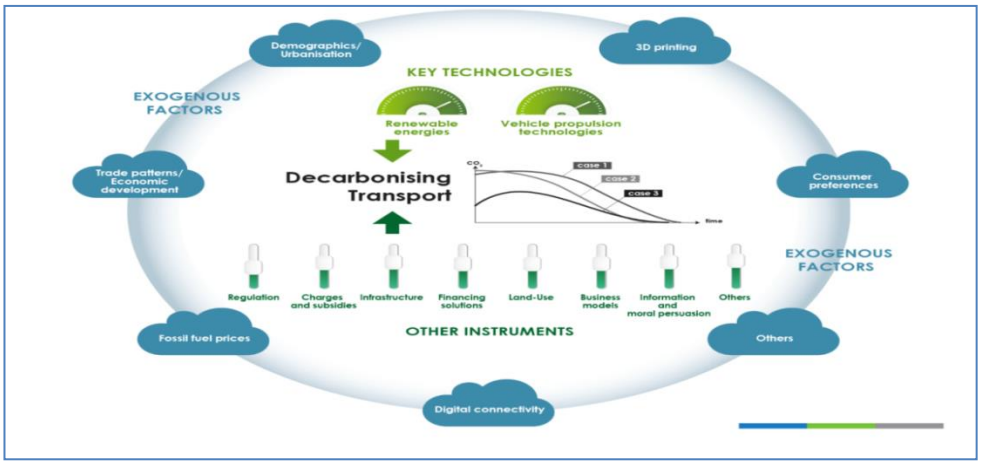
Abbreviations: 2DS = 2 ºC scenario; 1.5DS = 1.5 ºC scenario, BAU = business as usual.

77. To achieve transport decarbonization, transformational, innovative and multimodal transport planning frameworks must be rapidly expanded. As presented in figure 9, various exogenous factors (such as demographics, trade patterns, fossil fuel prices, technology availability and consumer preferences, among others) will have an impact on those frameworks and the technologies and policies that will enable implementation. Many of the factors are specific to unique national and jurisdictional circumstances and will inform the types of policy instrument and approaches that are pursued.

[54] As footnote 51 above.

[55] Presentation made by the Partnership on Sustainable Low Carbon Transport (SLoCaT) at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/transport_tem_cornie_huisenga_ppmc.pdf>.

Figure 9
Exogenous factors, technologies and policy instruments associated with transport decarbonization



Source: Presentation made by the International Transport Forum at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_itf_jari_kauppila.pdf>.

78. Transport decarbonization will require the design of complex, multimodal and transformative system pathways, which will be unique to specific national and urban contexts. National and city-level pathways will integrate various policies and actions, such as multimodal transport planning, including BRT, rail, non-motorized transport and car share programmes, among others. Other policies and actions for integration include fuel efficiency standards and regulations, economic incentives, integrated transport and land-use planning, clean transport technology deployment and research and development (R&D) programmes, among many others.

79. RE is an important element of robust low-carbon transport policy frameworks. In 2015 advances were made in supporting aviation biofuel application, infrastructure for biomethane, R&D for advanced biofuels, biofuel mandate development and EVs, rail and low-carbon charging infrastructure. In this context, RE made up approximately 4 per cent of road transport fuel at the global level in 2015. While linkages across the RE and transport sectors continue to grow, there is still a need for scaled-up action in this area. As compared with RE policies in the power sector, RE transport policy development and implementation is lagging behind, owing mainly to the heavy dependence of the global transport sector on fossil fuel consumption.[56] The coupling of power sector decarbonization with the electrification of the transport sector is an important area of focus going forward.

80. Development goals provide an essential foundation for low-carbon planning and implementation in the transport sector. Mitigation actions in the transport sector can support several economic, social and environmental benefits as highlighted in table 1.[57] Development impacts of transport actions should be carefully assessed to maximize benefits and reduce potential negative impacts that could be associated with land use and other factors. Careful consideration should also be given to the impact of policies on various societal groups such as the disabled, lower socioeconomic populations and gender groups, among others.[58]

[56] As footnote 43 above.
[57] Victoria Transport Policy Institute. *Ridesharing: Carpooling and Vanpooling*. Available at <http://www.vtpi.org/tdm/tdm34.htm>.
[58] For detailed guidance on addressing gender within transport policy, see the modules on social issues

Table 1
Potential sustainable development co-benefits of low-carbon transport action

Economic co-benefits	*Social co-benefits*	*Environmental co-benefits*
• Reduced fuel costs resulting from improved efficiency, which can support profitability and competitiveness for companies and provide an economic benefit for individuals • Job creation and local industry development to support low-carbon transport subsectors and technologies • Increased local investment in low-carbon infrastructure and technologies • Energy security improvements and trade benefits in relation to reduced dependence on fossil fuels and imports • Improved technological innovation and competitiveness • Improvement in travel time, reliability, connectivity and travel services	• Improved public health resulting from air quality improvements and reduced emissions, especially for vulnerable populations (e.g. children and the elderly) • Reduced public health/social welfare costs to address respiratory illnesses • Significant positive public health impacts from more active mobility (walking and cycling) • Improved safety on roadways and reduced accidents • Improved overall well-being resulting from reduced congestion, delays/stops and travel time • Improved accessibility of job opportunities	• Local air quality improvements • CO_2 and black carbon emission reductions • Reduced noise and water pollution • Improved biodiversity resulting from reduced road construction and effective land-use planning • Improved resilience in cases where low-carbon transport is planned to support disaster preparedness and recovery

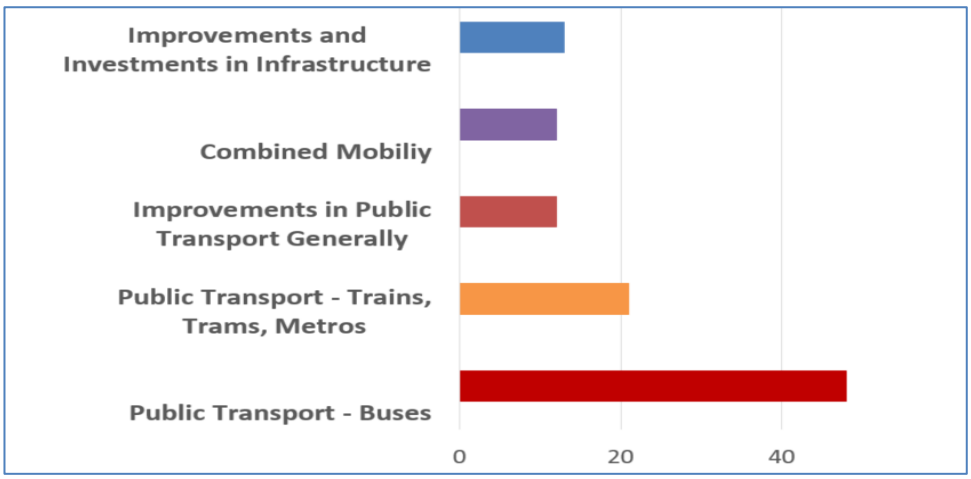
Sources: Adapted from Deutsche Gesellschaft für Internationale Zusammenarbeit. *Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I)*. Available at <http://www.sutp.org/files/contents/documents/resources/E_Fact-Sheets-and-Policy-Briefs/SUTP_GIZ_FS_Avoid-Shift-Improve_EN.pdf>; and the presentation made by Kapsch Group at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/kapsch_trafficcom_intelligent_mobility_solutions_to_mitigate_climate_change_gilbert_konzett.pdf>.

B. National policies, tools and schemes to advance low-carbon public transport on different scales

81. As highlighted in figure 10, countries put forward more than 100 actions within their intended nationally determined contributions, now called NDCs, to support low-carbon public transport systems. With countries focusing efforts on implementing their NDCs while also raising ambition over time, there is a crucial need to support the robust design of low-carbon public transport policies and to mobilize investment in transport technologies and infrastructure.

in transport in: Deutsche Gesellschaft für Internationale Zusammenarbeit. *Sustainable Urban Transport*. Available at <http://www.sutp.org/en/resources/publications-by-topic/sutp-sourcebook-modules.html>.

Figure 10
Public transport actions and policies in intended nationally determined contributions



Source: Presentation made by the International Union for Public Transport at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/unfccctem_philip_turner.pdf>.

82. To inform the development and implementation of sustainable public transport policies and actions through NDCs and other efforts, best practice policies and actions implemented at different levels in developed and developing countries and across public transport subsectors are highlighted below and also summarized in annex I (table 3).

1. National and local long-term transport and land-use policy, planning and regulation frameworks

83. Developing national and local frameworks for transport and land-use policies, regulations and planning is a critical first step in supporting low-carbon transport. The frameworks can articulate plans and actions to bridge and integrate urban planning, public transport, linked low-carbon energy needs and opportunities, and information technologies to improve efficiency.[59] Strong frameworks and good practices can be organized around the steps highlighted below, adapted from the Low-Emission Development Transportation Toolkit prepared by the Low Emission Development Strategies Global Partnership Transportation Working Group.[60]

84. **Evaluate the current situation**: planners and policymakers can evaluate the transport landscape in their country, including current land-use strategies. Demand for transport services and supply of transport infrastructure and services can also be evaluated to inform needs and opportunities. Government entities and agencies engaged in policy, regulation and finance for transport should also be identified to inform actors and stakeholders and to engage with the broader transport policy framework and actions.

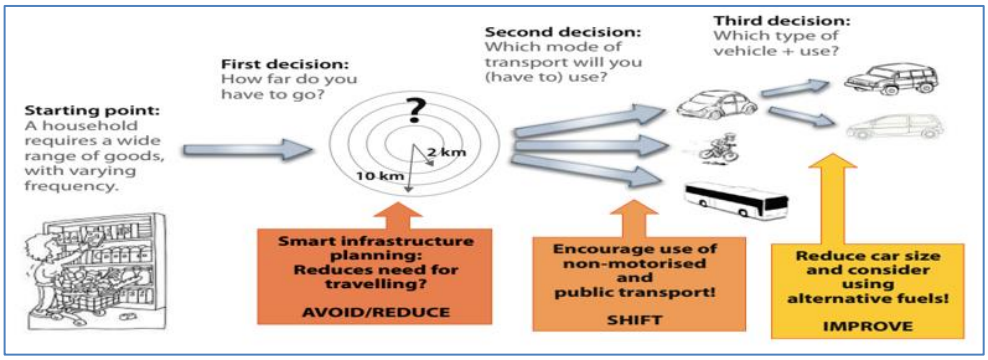
85. **Develop a baseline**: baseline scenarios for projected transport supply, demand, emissions, land use and other development impacts can be developed using various software tools. Baselines can be used to assess the impact of low-carbon transport policies and actions compared with the baseline scenario.

[59] Presentation made by the International Association of Public Transport at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/unfccctem_philip_turner.pdf>.

[60] Available at <http://en.openei.org/wiki/LEDSGP/Transportation_Toolkit/Key_Actionshttp://en.openei.org/wiki/LEDSGP/Transportation_Toolkit/Key_Actions/Implement_and_Monitor#implement-and-monitor>.

86. **Assess opportunities**: low-carbon transport opportunities are often assessed under the Avoid (transport demand), Shift (to low-carbon options) and Improve (infrastructure, technologies and policies) framework. Figure 11 depicts the types of action that can be assessed.

Figure 11
Avoid-shift-improve policy actions



Source: Deutsche Gesellschaft für Internationale Zusammenarbeit. *Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I)*. Available at <http://www.sutp.org/files/contents/documents/resources/E_Fact-Sheets-and-Policy-Briefs/SUTP_GIZ_FS_Avoid-Shift-Improve_EN.pdf>.

87. **Develop low-carbon scenarios and prioritize actions**: individual countries and jurisdictions can determine high-level low-carbon transport objectives and goals that best align with local priorities and circumstances. As presented in table 1, the objectives may align with various potential co-benefits related to economic, social and environmental development and improvement. Low-carbon transport scenarios can then be developed, assessed and prioritized on the basis of their alignment with specific low-carbon transport goals and objectives through inclusive stakeholder processes (see box 7).

88. **Implement, monitor and improve**: low-carbon transport plans can present detailed plans for implementation, including stakeholder engagement processes, roles and responsibilities for various agencies, funding sources for policy and technology actions, timelines, outreach and communication strategies, and monitoring, evaluating and reporting frameworks. Over time, as the plan and outcomes are monitored and evaluated, improvements can be made through an iterative process.

Box 7
Low-carbon mobility in India

India partnered with the United Nations Environment Programme to develop the National Action Plan for Low-carbon Transport and Low-carbon Comprehensive Mobility Plans (LCMPs). The efforts were closely aligned with India's broader development and climate goals and included a robust process to support the key activities, including:

- Developing and measuring low-carbon mobility indicators (economic, social, environmental and technical);
- Assessing long-term scenarios of low-carbon transport options (up to 2050);
- Designing a detailed road map for low-carbon transport based on prioritized options and making policy recommendations;
- Building the capacity of key actors at the national and subnational levels to support the development of the road map and the implementation of action;
- Enabling implementation at the subnational level through the development of LCMPs for cities;

- Supporting outreach and awareness building by disseminating information on actions and policy briefs;
- Developing proposals to fund the implementation of sustainable transport projects and infrastructure.

Source: United Nations Environment Programme Risoe Centre. *Promoting Low Carbon Transport in India.* Available at <http://www.unep.org/transport/lowcarbon/PDFs/publications/LCT_UpdatedProjectBrochure_Nov2012.pdf>.

2. Public transport policies to support improved efficiency and network innovations

89. On the basis of the broader long-term national and local planning frameworks highlighted above, several actions and approaches can support efficient and innovative public transport, which are highlighted below alongside related good practices.

90. **Multimodal transport system approaches** and policies can increase public transport coverage and service provision. This can occur by means of efficiently managing transport supply chains and infrastructure, including BRT systems, rail systems, non-motorized vehicles, ride and vehicle-sharing programmes and other transport options (see box 8).[61]

Box 8
London's multi-modal transport system

Multi-modal transport in London integrates rail, bus rapid transit and ferry systems to support efficient and low-carbon transport. Stations dedicated to multi-modal transport enable the efficient interchange of large numbers of passengers between modes of transport. For example, major bus stations are located very close to rail stations to allow passengers to easily walk between them. Stations also incorporate real-time information systems to support integrated travel planning and improved customer experience.

Source: Victoria Transport Policy Institute. *Introduction to Multi-Modal Transportation Planning. Principles and Practices.* Litman T. Available at <http://www.vtpi.org/multimodal_planning.pdf>.

91. **Assess current trends and data**: assessing supply, demand, growth trends and costs and benefits in relation to various public transport options and sizes is an important area of focus to begin the planning process and can assist in capturing opportunities for economies of scale.

92. **Design efficient access points and infrastructure**: planning for and designing easy access points to public transport in city centres (<500 m) and integrating transport infrastructure for multiple uses (e.g. BRT and bicycle stations) can support efficient multi-modal transport.

93. **Develop a funding plan**: developing a detailed funding plan is a major step in planning for a multi-modal system. The funding plan can include potential partnership and co-funding opportunities with businesses and other stakeholders benefiting from potential low-carbon transport investments.

94. **Support 'sustainable neighbourhood' approaches**: designing sustainable neighbourhood approaches that integrate efficient and low-carbon transport considerations is one innovative option to support multi-modal transport at the micro scale and can be linked with broader system plans. In addition, mixed land-use development decreases the

[61] FCCC/TP/2015/4.

distance between desired destinations (shops, work, etc.) and allows for more active transport (such as walking and cycling) and reduces the need for a car.

95. **Support public outreach**: designing public awareness campaigns allows beneficial service features of multi-modal transport systems to be highlighted for the public with a view to expanding public transport use.

96. **Integrate public transport fares (and include other shared modes)**: considering one fare mode for all transport options under a multi-modal system, including shared modes such as public bicycle systems, can increase overall efficiency and improve customer experience.

97. **Provide real-time data applications**: real-time data applications can support efficient multi-modal trip planning using smartphones and other devices and improve customer experience.

3. Public transport policies to support mass transit

98. As one key component of multi-modal transport planning, expanding efficient mass transit, including buses, trains, trams and metro, will be critical in supporting low-carbon transport around the world.

99. BRT is defined by the Institute for Transportation & Development Policy (ITDP) as a "high-quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. It does this through the provision of dedicated lanes, with busways and iconic stations typically aligned to the centre of the road, off-board fare collection, and fast and frequent operations".[62] According to the Renewable Energy Policy Network for the 21st Century (REN21), "by early 2016 (BRT) were located in at least 200 cities on all continents, transporting more than 33 million passengers per day – up from 150 cities and 28 million passengers in 2013".[63]

100. Actions and good practices to support BRT development taken from experience around the world are highlighted below. The good practices are adapted from the ITDP scorecard for BRT, which provides a framework for countries to assess the quality of BRT systems and to recognize leaders and other key sources.[64]

101. **Develop a strong plan and funding strategy**: developing a robust BRT plan with leadership and input from various stakeholders, including city planners, the private sector, technical institutions and civil society, is an essential element of BRT planning. The plan can also include a sustainable funding strategy that may include local and national funding as well as incremental funding mechanisms that may be linked to sales and property taxes.

102. **Support effective design**: ensure key design features can support effective BRT implementation, including: dedicated lanes for BRT and an enforcement plan, and mechanisms to support frequent, reliable and on-time service such as traffic signal priority, off-board fare collection and platform-level boarding. Effective design can also include plans for efficient demand-driven routes with support from control centres and infrastructure improvements, including passing lanes at bus stations, among many others (see box 9).

[62] ITDP. *The Scorecard.* Available at <https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/the-scorecard/>.

[63] As footnote 43 above.

[64] Blynn K and Rosenberg G. *Best Practices in Rapid Transit System Design.* Available at <http://www.smartergrowth.net/wp-content/uploads/2015/08/2015-BRT-best-practices-guide.pdf>.

Box 9
Rapid transit expansion in Curitiba, Brazil

The bus rapid transit system in Curitiba, Brazil, includes 340 bus lines covering 1,100 km and is managed by a public-private entity owned by the local government. Curitiba's buses carry 50 times more passengers than they did 20 years ago. The system uses express buses to support high-capacity, on-time operations and cost savings; faster buses for longer commutes for a specific market of customers that pay for service before boarding and enter the buses from raised tube stations; efficient boarding station design; and a specific entity to handle operations and management.

Source: Transportation Research Board. *Curitiba, Brazil: BRT Case Study.* Available at: <http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp90v1_cs/Curitiba.pdf>.

103. **Develop an outreach and communication plan:** BRT services and benefits can be communicated to customers through outreach efforts and awareness-raising campaigns. Providing customers with real-time information on BRT arrival times, etc., is also an important feature to support expanded use.

104. **Integrate BRT with multi-modal transport plans**: integrating BRT with broader multi-modal transport plans is critical in ensuring efficiency across modes of transport. For instance, bicycle lanes can be integrated with BRT corridors and bicycle parking and/or bicycle share services can be provided at stations to support the use of bicycles for short trips and overall cost savings. Considering providing one fare mode for all transport options is also a strong approach to supporting BRT integration with multi-modal transport.

4. Public transport policies to support railway transport, including trains, trams and metros

105. Rail transport is the most emission-efficient mode of passenger and freight transport and is a critical element of sustainable low-carbon transport frameworks.[65] According to the International Union of Railways (UIC), USD 1 invested in one passenger-kilometre of rail is 100 times more efficient than USD 1 invested in one passenger-kilometre of road in terms of CO_2 emissions.[66]

106. However, some barriers to low-carbon rail deployment exist, including: prioritization of road infrastructure over rail infrastructure in urban settings; misalignment of national and local land and transport policies; high capital costs and longer-term planning requirements; and the need for further assessment of passenger preferences. Several good practices, highlighted below, can be used to address these barriers and support successful rail policy design and implementation.

107. **Support balanced transport policy and planning**: assessing all transport options and taking into account long-term benefits associated with higher upfront cost can enable full consideration of rail options and optimal solutions.

