Transformative Carbon Asset Facility (TCAF)

Feasibility assessment and conceptualization note for Transport Sector

Objective of the Note:

- *Navigate TCAF strategic direction and value proposition in supporting transport sector*
- *Guide the identification of cost-effective TCAF transport programs by scoping out a list of mitigation policies/actions eligible for crediting with analysis on their abatement potential and ease of implementation*
- *Outline the key design features of crediting methodology to get the transport GP colleagues' feedback.*

Content of the Note:

1. Transport sector and climate mitigation

Global target to reduce GHG emissions and stabilize warming at below 2 degrees Celsius will fall short without including transport sector: The share of transport sector in the world's total final energy consumption was increased from 25.3 percent in 1990 to 28.9 percent in 2015[1]. This puts transport in second place behind "electricity and heat generation" in its contribution to GHG emissions from fuel consumption in 2015, accounting for 24.7 percent. Within the transport sector, road transport accounts for almost three-quarters (73.4 percent) of this total[2]. In many of the World Bank member countries, transport is the largest emitter of GHG emissions comparing with other sectors. In Latin America for example, transport is the largest emitting sector in 16 of 25 countries[3], bringing the regional transport average to 36 percent of total emissions[4]. The below figure 1 shows the increasing share of transport sector energy consumption in the world total final consumption from 1973 to 2015.

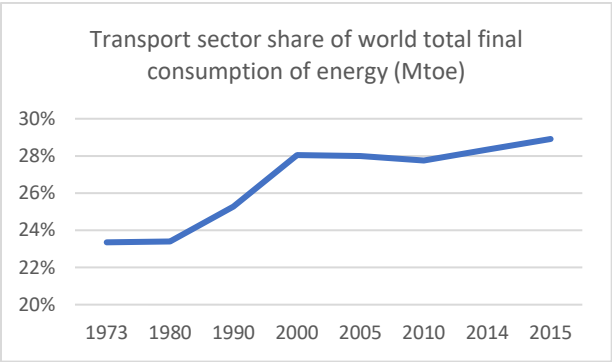

Figure 1 - Transport sector share of world total final consumption of energy (Mtoe) Source: IEA WORLD ENERGY BALANCES (2017 edition)

[1] In 2015, 2,713 Mtoe out of a total final energy consumption of 9,384 Mtoe Source: IEA WORLD ENERGY BALANCES (2017 edition)

[2] In 2015, the transport sector emitted 7,973 million tons of CO_2 (from fuel combustion with electricity and heat allocated to consuming sectors) of which 5,878 million tons was from road. World total CO_2 emissions in that year were 32,294 million tons CO_2. Source: IEA CO_2 EMISSIONS FROM FUEL COMBUSTION (2017 edition)

[3] The IEA reports a total of 25 countries and country groups in Latin America

[4] Source: IEA CO_2 EMISSIONS FROM FUEL COMBUSTION (2017 edition)

GHG emissions from the transport sector continue to rise. Transport sector GHG emissions are likely to increase faster than emissions from the other energy end-use sectors, from the current levels of 8 Gt CO2eq/yr in2015 to around 12 Gt CO2eq/yr by 2050[8]. This accelerated growth has two principal causes:

- Rising income in developing countries, together with infrastructure development is leading to increasing personal mobility and a rising private vehicle population. Whilst a strong slowing of light-duty vehicle (LDV) travel growth per capita has already been observed in several OECD cities suggesting possible saturation, this is not the case elsewhere and the current population of around 947 million passenger cars in 2015[5] could reach nearly 3 billion in 2050[6] driven by increasing transport demand per capita in developing and emerging economies.
- A similar situation exists for freight, where worldwide on-road freight traffic (freight ton-km) has been closely coupled to GDP growth with a certain decoupling being evident in Europe and some other countries. This is reflected in the global truck market outlook, where from 2014 to 2024, annual growth of > 3% is expected, mainly driven by global GDP growth, estimated at 3.3% per year. Little momentum is expected in Brazil, China, and Japan (estimated at 1% per year) with the U.S. also trailing the global average at 2%. However new growth markets are appearing in Eastern Europe (10%), Russia and Central America (5% each) and in the ASEAN countries (4%) with the highest expected growth in India (9% CAGR)[7].

The IPCC AR5 concludes that the continuing growth in passenger and freight activity could outweigh all mitigation measures unless transport emissions can be strongly decoupled from GDP growth[8].