108. **Develop a long-term vision**: a long-term vision can support the minimization of shorter-term political barriers that may arise and ensure that long-term objectives guide the design and development of investments in rail.

[65] Presentation made by the International Union of Railways Group at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/uic_craven_unfccc_tem.pdf>; and European Environment Agency. 2013 *Energy efficiency and specific CO_2 emissions.* Available at <http://www.eea.europa.eu/data-and-maps/indicators/energy-efficiency-and-specific-co2-emissions/energy-efficiency-and-specific-co2-5>.

[66] Trains to Paris. *Policy recommendations*. Available at <http://www.traintoparis.org/IMG/pdf/train_to_paris_policy_recommendations.pdf>.

109. **Integrate national and local decision-making processes**: integration of planning processes allows for vertical and horizontal planning and a whole system approach to transport development. According to UIC, integrating rail stations with urban design and planning can enable effective intermodality through transfers between urban public transport services in addition to cycling, walking, car sharing and city logistics.

110. **Design a sustainable funding plan or mechanism**: sustainable funding plans are critical for large rail infrastructure investments and could account for external costs, polluter pays, land value capture approaches and/or the development of a sustainable pricing structure, as described below.

111. **Support electrification**: electrification of railways is an important consideration to support GHG emission reductions and other benefits in the transport sector. Planning for rail electrification can be integrated with broader low-carbon transport planning frameworks and can be closely linked with RE power development plans.

112. **Standardize the rail system and simplify border crossing for freight transport**: according to UIC, simplifying border crossing and standardization systems for transport corridors would support low-carbon, efficient, multi-modal sustainable freight transport.

113. **Raise awareness and conduct customer research**: developing public awareness campaigns can raise the profile of rail transport and help potential customers to understand the benefits. Further, conducting customer research is critical in understanding needs and desires and to inform investments in quality rail services and marketing.[67]

5. Public transport policies to support non-motorized transport

114. The promotion of non-motorized transport (NMT), including pedestrians and bicycles, is considered one of the lower-cost and high-impact policy areas that could be replicated and scaled up in the pre-2020 period. Governments, the private sector and communities are actively engaging in redesigning urban transport systems, infrastructure, parking and traffic management policies to support NMT. NMT policies and actions are also an integral element of the multi-modal public transport systems highlighted above. Good practices to support NMT are highlighted below.[68]

115. **Assess current trends**: assessing current trends in the usage of NMT and personal motor vehicles, spatial patterns, income levels, demographics and economic growth can inform the design of NMT support policies and feed into broader transport strategies. The current provision, connectedness and quality of NMT infrastructure should be included in the assessment.

116. **Integrate with broader transport strategies**: several policies highlighted in this paper can support NMT by discouraging the use of private vehicles. NMT policies and actions can be integrated into broader transport frameworks to support a robust multi-modal low-carbon transport system. Such frameworks will also include detailed funding plans for infrastructure and other investments to support NMT.

117. **Develop conducive infrastructure based on robust land-use planning**: designing cycling and walking routes that are connected, direct, safe, enjoyable to use and attractive is a critical component in supporting NMT use (see box 10). Such routes should be anchored by coherent, connected and comfortable, preferably separated, infrastructure in order to

[67] Best practices adapted from the presentation made by UIC at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/uic_craven_unfccc_tem.pdf>.

[68] Deutsche Gesellschaft für International Zusammenarbeit. *Sustainable Transport: A Sourcebook for Policy-Makers in Developing Cities.* Available at <http://www.sutp.org/files/contents/documents/resources/A_Sourcebook/SB3_Transit-Walking-and-Cycling/GIZ_SUTP_SB3a_Mass-Transit-Options_EN.pdf>.

attract and maintain users. The networks should be integrated with broader multi-modal transport. Further, affordable bicycle sharing programmes can be developed to replace short-distance personal vehicle travel and facilitate connections to public transport, such as BRT.[69]

Box 10
Colombia's shift towards cycling

Colombia is supporting several policies to facilitate a shift towards non-motorized transport (NMT), particularly cycling. The actions are enabled under broader strategies and frameworks, including Colombia's National Urban Transport Policy, the Low-carbon Development Strategy, a nationally appropriate mitigation action for transportation and its National Development Plan.

With support from TRANSfer of Deutsche Gesellschaft für Internationale Zusammenarbeit, the Government identified various barriers to NMT, which informed infrastructure investments to support cycling through bicycle path construction and bicycle share systems. Thanks to those investments, the bicycle modal share increased from 0.5 per cent in 1999 to 5 per cent in 2015. Specific cities, such as Bogota, have also implemented key policies, such as prohibiting car use on major roads at certain times, which have resulted in emission reductions. Colombia is now working to further integrate cycling with other modes of transportation to support multi-modal systems. Initiatives include expanding bicycle space and infrastructure on BRTs, trams and cable cars and within stations.

Source: Presentation made by Colombia at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/presentacion_bonn_colombia_v1.pdf>.

6. Public transport policies to support ride sharing

118. New and innovative approaches to low-carbon transport are emerging through the 'sharing economy'. These approaches, such as car and ride sharing services, could play a pivotal role in supporting transport decarbonization. In the developing world, informal ride sharing fills a gap in service. Underserved populations or geographical areas in-between public transport options are served by privately owned vehicles or pedicabs.[70] Also, a study carried out in Lisbon found that 3 per cent of public vehicles could provide the same level of service as all private cars.[71] Good practices associated with car sharing programmes, informed by a 2015 Deloitte University Press Study,[72] are highlighted below.

119. **Assess ride sharing potential**: assessment can be undertaken to understand the ride sharing potential in certain urban locations. These areas can then be targeted for ride sharing programmes to support the greatest near-term impact.

120. **Develop 'ride sharing rings'**: using the above-mentioned assessment, ride sharing 'ring neighbourhoods' can be identified. According to Deloitte University Press, "Neighborhoods with high ridesharing potential […] are usually distributed in a ring 10 to 15 miles outside each city's urban core. These neighborhoods tend to have higher concentrations of commuters traveling each day to similar workplace destinations, both in the city center and in office parks and edge cities throughout the metro area".

[69] See document FCCC/TP/2015/4.

[70] Cervero R. *Informal Transport in the Developing World.* United Nations Centre for Human Settlements. Available at <mirror.unhabitat.org/pmss/getElectronicVersion.aspx?nr=1534&alt=1>.

[71] As footnote 51 above.

[72] Viechnicki P, Khuperkar A, Dovey Fishman T and Eggers WD. *Ridesharing.* Available at <http://dupress.com/articles/smart-mobility-trends-ridesharing/>.

121. **Support online real-time ride share platforms**: on the basis of experience in many cities and jurisdictions, online and mobile user-friendly ride sharing platforms can be developed to support efficient ride sharing programmes (see box 11).

122. **Collaborate with the private sector**: as many ride sharing programmes are implemented through the private sector (e.g. uberPOOL), governments can collaborate with these companies to understand trends and support scaled-up implementation and awareness-raising through public outreach campaigns on benefits.

123. **Design ride share tax incentives**: tax incentives can be designed to support car sharing. Examples include pre-tax benefits for parking and van sharing costs.

Box 11
Puget Sound vanpool programme and marketing plan

In the North American region, Puget Sound is considered to have one of the most effective vanpool programmes. To support the vanpool programme, the local government implemented a Commute Trip Reduction law under which large companies must facilitate use of alternative modes of transport. Further, the vanpool programme is operated by local transit agencies that support quality and integrated service across the region. In addition, the local transit agencies developed a dedicated marketing plan to expand the use of vanpool services.

Source: Victoria Transport Policy Institute. *Ridesharing: Carpooling and Vanpooling*. Available at <http://www.vtpi.org/tdm/tdm34.htm>.

7. Economic instruments and financing solutions in public transport

124. Robust economic instruments and finance mechanisms are critical in supporting the implementation of low-carbon transport actions. Key good practices to support finance and economic instruments for low-carbon transport are highlighted below.

125. **Develop a sustainable funding plan**: sustainable funding plans can integrate various approaches to financing investment in low-carbon public transport, including mechanisms that account for external costs, polluter pays, beneficiary pays and/or land value capture as well as other incentives and options highlighted below. As several institutions and actors can benefit from improved public transport, co-funding approaches can be explored and articulated within funding plans. The plan can also present approaches to cost recovery from public transport fares (including tiered classes), potential payment systems for non-users for tangential benefits and corresponding quality-cost trade-offs, as well as impacts on low-income groups.

126. Taking into account unique national and local circumstances, various financial and economic instruments can be considered to support low-carbon transport and articulated within sustainable funding plans. Selected instruments are highlighted below:[73]

(a) **Urban access charging schemes** can be designed to charge vehicles in relation to crossing into or out of a designated area or zone (for a full day or for each crossing) or to using a certain road, duration of time spent within a zone or distance travelled within a zone. The charges can also be dynamically set in relation to peak periods of travel (e.g. congestion pricing) or travel duration and location (e.g. parking pricing) and permits can be offered for certain types of users (e.g. disabled persons, government and commercial, residents, etc.). In addition to the air quality and efficiency benefits of

[73] Presentations made by Kapsch Group and UITP at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/kapsch_trafficcom_intelligent_mobility_solutions_to_mitigate_climate_change_gilbert_konzett.pdf> and <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/unfccctem_philip_turner.pdf>.

charging schemes, funding raised through charges can be reinvested into low-carbon transport policies and actions. Toll charges and private vehicle parking fees can also be used as mechanisms to support switching to lower-carbon public transport options (such as BRT and rail) and to fund low-carbon public transport projects. The design and implementation of variable road, toll or parking pricing will create more incentives to reduce vehicle use than fixed pricing;

(b) **Urban access restriction schemes** can restrict access to certain areas or require a permit, thereby supporting a number of objectives related to emissions, efficiency and safety. Permit sales can provide a potential mechanism to fund other low-carbon transport actions;

(c) Governments can consider **subsidies to support low-carbon transport investment**. Subsidies can be funded through land and tax revenues and can be allocated to clean fuel production, large public transport infrastructure projects, among many other options. Employers can also provide transit subsidies as a form of employee benefit, which will encourage the use of public transport for commute or non-commute trips;

(d) As a mechanism to fund sustainable public transport, **land value capture** involves capturing increases in property value that may occur as a result of investment in public transport and other infrastructure;

(e) Several policies can be put in place under the umbrella of **polluter pays** and can allow revenues to be reinvested in low-carbon transport actions. Such policies allow for external costs to the environment from polluting projects and investments to be internalized by companies through taxes and other mechanisms;

(f) **Beneficiary pays** systems can be put in place, whereby the people or institutions that are most greatly benefited by public transit need to pay for it. An example of this concept in action is the French *versement* tax: the magnitude of the tax varies depending on the employer's proximity to the city centre, where access to public transit is most valuable;[74]

(g) **Public–private partnerships** can be integral in supporting low-carbon public transport. Through them the private sector can support the overall design of effective projects and financing can be leveraged;

(h) **Tax and other financial mechanisms** can support investment in low-carbon transport technologies and infrastructure. For example, fossil fuel and private vehicle taxation revenue can be reinvested in low-carbon technologies and projects. Tax incentives can also be provided for private investment in lower-carbon technologies such as electric and hybrid vehicles and public transport projects (see box 12).

Box 12
Land value capture for rail expansion in Tokyo

To support low-carbon rail investment in Tokyo, the local transit agency used a land value capture approach. In Tokyo, economic growth and population expansion near railway corridors and stations provides an optimal setting for this financing approach. In particular, investments in rail and housing development were packaged together to capture land value increases associated with public investment. The following circumstances supported this approach:

- Optimal timing in relation to economic and population growth near railways and stations;
- Support of long-term property investment by railway companies;

[74] Enoch M, Nijkamp P, Potter S, Ubbels B and Verhoef E. *Alternative Ways of Funding Public Transport. A Case Study Assessment.* Available at <http://www.ejtir.tudelft.nl/issues/2001_01/pdf/2001_01_05.pdf>.

- Flexibility to focus and shift to new areas of investment on the basis of economic growth.

Source: Lincoln Institute of Land Policy. *Transit Value Capture: New Town Co-Development Models and Land Market Updates in Tokyo and Hong Kong.* Available at <https://www.lincolninst.edu/pubs/2198_Transit-Value-Capture-New-Town-Co-Development-Models-and-Land-Market-Updates-in-Tokyo-and-Hong-Kong>.

127. **Plan for large-scale and longer time-horizon investments**: for large-scale investments with a longer planning and construction time frame, such as low-carbon rail, several incentives and mechanisms to support investment can be considered and integrated into robust planning processes. Options include: lowering the minimum capital ratio for the investment and considering favourable tax rates and incentives; establishing special construction funds; and utilizing public–private partnership models to support investment, among others. China has developed a strong policy package centred around such actions to support investment in rail in the country.[75]

8. Research, development and demonstration of public transport technology

128. Many public and private sector institutions are investing in the research, development and demonstration (RD&D) of low-carbon public transport technologies. The good practices outlined below can support RD&D efforts in the transport sector.

129. **Identify high-level goals associated with transport-related RD&D**: high-level goals could relate to climate mitigation and resilience, economic development, social equity and many other outcomes, as presented in table 1. They will provide the foundation for the development of an effective RD&D strategy to support low-carbon transport.[76]

130. **Assess the local innovation ecosystem**: assessing the local innovation ecosystem will be unique to each country and jurisdictional circumstances, but can include the consideration of local expertise and research facilities, the level of development of technologies, approaches and supply chains (locally and internationally). Other aspects for consideration include status and preferences of local markets, level of development and engagement of private companies, opportunities for international partners and need for capacity-building, among many other considerations. Each of those areas is important in informing the design of a broader low-carbon transport RD&D strategy.[77]

131. **Design an RD&D strategy and funding mechanism**: on the basis of the technologies and approaches of focus articulated in national and local long-term transport and land-use policies, planning and regulation frameworks and the assessment of the local innovation ecosystem, a detailed strategy and road map can be prepared to support low-carbon transport RD&D. The strategy can also articulate national, subnational, multilateral and private funding sources to support RD&D activities.[78]

[75] Presentation made by China at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/chinas_urban_public_transport_rail_systems-revised.pdf>.

[76] International Renewable Energy Agency (IRENA). *Renewable Energy Innovation Policy: Success Criteria and Strategies*. Available at <https://www.irena.org/DocumentDownloads/Publications/Renewable_Energy_Innovation_Policy.pdf>.

[77] European Commission. *Towards Low Carbon Transport in Europe.* Available at <http://www.transport-research.info/sites/default/files/brochure/20120423_214705_81522_PB02_web.pdf>.

[78] United Kingdom of Great Britain and Northern Ireland Department for Transport. *Low Carbon Transport Innovation Strategy*. Available at <http://webarchive.nationalarchives.gov.uk/20081022212629/http:/www.dft.gov.uk/pgr/scienceresearch/technology/lctis/lctisdoc.pdf>.

132. **Establish collaborative partnerships**: engaging the private sector is often critical in supporting RD&D efforts and collaborative initiatives can be developed between public and private entities to support robust RD&D. Further, international collaboration can play a key role in learning from experience internationally and provide an important opportunity for a partnership to address common challenges and goals related to low-carbon transport and to support technology transfer.[79,80] An example of the integrated approach to the partnership building in the transport sector is presented in box 13.

Box 13
Morocco's low-carbon transportation initiatives

Morocco's green bus rapid transit system and the city-level urban electric mobility plans are supporting emission reductions, improved transport services, renewable energy deployment, cost reductions and job creation. Efforts have focused heavily on international cooperation to catalyse transformation. Several activities led by Morocco's Ministry of Environment are enabling the development of low-carbon transport markets in the country:

- Electric bus rapid transit pilot projects at the municipal level utilizing solar and hydro technologies for bus charging;
- Partnership under the Global Coalition of Electric Mobility launched at the twenty-first session of the Conference of the Parties and leadership of an effort to create an International Association of Electric Mobility to support worldwide development of electric vehicle markets;
- Tripartite operational cooperation between the cities of Kénitra (Morocco), Alès (France) and Starkville (United States of America) to implement urban electric mobility approaches and showcase leading technologies;
- Low-carbon transport research, development and demonstration partnership with Mississippi State University;
- Development of a Green Tech Valley in the city of Salé, a technology hub to showcase green technologies open to all Africans;
- Consideration and design of incentives and tax mechanisms to support low-carbon transport.

Source: Presentation made by Morocco at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/sustainable_mobility_in_morocco_-_may_2016.pdf>.

C. Policy and technology solutions for supporting the energy efficiency of vehicles and other modes of transport

133. Policy and technology solutions to support the energy efficiency of vehicles and other modes of transport are also critical in developing robust low-carbon transport policy portfolios. Key policy options and approaches, as well as good practices to support effective design and implementation, are highlighted below.[81]

[79] IRENA. *Renewable Energy Innovation Policy: Success Criteria and Strategies*. Available at <https://www.irena.org/DocumentDownloads/Publications/Renewable_Energy_Innovation_Policy.pdf>.

[80] Presentation made by Clean Energy Partnership at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/cep_bystry_unfccc_2016-05-23.pdf>.

[81] It should be noted that several actions to support the efficiency of public transport were highlighted in the previous section for specific technologies and actions, such as BRT, and are not repeated in this section.

1. Intelligent transport system approaches and policies

134. According to the United States Department of Transportation instruction manual, an intelligent transport system (ITS) includes the application of advanced sensors, computers, electronics and communication technologies and management strategies in an integrated manner, providing traveller information, to increase the safety and efficiency of the surface transport system. ITS plans can be designed for specific cities and jurisdictions on the basis of transport supply and demand and other key factors (see box 14). ITS plans can be integrated into broader low-carbon transport frameworks and can integrate mechanisms (such as charging schemes) to support investments in other low-carbon transport options. In a number of cases, there is a need to further integrate climate objectives and planning with ITS processes. Beyond supporting mitigation goals, ITS policies can provide multiple co-benefits, such as road safety, efficient traffic flows, comfort and convenience, productivity improvements and improved local air quality.[82]

Box 14
Thailand's intelligent transportation system

Thailand has implemented a number of measures to support low-carbon transportation through intelligent systems. In particular, hardware and software is being used to manage traffic and support efficiency, real-time information is being provided to travellers and public transportation management practices are in place to support improved services, among other actions. Building on this work, Thailand is working with Bhutan to share information from their experience and inform similar efforts through South–South cooperation. The partnership was facilitated by the Climate Technology Centre and Network.

Source: Presentation made by Thailand at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_thailand_jakapong_pongthanaisawan.pdf>.

135. **Support connected and automated real-time transit management**: several options exist to support real-time traffic management and connection. Planners can consider traffic signal controls, speed enforcement, integrated corridor management (across operators and agencies), specific ITS information services for real-time traffic data and other software and hardware options to enable efficient traffic management. Potential benefits of these actions include reduced travel time, fuel savings, emission reductions and improvement in travel time reliability. Provision of real-time information using various hardware and software tools can allow for efficient management of multi-modal public transport. For instance, BRT and other public transport routes can be optimized using traffic patterns.[83]

136. **Consider measures for managing travel demand**: various actions and mechanisms can support travel demand management, including charging and other pricing schemes dynamically set in relation to peak travel times (highlighted above) and urban access restriction schemes (especially low-emission zones designated for low-emission vehicles), among others. These actions can enable transport efficiency, improve air quality and reduce emissions, but need to be considered in relation to unique local circumstances.

[82] TEM on low-carbon public transport. Summary by the facilitator Ms. Sheila Watson (United Kingdom). Available at <http://climateaction2020.unfccc.int/tep/technical-expert-meetings/>.

[83] Presentation made by Kapsch Group at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/kapsch_trafficcom_intelligent_mobility_solutions_to_mitigate_climate_change_gilbert_konzett.pdf>.

2. Fuel efficiency and clean fuels

137. Many policies aim to increase fuel efficiency and encourage electric and hydrogen mobility to support low-carbon development. In addition, fuel-efficient driving practices, or ecodriving, can serve to decrease fuel demand from petroleum-powered vehicles.