Countries are taking notice of transport sector in their NDCs target setting and implementation. The importance and potential of the transport sector for GHG mitigation are commonly highlighted by various countries' National Determined Contributions (NDCs). Among 160 NDCs representing 187 countries that were submitted as of Aug 1, 2016, 75% explicitly identify the transport sector as a mitigation source, and more than 65% of them propose transport sector-specific mitigation measures. More specifically, 9% of NDCs have a transport sector emission reduction target. For instance, Bangladesh set an economy-wide reduction target of 5% compared to BAU by 2030 including an estimated 9% reduction in transport. Cambodia's 27% target by 2030 consisting of a 3% reduction target for transport. Passenger transport and freight transport are two major transport modes highlighted by NDCs[9].

Policy crediting approach brings new opportunity in awarding policy-level interventions against increased mitigation ambitious. CDM provided a learning experience on emissions crediting that can form a background to policy-level crediting, such as, energy efficiency standards. However, this experience has been very limited in the transport sector: only 30 out of 7,632 registered CDM projects are transport related and half of them are for BRT and metro projects[10]. Policy crediting is a new concept and it looks to increase the appetite for expanding mitigation efforts by using a payment-for-results mechanism against emission reductions generated from the implementation of a policy action. From TCAF perspective, a methodology to credit policies in the power sector (i.e. fuel or electricity subsidy reduction) was developed and is currently being tested in the Morocco power sector. This note aims at advancing the thinking on how the policy crediting approach could be used to increase ambition for mitigation measures in the transport sector.

2. Potential role for TCAF to play

Given the above context, the transport sector requires increasing attention to achieve the needed GHG mitigation, however it presents a higher level of complexity for GHG emission reduction and crediting than other sectors. The below highlights associated with transport sector reality pose both challenges and opportunities for TCAF to engage:

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[5] https://www.statista.com/statistics/281134
[6] IEA Transport Energy and CO2, 2009
[7] Source: Deloitte Truck Market 2024 Sustainable Growth in Global Markets (https://www2.deloitte.com/content/dam/Deloitte/de/Documents/strategy/DELO_Truck-Studie-2014-s.pdf)
[8] IPCC AR5 Ch8
[9] http://www.ppmc-transport.org/wp-content/uploads/2015/06/NDCs-Offer-Opportunities-for-Ambitious-Action-Updated-October-2016.pdf
[10] The CDM is a market based mechanism driven largely by private companies to generate income thorough emissions reductions. As it was a project-by-project approach the administrative costs of individual CDM projects was high, driven by a highly conservative approach to ensure that the buyer could purchase CERs with total confidence that that did not have diminished value through uncertainties or double-counting. This resulted in projects focusing on "low hanging" mitigation projects concentrated principally in China and India leaving more complicated transport sector mitigation largely ignored.

i. The price elasticity of demand for transport is low so putting a direct price on carbon will have limited effect
ii. Transport has significant externalities in addition to GHG reductions
iii. Transport sector GHG improvements are often complex because of institutional arrangements
iv. Transport has significant investment needs
v. There is a sense of urgency in transforming many of the transport decisions to avoid lock-in

2.1 The price elasticity of demand for transport is low so putting a direct price on carbon will have limited effect

Since transport is a derived demand, its average price elasticity is generally low[11]. For road freight transport that usually uses diesel as fuel, price elasticity values of -0.1 to -0.2 are typically used in most developing countries with slightly higher elasticity values for gasoline-fueled personal mobility[12]. Sensitivity to fuel price increases is even lower, as fuel prices represent on average 20% to 30% of total vehicle operating cost. Further insights come from a study by Significance and CE Delft[13] on potential freight modal shift resulting from changes in relative prices. Overall, the demand for transport of commodities was found to be relatively inelastic for both rail and road modes, tending to confirm the view that the potential for achieving modal shift through price changes alone is limited. Even with oil prices rising to US$200/bbl, rail's share of total freight volume in the EU27 would only increase by around 2%.

Since World War II, gasoline has been heavily taxed in Europe as a luxury good to fund reconstruction. This has led to far higher prices at the pump than in the US. The current difference in prices would be equivalent to adding a carbon tax on US fuel prices of US$390 / t CO_2[14] and despite this, the fuel prices to the user in Europe are not by themselves sufficient to resolve the growth in GHG emissions from transport.