138. **Fuel economy standards**: building on close to five decades of experience, several countries have designed and implemented fuel economy standards to support low-carbon transport. Further, fuel economy standards now cover 70 per cent of the global passenger car market and have had a large impact on emission levels to date. According to REN21, between 2008 and 2013 road transport fuel economy improved at an average annual rate of 2 per cent, with higher average improvement rates in OECD countries as a result of effective policies, especially fuel economy standards.[84] Good practices to support the design and implementation of fuel economy standards are highlighted below and are based on recommendations made by the International Energy Agency (IEA) and other institutions.

Box 15
Canada's fuel efficiency standards and complementary programmes

Canada is a global leader in clean vehicle and fuel policies and currently has "world-class emission standards, passenger vehicle fuel economy standards, [and a] green freight program" in place. In addition, the Government has supported the development of the 2016 Fuel Consumption Guide and the EnerGuide fuel consumption label, which supports consumers in comparing fuel consumption of vehicles to inform buying decisions. To build on these efforts, the International Council on Clean Transportation recommends further action on light- and heavy-duty fuel economy standards to reach a world-class level as well as efforts to address differences in laboratory test emissions and emissions on the ground.

Sources: International Council on Clean Transportation. *Policies to Reduce Fuel Consumption, Air Pollution, and Carbon Emissions from Vehicles in G20 Nations*. Available at <http://www.theicct.org/sites/default/files/publications/ICCT_G20-briefing-paper_Jun2015.pdf>; and Natural Resources Canada. *2016 Fuel Consumption Guide*. Available at <http://www.nrcan.gc.ca/energy/efficiency/transportation/cars-light-trucks/buying/7487>.

139. **Design regulations that are flexible and technology neutral and maximize social benefits**: IEA recommends that fuel economy standards be implemented as regulations rather than voluntary policies to enable implementation (see box 15). Regulations, however, can be designed to have flexibility through multiple approaches such as attribute-based targets and credit trading systems. Flexibility can support cost-effectiveness. Importantly, standards can also be designed to be technology neutral to ensure that certain technologies are not promoted over others. Finally, the stringency of regulations will be informed by unique local circumstances, but can be based on analysis of key policy goals that will maximize social benefits.

140. **Consider the scope of the standard**: the scope of the standard, at the least, can include light-duty vehicles and can also consider heavy-duty vehicles to support greater fuel savings. Standards can also be designed to avoid leakage into other vehicle categories.

141. **Develop efficient testing approaches**: procedures to test vehicles can integrate a comprehensive set of factors that have an impact on fuel efficiency and can be combined with testing procedures for local emissions to support cost savings. International guidance to harmonize test procedures was developed through the World Forum for Harmonization of Vehicle Regulations and can support effective and consistent fuel economy standards, building on international experience.

[84] As footnote 43 above.

142. **Design complementary policies**: labelling programmes can be an effective policy mechanism to complement fuel economy standards. Labelling programmes are commonly implemented by manufacturers and can play an important role in consumer choice, especially between similar vehicles. Financial incentives, such as tax deductions for fuel-efficient vehicles or voluntary accelerated vehicle retirement programmes, can also be considered to complement fuel economy standards.[85]

Biofuel policies

143. Biofuels are widely supported in a number of countries internationally, with renewable fuel standards as one of the most common policies to support industry development.[86] Mandates vary by country and create requirements around the certain types and blends of biofuels that qualify.[87] This kind of biofuel promotion is under a high level of scrutiny owing to concerns around land-use change and land-cover effects; in addition, recent studies have called into question projected GHG reductions due to soil-released carbon and methane.[88] However, numerous studies have also shown life cycle emissions to be decreased from the use of biofuels over fossil fuels.[89] Taking this debate into consideration, common good practices, highlighted below, can support effective biofuel standard policies. Requirements for the types and blends of biofuel vary considerably across countries and jurisdictions.

144. **Consider biofuel crops in relation to food and fuel priorities**: prioritizing types of feedstock utilized in the production of biofuels can be critical in areas with concerns about potential food and fuel competition.[90] Certain feedstocks – such as municipal solid waste, agricultural residues[91] and forestry waste – do not displace agricultural land and cause fewer concerns about land-use change. Furthermore, some non-edible energy crops (e.g. camelina) can be grown on marginal or fallow lands that do not compete with food production (see box 16).

[85] International Council on Clean Transportation. *Policies to Reduce Fuel Consumption, Air Pollution, and Carbon Emissions from Vehicles in G20 Nations*. Available at <http://www.theicct.org/sites/default/files/publications/ICCT_G20-briefing-paper_Jun2015.pdf>.

[86] As footnote 54 above.

[87] Mosey G and Kreycik C. *State Clean Energy Practices: Renewable Fuel Standards.* NREL. Available at <http://www.nrel.gov/docs/fy08osti/43513.pdf>.

[88] Liska AJ, Yang H, Milner M, Goddard S, Blanco-Canqui H, Pelton MP, Fang XX, Zhu H and Suyker AE. 2014. Biofuels from crop residue can reduce soil carbon and increase CO_2 emissions. *Nature Climate Change*. 4: 398–401. Available at <http://www.nature.com/nclimate/journal/v4/n5/full/nclimate2187.html%3Fmessage-global%3Dremove>.

[89] Han J, Elgowainy A, Dunn JB and Wang MQ. 2013. Life cycle analysis of fuel production from fast pyrolysis of biomass. *Bioresource Technology*. 133: 421–428. Available at <http://www.sciencedirect.com/science/article/pii/S0960852413001739>.

[90] Smolinski S and Cox S. *Policies to Enable Bioenergy Deployment: Key Considerations and Good Practices.* NREL. Available at <http://www.nrel.gov/docs/fy16osti/66322.pdf>.

[91] However, removal of agricultural residues could cause a decrease in soil organic carbon.

Box 16
European Union sustainability criteria for biofuel development

The European Commission has developed sustainability criteria as well as measurement frameworks to support biofuel development. The criteria include initial requirements for a 35 per cent reduction in greenhouse gas emissions compared with traditional fuels and increases of this percentage over time, as well as criteria related to land use and biodiversity. In addition, the European Commission provides a methodology for complete life cycle analysis of biofuel emissions and information on data sources, on-site assessment and definitions related to biodiversity and other areas of consideration.

Source: European Commission. "Energy. Sustainability criteria". Available at <https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/sustainability-criteria>.

145. **Ensure flexibility of mandates**: with changes to markets and technologies constantly evolving, it is critical to ensure that mandates are flexible and adjusted over time. Adjustments can be made on the basis of assessments of the market, especially in relation to the improvement and development of advanced biofuels. However, adjustments should be implemented transparently to ensure that policy signals are clear for market actors.[92]

146. **Create broader biofuel support frameworks**: broader biofuel policy frameworks can incorporate incentives for biofuel production (e.g. production incentives for more advanced fuels) and sales (e.g. tax incentives for fuelling stations that sell certain levels of biofuel blends) and grants to support infrastructure for biofuel supply chains and deployment.[93] Further, incentives to support flexible fuel vehicles can also build demand for biofuels. Ensuring complementary policies are in place within broader frameworks and across the biofuel supply chain can support the effectiveness of biofuel mandates and the achievement of targets.[94]

Electric vehicle policies

147. According to REN21, "by one estimate, global sales of plug-in electric cars were up more than 70 per cent in 2015, and by year's end more than 1 million plug-in electric cars and vans were estimated to be on the world's roads, with the largest number operating in the United States".[95] In addition, electric two-wheelers have seen tremendous growth in various developing countries since the 1990s (see box 17). Trends related to gasoline prices did have a negative impact on the United States market in 2015, but markets in China, Norway and the European Union continued to expand in relation to strong policy incentives. Building on international experience, policies and good practices to support effective EV programme design and implementation are highlighted below, informed by studies of the Electric Vehicle Policy Initiative.[96]

[92] REN21. *Renewables 2015 Global Status Report.* Available at <http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf>; Renewable Fuels Association. *Renewable Fuel Standard Flexibility Provisions*. Available at <http://www.ethanolrfa.org/wp-content/uploads/2015/11/RFS-Flexibility-Provisions-Talking-Points1.pdf>.

[93] Paulsworth A. 2013. *Increasing Sustainable Biomass through Production Tax Credits.* Available at <http://www.sciencepolicyjournal.org/uploads/5/4/3/4/5434385/increasing_sustainable_biomass_through_production_tax_credits.pdf>.

[94] As footnote 90 above.

[95] As footnote 43 above.

[96] The Climate Group Quebec. *Electric Vehicle Policy Initiative: Summary – Sharing best practices on electric vehicle policy.* Available at <http://www.theclimategroup.org/_assets/files/Electric-Vehicle-Policy-Initiative-v5.pdf>.

Box 17
Electric two-wheeler dominance in China

Since the late 1990s, China has seen accelerated demand for electric vehicles. Sales for electric two-wheelers grew from 52,000 vehicles in 1998 to over 21 million in 2008. Much of this growth has come from policies that banned motorcycles rather than those that promoted electric vehicles. Policies that promoted electric scooters in Taiwan without limiting petroleum-fuelled motorcycles resulted in little success.

Source: Yang C. 2010. Launching strategy for electric vehicles: lessons from China and Taiwan. *Technological Forecasting and Social Change*. 77. Available at <https://www.researchgate.net/publication/222655447_Launching_strategy_for_electric_vehicles_Lessons_from_China_and_Taiwan>.

148. **Assess the market and develop an EV deployment strategy, including near- and long-term target markets**: policymakers can design EV policy approaches and strategies that target particular markets using a phased approach informed by a detailed market assessment. For instance, targeting actions to support markets or groups of consumers that may have already shown interest in EVs rather than consumers broadly can be an effective initial step. Actions for this market could include improving the safety and performance of currently available vehicles. Policymakers can also consider targeting corporate and government fleets that may be more willing to consider broad costs fully and the benefits and risks of EV ownership. Building and supporting targeted markets can support scaled-up battery manufacturing to drive down costs and set the stage for broader market development.

149. **Provide basic information and education on EVs through outreach programmes**: as a relatively new technology, there is a need to educate the public on the basics of EV technologies and dispel any myths related to the technologies that may be widely accepted. Outreach and awareness-raising programmes broadcast through various marketing mechanisms (e.g. websites, advertisements and social media) and events can provide a valuable approach to strengthening and building EV markets.

150. **Design plans for developing and funding charging infrastructure**: in addition to private charging stations at consumer homes, it is necessary to consider public EV charging infrastructure, as many consumers have indicated concerns related to the range of EV vehicles between charges. Funding plans can be designed that bring together national, subnational and private sector sources of finance. Funding plans may also be designed in a phased approach, with governments providing initial funding for basic infrastructure to support building the market and to ease consumer worries. In other cases, governments can observe and assess pilot infrastructure developed privately to determine the level of funding required. Local planning processes that engage various stakeholders can support informed identification of charging station locations. Policymakers can also work with local businesses to encourage charging at workplaces through education and information on incentives. Governments can also invest in highway charging infrastructure to support travel between major cities. Finally, there is a need to consider standardization across charging infrastructure, which is likely to be an area of focus as markets develop.

151. **Design policy and incentive packages that integrate complementary policies**: on the basis of specific country and jurisdictional circumstances and the good practices highlighted above, robust policy and incentive packages can be developed, which may include:

(a) Financial mechanisms such as tax credits and/or differentiated taxation for EV and hybrid vehicles;

(b) Regulations such as fuel economy standards that can integrate mechanisms to support EVs, including increased weight limits for EVs and/or EV credits;

(c) Other incentives, including EV parking fee and toll waivers and/or access restriction waivers (e.g. for high-occupancy vehicle lanes) that could entice first-time EV buyers in the nascent market.[97]

Hydrogen policies

152. In order for fuel cell vehicles to flourish in a region, substantial infrastructure must be put in place so that fuel is available for vehicle operation. Various actions can be undertaken to support hydrogen fuel development and markets. Such actions, and related good practices, which will be unique to individual countries and jurisdictions, are highlighted below.[98]

153. **Develop long-term strategies**: low-carbon transport strategies and support frameworks can integrate hydrogen development considerations and actions that will occur over a longer time frame to spur investment in essential infrastructure. They can also provide a framework for collaboration across government, hydrogen developers and infrastructure suppliers to support an integrated vision and path forward.

154. **Assess and mitigate legal barriers**: in some cases, significant legal barriers to hydrogen fuel deployment (e.g. industrial regulations) may exist. Designing legislation to facilitate the approval and operation of technologies can enable hydrogen fuel deployment.

155. **Support partnerships and coordination**: collaboration among technical institutions and NGOs can provide a solid basis for hydrogen development and allow for ongoing research even in times of political uncertainty. Collaboration can also allow investment risks to be shared among partners, exchange of information and overall cost reductions.

156. **Research, develop and demonstrate**: the development of vehicle and supply chain technologies is necessary in order to advance to hydrogen fuel deployment. International and domestic RD&D efforts will play a crucial role in advancing the technology and reducing high costs.

D. Freight transport policies

157. At the global level, CO_2 emissions from freight transport are increasing more rapidly than emissions from passenger vehicles. By 2035 heavy-duty vehicles are projected to emit the greatest amount of CO_2 emissions within the transport sector. Black carbon, a significant short-term climate pollutant, is also largely attributed to freight transport within the transport sector.[99] Actions and good practices to address these important climate concerns and to support low-carbon freight transport are highlighted below, adapted from the United States Environmental Protection Agency publication *How to Develop a Green Freight Program*.[100]

158. **Develop a 'green freight' programme**: green freight can be highly beneficial in supporting GHG emission mitigation. Green freight programmes can be informed by the assessment of the current freight market, including technologies, non-technological measures, such as vehicle optimization and driving behaviour, important actors and related policies (see box 18). Using that assessment, leaders and champions for the programme can be identified within the private sector, government and technical institutions, and structures can be put in place to administer the programme. Performance can also be established

[97] IEA. *Global EV Outlook 2016*. Available at <https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf>.

[98] As footnote 80 above.

[99] As footnote 85 above.

[100] Available at <https://www.epa.gov/sites/production/files/2016-06/documents/7511_teacher_training_guide.pdf>.

upfront on the basis of stakeholder engagement and overall economic, climate and other objectives. Finally, budget options can be assessed for funding the programme, which will be unique to specific city and national contexts. Green freight programmes can also be integrated into broader low-carbon transport policy frameworks.

Box 18
Lean and Green initiative in the Netherlands

In 2008 the Government of the Netherlands began the Lean and Green initiative to promote reducing the carbon footprints of freight companies by optimizing logistics. As at 2016 more than 500 companies across Europe participate in the programme. Over 400,000 tonnes of carbon dioxide have been prevented from entering the atmosphere, and exponential growth is to be expected with the launch of Lean and Green Europe.

Source: Connekt Lean & Green. Available at <http://lean-green.nl/en-GB/>.

159. **Consider policies and actions to support green freight under the programme**: programme leaders can consider regulatory or voluntary partnership or a mix of the two mechanisms to support green freight. Under voluntary programmes, partners will voluntarily commit to measures that will achieve certain goals compared with a baseline. Various measures can be considered, including green logistics programmes, truck efficiency improvement programmes and intermodal hubs.[101] Voluntary partnership programmes can also be complemented by regulations such as fuel efficiency standards for heavy-duty vehicles and other freight transport modes.

160. **Support standardized and consistent data collection, benchmarking, measuring and reporting**: providing tools and methods to support consistent data collection and measurement can allow for more accurate and standardized reporting. This can be supported by third-party neutral institutions.

161. **Strongly engage the private sector and other stakeholders in the design and implementation of the programme**: the private sector and other stakeholders can be actively engaged in designing green freight programmes to ensure inclusivity, transparency and the long-term success of the programme.

162. **Market the programme and recognize the leadership**: it is worth noting that marketing and outreach are critical aspects of building support for green freight programmes. Recognizing leaders can expand interest and support positive outcomes of voluntary programmes.[102]

E. Maritime policies and approaches

163. Approximately 90 per cent of global trade occurs within the maritime sectors and trade is expected to grow, in particular through interregional cooperation agreements and South–South partnerships and within the Asian region. In this context, the maritime sector currently makes up approximately 3 per cent of global CO_2 emissions, with emissions from the sector forecast to increase by 50 to 250 per cent by 2050. To address that challenge, the

[101] Presentation made by Germany at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/tem_presentation_markus_kurdziel_long_version.pdf >.

[102] United States Environmental Protection Agency. *How to Develop a Green Freight Program.* Available at <https://www.epa.gov/sites/production/files/2016-06/documents/7511_teacher_training_guide.pdf>.

following actions and good practices are being pursued at the international, regional and national levels.[103,104]

164. **Develop globally harmonized maritime rules**: through the International Maritime Organization (IMO), rules and regulations have been developed for energy efficient and low-emission shipping. Energy efficiency regulations include the attainment of an energy efficiency design index (required for new ships), an energy efficiency management plan (required for all ships) and approaches to support technical cooperation and technology transfer. These measures require a 30 per cent improvement in the energy efficiency of new ships by 2025. Draft amendments have also been approved for a mandatory fuel consumption data collection system to be implemented for ships of 5,000 gross tonnage and above. IMO is also considering the appropriate response by international shipping to the Paris Agreement. In addition, emission control areas limit the amount of sulphur that can be emitted within a certain distance from land.

165. **Support technology innovation and deployment**: several institutions are supporting the development of innovative hardware and software to transform current technologies, reduce emissions and support efficiency in the maritime sector. Key hardware-related measures to improve efficiency include improving propulsion efficiency and reducing hull resistance, waste heat recovery and application of RE technologies. Key operational measures to improve efficiency include optimizing routes and operation plans, reducing speed, hull and propeller cleaning and other technology maintenance actions. Key software innovations include digitalization to support the optimization of shipping performance and routes across supply chains, and real-time data collection and analysis to support recommendations and action. These software innovations will be critical to enable operational decision-making to be enhanced. In addition to R&D to support improvements in the energy efficiency of maritime transport, the adoption of alternative fuels such as gas and methanol is occurring and will grow further as the supply network for the fuels develops.

166. **Facilitate enabling environments**: the adoption of low-emission and energy-efficient maritime technologies and approaches requires the support of enabling environments at the international, regional and national levels. The development of enabling environments can be supported by robust data collection and analysis to support decision-making and the bridging of operation, hardware and software technology needs. Furthermore, the business of international maritime transport needs to consider how it can best enable decision-making to enhance the energy efficiency of shipping.

167. **Support technology transfer and capacity-building:** IMO is undertaking several actions to support technology transfer and capacity-building in the maritime sector. Key actions include: the development of specific regulations, awareness-raising activities, assessing technology transfer needs, supporting private sector partnerships, developing capacity-building tools and programmes supporting technical assistance, technology cooperation centres and 'train the trainer' efforts, and developing a global network for technology cooperation (see box 19).[105, 106]

[103] Presentation made by Finland at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/06_finland_lolan_margaretha_eriksson.pdf>.

[104] Presentation submitted by the International Maritime Organization for the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/imo_unfccc_tem_presentation_may_2016.pdf>.

[105] As footnote 103 above.

[106] As footnote 104 above.

Box 19
Clean Cargo Working Group

The Business for Social Responsibility and other industry leaders established the Clean Cargo Working Group in 2003 to support the use of standardized data, tools and reporting on the environmental performance of marine container transport. According to the Global Green Freight Programme, "data from more than 20 of the world's leading ocean carriers are reported to the working group, representing approximately 85 per cent of global ocean trade".

Source: Clean Cargo Working Group. Available at <http://www.globalgreenfreight.org/green-freight/clean-cargo-working>.

F. Policies and approaches in aviation

168. The aviation sector is currently responsible for 2 per cent of global CO_2 emissions, with 1.3 per cent from international aviation,[107] and approximately 13 per cent of fossil fuel use within the transport sector is used for aviation.[108] Aviation emissions are expected to grow under a 'business as usual' scenario. The International Civil Aviation Organization (ICAO) is supporting three linked environmental goals focused on reducing GHG emissions, improving local air quality and reducing noise pollution. Progress has been made in improving aircraft over the last 50 years, as fuel efficiency has increased by 80 per cent since 1960.[109] However, several measures are being developed to improve the industry further and support low-carbon aviation (see box 20). Good practice policy areas are highlighted below.[110]

169. **Design and implement low-carbon aviation technologies**: an aviation design standard to reduce CO_2 emissions from aircraft is being developed by ICAO. The standard will apply to aircraft design after 2020 and aircraft to be produced must meet the standard by 2028. The standard will be most stringent for larger aircraft used for international flights. Other technologies have also recently been implemented through the clean development mechanism to support low-carbon aircraft, including use of RE to provide power and airflow within the aircraft at the gate and systems to allow for aircraft taxiing while engines are off.

170. **Improve efficiency of systems, operations and air traffic management**: upgrades to aviation systems, operations and air traffic management are required to improve aviation performance in several areas that will support efficiency and emission reductions. Those areas include: reducing on-board equipment weight, improving airport and in-flight operations, developing globally interoperable data and systems, supporting optimal capacity and flexible flights and ensuring efficient flight paths.

171. **Scale up the deployment of sustainable alternative fuels**: several certified sustainable alternative fuels exist to reduce emissions from the aviation sector. Since 2011, 2,200 commercial flights have used alternative fuels; however, there is a need to scale up alternative fuel deployment. To encourage the development of such facilities, airlines have signed offtake agreements for renewable jet fuel from proposed biorefineries that will

[107] Presentation submitted by the International Civil Aviation Organization for the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/07_icao_icao_secretariat.pdf>.

[108] As footnote 43 above.

[109] According to REN21, "between 1990 and 2000, the average fuel efficiency of new aircraft of similar size improved by about 10 per cent, while aviation activity for both passenger travel and freight transport grew by a factor of 2.5, but it levelled off thereafter".

[110] As footnote 107 above.

produce fuel certified by ASTM International. Additional scaled-up deployment will depend on the design and implementation of key policies, including market-based measures.

Box 20
Sustainable Aviation Engagement Programme

The Airbus Sustainable Aviation Engagement Programme supports airlines in reducing emissions and supports other environmental goals through a long-term partnership. In the pilot phase, Airbus is working with Cathay Pacific, British Airways and KLM on four areas of support: aircraft technology and operations, air traffic management and sustainable fuels. Using experience from the pilot work, in 2016 the programme was planned to be expanded to other airline operators around the world.

Source: Airbus. "Airbus helps airlines further improve their environmental performance". Available at <http://www.airbus.com/presscentre/pressreleases/press-release-detail/detail/airbus-helps-airlines-further-improve-their-environmental-performance/>.

V. Options and ways to mobilize support for the implementation of policies to recognize the social and economic value of carbon and promote low-emission transport

A. Role of the subsidiary bodies and institutions under the Convention in advancing the objectives of the technical examination process on mitigation

172. Institutions under the Convention are playing an important role in supporting the use and recognition of the social and economic value of carbon and catalysing low-carbon transport actions. In particular, key actions taken under the SBI, the SBSTA, the Technology Mechanism, the Financial Mechanism and the Durban Forum on capacity-building are highlighted below.

173. In recognition of the essential role of both the SBI and the SBSTA in advancing the implementation of the Convention using best available information on science and technology, the COP, by decision 1/CP.21, paragraph 112, requested the bodies to organize jointly the TEPs for mitigation and adaptation. Noting that the constituted bodies under the Convention have a role in supporting TEP-M in accordance with their mandates and competencies and also noting that they report to the COP through the subsidiary bodies, the subsidiary bodies could provide a platform to catalyse action by Parties and non-Party stakeholders towards greater ambition by facilitating the coherency and inclusiveness of the overall effort undertaken by various bodies and stakeholders.

174. With regard to the role of the Technology Executive Committee (TEC), it was noted at the TEMs that, as the policy arm of the Technology Mechanism, the TEC is critically important in the analysis of technology policy issues and the provision of policy recommendations to support countries in enhancing their climate action. The TEC 2016–2018 rolling workplan takes into account key outcomes of the Paris Agreement and includes important activities in relation to facilitating mitigation action. Key elements include: (1) taking forward the outcomes of the TEC; (2) analysing possible linkages between the technology needs assessment (TNA) process and the NDC process; and (3) considering linkages between the Technology Mechanism and the Financial Mechanism. The TEC also acknowledges key challenges that will need to be overcome to advance mitigation action, including more effective engagement of national policymakers and

related key non-Party stakeholders, the provision of effective capacity-building support and matching the needs of countries with targeted support programmes and organizations.

175. The work of the TEC is informed by TNAs, providing information on country-driven priorities for mitigation and adaptation technologies, approaches and capacity-building needs. Ninety countries have submitted TNAs since 2001 and 41 per cent of energy-related TNAs have prioritized actions to support low-carbon transport through fuel and modal shifting. TNAs also present information on social, economic and environmental co-benefits of technology actions and can feed into NDC design and implementation.[111] TNAs will continue to play a major role in informing and enabling scaled-up action on low-carbon transport. The TEC has not yet pursued work related to the social and economic value of carbon. However, it may consider such topics and others in the future.

176. As the implementation arm of the Technology Mechanism, the Climate Technology Centre and Network (CTCN) has received approximately 100 requests from 60 countries, including requests related to low-carbon transport (approximately 8 per cent of requests) and the social and economic value of carbon. As an example, on the latter topic, the CTCN has supported gender-smart energy-sector investments in 11 countries in West Africa and water impact assessment for a biomass project in Asia. Going forward, the CTCN is keen to be more engaged in the TEP and to build the strong participation of Parties, especially developing country Parties.[112]

177. The two entities of the Financial Mechanism, the Global Environment Facility (GEF) and the Green Climate Fund (GCF), provide support to enable developing country Parties to implement climate action. Since its creation in 1992, the GEF has provided support to projects aligned with low-carbon development around the world.[113] In particular, since 1997 the GEF has committed USD 480 million to transport projects, with USD 6.7 billion leveraged in co-financing.[114] In particular, the GEF has developed a sustainable cities programme supporting 90 cities around the world with low-carbon transport projects and designed a manual for calculating GHG-related benefits of sustainable transport projects, among other activities.[115, 116] In relation to the social and economic value of carbon, the current GEF strategy includes efforts to support the establishment of ETSs and the design of measures to de-risk emission reduction investments. For example, the GEF supported China's development of a market-based energy efficiency programme through targeted capacity-building. The GEF plays a critical role in supporting the scale-up of low-carbon investment at the national and global levels and is interested in scaling up support related to the social and economic value of carbon.

178. The TEP-M has been instrumental in identifying barriers and unleashing the catalytic role of initiatives, which are crucial components for the success of the GCF. Low-carbon transport has been identified as a strategic priority for the GCF. In particular, one of the eight key impact areas under the GCF results management framework is to reduce emissions through increased access to low-emission sustainable transport.[117] The GCF does not currently have projects focused on the social and economic value of carbon, but is

[111] Presentation made by the TEC at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/tecpresentation-temtransport.pdf>.

[112] As footnote 10 above.

[113] GEF. *Investing in Sustainable Transport and Urban Systems. The GEF Experience.* Available at <https://www.thegef.org/gef/sites/thegef.org/files/publication/26211_lowres.pdf>.

[114] Presentation made by the GEF at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/03_gef_masako_ogawa.pdf>.

[115] GEF. *Transforming Transport Systems for a Sustainable Future*. Available at <https://www.thegef.org/gef/node/11579>.

[116] GEF. *Manual for Calculating GHG Benefits of GEF Transportation Projects*. Available at <https://www.thegef.org/gef/pubs/STAP/CO2-Calculator>.

[117] As footnote 82 above.

pursuing support opportunities in that area.[118] Broadly, the GCF has emphasized that NDC implementation will require high-level support, packages of diverse and effective financial mechanisms and strong coordination at the local and national levels, particularly across ministries of finance and environment.

179. Though not explicitly mentioned in decision 1/CP.21 in relation to the TEP, the role of the Durban Forum on capacity-building is also important. By focusing on aspects of capacity-building such as institutional frameworks and expert capacity, the Durban Forum facilitates action by developing countries, including in areas such as sustainable transport and the social and economic value of carbon.[119] In addition, under the Paris Agreement, the report of the Durban Forum serves as an input to the Paris Committee on Capacity-building.[120]

B. Role of multilateral development institutions and United Nations organizations supporting finance, technology transfer and capacity-building

180. Several multilateral development institutions and United Nations organizations are supporting finance, technology transfer and capacity-building for low-carbon development. In particular, several partnerships are focused on recognizing the social and economic value of carbon and promoting low-carbon transport.

181. Achieving key climate goals aligned with sustainable development objectives requires the engagement of actors across diverse sectors and disciplines. Bringing those actors together under collaborative partnerships allows for the integration of expertise and knowledge and the pooling of funding sources. Voluntary partnerships engage numerous stakeholders in supporting common intergovernmentally agreed climate and development goals and collaborative action.

182. The LPAA provides a key forum for supporting partnerships to enable low-carbon sustainable development. The LPAA plays three key roles that enable effective partnerships and climate action more broadly: mobilizing robust global action towards low-carbon and resilient societies; providing enhanced support to existing initiatives; and mobilizing new partners and providing a platform for the visibility of their actions, commitments and results.[121]

183. Building on the LPAA, it is important for partnerships to learn from each other and exchange knowledge, especially given the cross-sectoral nature of low-carbon development activities. Such exchange can occur at in-person forums during climate and sustainable development events and via online platforms. These forums can enable exchange of information and data and sharing of challenges and successes. For example, a Transport Day is held at the sessions of the COP to bring together various partnerships focused on low-carbon transport to exchange information and support peer networking.

184. As another example, the SDGs online platform provides a forum for remote knowledge exchange across climate and development partnerships. Finally, it is also important for partnerships to report on progress and achievement of goals. As an example, the progress reports from the Partnerships for SDGs online platform provide information on whether initiatives are on track to meet stated goals and objectives. Several partnerships highlighted herein are included on the SDGs progress report online platform.[122] The LPAA

[118] As footnote 10 above.

[119] Further information on the Durban Forum is available at <http://unfccc.int/cooperation_and_support/capacity_building/items/6802.php>.

[120] Decision 1/CP.21, paragraph 79.

[121] Information on the LPAA is available at <http://newsroom.unfccc.int/lpaa/about/>.

[122] United Nations Department of Economic and Social Affairs Division for Sustainable Development.

could be expanded to incorporate further activities to enable effective partnerships, including the convening of additional cross-partnership events for knowledge-sharing, the development of online information and data exchange portals and the further tracking and presentation of partnership progress.

185. Further support is required to enable activities related to the recognition of the social and economic value of carbon. In particular, there is a need to pursue a robust global assessment of the social and economic value of carbon that could support numerous efforts related to low-carbon development and, in turn, support further investment and technology transfer. There is also a need to build the capacity of the private sector and investors to use the social and economic value of carbon, as well as capacities within ministries of environment and finance and other government agencies. Multilateral partnerships and United Nations organizations highlighted in box 21 are working to provide support in those and other key areas related to the social and economic value of carbon.

186. Supporting finance, technology transfer and capacity-building for low-carbon transport will require action in a number of areas. As a starting point, there is a need for improved definitions of sustainable transport to allow for further stakeholder engagement, support of action and finance. Such definitions could be developed from the ground up on the basis of local technical needs and capacities. Building on this point, there is a need for improved collection and management of data on transport supply and demand to inform technical areas of focus and related definitions. Such actions will leverage further support from the financial community for investment in low-carbon transport projects and programmes and build demand for such transport services at the local and national levels.

187. Strengthening the policy and regulatory environment for low-carbon transport is also a key area of need. In particular, the development of loan guarantees and other financial mechanisms to reduce risks related to low-carbon transport infrastructure and investment could be an area of focus in a number of contexts. International funding and support institutions could focus on the demonstration of innovative approaches to enable low-carbon development, strengthening national and local investment frameworks and building capacity for project and programme implementation and MRV. There is also a particular need for building capacity within the private sector in relation to financial mechanisms and incentives to reduce the risk of investment in low-carbon transport and within governments to develop pools of aggregated investment-ready projects.

188. Developing further domestic revenue sources for low-carbon transport is another important area where support is required. Building the capacity of local governments to effectively design and implement the policy instruments could support the scaling up of low-carbon transport. Also, support programmes, such as TRANSfer, have highlighted the need for long-term (e.g. several years) and regular (e.g. daily) collaboration to support low-carbon transformational and structural changes in the transport sector. For example, effective design of a transport nationally appropriate mitigation action can require one and a half to two years of support. Activities to address key constraints related to capacity development to prepare a strong project pipeline in the transport sector, rather than simply financial proposals, are also necessary.[123]

Partnerships for Sustainable Development Goals. Available at <https://sustainabledevelopment.un.org/content/documents/2329Partnership%20Report%202016%20web.pdf>.

[123] Presentation made by Germany at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/tem_presentation_markus_kurdziel_long_version.pdf>.

Box 21

Selected multilateral institutions and United Nations organizations supporting activities related to the social and economic value of carbon

The World Bank supports three key initiatives that support activities related to the social and economic value of carbon: the Carbon Pricing Leadership Coalition, which facilitates carbon pricing, peer learning and knowledge-sharing among governments, the private sector and civil society leaders; the Partnership for Market Readiness, which provides support, builds capacity and enables knowledge-sharing to prepare and implement climate change mitigation policies, including carbon pricing; and the Networked Carbon Markets Initiative, which focuses on complementary services, such as enabling comparability and addressing challenges associated with linking carbon markets, based on unique circumstances.

The European Bank for Reconstruction and Development (EBRD) supports a number of activities related to the social and economic value of carbon to enable the transition to green economies. In particular, EBRD uses carbon price scenarios to inform feasibility studies for investments under emissions trading schemes and social cost of carbon studies to inform policy design and other low-carbon investments.

The United Nations Environment Programme is a partner of the United Nations Global Compact, which supports Business Carbon Pricing Champions and Business Leadership Criteria on Carbon Pricing, which is a workstream of the Carbon Pricing Leadership Coalition highlighted above.

Carbon Disclosure Project (CDP) works with thousands of companies and over 800 institutional investors to support climate action in the private sector. In particular, CDP supports partners in applying carbon pricing and integrating climate risks and opportunities with broader business strategies. CDP engages with the Lima–Paris Action Agenda and other multilateral initiatives, including the United Nations Global Compact and the Science-based Targets Initiative.

The World Resources Institute is involved with many efforts to support carbon pricing in the public and private sectors. Key initiatives include the United Nations Global Compact and the Science-based Targets Initiative, among others.

The Organisation for Economic Co-operation and Development (OECD) is a panel member of the Carbon Pricing Leadership Coalition, bringing valuable expertise to support the coalition. In addition, OECD has produced several reports on carbon pricing, the social cost of carbon and fossil fuel subsidy reform that inform efforts around the world.

The International Institute for Sustainable Development (IISD) is a key actor engaged with the Global Subsidies Initiative. IISD has produced reports and knowledge products describing good practices and important steps to support fossil fuel subsidy reform using experience around the world.

189. Finally, considering regional approaches to low-carbon transport that move beyond national borders can also allow for the pooling of resources, more efficient planning and implementation and cost savings. Capacity-building, development of knowledge resources and good practices and support for collaboration across countries could enable positive outcomes at the regional level.[124] Selected multilateral institutions and United Nations organizations that are providing support in a number of low-carbon transport areas are presented in box 22.

[124] United Nations. "Issue briefs prepared by the technical working group for information of the Secretary-General's high-level advisory group on sustainable transport". Available at <https://sustainabledevelopment.un.org/content/documents/7627Compiled%20issue%20briefs_final%20version.pdf>.

Box 22

Selected multilateral institutions and United Nations organizations supporting activities related to low-carbon transport

The **EcoMobility initiative** of **ICLEI – Local Governments for Sustainability** includes three elements: the EcoMobility Alliance of cities that have achieved excellent results in sustainable mobility; EcoMobility World Festival that will present a real-life vision of car-free urban living in the future and feature a neighbourhood in Suwon, Republic of Korea; and EcoMobility SHIFT as a project to develop a total quality management scheme to assess current EcoMobility performance and evaluate the effectiveness of policies in terms of environment, accessibility, safety and equity.

International climate initiative TRANSfer supports low-carbon transport nationally appropriate mitigation action (NAMA) development, financing and implementation. To date, the initiative has supported the development of four NAMAs (with two at the implementation stage), developed a number of tools and handbooks and mobilized significant finance. TRANSfer is seeking to move to a multi-donor platform to scale up the provision of support to countries. TRANSfer also works with several organizations and networks such as MobiliseYourCity and the Partnership on Sustainable Low Carbon Transport to build a global dialogue, learning and consensus around low-carbon transport.

The International Civil Aviation Organization (ICAO) is a United Nations specialized agency that provides a forum for civil aviation cooperation, including on greenhouse gas (GHG) emission mitigation and local air quality improvement. To enable GHG emission mitigation, ICAO supports technologies and standards, operation and market-based measures and alternative fuels.

The International Maritime Organization (IMO) is a United Nations specialized agency that supports a comprehensive regulatory framework for shipping. Broadly, IMO supports energy efficiency in the shipping sector through policies, practices and data collection. In addition, IMO supports capacity-building, awareness-raising and global dialogue to support emission reductions in the maritime sector.

The Institute for Transportation & Development Policy (ITDP) supports cities globally in addressing transport challenges and enabling solutions for low-carbon transport aligned with development goals. ITDP provides technical assistance and supports public awareness-raising and policy decision-making for a low-carbon transport future. In particular, ITDP has focused on the effective design of bus rapid transit systems, among other important initiatives.

The Low-Emission Development Strategies Global Partnership Transport Working Group provides technical assistance, tools and training for low-emission development in the transport sector. In particular, the group works to: (1) share approaches and practices for transport and land-use planning; (2) provide transport analysis methods and tools; and (3) offer peer-to-peer, transport-specific financial training and expert assistance.

The International Transport Forum is an intergovernmental organization with 57 member countries. Focused on strategic outcomes, ITF supports policymaking and brings together transport ministers for an annual summit. The ITF goal is to help to shape the transport policy agenda on a global level and ensure that it contributes to economic growth, environmental protection, social inclusion and the preservation of human life and well-being.

The **World Bank** supports low-carbon transport projects focused on land-use planning, shifting to lower-carbon, climate-resilient efficient transport and accounting for GHG emissions in the transport sector. It is working with a number of partners to strengthen the recognition of sustainable transport as a key part of the transition to a decarbonized economy by the end of this century.

The United Nations Human Settlements Programme supports a number of activities to promote socially and environmentally sustainable human settlements development and the achievement of adequate shelter for all and engages with work to support low-carbon transport at the urban level.

C. Selected examples of initiatives related to the social and economic value of carbon and low-carbon transport

190. To further mobilize support and advance action related to the social and economic value of carbon and low-carbon transport, several of the institutions highlighted above as well as many others are collaborating under various initiatives. Key selected initiatives are highlighted below and a more comprehensive list of initiatives is provided in annex II (table 4).

191. The LPAA encourages collaboration across the public and private sectors to enable ambitious climate action through effective policy design and implementation, notably policies related to carbon pricing.[125] Various LPAA and other initiatives are supporting key actions to enable climate action related to the social and economic value of carbon, carbon pricing, carbon markets, fossil fuel subsidy reform and cross-cutting support.