Interestingly, having a higher fuel efficiency in light duty vehicles generates an increasing benefit during the different stages of the active service life of a vehicle and for the different owners during its lifetime. In Europe, light duty vehicles have average ownership periods of about 5-7 years, and average 3-4 different owners during the lifetime. The purchaser of the new vehicle may not offset the initial price premium of a more efficient vehicle through fuel savings. However, as the vehicle gets passed from hand to hand, lower income groups proportionally benefit more from the fuel efficiency. Thus, fuel efficient passenger cars have a positive price premium in the second-hand market. The value of this premium is estimated to be of around €22 per gram CO2 emitted per kilometer[15]. This result is statistically significant at a very high rate, and robust to plausible changes in model specification or the removal of outliers in the dataset.

2.2 Transport has significant externalities

Transport, and particularly road transport, is responsible for significant external costs[16] that only marginally accrue to the individual transport user or investor:

- Congestion;
- Accidents;
- Noise;
- Air pollution;
- Climate change;
- Other environmental impacts (costs of up- and downstream processes);
- Infrastructure wear and tear for road and rail.

Under a "polluter pays" principal these would be charged through to the transport user. Whilst there are notable cases of this partially occurring (for example carbon based vehicle registration taxes, congestion-, and high emission-charge

[11] Oum, T., W. Waters, and Y. Jong (1990), A Survey of Recent Estimates of Price Elasticities of Demand for Transport, working paper, World Bank
[12] Dahl, Measuring global gasoline and diesel price and income elasticities,2012
[13] De Jong, Gerard (Significance) & Schroten, Arno (CD Delft) & van Essen, Huib (CD Delft) & Otten Matthijs (CD Delft) & Bucci, Pietro (Significance) (2010), Price sensitivity of European road freight transport: towards a better understanding of existing results, Report 9012-1, 2010
[14] Author's calculations based prices for regular gasoline on 9/28/2017 of US$2.52 per US gallon average in Maryland and US$6.01 per US gallon in Germany
[15] Source: Data gathering and analysis to improve the understanding of 2nd hand car and LDV markets and implications for the cost effectiveness and social equity of LDV CO2 regulations. EC DG Climate Action 2016
[16] Source: Ricardo-AEA Update of the Handbook on External Costs of Transport, 2014 for the European Commission –DG Mobility and Transport

zones), in general the transport user or investor does not have to figure-in these additional charges in his purchase and use decisions. Table 1 shows the main issues and cost drivers per cost component of transport externalities.
From the perspective of the local authority (such as a city's mayor) that is responsible for transport choices and regulations, the externalities that most effect his decisions are likely to be those that most impact his constituents which often puts climate change in one of the lower importance positions.