Carbon pricing

192. **The Carbon Pricing Leadership Coalition** (CPLC), a voluntary partnership, convenes leaders from the public and private sectors and civil society to share lessons learned and good practices related to carbon pricing and to develop evidence-based policies and systems to support effective carbon pricing. CPLC has a long-term objective of supporting a carbon price for the global economy.[126]

193. **The High-Level Panel on Carbon Pricing** convenes Prime Ministers, Presidents and subnational leaders from eight countries and leaders from the World Bank, OECD and the International Monetary Fund to set a transformation vision for carbon pricing for 2020 and beyond. In particular, the panel put forward the goal to double the percentage of global emissions covered by explicit carbon prices to 25 per cent by 2020 and to double it again to 50 per cent within a decade.[127]

194. **The United Nations Global Compact**, through collaboration with the United Nations Environment Programme (UNEP), the UNFCCC secretariat and partners of the Caring for Climate (C4C) initiative (World Resources Institute, Carbon Disclosure Project, The Climate Group, United Nations Foundation and Principles for Responsible Investment) is supporting and encouraging companies to become Carbon Pricing Champions. Key initiatives supported include the Business Leadership Criteria on Carbon Pricing (a workstream of the CPLC described above) and C4C, which advances the role of business in addressing climate change and provides a framework for business leaders to implement practical climate change solutions and help to shape public policy (related to carbon pricing and other areas).[128]

Carbon markets

195. **The G7 Carbon Market Platform** is a forum for dialogue on carbon market policies. In addition, the platform seeks to identify gaps to enable collaboration and common approaches related to carbon markets.[129]

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[125] As footnote 121 above.

[126] Information on CPLC is available at <http://www.carbonpricingleadership.org/leadership-coalition/>.

[127] World Bank. Speeches & Transcripts. *Carbon Pricing Panel – Setting a Transformational Vision for 2020 and beyond.* 21 April 2016. Available at <http://www.worldbank.org/en/news/speech/2016/04/21/carbon-pricing-panel---setting-a-transformational-vision-for-2020-and-beyond>.

[128] United Nations Global Compact. *Executive Guide to Carbon Pricing Leadership. A Caring for Climate Report.* Available at <https://www.unglobalcompact.org/docs/issues_doc/Environment/climate/CarbonPricingExecutiveGuide.pdf>.

[129] German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. *Carbon Market Platform. Strategic Dialogue on Carbon Markets and the Regulatory Environment.* Available at <http://www.bmub.bund.de/fileadmin/Daten_BMU/Download_PDF/Klimaschutz/

196. **The Networked Carbon Markets initiative** (convened by the World Bank) brings together public and private sector and civil-society stakeholders to discuss and develop plans for an international carbon market and trading across borders. Building on pilot work, in 2016 the initiative is focused on supporting linked carbon action within jurisdictions and will include modelling and analytical efforts and global outreach and peer learning.

197. **The Partnership for Market Readiness** (convened by the World Bank) facilitates peer exchange and learning among 30 government and technical institutions engaged with carbon markets and pricing. The partnership enables readiness for carbon markets through effective policy design and supports capacity-building and peer learning programmes at the country, regional and global levels.[130]

Fossil fuel subsidy reform

198. **Friends of Fossil Fuel Subsidy Reform** brings together non-G20 countries to support consensus building around fossil fuel subsidy reform. Established in 2010, the members are Costa Rica, Denmark, Ethiopia, Finland, New Zealand, Norway, Sweden and Switzerland.[131]

199. **The Global Subsidies Initiative** was established by the International Institute for Sustainable Development in 2005 to analyse subsidies and their impact on sustainable development. It seeks to encourage individual governments to undertake unilateral reforms on subsidy policy where these would deliver clear economic, environmental and social benefits and to generate a consensus in the World Trade Organization and in other forums on the need to take resolute, ongoing and systematic action to reduce or eliminate subsidies that both distort trade and undermine sustainable development.[132]

200. Building on previous discussions and a pledge made in 2009, in May 2016 the G7 made a pledge to end most fossil fuel subsidies by 2025.[133]

201. Transformative change within the transport sector is required to reach the 2 ºC goal described in the Paris Agreement. The challenges impeding such transformation could be overcome through collective action, strong collaboration and partnerships bringing together governments, private companies, civil society and other non-Party stakeholders. Mobilization of such action is occurring through the LPAA and the Paris Process on Mobility and Climate.[134] As presented in figure 12, key initiatives under those programmes also align closely with actions articulated in NDCs.

kohlenstoffmarkt_handout_en_bf.pdf>.

130 Partnership for Market Readiness. *Supporting Action for Climate Change Mitigation*. Available at <https://www.thepmr.org/content/supporting-action-climate-change-mitigation>.

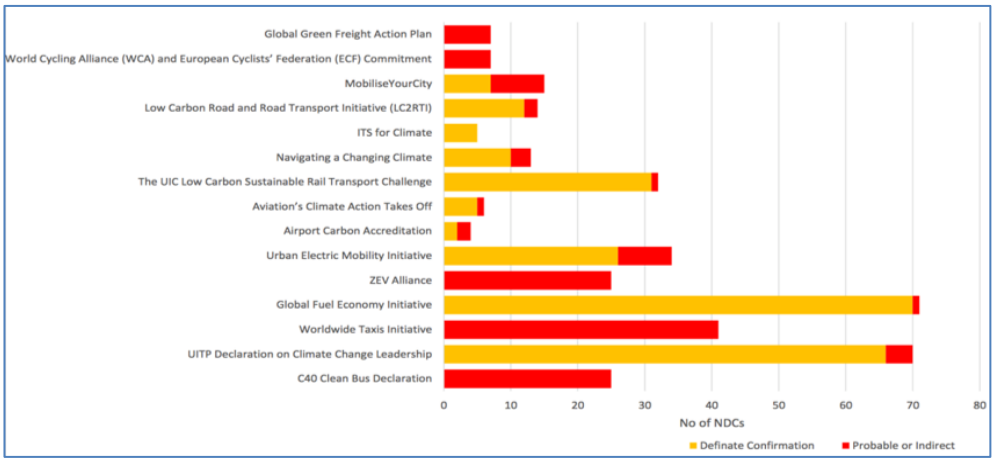
131 Presentation made by New Zealand at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/05_new_zealand_rebekah.pdf>.

132 Information on the Global Subsidies Initiative is available at <https://www.iisd.org/gsi/about-gsi>.

133 As footnote 6 above.

134 As footnote 55 above.

Figure 12
Lima–Paris Action Agenda initiatives in transport and alignment with nationally determined contributions



Source: Presentation made by the Partnership on Sustainable Low Carbon Transport at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/transport_tem_cornie_huisenga_ppmc.pdf>.

Abbreviations: C40 = C40 Cities Climate Leadership Group, ITS = intelligent transport system, UIC = International Union of Railways, UITP = International Union for Public Transport, ZEV = zero emission vehicle.

202. Effective and long-standing programmes supporting low-emission transformation in the transport sector, such as TRANSfer, have demonstrated a need for long-term collaboration, commitment and capacity-building through targeted assistance and the development of specialized resources such as handbooks, toolboxes and MRV guidelines.

203. Multilateral partnerships between governments, cities, development institutions and the private sector can play a critical role in building commitment and supporting robust capacity-building and ongoing collaboration. Selected initiatives launched under the LPAA are highlighted below.

Cross-cutting initiatives

204. **The Paris Process on Mobility and Climate** was launched in 2015 as a platform that brings together over 200 organizations from the United Nations, development institutions, civil society, business and academia in an open and inclusive manner. The effort has made strong progress in its first year, including: convening 15 major non-state initiatives on transport under the LPAA; supporting several events, such as the LPAA high-level transport focus event; expanding the knowledge base on transport and climate change by launching the #WeAreTransportation information campaign; documenting over 100 innovative low-emission transport actions through the 80 Days Campaign on Climate Action in the Transport Sector; and convening and supporting a number of activities at COP 21. The process has proposed a number of short-, medium- and long-term actions to accelerate sustainable transport efforts in 2016, including developing a common framework and goals for transport, sustainable development and climate change, a global road map to decarbonize transport, and support for quick-win actions to kick-start transport sector transformation.[135]

205. **MobiliseYourCity** is working to engage 100 cities in developing and developed countries and to support commitments around improved urban mobility and CO_2 emission mitigation, share best practices and support mobilization and access to funding for low-

[135] As footnote 55 above.

carbon transport. Notably, the initiative will aim to support a 50–75 per cent CO_2 emission reduction in urban transport by 2050 compared with a 'business as usual' scenario. To achieve that objective the initiative will support adapting transport methodological frameworks, developing sustainable national and urban mobility plans and policies, designing monitoring tools, and providing technical assistance and capacity-building at the national and local levels.[136]

206. **The Partnership on Sustainable Low-Carbon Transport (SLoCaT**) is a partnership of more than 90 organizations, including United Nations agencies, multilateral and bilateral development banks, NGOs and the private and academic sectors. SLoCaT's Bridging the Gap programme connects Parties to the Convention with transport expertise and also provides a website, informational resources and organizes Transport Day events at sessions of the COP as well as related side events.[137]

207. **The OECD ITF** is an intergovernmental organization with 57 member countries. It launched the Decarbonising Transport project in May 2016 to help to close gaps between commitments and delivery on climate change mitigation and provide decision makers in government and business with the navigation tool that they need to chart the pathways to decarbonize transport. It will integrate and expand the ground-breaking quantitative modelling work of ITF on international freight transport, air passenger travel and urban mobility to deliver the most precise and comprehensive model of global transport activity available. The ambition of the project is to leverage the capabilities of the ITF data-driven models along with those of project partners by linking them within a dynamic modelling framework that will enable the simulation of the effects of policy measures while taking into account multilayered interdependencies. Anchored in the ITF Corporate Partnership Board, the project will involve companies, governments, universities and research institutions, financial sector entities, multilateral agencies, international organizations, professional associations and other interested stakeholders.

Public transport

208. **The C40 Clean Bus Declaration** commits cities to reduce emissions from vehicles by adopting innovative clean bus technologies such as electric, hybrid and hydrogen buses. By incorporating low- and zero-emission buses, cities signing the declaration help to curb GHG emissions and air pollution from the rapidly growing urban transport sector and raise overall levels of climate ambition.

209. **International Association of Public Transportation (UITP) and the Declaration on Climate Leadership:** UITP recently announced a commitment to doubling the market share of public transport by 2025. At the 2014 United Nations Climate Summit, UITP put forward a declaration to double the market share of public transport by 2025 and build capacity and technical knowledge through action on the ground and committed to supporting cities to ensure efficient urban mobility and implementation of the SDGs. Key actions include: supporting the integration of urban planning, public transport, energy and information technologies; developing public and other low-carbon modes of transport; and supporting efforts to control and price traffic and parking.[138]

210. **Low Carbon Rail Transport Challenge of UIC**: in 2016 UIC launched the Low Carbon Rail Transport Challenge, which supports scaled-up use of low-carbon rail for transport and freight.[139] The challenge puts forward ambitious but achievable targets for

[136] Presentation made by CODATU at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/mobiliseyourcity_tem_mitigation_mael_martine_20160523.pdf>.

[137] See document FCCC/TP/2015/4.

[138] Presentation made by UITP at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/unfccctem_philip_turner.pdf>.

[139] United Nations News Centre. 23 September 2014. "Commitment to sustainable transport mobilized at UN Climate Summit". Available at

improved energy efficiency, GHG emission reductions and improved balance and consideration of modes of transport.[140]

Individual vehicles

211. **The Global Fuel Economy Initiative (GFEI)** is a collaboration of IEA, UNEP, ITF, the University of California-Davis, the International Council on Clean Transportation and the Fédération Internationale de l'Automobile Foundation. GFEI enables real-world improvements in fuel economy through global outreach, an in-country capacity-building toolkit and research.[141]

212. **G20 heavy-duty vehicle standards to improve efficiency and reduce emissions**: the G20 major economies have committed to introducing heavy-duty vehicle standards and efficiency policies and practices to support GHG emission reductions. Such policies and actions are key aspects of the G20 2014 Energy Efficiency Action Plan.[142]

213. **The Electric Vehicles Initiative** has been developed under the Clean Energy Ministerial to enable the deployment of 20 million EVs (including plug-in hybrid electric and fuel cell vehicles) globally by 2020. Key activities include: supporting national deployment goals, best practices and policies; sharing experiences at the city level; enabling information sharing on RD&D programmes; and engaging the private sector with critical dialogues and actions.[143]

D. Way forward in strengthening collaboration across governments, non-Party stakeholders and other stakeholders

214. There is a need to catalyse further action in the two thematic areas covered in this paper, namely recognizing the social and economic value of carbon and promoting efficient public transport.

Social and economic value of carbon

215. Potential catalytic actions and approaches that can bring together governments, non-Party stakeholders and multilateral organizations through high-value partnerships to promote and recognize the social and economic value of carbon are:

(a) **Robust assessment of the global social and economic value of carbon**: building on learning and efforts around the world, a collaborative analysis could be undertaken to assess the climate change impacts and losses up to a specified date using the good practices highlighted in chapters III and IV above. This collaborative analysis could support global consensus building on the social and economic value of carbon and could be coordinated by NGOs with the technical expertise to move the process forward;

(b) **Further development of methodologies to quantify the co-benefits of avoided emissions or removals**: additional work is needed to understand the full co-benefits of avoided emissions and removals as well as methodologies to account for those co-benefits within estimates of the social and economic value of carbon. Collaborative teams could be convened to undertake that work and the outputs could be integrated with those of broader global assessment activities;

<http://www.un.org/apps/news/story.asp?NewsID=48794#.V2l5e2QrIy4/>.

140 Craven N. *UIC Low Carbon Rail Challenge*. Technical Report. UIC. Available at <http://old.uic.org/IMG/pdf/low_carbon_rail_challenge_technical_report.pdf >.

141 Information on the FIA Foundation is available at <http://www.fiafoundation.org>.

142 As footnote 85 above.

143 Information on the Electric Vehicles Initiative is available at <http://www.cleanenergyministerial.org/Our-Work/Initiatives/Electric-Vehicles>.

(c) **Supporting global consensus building on the social and economic value of carbon**: undertaking the above assessment in a collaborative manner could allow for consensus building at the global level on the social and economic value of carbon. Such consensus could support consistency around climate-related policymaking and the cost-effectiveness of policy design and implementation;

(d) **Coordination across key actors**: to support consensus building on the social and economic value of carbon, coordination is needed at the regional and national levels and particularly across ministries of environment and finance. Multilateral partnerships highlighted in this paper could support coordination efforts in collaboration with UNFCCC institutions and potentially through high-level meetings organized under the Road Map for Global Climate Action process highlighted in chapter VI below;

(e) **Increasing knowledge and awareness and building capacity**: there is also a need for targeted support and information-sharing on common methodologies and standards to support effective carbon pricing. In particular, project developers and investors require specific capacity-building on the social and economic value of carbon and carbon pricing to support investment decisions. Multilateral initiatives highlighted in this paper could be built upon and expanded to provide further support in this area.[144]

216. Expanding on those areas, there is also a need to build further political momentum on the topic of the social and economic value of carbon through the UNFCCC and other multilateral processes. Further, to move from high-level political momentum to implementation, there is a need for the participation of diverse non-Party and other stakeholders (private sector, NGOs, etc.) in supporting the recognition and promotion of the social and economic value of carbon.[145]

Low-carbon public transport

217. Scaling up low-carbon action in the transport sector is an area of great importance in reducing global GHG emissions. As proposed by the Paris Process on Mobility and Climate, going forward, low-carbon transport action can be catalysed around three collaborative areas at the global level: building a common global framework and goals (from 2016 to 2030); developing a sustainable low-carbon transport road map (with time frames up to 2050 and 2080); and implementing quick-win solutions to encourage short-term action up to 2020 and to kick-start transformation. These activities would bring together governments, non-state actors and other stakeholders to enable comprehensive action and support.[146]

218. Under this approach, key actions for support would include: speeding up the phase-out of fossil fuel subsidies at the global level; supporting sustainable urban mobility planning; recognizing effective sustainable freight programmes and schemes; and increasing fuel economy standards. Quick-win solutions are also a key aspect and could be determined in relation to the following criteria: feasibility of implementation by 2020; substantial sustainable development and climate change benefits; testing at scale and replicability across regions; contribution to long-term economic transformation; cost-effectiveness; and ability to spur action in the area of passenger and freight transport.[147]

219. To move the three elements of a global approach to low-carbon transport forward, the following actions could be taken in 2016:

[144] Presentation made by the European Bank for Reconstruction and Development at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/02_ebrd_jan_willem.pdf>.

[145] As footnote 10 above.

[146] As footnote 55 above.

[147] Text drawn directly from the presentation made by SloCat at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/transportation_tem_cornie_huisenga_ppmc.pdf>.

(a) Building consensus around the three key elements: a common framework and tracking approach, a global road map and quick wins;

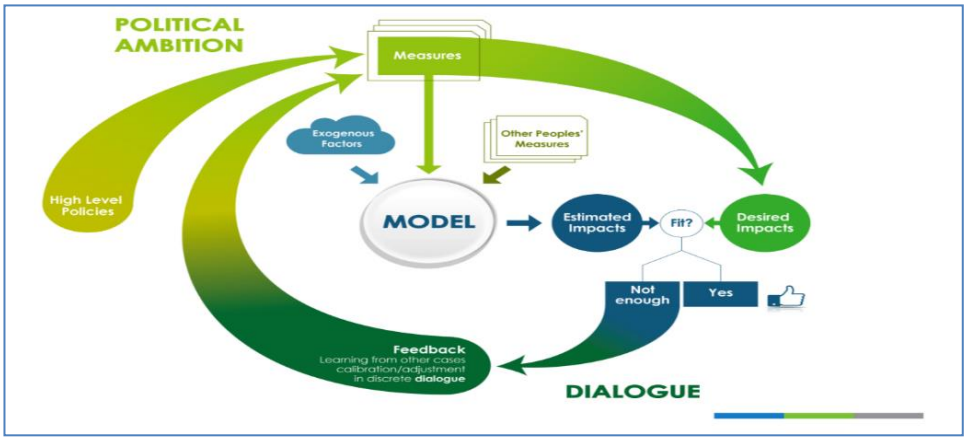
(b) Engaging all key stakeholders, including national and subnational governments, the private sector and NGOs, in order to build support and buy-in;

(c) Developing a medium-term strategy to mobilize action in support of NDCs;

(d) Designing a governance structure to strengthen and expand existing coalitions on sustainable transport and, where helpful, creating new institutional arrangements.[148]

220. Building on the actions highlighted above, further efforts to develop a global modelling framework and collaborative dialogue will be critical in supporting a decarbonized or 'zero net emission' economy by 2050. In particular, the continued work of the ITF Decarbonising Transport project is supporting the development of a comprehensive quantitative modelling framework covering all modes of transport and policy instruments and actions to support the robust analysis of complementary actions and policies globally with the engagement of diverse stakeholders (see figure 13).[149]

Figure 13
The Decarbonising Transport project of the International Transport Forum



Source: Presentation made by the International Transport Forum at the technical expert meeting in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_itf_jari_kauppila.pdf>.

VI. Possible next steps to accelerate policy implementation in the pre-2020 period

221. The TEP-M will continue to catalyse and support scaled-up low-carbon development action. Governments around the world and numerous multilateral initiatives and institutions covered in this paper, as well as the subsidiary bodies and UNFCCC institutions, will play key roles in moving the TEP-M forward.[150] To advance the process in the pre-2020 period, the following actions could be pursued:

(a) **Enabling regional dialogue, engagement and action**: regional dialogues and forums to present outcomes of the process and actively engage new and targeted non-Party stakeholders could be supported by the TEP. They could enable more effective

[148] As footnote 55 above.
[149] As footnote 51 above.
[150] As footnote 10 above.

engagement of policymakers at the national level and related non-Party stakeholders and allow regional organizations engaged in providing capacity-building, technical and financial support to tailor their activities to the needs of diverse developing countries;

(b) **Sharing replicable success stories**: as presented in this paper, many replicable success stories from around the world demonstrate effective approaches and policies to support low-carbon transport and address technical and non-technical challenges in utilizing the social and economic value of carbon, as well as in implementing different carbon pricing instruments. It is important that successes and challenges related to policies and actions continue to be shared through the TEP to allow for knowledge exchange and peer learning;

(c) **Focusing on approaches to improve support mechanisms**: an inclusive dialogue and event (e.g. 'Support Day') could be organized with a focus on targeted issues related to support through finance, capacity-building and technology transfer. Such an event could be organized as part of the Climate Action Fair and could be informed by broader discussions under the Durban Forum on capacity-building focused on mitigation;

(d) **Improving the TEMs** by: (1) having more focused meetings with deeper discussion of technical issues; (2) increasing interactivity through informal breakout groups; (3) considering the failures and difficulties of projects and programmes to support learning and discussion on solutions; (4) learning about innovations relating to technology, finance and business models and partnerships; (5) bringing in diverse perspectives of stakeholders working on the same project; (6) further engaging non-Party stakeholders as the actual implementers of action; (7) convening the TEMs not only in conjunction with the sessions of the subsidiary bodies to allow for the wider participation of Parties and non-Party stakeholders; and (8) allowing adequate planning time and undertaking a follow-up process to continue engagement;

(e) **Continuing to support the momentum of the LPAA**: several initiatives launched under the LPAA are playing an important role in accelerating policy implementation in the pre-2020 period. They could be actively engaged in each of the next steps listed above in order to strengthen momentum and support activities under way;

(f) **Engaging the private sector** is also a key area of emphasis to accelerate policy implementation in the pre-2020 period. In particular, business and industry NGOs (BINGOs) have recommended individual consultations between BINGO representatives and individual constituencies to inform climate discussions and actions, the design and delivery of a meeting before sessions of the COP with BINGOs and constituencies, and the development of an online forum to support information exchange and discussion.