Cost component	Cost elements	Critical valuation issues	Cost function	Data needs	Main cost drivers
Congestion costs (road)	Time and operating costs Additional safety and environmental costs	Speed-flow relations Valuation of economically relevant value of time (reliability)	Increasing marginal cost in relation to traffic amount, depending on time of the day/week/year and region	Speed-flow data Level of traffic and capacity per road segment	Type of Infrastructure Traffic and capacity levels, mainly depending on: - Time of the day - Location - Accidents and constructions
Scarcity costs (scheduled transport)	Delay costs Opportunity costs Loss of time for other traffic users	Valuation approach as such (measurement of opportunity costs, WTP enlargement costs, optimisation model)	Increasing marginal cost in relation to traffic amount, depending on time of the day/week/year and region	Level of traffic, slot capacity per infrastructure segment	Type of infrastructure Traffic and capacity levels, mainly depending on: - Time of the day - Location
Accident costs	Medical costs Production losses Loss of human life	Valuation of human life Externality of self-induced accidents in individual transport Allocation of accidents (causer/victim related)	Only limited correlation between traffic amount and accidents; other factors (such as individual risk factors and type of Infrastructure)	Accident database. Specification of the number of fatalities and heavy/slight injuries very important.	Type of Infrastructure Traffic volume Vehicle speed Driver characteristics (e.g. age, medical conditions, etc.) Others
Air pollution	Health costs Years of human life lost Crop losses Building damages Costs for nature and biosphere	Valuation of life years lost Market prices for crops Valuation of building damages Valuation of long term risks in biosphere	Correlation with traffic amount, level of emission and location	Emission and exposure data (exp. PM, NOx, SO2, VOC)	Population and settlement density Sensitivity of area Level of emissions, dep. on: - Type and condition of vehicle - Trip length (cold start emissions) - Type of Infrastructure - Location - Speed characteristics
Noise costs	Annoyance costs Health costs Rent losses	Valuation of health and annoyance impacts	Declining marginal cost curve in relation to traffic amount	Noise exposure data (persons) House price data for applying hedonic pricing methods.	Population and settlement density Day/Night Noise emissions level, depending on: - Type of Infrastructure - Type and condition of vehicle - Vehicle speed characteristics
Climate change	Prevention costs to reduce risk of climate change Damage costs of increasing temperature	Long term risks of climate change Level of damage in high altitudes (aviation)	Proportional to traffic amount and fuel used (marginal cost close to average cost)	Emission levels	Level of emissions, depending on: - Type of vehicle and add. equipment (e.g. air conditioning) - Speed characteristics - Driving style - Fuel use and fuel type
Costs for nature and landscape	Costs to reduce separation effects Compensation costs to ensure biodiversity	Valuation approach as such (replacement versus WTP approach)	Most of the costs are Infrastructure related, and do not vary very much with traffic volumes	GIS information on Infrastructure	Type of Infrastructure Sensitivity of area
Additional environmental cost (water, soil)	Costs to ensure soil and water quality	Valuation approach as such (avoidance versus damage cost approach)	Complex: Increasing marginal cost curve in relation to traffic amount	GIS information Infrastructure, emission levels	Level of emissions Type of Infrastructure
Additional costs in urban areas	Separation costs for pedestrians Costs of scarcity for non-motorised traffic	Valuation approach as such (Avoidance versus WTP approach)	Increasing marginal cost curve in relation to traffic density	Infrastructure data in urban areas (network data, data on slow traffic)	Type of Infrastructure Level of traffic

Table 1 - Main issues and cost drivers per cost component of transport externalities

2.3 Transport sector GHG improvements are often complex because of institutional arrangements

Because of the low price-elasticity of transport demand and the extent of transport's externalities, most large scale transport improvements in GHG emissions tend to be driven principally by regulations, rather than market forces. This is further complicated by the institutional arrangements that often impact transport operation. Figure 2 illustrates the Institutional Arrangement for Urban Transport Administration and Operation in China. Here it can be seen that at least three levels of government are involved in significant GHG emissions improvements from the national-level (emissions and fuel economy standards; authorization to manufacture or import vehicles etc) through provincial-level

control on freight modes and routes to local area demands for passenger mobility which can involve more than one urban authority.

Additionally, many transport measures can be seen as negatively affecting literally millions of voters, requiring changes in habits (such as foregoing the use of hard-earnt private vehicles in favor of public transport, parking restrictions etc). This can make it very hard for an elected local official to fully support such measures. Getting all these stakeholders to work together towards a goal that may not be of primary importance to any of them individually can be a major challenge in many countries.

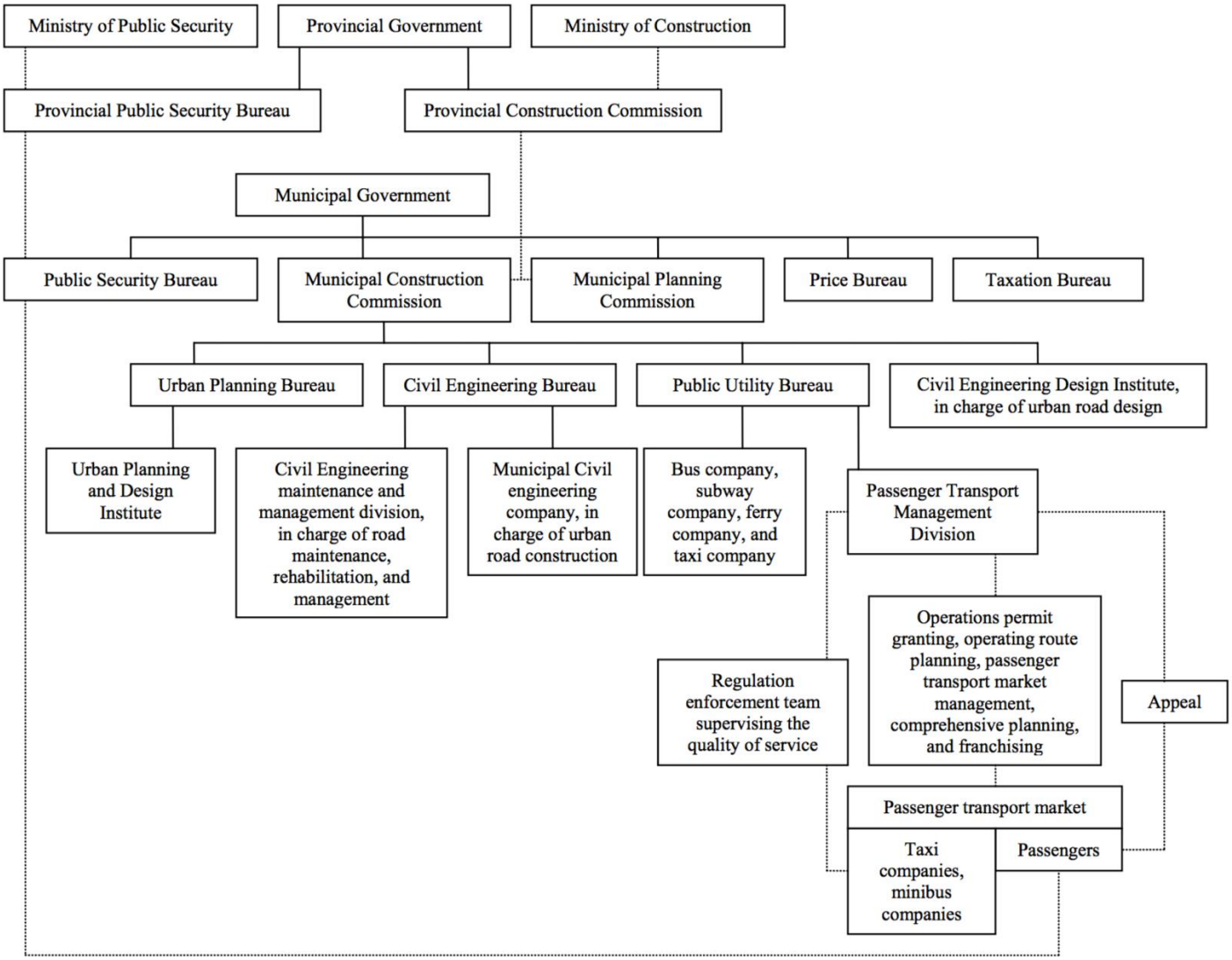


Figure2 - Institutional Arrangement for Urban Transport Administration and Operation Source: China's Urban Transportation System: Issues and Policies Facing Cities, Chris Cherry, WORKING PAPER UCB-ITS-VWP-2005-4, UC Berkeley Center for Future Urban Transport

2.4 Transport has significant investment needs

Additional Investment of around $3 trillion is required to increase the sustainability of existing and new transport systems and mitigate climate change over the 2015–35 period. This is in addition to existing annual investments estimated at $1–2 trillion[17]. Around 85 percent of this additional financing would need to be directed to fast growing developing countries, in contrast to 60% of investments in developed OECD countries today[18].

[17] Partnership on Sustainable Low Carbon Transport (SLoCaT) 2014

[18] Climate Finance as the Engine for More Low-Carbon Transport SLoCat 2015

In October 2015, the MDBs agreed to significantly ramp up overall climate finance by 2020, and transport is expected to play a key role. From 2011 to 2014, they committed more than $100 billion to climate mitigation and adaptation, including about $20 billion in the transport sector. More precisely, the World Bank Group pledged to increase its climate finance by one-third, to 28 percent of its annual commitments, by 2020. Currently, transport is second only to the energy sector in its contributions to mitigation and adaptation co-benefits in World Bank projects.

Public sector financing while an important catalyst will not be sufficient to meet these demands. Using scarce public, and international climate finance to incentivize the right choices in transport and crowd-in finance from the private sector will be important to avoid lock-in to unsustainable growth patterns in the future. So far, finance flows to the transport sector through dedicated climate instruments have been small relative to other sectors, such as energy:

The actions taken today to send the right policy signals, and establish the enabling institutions and regulations to attract the necessary private finance will be critical to support this transformation. Significant investment opportunities exist in public transport systems, vehicle efficiency improvement, and reducing the need for travel through demand management, regional development policies, and land use planning.