222. Building on the LPAA and key initiatives, the Road Map for Global Climate Action could provide a strong foundation for accelerated policy implementation in the pre-2020 period. The road map lays out a plan to build on the initiatives of the LPAA, engage with further non-Party stakeholders and develop new initiatives with greater geographical diversity.[151]

223. While the TEP focuses on the pre-2020 period, the policies and actions presented in this paper can provide a critical foundation for the implementation of actions post-2020. In particular, the policies and actions can be scaled up over time to support increasingly ambitious NDCs and crucial goals presented in the Paris Agreement. In this context, the TEP-M can continue to serve as a forum for near-term action while also enabling a strong and clear connection to implementation needs in the post-2020 period as well as longer-term objectives.

[151] As footnote 9 above.

Annex I

Policy options relating to the social and economic value of carbon and efficient public transport and energy efficiency of vehicles

Table 2
Policy options and enabling practices to recognize the social and economic value of carbon

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
Estimating and applying the social and economic value of carbon	
• **Convene stakeholders** with a view to informing efforts to estimate and apply a social and economic value of carbon and to build support more broadly through workshops and meetings aimed to receive input and feedback on approaches, methodologies and application • **Address uncertainties** in order to consider a full picture of potential climate impacts and risks and estimate the social and economic value • **Establish key parameters (**discount rate applied, time horizon and equity weighting for different regions, among others) – a critical step in evaluating the social and economic value of carbon[d] • **Support consistency** among multiple policies and/or projects within a government or institution for improved efficiency in the assessment and communication of the approach used to estimate policy or project decisions taken on the basis of the social and economic value of carbon • **Build capacity** to estimate an internal carbon price and the social and economic value of carbon, set appropriate project boundaries, collect and develop reliable, accurate and standardized data, and apply estimates consistently to support regulatory decision-making and policymaking	• European Bank for Reconstruction and Development – various applications[a] • Owens Corning – corporate carbon price[b] • Rio Tinto – exposure to carbon pricing mechanisms across jurisdictions[c] • Shell – internal CO_2 project screening value[d] • Slovakia – design of a finance instrument for low-carbon technologies • United Kingdom – social cost of carbon to inform various regulations and actions[e] • United States – social cost of carbon to inform various regulations and actions[f]
Carbon pricing – high-level good practices	
• **Ensure fairness and equitable outcomes** of the carbon pricing mechanisms integrating a 'polluter pays' framework and designed to ensure equitability across cost and benefit allocations, with a particular emphasis on lessening burdens on vulnerable populations[g] • **Integrate carbon pricing with broader climate strategies and action** by collecting data, establishing greenhouse gas (GHG) emission inventories, assessing broader policy portfolios in relation to mitigation and development impacts, designing monitoring and evaluation strategies and implementing policies. Policy packages can be designed to enable maximum effectiveness of policy action and investment • **Ensure stability and transparency of climate policy frameworks** for the success of carbon pricing mechanisms and broader climate action • **Enable cost-effective outcomes** achieved through carbon pricing mechanisms used by market actors to reduce emissions. To lessen costs, carbon pricing administrative processes can build on and be integrated with similar policy	• See examples below for emission trading schemes (ETSs) and carbon taxes

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
frameworks (e.g. tax policy frameworks)[h]	
• **Align with environmental objectives** (e.g. local air quality improvement) for effective policy design built around high-level goals established at the beginning of the policy development process[i]	
Carbon taxes	
• **Determine the carbon tax payers** based on the circumstances of individual countries and jurisdictions (i.e. where the tax falls within the energy supply chain). Carbon taxes may be most cost-effectively applied to upstream energy suppliers rather than at the midstream (e.g. utility) or downstream (e.g. household and energy-using business) levels[h]	• Boulder, Colorado, United States – USD 12–13/t CO_2 (2013)[h]
• **Establish the tax rate** by either setting the rate based on the social and economic value of carbon or aligning the rate with specific emission or revenue goals. In both cases, the tax rate can be evaluated and increased over time in relation to marginal emission damages and/or broader emission and development goals[h, j]	• Costa Rica – 3.5 per cent tax on hydrocarbon fossil fuels (2013)
• **Evaluate carbon tax impacts and adjust evaluations over time** to inform tax level and other policy adjustments over time. Impacts of carbon tax revenue reinvestment programmes (e.g. in low-carbon infrastructure projects) can also be assessed to communicate benefits and inform policy direction over time[j]	• Denmark – USD 16.41/t CO_2 (2013)
• **Reduce costs** associated with carbon taxes by using existing monitoring, reporting and evaluation systems and other administrative processes	• Portugal – carbon tax and climate funding
	• Quebec, Canada – USD 3.20/t CO_2 (2013)
	• South Africa – draft carbon tax bill (2015)[c]
	• Switzerland – USD 34.20/t CO_2 (2013)
Carbon markets or emission trading schemes	
• **Design an effective ETS planning and implementation process** by identifying the sectors to be covered by an ETS, setting an overall emissions cap, emission allowance allocation approach, legal and regulatory framework, time frames, financial instruments, stakeholder engagement and consultation channels and considering opportunities for linking with other ETSs and other climate development goals	• Alberta, Canada – ETS
• **Support a robust framework** for collecting and analysing GHG emission and other key economic and social data, developing a strong monitoring, reporting and evaluation framework, reducing carbon leakage through various actions, and ensuring a system that accurately accounts for carbon offsets	• California, United States – ETS
• **Enable cost-effectiveness** by allowing for flexibility within the system that supports lower-cost abatement options. This flexibility gives market participants several choices regarding how to fulfil their ETS requirements. Further, effectively integrating an ETS with complementary policies within specific sectors can also support cost-effective outcomes. Linking ETSs may also improve cost-effectiveness as it increases the number of carbon abatement options	• China, various subnational – ETS
• **Design a predictable and transparent yet flexible policy framework** to support long-term investment mobilization	• European Union – ETS
• **Consider design features to link with other markets** to allow for transactions and compliance across markets. Specific design features to support linkages will be dependent on unique jurisdictional circumstances.[c,k,l] The regulators of each ETS would need to collaborate to ensure the markets are compatible and also to analyse the implications of linkages	• Kazakhstan – ETS

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
Fossil fuel subsidy reform	
• **Consider timing, coordinate across entities and develop a detailed plan** with the key steps, including engaging stakeholders and communicating to the public to build awareness, analysing reform options and timing for implementation, assessing impacts and mitigation options, implementing pricing reforms and impact mitigation actions, monitoring and evaluation, and improving over time. Gradual reform can be an effective approach and allow for incremental action on various fuel subsidies over time. It is also critical to build support and coordination mechanisms across government entities and sectors that will be involved and affected • **Establish an effective pricing approach** that eliminates subsidies, allows for automatic reflection of international price changes, provides transparency and integrates an effective enforcement mechanism • **Assess and address impacts** on various population groups and sectors. Assessments can be stakeholder-driven to ensure all relevant impacts are considered and to build support for action • **Support outreach and awareness-raising** among the public and stakeholders	• France – fossil fuel subsidy reform[m] • Ghana – fossil fuel subsidy reform[m] • Group of Seven - declaration on fossil fuel subsidy reform[n] • India – diesel subsidy reform[o] • Malaysia – fuel subsidy reform[p] • Senegal – fossil fuel subsidy reform[m]

Sources:

[a] Presentation made by the European Bank for Reconstruction and Development at the technical expert meeting (TEM) in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/02_ebrd_jan_willem.pdf>.

[b] Presentation made by the Carbon Disclosure Project at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/03_cdp_sara.pdf>.

[c] Partnership for Market Readiness. *Preparing for Carbon Pricing Case Studies from Company Experience: Royal Dutch Shell, Rio Tinto, and Pacific Gas and Electric Company.* Available at <https://openknowledge.worldbank.org/bitstream/handle/10986/21358/PCP.pdf?sequence=4&isAllowed=y>.

[d] Presentation made by Shell at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/04_shell_angus.pdf>.

[e] Watkiss P. *The Social Cost of Carbon.* Organisation for Economic Cooperation and Development (OECD). Available at <https://www.oecd.org/env/cc/37321411.pdf>.

[f] United States Environmental Protection Agency. *The Social Cost of Carbon.* Available at <https://www3.epa.gov/climatechange/EPAactivities/economics/scc.html>.

[g] Morris D F and Munnings C. *Designing a Fair Carbon Tax*. Resources for the Future. Available at <http://www.rff.org/research/publications/designing-fair-carbon-tax>.

[h] Center for Climate and Energy Solutions (C2ES). *Options and Considerations for a Federal Carbon Tax.* Available at <http://www.c2es.org/publications/options-considerations-federal-carbon-tax>.

[i] OECD/World Bank. *The FASTER Principles for Successful Carbon Pricing: An Approach Based on Initial Experience.* Available at <https://www.oecd.org/environment/tools-evaluation/FASTER-carbon-pricing.pdf>.

[j] Sumner J, Bird L and Smith H. *Carbon Taxes: A Review of Experience and Policy Design Considerations.* National Renewable Energy Laboratory. Available at <http://www.nrel.gov/docs/fy10osti/47312.pdf>.

[k] Guigon P. *10 Practical Steps to Create an Emissions Trading System*. World Bank. Available at <http://blogs.worldbank.org/climatechange/10-practical-steps-create-emissions-trading-system>.

[l] Ellerman AD, Joskow PL and Harrison D Jr. *Emissions Trading in the U.S.: Experience, Lessons and Considerations for Greenhouse Gases.* C2ES. Available at <http://www.c2es.org/publications/emissions-trading-us-experience-lessons-and-considerations-greenhouse-gases>.

[m] International Institute for Sustainable Development (IISD) Global Subsidies Initiative (GSI). *Untold Billions: Fossil Fuel Subsidies, Their Impacts and the Path to Reform. Strategies for Reforming Fossil-Fuel Subsidies: Practical lessons from Ghana, France and Senegal.* Available at <https://www.iisd.org/gsi/sites/default/files/strategies_ffs.pdf>.

[n] Mathiesen K. 2016. G7 nations pledge to end fossil fuel subsidies by 2025. *The Guardian*. Available at <https://www.theguardian.com/environment/2016/may/27/g7-nations-pledge-to-end-fossil-fuel-subsidies-by-2025>.

[o] Clark K. *Diesel Subsidy Reform in India: Lessons Learned.* IISD/GSI. Available at <https://www.iisd.org/gsi/sites/default/files/ffsr_india_lessons%20learned_may_2015.pdf>.

[p] Bridel A and Lontoh L. *Lessons Learned: Malaysia's 2013 Fuel Subsidy Reform.* IISD/GSI. Available at <https://www.iisd.org/gsi/sites/default/files/ffs_malaysia_lessonslearned.pdf>.

Table 3
Policy options and good practices for supporting low-carbon transport

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
National and local long-term transport and land-use policy, planning and regulation frameworks	
• **Evaluate the current situation** in the transport sector, including transport and land-use strategies, policies, plans and projects. Demand for transport services, supply of transport infrastructure and services and relevant government entities and agencies can also be evaluated to inform needs and opportunities and inform actors and stakeholders • **Develop baseline** scenarios for projected transport supply, demand, emissions, land use and other development impacts to assess the impact of policies and actions • **Assess opportunities and design low-carbon scenarios** under the Avoid (transport demand), Shift (to low-carbon options) and Improve (infrastructure, technologies and policies) framework • **Develop low-carbon scenarios and prioritize actions** that align most closely with local priorities and circumstances. Prioritized scenarios can provide the basis for detailed low-carbon transport plans laying out specific actions and best practice policies • **Implement, monitor and improve** low-carbon transport implementation plans, including stakeholder engagement processes, roles and responsibilities for various agencies, funding sources for policy and technology actions, timelines, outreach and communication strategies, and monitoring, evaluating and reporting frameworks	• Curitiba, Brazil – integrated transport and land-use planning[a] • India – low-carbon transport road map and low-carbon comprehensive mobility plans for cities • Madrid, Spain – integrated transport and land-use planning[b] • Qingdao, China – integrated transport and land-use planning[c]
Multi-modal transport system approaches	
• **Assess current trends and data**, including supply, demand, growth trends, costs and benefits of various public transport options and sizes • **Design efficient access points** for public transport in city centres (<500 m) and integrate transport infrastructure for multiple uses (e.g. bus rapid transit (BRT) and bicycle stations) • **Develop a funding plan** for a multi-modal system. The funding plan can include potential partnership and co-funding opportunities with businesses and other stakeholders • **Support sustainable neighbourhood approaches** that integrate efficient and low-carbon transport considerations to support multi-modal transport at the micro scale linked with broader system plans • **Support public outreach** through public awareness campaigns to allow beneficial service features of multi-modal transport systems to be highlighted for the public to increase usership • **Integrate public transport fares (and include other shared modes)** through a one fare mode for all transport options in a multi-modal system to increase overall efficiency and improve customer experience • **Provide real-time data applications** for efficient multi-modal trip planning using smartphones and other devices to	• Bogor, Indonesia – multi-modal mobility development policy[d] • London, United Kingdom – integrated transport system (ITS)[e] • Hong Kong, China – ITS[e] • Singapore – ITS[e]

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
improve customer experience	
Bus rapid transit	
• **Develop a strong plan and funding strategy** with leadership and input from various stakeholders, including city planners, the private sector, technical institutions and civil society. The plan can also include a sustainable funding strategy that may include local and national funding as well as incremental funding mechanisms that may be linked to sales and property taxes • **Support effective design,** including: dedicated lanes for BRT and an enforcement plan, mechanisms to support frequent, reliable and on-time service such as traffic signal priority, off-board fare collection and platform-level boarding, plans for efficient demand-driven routes with support from control centres and infrastructure improvements • **Develop an outreach and communication plan** to communicate BRT services and benefits to customers through outreach efforts and awareness-raising campaigns • **Integrate BRT into multi-modal transport plans** to ensure efficiency across modes of transport. Considering providing a one fare mode for all transport options is a strong approach to supporting BRT integration into multi-modal transport	• Auckland, New Zealand – BRT[f] • Belo Horizonte and Curitiba, Brazil – BRT[g] • Bogota, Colombia – BRT[h] • Buenos Aires, Argentina – BRT[h] • Chengdu, China – BRT[i] • Mexico City, Mexico – BRT[h] • Seoul, Republic of Korea – BRT[j] • Yichang, China – BRT[h] • Johannesburg, South Africa – BRT[k]
Rail – trains, trams and metros	
• **Support balanced transport policy and planning** by assessing all transport options and taking into account long-term benefits associated with higher upfront cost • **Develop a long-term vision** to support the reduction of short-term political barriers that may arise and ensure that key long-term objectives guide the design and development of rail investments • **Integrate national and local decision-making processes** for vertical and horizontal planning and a whole system approach to transport development • **Design a sustainable funding plan/mechanism** for large rail infrastructure investments, including: accounting for external costs, polluter pays, land value capture approaches and development of a sustainable pricing structure • **Support electrification** of railways to support emission reductions and other benefits in the transport sector and plan for rail electrification, taking into account broader low-carbon transport planning frameworks and renewable energy power development plans[n] • **Standardize the rail system and simplify border crossing for freight transport** to support low-carbon, efficient, multi-modal sustainable freight transport[n] • **Raise awareness** through public awareness campaigns **and conduct customer research** to understand needs and desires and to inform investments in quality rail services and marketing[o]	• Bangkok, Thailand – SkyTrain • Singapore – metro rail system[l] • Cagliari, Italy – light-rail service[m]
Non-motorized transport	
• levels, demographics and economic growth to inform design of the NMT support policies and feed into broader transport	• Beijing, China – bicycle sharing

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
strategies	programme[p]
• **Integrate NMT into broader transport strategies** to support robust multi-modal low-carbon transport systems. Such frameworks will also include detailed funding plans for infrastructure and other investments to support NMT	• Bogota, Colombia – segregated bicycle lanes[q]
• **Develop conducive infrastructure for cycling and walking routes based on robust land-use planning** in order to attract and maintain users. Affordable bicycle sharing programmes can be developed to replace short-distance personal vehicle travel and facilitate connections to public transport, such as BRT[t]	• Lviv, Ukraine – bicycle planning and development[r] • Muenster, Germany – high-quality cycling infrastructure[s] • Nanjing Road, China – pedestrian road[q] • Utrecht, Netherlands – mini-roundabouts and other approaches to support cycling[q]
Ride sharing	
• **Assess ride sharing potential** in certain urban locations	• Los Angeles, United States – Smart Traveler[u]
• **Develop ride sharing rings** with high ride sharing potential, usually distributed 10 to 15 miles outside each city's urban core	• Puget Sound, United States – vanpool programme and marketing plan[u]
• **Support online real-time ride share platforms** to support efficient ride sharing programmes	• uberPOOL[v]
• **Collaborate with the private sector** to understand trends and support scaled-up implementation and awareness-raising through public outreach campaigns on benefits	
• **Design ride share tax incentives** to support car sharing[w]	
Economic instruments and financing solutions in public transport	
• **Develop a sustainable funding plan** that integrates various approaches to finance low-carbon public transport investment, including mechanisms that account for external costs, polluter pays, beneficiary pays, and/or land value capture as well as other incentives and options highlighted in the table	• Bogota, Colombia – land-value capture to support BRT[x]
• **Design innovative public and private financing solutions** integrating various funding mechanisms such as charging mechanisms, land value capture, subsidies, and tax incentives and approaches	• Hong Kong, China – land value capture[y] • Tokyo, Japan – land value capture[y]
• **Plan for large-scale and longer time horizon investments**. Options include: lowering the minimum capital ratio for the investment and considering favourable tax rates and incentives, establishing special construction funds, and utilizing public-private partnership models to support investment, among others[z]	
Research, development and demonstration of public transport technology	
• **Identify high-level goals associated with transport research, development and demonstration (RD&D)** relating to climate mitigation and resilience, economic development and social equity, among other development areas[ee]	• India – electric vehicle scenarios and road map[aa]
• **Assess the local innovation ecosystem,** including local expertise and research facilities, level of development of	• Toyota – environmental technology