2.5 There is a sense of urgency in transforming many of the transport decisions to avoid lock-in.

Many transport changes have a long lead time. Not performing the change on time can lead to lock-in. A technology that is included in 100 percent of new vehicles on-sale today may still require 20 years for it to be predominant in the in-use vehicle population due to the slow scrappage rate for old vehicles. Urban design can be difficult to change once the city has been built (for example, the inner city of London has a road layout that was basically decided by the Romans two thousand years ago). So, getting public transport to work effective and well in a city that was originally designed as low-density can be very challenging.

2.6 Can TCAF have a role to play to support transformation in transport?

As discussed above, many of the mitigation measures in transport are unlikely to occur due only to market forces driven by the direct price of carbon, or by the revenue generated from selling emissions reductions at market price. Many transport mitigation measures will only be effective with government intervention and this often gives rise to significant political concerns. Therefore, the achievable emissions reductions are strongly dependent on the stringency of these interventions and on the fiscal resources that can be focused on this sector.

TCAF could have an important role to play in helping to overcome barriers to effective policy implementation and operation, and in reducing the perceived risk to investors/early adopters. The addition of TCAF can enhance the acceptability of a reform policy to the different stakeholders by reducing compliance costs to participants through MRV support, or by increasing the capacity of participants. TCAF can also be an important “rallying flag” to get stakeholders from different levels of government (and often different political affiliation) to pull together towards a common outcome and strengthens commitment to follow through to ensure that the stated targets are met.

- Provide critical MRV support: Whilst the additional funds that TCAF could add to a policy’s economic analysis are small, they can be sufficient to develop and support the necessary MRV systems to evaluate the existing policy performance and inform the follow-up policy decision making. Lack of creditable database is a critical factor preventing transport decision makers in taking right and on time mitigation interventions.
- Reduce uncertainty in outcome. Transport finance initiatives differ in their risk perception and a lack of certainty in outcome translates into greater perceived risks. Private actors usually require higher returns to justify uncertainties or challenges. However sustainable or low-carbon transport is less well established and therefore turns to be less attractive to private investors. Through proper arrangement case by case, TCAF carbon revenue can be utilized as an effective means in attractive private participation by reducing the uncertainty in outcome.
- Data collected from TCAF-supported MRV systems can strengthen and institutionalize the sector planning process while mainstreaming a “green” concept. The mitigation targets for the transport sector are usually set in the absence of rigorous data, analysis, and sector planning. Particularly, a knowledge gap exists about how to turn the target into economically and financially viable investments and policy interventions. Strategic planning and policy/ financial interventions are urgently needed to guide the whole sector development in cost-effective

and sustainable ways. The results-based payment from TCAF can be used for data analysis and contribute to strengthening sector planning while mainstreaming a "green" concept.

- "Rallying Flag". GHG mitigation from transport requires coordination between a large number of different private and institutional stakeholders, with the latter from many different levels of government, and each with their own priorities and problems. Having a Rallying Flag that all can agree to be beneficial, can be key to building consensus and momentum to benefit a common goal, even when that goal (GHG mitigation) may not be of maximum priority for several of the actors involved. Selection of prospective transport program will be a test of the understanding of the program entities on how the performance-based incentive works for their sector as well as their ability to convene multiple stakeholders to take concerted mitigation actions.
- Strengthening commitment. The inclusion of an agreed TCAF component can be critical in strengthening the commitment of the involved stakeholders to make things happen correctly. As an example, this was clearly seen in the Mexico City Pilot BRT line (Insurgentes) which transverses an area of high-end restaurants. The segregation of a road lane for BRT exclusive usage, made it more critical to keep the traffic flowing in the remaining road space. Restaurant owners lobbied extensively to be allowed to receive cars for valet parking in the curb-side lane, in front of their establishments main entrances. Had this been allowed, the reduction in traffic flow in peak hours would have completely negated the ERs generated by the BRT operation. The incorporated CDM component in this project provided evidenced data and was decisive in moving all valet parking to side streets and prohibiting vehicle reception along the BRT route.

Given these, TCAF enabling support can push the governments to extend their comfort zone towards more ambitious actions. Whilst in many sectors of the economy, transformative investment can be targeted at GHG emissions reduction, in transport it is, in many ways different. As shown in the World Bank, Climateworks Foundation report[19], many of the most effective policies and interventions to reduce GHG emissions in transport need to be promoted by focusing on the direct benefits to local stakeholders for whom, often GHG mitigation is but a minor co-benefit. However, TCAF support can in many cases be sufficient to tip the balance that allows the transformative change to occur. More precisely, it can allow stock taking and mapping of transport policy and investment interventions in the matrix of mitigation potentials and costs and by matching TCAF with targeted interventions, push local and national governments to go beyond their comfort zones in decision making, financial risk mitigation, and MRV, which put together makes interventions attractive to private and institutional investors.

The left graph on Figure 3 below shows 34 illustrative transport policies and other urban interventions that can result transport GHG emissions reductions[20] in two ways showing their relative abatement potential and ease of implementation.,These illustrative policies (shown in more detail in Annex 1) are shown grouped into 5 categories of pricing and regulatory measures to reflect their inter-linkages:

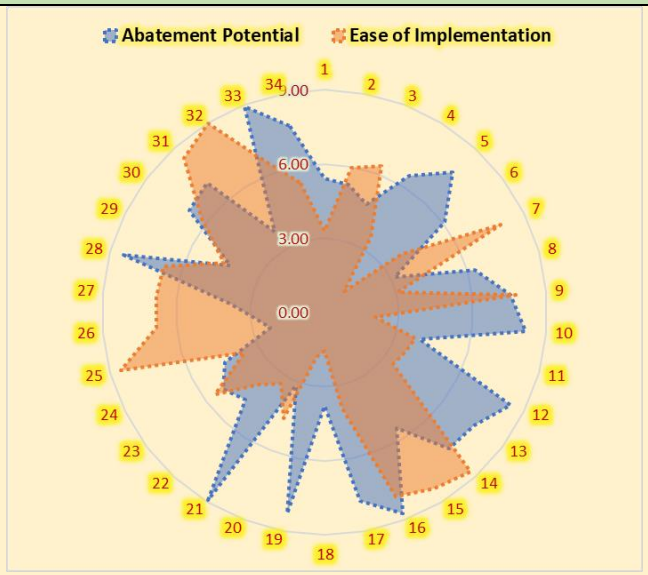
1. To reduce private car usage
2. To reduce/control vehicle ownership
3. To promote modal shift to mass transit and other low emission motorized modes
4. To promote non-motorized cycling and pedestrian transport (NMT)
5. To improve vehicle efficiency and reduce emissions

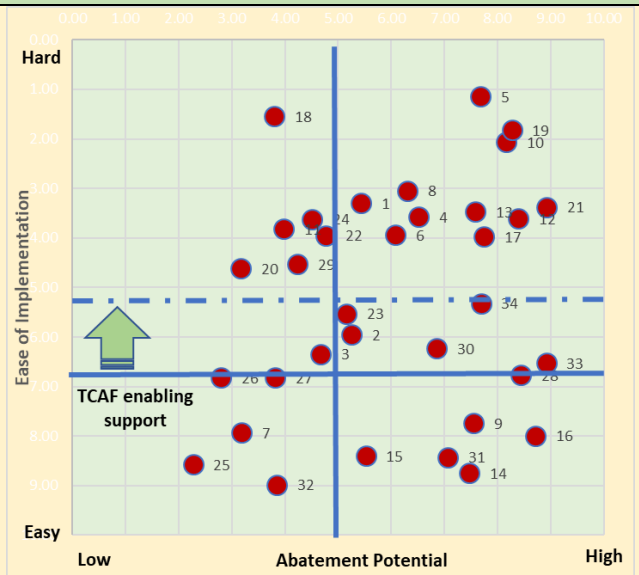
Even in those cases where TCAF funding only covers the cost of stock taking and MRV, having NDC-focused climate funding on board, TCAF can potentially leverage political and social support that could otherwise be lacking in undertaking more ambitious mitigation policies/interventions as shown in the right graph, for example, by expanding the government comfort zone from the solid blue line to the dotted blue line.