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
technologies, approaches and supply chains (locally and internationally), status and preferences of local markets, level of development and engagement of private companies, opportunities for international partners and needs for capacity-building, among many other considerations[ee] • **Design an RD&D strategy and funding mechanism** based on key technologies and approaches identified, planning and regulation frameworks, assessment of the local innovation ecosystem, and national, subnational, multilateral and private funding sources[dd] • **Establish collaborative partnerships** with the private sector and internationally to learn from experience internationally and provide an important opportunity to address common challenges and goals[cc,gg]	strategies[bb] • United Kingdom – low-carbon transport innovation strategy[dd] • United States – Department of Energy research and development of electricity as a vehicle fuel[ff]
Policy and technology solutions for supporting the energy efficiency of vehicles and other modes of transport	
Intelligent transport system approaches and policies	
• **Support connected and automated real-time transit management**, including traffic signal controls, speed enforcement, integrated corridor management (across operators and agencies), specific intelligent transport system approaches (ITS) information services for real-time traffic data, and other software and hardware options to enable efficient traffic management[hh] • **Consider travel demand management measures** such as charging and other pricing schemes for peak travel times and urban access restriction schemes	• European Union – ICT-Emissions project[hh] • France – ITS for Climate Initiative[hh] • Thailand – ITS[ii] • United States National Center for Sustainable Transportation – ITS for Improving Traffic Energy Efficiency and Reducing GHG Emissions from Roadways[hh]
Fuel economy standards	
• **Design regulations that are flexible, technology neutral and maximize social benefit** using multiple approaches such as attribute-based targets and credit trading systems • **Consider scope of the standard** that, at the least, can include light-duty vehicles and consider heavy-duty vehicles to support greater fuel savings • **Develop efficient testing approaches** that integrate a comprehensive set of factors that impact fuel efficiency and can be combined with testing procedures for local emissions to support cost savings • **Design complementary policies** such as labelling programmes and financial incentives or voluntary accelerated vehicle retirement programmes[ii,kk,ll]	• Brazil, Canada, China, Japan, Mexico, Republic of Korea and United States – fuel economy standards for passenger vehicles, light commercial vehicles and light trucks
Biofuel policies	
• **Consider biofuel crops in relation to food and fuel priorities**, especially in areas with concerns over potential food and fuel competition[nn] • **Ensure flexibility of mandates** and adjust over time. Adjustments can be made based on assessments of the market, especially in relation to the improvement and development of advanced biofuels[oo] • **Create broader biofuel support frameworks** that incorporate incentives for biofuel production (e.g. production	• Brazil – E27.5 and B10 biofuel blend mandates[mm] • Ethiopia – E10 biofuel blend mandate • European Union – Sustainability criteria for

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
incentives for more advanced fuels) and sales (e.g. tax incentives for fuelling stations that sell certain levels of biofuel blends), and grants to support infrastructure for biofuel supply chains and deployment.[pp] Further, incentives to support flexible fuel vehicles can also build demand for biofuels	biofuel development • India – E10 biofuel blend mandate • Malaysia – E10 and B10 biofuel blend mandates • Norway – B3.5 biofuel blend mandate • South Africa – E2 and B5 biofuel blend mandates
Electric vehicle policies	
• **Assess the market and develop an electric vehicle (EV) deployment strategy including near- and long-term target markets**. Improving safety and performance of currently available vehicles could support markets that may have already shown interest in EVs. Policymakers can also consider targeting corporate and government fleets that may be more willing to fully consider broad costs, benefits and risks of EV ownership. Building and supporting targeted markets can support scaled-up battery manufacturing to drive down costs and set the stage for broader market development[ss] • **Provide basic information and education on EVs through outreach programmes** through various marketing mechanisms (e.g., websites, advertisements and social media) and events[ss] • **Design plans for developing and funding charging infrastructure**. For supporting EV markets, this is also an important consideration as many consumers have worries related to the range of EV vehicles between charges. Funding plans can be designed that bring together national, subnational and private sector funding sources and also be designed in a phased approach (i.e. certain actions occurring over a specified period of time), with governments providing initial funding for basic infrastructure to support building the market and to ease consumer worries noted above[ss] • **Design policy and incentive packages that integrate complementary policies** such as regulations (fuel economy standards), financial mechanisms and other incentives, including parking fee and toll waivers and/or access restriction waivers[rr]	• Bogota, Colombia – electric taxi programme[qq] • China – 5 million EV deployment target[rr] and EV two-wheeler deployment actions • European Union – directive on the deployment of alternative fuels infrastructure • France – target to deploy 7 million charging outlets by 2030[rr] • India – National Electric Mobility Mission Plan 2020 • Oslo, Norway – Local tax incentives for EVs[qq] • Tokyo City, Japan – Integrated urban system supporting EVs[qq] • United States – California's Drive Clean website to educate consumers on EVs[tt]
Hydrogen fuel policies	
• **Develop long-term strategies** and support frameworks that integrate hydrogen development considerations and actions in order to spur investment in essential infrastructure • **Assess and mitigate legal barriers** to facilitate approvals and operation of technologies enabling hydrogen deployment • **Support partnerships and coordination** among technical institutions and non-governmental organizations to provide a strong foundation for hydrogen development, and allow for ongoing research and investment risk sharing across partners, sharing of information and overall cost reductions	• Germany – National Innovation Programme for Hydrogen and Fuel Cell Technology[uu] • Finland – Fuel Cell Programme[vv] • Republic of Korea – hydrogen and fuel cell automobile research

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
• **Research, develop and demonstrate**. International and domestic RD&D efforts will play a crucial role in advancing the technology and reducing high costs	• United Kingdom – H_2 Mobility Project
Freight transport policies	
• **Develop a 'green freight' programme** that is informed by assessment of the current freight market, including technologies, non-technological measures, such as vehicle optimization and driving behaviour, important actors and related policies. Performance can also be established up-front based on stakeholder engagement and overall economic, climate and other objectives. Finally, budget options can be assessed to fund the programme and will be unique to specific city and national contexts • **Consider policies and actions to support the green freight programme** such as regulatory policies, voluntary partnership or a mix of the two mechanisms. Various measures can be considered, including green logistics programmes, truck efficiency improvement programmes and intermodal hubs[yy] • **Support standardized and consistent data collection, benchmarking, measuring and reporting** using tools and methods for consistent data collection and measurement for more accurate and standardized reporting • **Strongly engage the private sector and other stakeholders in the design and implementation of the programme** to ensure inclusivity, transparency and long-term success of the programme • **Market the programme and recognize leadership** to build support[zz]	• Asia – Green Freight Asia • Canada and United States – SmartWay Transport Partnership[ww] • China – China Green Freight Initiative • Europe – ECO Stars Fleet Recognition[xx] • Mexico – Transporte Limpio • Netherlands – Lean and Green • United Kingdom – Logistics Carbon Reduction Scheme
Maritime policies and approaches	
• **Develop globally harmonized maritime rules** – through the International Maritime Organization (IMO) rules and regulations have been developed for energy-efficient and low-emission shipping. Energy efficiency regulations include attainment of an energy efficiency design index (required for new ships), an energy efficiency management plan (required for all ships) and approaches to support technical cooperation and technology transfer • **Support technology innovation and deployment** to transform current technologies, reduce emissions and support efficiency. Key hardware-related measures to improve efficiency include: improving propulsion efficiency and reducing hull resistance, waste heat recovery and application of renewable energy technologies. Key operational measures include: optimizing routes and operation plans, reducing speed, hull and propeller cleaning and other technology maintenance actions. Key software-related innovations include: digitalization to support optimization of shipping performance and routes across supply chains, and real-time data collection and analysis to support recommendations and action • **Facilitate enabling environments** for adoption of low-emission and energy efficient maritime technologies and approaches. Development of enabling environments can be supported by robust data collection and analysis to support decision-making and the development of actions that bridge operation, hardware and software technology needs described above • **Support technology transfer and capacity-building**. Key actions include development of specific regulations, awareness-raising activities, assessing technology transfer needs, supporting private sector partnerships, developing capacity-building tools and programmes supporting technical assistance, technology cooperation centres and 'train the trainer' efforts, and developing a global network for technology cooperation, among others[bbb]	• Clean Cargo Working Group[aaa] • IMO rules and regulations

Policy options and key elements of an enabling environment to support successful policy replication and implementation	*Select examples*
Aviation policies and approaches	
• **Design and implement low-carbon aviation technologies** – an aviation design standard to reduce aircraft CO_2 emissions is being developed by the International Civil Aviation Organization (ICAO). Other technologies have also recently been implemented through the clean development mechanism to support low-carbon aircraft, including use of renewable energy to provide power and airflow within the aircraft at the gate and systems to allow for aircraft taxiing while engines are off • **Improve efficiency of aviation systems, operations and air traffic management** to improve aviation performance in several areas that will support efficiency and emission reductions. These areas include: reducing on-board equipment weight, improving airport and in-flight operations, developing globally interoperable data and systems, supporting optimal capacity and flexible flights, and ensuring efficient flight paths • **Scale up the deployment of sustainable alternative fuels.** Since 2011, 2200 commercial flights have used alternative fuels; however, there is a need to scale up alternative fuel deployment. Airlines have signed offtake agreements for renewable jet fuel from proposed certified biorefineries. Additional scaled-up deployment will depend on the design and implementation of key policies, including market-based measures[hhh]	• Airbus – Sustainable Aviation Engagement Programme[ccc] • Boeing – 777 Performance Improvement Package[ddd] • ICAO standards[eee] • United States Massachusetts Institute of Technology – Partnership for Air Transportation Noise and Emissions Reduction[fff] • United States Navy – Great Green Fleet[ggg]

Sources:

[a] Transit Cooperative Research Program. *Curitiba, Brazil – BRT Case Study.* Available at <http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp90v1_cs/Curitiba.pdf >.

[b] Carpio-Pinedo J, Martínez-Conde JA, and Lamíquiz Daudén F. *Mobility and Urban Planning Integration at City-regional Level in the Design of Urban Transport Interchanges.* Available at <http://www.sciencedirect.com/science/article/pii/S1877042814062351>.

[c] World Resources Institute (WRI) Ross Center for Sustainable Cities. "Our work". Available at <http://www.wricities.org/our-work/project-city/integrating-transportation-and-land-use-planning-qingdao-china>.

[d] Presentation made by the city administration of Bogor, Indonesia, at the technical expert meeting (TEM) on energy efficiency in urban environments in June 2015. Available at <http://unfccc.int/files/bodies/awg/application/pdf/01_bogor_lorina_darmastuti.pdf >.

[e] Litman T. 2014. *Introduction to Multi-Modal Transportation Planning. Principles and Practices.*. Victoria Transport Policy Institute (VTPI). Available at <http://www.vtpi.org/multimodal_planning.pdf>.

[f] Railway Technology. *Auckland Rapid Transit System, New Zealand.* Available at <http://www.railway-technology.com/projects/auckland_rapid/>.

[g] WRI Ross Center for Sustainable Cities. *MOVE Bus Rapid Transit - Belo Horizonte, Brazil.* Available at <http://www.wricities.org/media/photo-essay/move-bus-rapid-transit-brt-belo-horizonte-brazil>.

[h] Institute for Transportation & Development Policy. *Best Practices.* Available at <https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/best-practices-2013/>.

[i] WRI Ross Center for Sustainable Cities. "Our work". <http://www.wricities.org/our-work/project-city/multimodal-transportation-integration-chengdu-china>.

[j] United Nations Human Settlements Programme. *Bus Reform in Seoul, Republic of Korea.* Available at <http://unhabitat.org/wp-content/uploads/2013/06/GRHS.2013.Case_.Study_.Seoul_.Korea_.pdf>.

[k] South African Government. *Bus Rapid Transit System (BRT)*. Available at <http://www.gov.za/about-government/government-programmes/bus-rapid-transit-system-brt>.

[l] Singapore Mass Rapid Transportation. Available at <http://www.smrt.com.sg/>.

[m] Chiandoni M. Cagliari opens light rail extension. *International Railway Journal*. Available at <http://www.railjournal.com/index.php/light-rail/cagliari-opens-light-rail-extension.html>.

[n] Trains to Paris. *Policy Recommendations*. Available at <http://www.traintoparis.org/IMG/pdf/train_to_paris_policy_recommendations.pdf>.

[o] Best practices adapted from the presentation made by the International Union of Railways at the TEM held in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/uic_craven_unfccc_tem.pdf>.

[p] Jiang Q. *Bicycle Sharing in Beijing*. GIZ China. Available at <http://sutp.org/files/contents/documents/resources/E_Fact-Sheets-and-Policy-Briefs/GIZ_SUTP_FS_Good-Practice-in-China_EN.pdf>.

[q] GIZ. Sustainable Urban Transport Programme (SUTP). *Sustainable Transport*: *A Sourcebook for Policy-makers in Developing Cities.* <http://sutp.org/files/contents/documents/resources/A_Sourcebook/SB3_Transit-Walking-and-Cycling/GIZ_SUTP_SB3d_Preserving-and-Expanding-the-Role-of-Non-motorised-Transport_EN.pdf>.

[r] GIZ SUTP. *Case Studies.* Available at <http://sutp.org/en/resources/publications-by-topic/case-studies.html>.

[s] Doehn G. *Case Study No. 2. Muenster, Germany: An Example of Promoting Cycling in Cities – Components of a High Quality Bicycle Infrastructure.* GIZ SUTP. Available at <http://sutp.org/files/contents/documents/resources/C_Case-Studies/GIZ_SUTP_CS_An-Example-of-Promoting-Cycling-in-Cities_EN.pdf>.

[t] FCCC/TP/2015/4.

[u] VTPI. *Ridesharing - Carpooling and Vanpooling*. Available at <http://www.vtpi.org/tdm/tdm34.htm>.

[v] uberPOOL. "Share your ride and save". Available at <https://www.uber.com/ride/uberpool/>.

[w] Viechnicki P, Khuperkar A, Dovey Fishman T, and Eggers WD. *Ridesharing*. Available at <http://dupress.com/articles/smart-mobility-trends-ridesharing/>.

[x] WRI Ross Center for Sustainable Cities. *TransMilenio BRT in Bogotá, Colombia.* Image. Available at <http://www.wricities.org/media/image/transmilenio-brt-bogot%C3%A1-colombia>.

[y] Lincoln Institute of Land Policy. *Transit Value Capture: New Town Co-development Models and Land Market Updates in Tokyo and Hong Kong.* Available at <https://www.lincolninst.edu/pubs/2198_Transit-Value-Capture-New-Town-Co-Development-Models-and-Land-Market-Updates-in-Tokyo-and-Hong-Kong>.

[z] Presentation made by China at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/chinas_urban_public_transport_rail_systems-revised.pdf>.

[aa] United Nations Environment Programme. *Promoting Low Carbon Transport in India.* Available at <http://www.unep.org/transport/lowcarbon/PDFs/ElectricVehicleScenarios.pdf >.

[bb] Toyota. "Toyota's approach to environmental technology". Available at <http://www.toyota-global.com/innovation/environmental_technology/strategy_environmental_tech.html>.

[cc] International Renewable Energy Agency. *Renewable Energy Innovation Policy: Success Criteria and Strategies*. Available at <https://www.irena.org/DocumentDownloads/Publications/Renewable_Energy_Innovation_Policy.pdf>.

[dd] United Kingdom Department for Transport. *Low Carbon Transport Innovation Strategy*. Available at <http://webarchive.nationalarchives.gov.uk/20081022212629; http:/www.dft.gov.uk/pgr/scienceresearch/technology/lctis/lctisdoc.pdf>.

[ee] European Commission. *Towards Low-carbon Transport in Europe.* Available at <http://www.transport-research.info/sites/default/files/brochure/20120423_214705_81522_PB02_web.pdf>.

[ff] Alternative Fuels Data Center. *Research and Development of Electricity as a Vehicle Fuel*. Available at <http://www.afdc.energy.gov/fuels/electricity_research.html>.

[gg] Presentation made by the Clean Energy Partnership at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/cep_bystry_unfccc_2016-05-23.pdf>.

[hh] Presentation made by Kapsch Group at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/kapsch_trafficcom_intelligent_mobility_solutions_to_mitigate_climate_change_gilbert_konzett.pdf>.

[ii] Presentation made by Thailand at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/01_thailand_jakapong_pongthanaisawan.pdf>.

[jj] Onoda T. *Review of International Policies for Vehicle Fuel Efficiency*. International Energy Agency (IEA). Available at <http://www.iea.org/publications/freepublications/publication/vehicle_fuel.pdf>.

[kk] The International Council on Clean Transportation (ICCT). *Policies to Reduce Fuel Consumption, Air Pollution, and Carbon Emissions from Vehicles in G20 Nations*. Available at <http://www.theicct.org/sites/default/files/publications/ICCT_G20-briefing-paper_Jun2015.pdf>.

[ll] ICCT. *Global Best Practices in Fuel Efficiency Policies*. Presentation. Bandivadekar A. Available at <http://www.cseindia.org/userfiles/Anup%20Bandivadekar.pdf>.

[mm] All mandates in this section drawn from: Renewable Energy Policy Network for the 21st Century (REN21). *Renewables 2016 Global Status Report*. Available at <http://www.ren21.net/wp-content/uploads/2016/06/GSR_2016_Full_Report_REN21.pdf>.

[nn] Eisentraut A. *Sustainable Production of Second-Generation Biofuels: Potential and Perspectives in Major Economies and Developing Countries.* IEA. Available at <https://www.iea.org/publications/freepublications/publication/second_generation_biofuels.pdf>; and Smolinski S and Cox S. *Policies to Enable Bioenergy Deployment: Key Considerations and Good Practices.* National Renewable Energy Laboratory (NREL). Available at <http://www.nrel.gov/docs/fy16osti/66322.pdf>.

[oo] REN21. *Renewables 2015 Global Status Report.* Available at <http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf>; and Smolinski S and Cox S. *Policies to Enable Bioenergy Deployment: Key Considerations and Good Practices.* NREL. Available at <http://www.nrel.gov/docs/fy16osti/66322.pdf>.

[pp] Mosey G and Kreycik C. *State Clean Energy Practices: Renewable Fuel Standards.* NREL. Available at <http://www.nrel.gov/docs/fy08osti/43513.pdf>; and Paulsworth A. *Increasing sustainable biomass through production tax credits.* Available at <http://www.sciencepolicyjournal.org/uploads/5/4/3/4/5434385/increasing_sustainable_biomass_through_production_tax_credits.pdf>.

[qq] IEA. *50 Big Ideas Shaping the Future of Electric Mobility.* Available at <http://www.iea.org/topics/transport/subtopics/electricvehiclesinitiative/EVI_2014_Casebook.pdf>.

[rr] IEA. *Global EV Outlook 2016.* Available at <http://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf>.

[ss] The Climate Group, Quebec. *Electric Vehicle Policy Initiative Summary – Sharing Best Practices on Electric Vehicle Policy.* Available at <http://www.theclimategroup.org/_assets/files/Electric-Vehicle-Policy-Initiative-v5.pdf>.

[tt] California Air Resources Board. *Drive Clean Buying Guide.* Available at <http://www.driveclean.ca.gov/>.

[uu] IEA. Policies and measures databases: Germany. Available at <http://www.iea.org/policiesandmeasures/pams/germany/>.

[vv] Tekes. *Fuel cells and hydrogen in Finland Finnish Fuel Cell Programme 2007–2013.* Available at <http://www.ieafuelcell.com/documents/Finnish_Fuel_Cell_Technlogy_Program.pdf>.

[ww] Global Green Freight. *SmartWay Transport Partnership*. Available at <http://www.globalgreenfreight.org/green-freight/smartway-transport>.

[xx] Global Green Freight. *ECO Stars Fleet Recognition (Europe).* Available at <http://www.globalgreenfreight.org/green-freight/ecostars-fleet>.

[yy] Presentation made by Germany at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/tem_presentation_markus_kurdziel_long_version.pdf>.

[zz] United States Environmental Protection Agency. *SmartWay*. Available at <https://www3.epa.gov/smartway/forcountries/documents/420b14054.pdf>.

[aaa] Global Green Freight. *Clean Cargo Working Group (Marine).* Available at <http://www.globalgreenfreight.org/green-freight/clean-cargo-working>.

[bbb] Presentation made by Finland at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/06_finland_lolan_margaretha_eriksson.pdf>.

[ccc] Airbus. "Airbus helps airlines further improve their environmental performance". Available at <http://www.airbus.com/presscentre/pressreleases/press-release-detail/detail/airbus-helps-airlines-further-improve-their-environmental-performance/>.

[ddd] Boeing. "Delivering fuel and emissions savings for the 777". Available at <http://www.boeing.com/commercial/aeromagazine/articles/qtr_03_09/article_02_1.html>.

[eee] International Civil Aviation Organization. Available at <http://www.icao.int/Pages/default.aspx>.

[fff] Partnership for Air Transportation Noise and Emissions Reduction. Available at <http://partner.mit.edu/>.

[ggg] United States Navy - Energy, Environment and Climate Change. *Great Green Fleet.* Available at <http://greenfleet.dodlive.mil/energy/great-green-fleet/>.

[hhh] Presentation made by the International Civil Aviation Organization at the TEM in May 2016. Available at <http://unfccc.int/files/focus/mitigation/technical_expert_meetings/application/pdf/07_icao_icao_secretariat.pdf>.

Annex II

Institutions and initiatives providing finance, technology transfer and capacity-building support

Table 4
Selected multilateral, regional and bilateral development institutions and initiatives providing finance, technology transfer and capacity-building support to promote the social and economic value of carbon

Category/title	*Overview*	*Link(s)*
Carbon pricing		
Carbon Pricing Leadership Coalition (CPLC)	CPLC convenes leaders to share lessons learned and good practices related to carbon pricing. It has a long-term objective of supporting a carbon price for the global economy	<http://www.carbonpricingleadership.org/>
United Nations Global Compact	The United Nations Global Compact supports and encourages companies to become Carbon Pricing Champions. Key initiatives supported include the Business Leadership Criteria on Carbon Pricing and Caring for Climate, which advances the role of business in addressing climate change and provides a framework for business leaders to implement practical climate change solutions and help to shape public policy	<https://www.unglobalcompact.org/>
Carbon markets		
Networked Carbon Markets Initiative	Convened by the World Bank, this initiative brings together public and private sector and civil-society stakeholders to discuss and develop plans for an international carbon market and trading across borders	<http://www.worldbank.org/en/topic/climatechange/brief/globally-networked-carbon-markets>
Partnership for Market Readiness	Convened by the World Bank, the partnership facilitates peer exchange and learning among 30 government and technical institutions engaged with carbon markets and pricing, enables readiness for carbon markets through effective policy design and supports capacity-building programmes at the country, regional and global levels	<https://www.thepmr.org/> <https://www.thepmr.org/content/supporting-action-climate-change-mitigation>
Fossil fuel subsidy reform		
Friends of Fossil Fuel Subsidy Reform	Brings together countries that are not members of the Group of 20 major economies to support consensus building around fossil fuel subsidy reform. Established in 2010. The members are Costa Rica, Denmark, Ethiopia, Finland, New Zealand, Norway, Sweden and Switzerland	<http://fffsr.org/wp-content/uploads/2015/07/ffrs-communique-briefing-note.pdf>
Group of Seven fossil fuel subsidy reform	Building on previous discussions and a pledge made in 2009, in May 2016 the Group of Seven made a pledge to end most fossil fuel subsidies by 2025	<https://www.theguardian.com/environment/2016/may/27/g7-nations-pledge-to-end-fossil-fuel-subsidies-by-2025>
Global Subsidies	The International Institute for Sustainable Development established this initiative in 2005 to analyse subsidies and their impact on sustainable development. It seeks to “encourage individual governments to	<https://www.iisd.org/gsi/>

Category/title	*Overview*	*Link(s)*
Initiative	undertake unilateral reforms on subsidy policy where these would deliver clear economic, environmental and social benefits"	
Cross-cutting		
Divest-Invest Global Movement	An expanding movement of institutions (Divest-Invest Philanthropy) and individuals (Divest-Invest Individuals) that commit to divest from carbon-intensive fossil fuels, modelling and accelerating the crucial global transition to clean and affordable forms of energy	<http://newsroom.unfccc.int/lpaa/private-finance/divest-invest-global-movement/>
Montreal Carbon Pledge	With the Montreal Carbon Pledge, investors pledge to measure and publicly disclose the carbon footprint of their investment portfolios on an annual basis. The pledge allows investors (asset owners and investment managers) to formalize their commitments to the goals of the Portfolio Decarbonization Coalition, with a view to mobilizing investors to measure, disclose and reduce their portfolio carbon footprints at the scale of USD 100 billion by the December 2015 United Nations Climate Change Conference	<http://newsroom.unfccc.int/lpaa/private-finance/montreal-carbon-pledge/>
We Mean Business coalition	Brings together many private sector institutions via a platform to support business engagement in policy dialogue, the development of smart policies and robust climate action. It is engaged with various activities and discussions related to carbon pricing, markets and fossil fuel subsidy reform	<http://www.wemeanbusinesscoalition.org/>
World Wildlife Fund Climate Savers	Bringing together 30 companies and industry leaders, the Climate Savers programme was launched in 1999 as an international platform for private-sector engagement on energy and climate issues. The platform works to inspire leadership, transformation and replicable action in the private sector to support low-carbon development	<http://newsroom.unfccc.int/lpaa/business/wwf-climate-savers-recognizing-corporate-leadership-on-climate-solutions/>
Portfolio Decarbonization Coalition	A multi-stakeholder initiative, launched in September 2014 at the United Nations Climate Summit, that will drive emission reductions on the ground by mobilizing a critical mass of institutional investors committed to gradually decarbonizing their portfolios. The coalition is expected to send a strong and unprecedented signal to policymakers, investor peers and corporations that investors see corporate emissions and climate change as 'centre stage'	<http://unepfi.org/pdc/>
Science Based Targets initiative	Science-based targets allow companies to work towards an overall goal by aligning corporate greenhouse gas emission reductions with global emission budgets generated by climate models. The initiative, a partnership of the Carbon Disclosure Project, the United Nations Global Compact, the World Resources Institute and the World Wildlife Fund, has worked to develop methodologies and tools to support companies in setting and working towards such targets	<http://sciencebasedtargets.org/>
Smart Risk Investing initiative	The initiative focuses on the insurance community, which controls more than USD 30 trillion, to ensure that risk and resilience as defined by United Nations global agreements, such as the Sendai Framework for Disaster Risk Reduction 2015–2030 and the United Nations Sustainable Development Goals, are taken into account in their stock selections across all assets classes. The initiative aims at driving more investments into smarter risk and resilience projects that will benefit public, private and mutual organizations	<http://newsroom.unfccc.int/lpaa/private-finance/smart-risk-investing/>

Table 5
Selected multilateral, regional and bilateral development initiatives supporting finance, technology transfer and capacity-building for low-carbon transport

Category/title	*Overview*	*Link*
Cross-cutting		
Partnership on Sustainable Low Carbon Transport (SLoCaT)	SLoCaT is a partnership of more than 90 organizations, including United Nations agencies, multilateral and bilateral development banks, non-governmental organizations and the private and academic sectors. Its Bridging the Gap programme connects Parties to the Convention with transport expertise and also provides a website and informational resources and organizes the Transport Day event held at sessions of the Conference of the Parties as well as related side events	<http://www.slocat.net>
Africa Sustainable Transport Forum	The forum seeks to enable and catalyse development, planning and funding for low-carbon transport programmes and projects in Africa. In addition to emission reductions and air quality improvements, the activities enable improved transport access, safety and health	<http://www.unep.org/Transportation/astf/>
Ministers' Declaration on Green and Inclusive Transport	The Council of Ministers of Transportation agreed on a high-level declaration at the 2016 International Transport Forum's Annual Summit. The declaration articulates key actions to decarbonize and support inclusive transport through various transport modes, technologies and digitalization approaches	<http://www.itf-oecd.org/declaration-ministers-green-and-inclusive-transport>
International Climate Initiative	The initiative funds several low-carbon transport projects around the world and globally, including through the TRANSfer project highlighted below. Areas of support include urban mobility, freight transport, and national vehicle and fuel policies and standards. Support efforts are designed in relation to unique country circumstances and include a comprehensive suite of measures and policies for assistance	<https://www.international-climate-initiative.com>
TRANSfer	As part of the International Climate Initiative, TRANSfer supports the development, financing and implementation of nationally appropriate mitigation actions (NAMAs) for low-carbon transport. To date the initiative has supported the development of four NAMAs (with two in the implementation stage), developed a number of tools and handbooks and mobilized finance. TRANSfer is seeking to move to a multi-donor platform to scale up support provided to countries. TRANSfer also works with several organizations and networks such as MobiliseYourCity and SLoCaT to build a global dialogue, learning and consensus around low-carbon transport	<https://www.international-climate-initiative.com/en/projects/projects/details/transfer-klimafreundlicher-transportationtechnologien-und-massnahmen-transfer-132/>
Institute for Transportation & Development Policy	The institute supports cities globally in addressing transport challenges and enabling solutions for low-carbon transport aligned with development goals. It provides technical assistance and supports public awareness-raising and policy decision-making for a low-carbon transport future. In particular, it has focused on the effective design of bus rapid transit systems, among other important initiatives	<http://www.slocat.net/member/176>
Low Emission Development Strategies Global Partnership	The group provides technical assistance, tools and training for low-emission development in the transport sector. In particular, it works to: (1) share approaches and practices for transport and land-use planning; (2) provide transport analysis methods and tools; and (3) offer peer-to-peer, transport-specific financial training and expert assistance	<http://ledsgp.org/working-groups/transportation>

Category/title	*Overview*	*Link*
Transportation Working Group		
ITS for Climate	The initiative aims at: (1) facilitating co-modality of people and goods and eco-efficient navigation as well as reducing congestion and supporting traffic management; (2) encouraging local authorities to develop a clear mobility policy based on inter-modality and new services for intelligent mobility to make better use of investments in infrastructure, vehicles and training; (3) sharing best practices and identifying best opportunities for deployment to reduce carbon dioxide and associated emissions; and (4) improving awareness of the potential of intelligent transport systems and facilitating the implementation of best practices	<http://www.itsforclimate.org/its-for-climate-initiative/>
International Transport Forum	An intergovernmental organization with 57 member countries focused on strategic outcomes, the forum supports policymaking and brings together transport ministers for an annual summit. Its goal is to help shape the transport policy agenda on a global level and ensure that it contributes to economic growth, environmental protection, social inclusion and the preservation of human life and well-being	<http://www.slocat.net/member/237>
United Nations Human Settlements Programme	Supports a number of activities to promote socially and environmentally sustainable human settlements development and the achievement of adequate shelter for all. Among many other activities, it engages with work to support low-carbon transport at the urban level	<http://unhabitat.org>, <http://unhabitat.org/about-us/un-habitat-at-a-glance/>
World Business Council for Sustainable Development, Sustainable Mobility Project	Brings together companies and other stakeholders to support optimal city planning through coordination and other activities, development of a high-level vision for future sustainable mobility, design of a metric to measure transport sustainability in cities, and within demonstration cities to use indicators, road maps and policies, among other activities	<http://www.wbcsd.org/Pages/Adm/Download.aspx?ID=8727&ObjectTypeId=7>
World Conference on Transport Research Society	Provides a forum and network for information-sharing among researchers, practitioners, policymakers and other stakeholders on transport-related topics, including low-carbon and multi-modal options and cross-sectoral approaches and practices	<http://www.wctrs-society.com/>
World Resources Institute, EMBARQ	EMBARQ is a global network of more than 100 experts that seeks to support environmentally and financially sustainable transport solutions to improve quality of life in cities. The network includes five Centres for Sustainable Transport in Mexico, Brazil, India, Turkey and the Andean region. They work with local governments to support low-carbon transport aligned with key development goals	<http://www.slocat.net/member/164>
Aviation transport		
Airport Carbon Accreditation	Launched in June 2009 by Airports Council International Europe, the initiative was designed as a supporting tool for airports to reduce their carbon dioxide emissions, with the ultimate objective of becoming carbon neutral. It aims at collectively engaging the airport community to play its part in addressing the impact of aviation on climate change. The programme is specifically designed to ensure that suitable management processes are in place, which will enable reductions to be identified and achieved	<http://www.airportcarbonaccreditation.org/>
Collaborative	A commitment to climate action between the International Civil Aviation Organization and the aviation	<http://www.icao.int/newsroom/pages

Category/title	*Overview*	*Link*
Aviation Climate Action	industry represented by the Air Transport Action Group. The partnership expands on work already being undertaken across the air transport sector to reduce emissions from this important global industry. The commitment says: "Air transport connects the world. It is a vital engine of global economic growth supporting over 58 million jobs and USD 2.4 trillion in gross domestic product. In order that all parts of the world are able to benefit from the rapid connectivity advantages of air transport, the sector has committed itself to a pathway of sustainable growth encompassing all areas of the commercial industry and governments working in partnership"	/collaborative-aviation-climate-action-takes-flight.aspx>
International Civil Aviation Organization	A United Nations specialized agency that provides a forum for civil aviation cooperation, including on emission mitigation and local air quality improvement. To enable emission mitigation, it supports technologies and standards, operation and market-based measures and alternative fuels	<http://www.icao.int/>
Freight transport		
Global Green Freight Action Plan	The plan aims to foster the environmentally friendly transportation of goods within and between countries in order to curb greenhouse gas emissions and other highly damaging pollutants. This involves expanding and harmonizing green freight programmes and improving fuel efficiency, while protecting public health and boosting innovation in the global freight transportation supply chain	<http://www.globalgreenfreight.org/GreenFreightActionPlan_May2015.pdf>
Individual vehicles		
Global Fuel Economy Initiative	A collaboration of the International Energy Agency, United Nations Environment Programme, International Transport Forum, University of California-Davis, International Council on Clean Transportation and Federation Internationale de l'Automobile Foundation, the initiative enables real-world improvements in fuel economy through global outreach, an in-country capacity-building toolkit and research	<http://www.globalfueleconomy.org>
Group of 20 heavy-duty vehicle standards and efficiency policies to reduce emissions	The Group of 20 major economies committed to introducing heavy-duty vehicle standards and efficiency policies and practices to support emission reductions. Such policies and actions are a key aspect of its 2014 Energy Efficiency Action Plan	<http://www.newsx.com/world/31632-ban-ki-moon-welcomes-india-us-commitment-to-climate-agreement>
Clean Energy Partnership	A partnership between Germany's Federal Ministry of Transport and Digital Infrastructure and several private companies to support hydrogen fuel research and development. The partnership focuses on infrastructure, mobility and communication	<https://cleanenergypartnership.de/en/clean-energy-partnership/what-is-the-cep/?scroll=true>
Electric Vehicles Initiative	Developed under the Clean Energy Ministerial, the initiative is working to enable the deployment of 20 million electric vehicles (including plug-in hybrid electric and fuel cell vehicles) globally by 2020. Key activities include: supporting national deployment goals, best practices and policies; sharing experiences at the city level; enabling information-sharing on research, development and demonstration programmes; and engaging the private sector with critical dialogues and actions	<http://www.cleanenergyministerial.org/Our-Work/Initiatives/Electric-Vehicles>
International Zero Emission Vehicle	A collaboration of national and subnational governments working together to accelerate the adoption of zero-emission vehicles (ZEVs). The participants set ambitious, achievable targets for ZEV deployment, take actions to achieve those targets as appropriate in each jurisdiction, act together to achieve individual	<http://www.zevalliance.org/>

Category/title	*Overview*	*Link*
Alliance	and collective targets and encourage and support other jurisdictions in setting and achieving ambitious ZEV targets	
Paris Declaration on Electro-Mobility and Climate Change and Call to Action	Brings together individual and collective commitments to increase electro-mobility to levels compatible with a lower than 2 ºC pathway. Builds on current successful experiences worldwide and the converging interest of all transportation modes for hybrid/electric solutions	<http://newsroom.unfccc.int/lpaa/transportation/the-paris-declaration-on-electro-mobility-and-climate-change-and-call-to-action/>
Taxis 4 Smart Cities	The initiative gathers companies willing to accelerate the energy transition of their vehicle fleet by 2020 and 2030. Each company undertakes to ensure that 33–50 per cent of the new vehicles entering their fleet emit less than 60 g carbon dioxide per km by 2020 at the latest, and 100 per cent emit less than 20 g carbon dioxide per km by 2030. This commitment fosters the best effort by every company and spreads the word among the taxi sector of the necessity to move forward faster towards cleaner vehicles	<http://www.taxis4smartcities.org/>
Urban Electric Mobility Initiative	The initiative aims to help phasing out conventionally fuelled vehicles and increase the share of electric vehicles (two, three and four wheelers) in the total volume of individual motorized transport in cities to at least 30 per cent by 2030. It is an active partnership that aims to track international action in the area of electric mobility and aims to initiate local action	<http://www.uemi.net/>
Maritime transport		
International Maritime Organization	A United Nations specialized agency that supports a comprehensive regulatory framework for shipping. Broadly, it supports energy efficiency in the shipping sector through policies, practices and data collection. In addition, it supports capacity-building, awareness-raising and global dialogue to support emission reductions in the maritime sector	<http://www.imo.org/>
Navigating a Changing Climate	Under the Think Climate Initiative, this initiative has three main themes: • Encouraging owners, operators and users to take steps to reduce emissions associated with waterborne transport infrastructure, and to shift to low-carbon waterborne transport infrastructure and operations, wherever this is practicable and not disproportionately costly; • Building adaptation capacity and supporting the owners, operators and users of inland and maritime navigation infrastructure as they strengthen resilience and prepare to adapt to changes in sea level, flooding extent or frequency, flow conditions, storminess, precipitation, temperature, extreme wind or waves or fog, among others; • Encouraging new ways of thinking about waterborne transport infrastructure with an emphasis on working with nature and identifying sustainable, integrated solutions	<http://www.pianc.org/thinkclimatewhat.php>
Public and non-motorized transport		
C40 Clean Bus Declaration	The declaration commits cities to reduce emissions from vehicles by adopting innovative clean bus technologies such as electric, hybrid and hydrogen buses. By incorporating low- and zero-emission buses, cities signing up to the declaration help to curb greenhouse gas emissions and air pollution from	<http://newsroom.unfccc.int/lpaa/transportation/c40-clean-bus-declaration-technology-and-finance-for-clean-

Category/title	*Overview*	*Link*
	the rapidly growing urban transportation sector and raise overall levels of climate ambition	urban-transportation/>
International Association of Public Transportation (UITP) and UITP Declaration	UITP provides capacity-building and technical support to enable climate leadership. UITP recently declared a commitment to doubling the market share of public transportation by 2025	<http://www.uitp.org/>
International Union of Railways and Low Carbon Rail Transport Challenge	A professional association that brings together 240 members from around the world to promote rail transport, in 2016 it launched the Low Carbon Rail Transport Challenge, which supports scaled-up use of low-carbon rail for transport and freight	<http://www.uic.org/>
Commitment of the World Cycling Alliance and European Cyclists' Federation	The European Cyclists' Federation (ECF) and World Cycling Alliance (WCA) are collecting the ambitions and flagship projects from cities and regions around the world regarding their concrete proposals for a modal shift to cycling. For the European continent, the mission since 2009 has been to double cycling in Europe by 2020. Combined with the creation of the network WCA, ECF and WCA seek to also increase the modal share on the global level. They have committed to sharing knowledge and promoting cycling by doing the following: • Showing the importance of cycling to achieve the United Nations Sustainable Development Goals, with special attention paid to climate action; • Showcasing the ambitions of cities to increase the modal share of cycling worldwide and to double cycling in Europe by 2020; • Mobilizing the support of WCA and ECF members to enable local, national and international governments and institutions to scale up action on cycling; • Campaigning for the creation of a world bicycle day to be observed by the United Nations to raise awareness of the potential of the bicycle to contribute to the achievement of global goals	<http://www.ppmc-transport.org/world-cycling-alliance-wca-and-european-cyclists-federation-ecf-commitment/>
Road transport		
Low-Carbon Road and Road Transport Initiative	The initiative is led by the World Road Association and its objectives are: • Building strong and sustainable adaptation policies for the road network, including sensitive engineering structures and infrastructure (bridges, rural roads, etc.); • Providing guidance to road authorities in implementing sustainable national strategies addressing climate change; • Reducing the carbon footprint of road construction, maintenance and operation through technological innovation, including intelligent transport systems, and the implementation of green tendering and contracting;	<http://www.ppmc-transport.org/low-carbon-road-and-road-transport-initiative-lc2rti>

Category/title	*Overview*	*Link*
	• Developing road networks in line with new vehicle technologies (electric propulsion, autonomous cars, road/vehicle and vehicle/vehicle interactions, etc.) and enhancing intermodal cooperation	

Note: Another list can be accessed on the Partnership on Sustainable Low Carbon Transport website at <http://www.slocat.net/members/by-name>.