[19] see box: Climate-Smart Development, Adding up the benefits of actions that help build prosperity, end poverty and combat climate change

[20] Builds upon ICAT Transport Pricing Guidance, July 2017, INFRAS, VCS and Atkins' report Future Proofing Cities which was produced in partnership with the UK Department for International Development and University College London in 2012

Abatement potential and ease of implementation of 34 individual mitigation policies	How TCAF enabling support can increase the number of policies that can be implemented





1	Road Tolls and time-of-day pricing	18	Promotion of Bike share programs
2	Congestion or low emission zone charging	19	National regulations that promote NMT
3	Parking restrictions and pricing	20	Provision for bicyclists and pedestrians in new road infrastructure design
4	Distance-based vehicle insurance and registration fees	21	Incorporation of responsibilities for provision for NMT in statutes and procedures
5	Transit-oriented urban planning	22	Cycling and pedestrian infrastructure
6	Vehicle import duty	23	End-of-trip facilities
7	Vehicle special sales tax	24	Development of interchange facilites from NMT to motorized modes
8	Vehicle Quota systems	25	Reduce Fuel Subsidies
9	Mass-transit fare reform and integration	26	Increase tax on fuels
10	Development of intermodal hubs for freight	27	Carbon taxes
11	Development of rail links	28	Vehicle feebate based on emissions
12	Modal shift of freight from road to rail	29	Vehicle registration fees based on emissions
13	Modal shift of freight from road to waterways	30	Strict efficiency and emissions stanards for new vehicles
14	Formalize and improve standard bus services	31	Introducing Low-Emission Vehicles to Commercial Vehicle Fleets
15	Development of BRT lines	32	Reduce max age of in-use vehicles
16	Intelligent Transport Systems	33	Use of Biofuels in all vehicles
17	Development of metro lines	34	Electric vehicle charging infrastructure

Figure 3 - The abatement potential and ease of implementation of the individual mitigation policies in transport[21]

3. Examples of TCAF applicability in transport

3.1 Mexico, liberalization of gasoline and diesel prices

Gasoline and diesel prices in Mexico have traditionally been regulated by the government and until 2015, were gradually raised on a monthly basis through the "Impuesto Especial sobre Productos y Servicios" (IEPS) a "special" tax on certain goods including fuel. Liberalization of gasoline and diesel prices was one of the pillars of the country's energy reform in order to align domestic prices with global ones. Throughout the 36 years of IEPS it has functioned as a price smoothing mechanism, helping Mexican consumers pay below-market prices to compensate paying above-market prices while oil prices were low. However, over the last 10 years, before recent price increases it as a subsidy.

[21] The details of listed interventions can be found in Annex 1

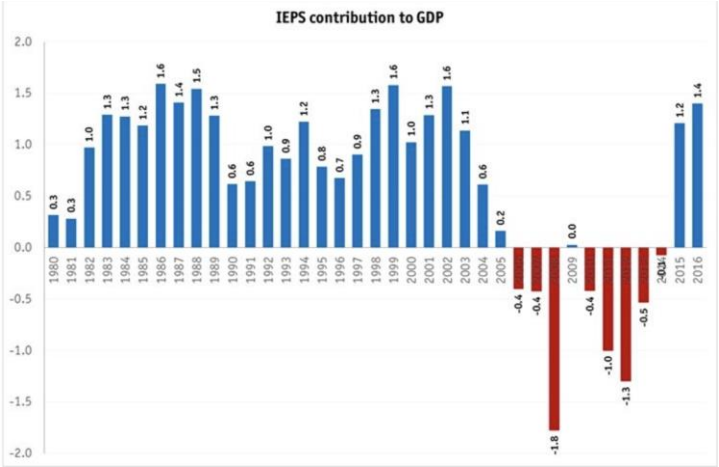


Figure 4 - Contribution of IEPS to GDP Source: SHCP (2016 is January-October). Blue is tax, red is subsidy.

Whilst Mexican gasoline prices were low by global averages, fuel costs amount to nearly 3.4% of the average Mexican's real income, almost double that of the average American. However, the middle class is dependent on car ownership. Mexican cities are notoriously badly designed for mass transit. In Mexico City, the best as far as mass transit is concerned, the Metro and Metrobus (BRT) are heavily overcrowded and the remainder of the bus network is composed primarily of microbuses, operated as individual concessions with no central authority and where personal safety is a disincentive to switch from car use. The Liberalization agenda has led to a price increase of 22.5 percent on average during 2017. According to Citibanamex, if the government had wished to avoid this increase the fiscal cost would have been 145 trillion pesos. The liberalization is taking place in 2017 in five stages, with dates as shown in Figure 5.

Figure5 - Stages of the liberalization of prices. Source: La Comisión Regladora de Energía.

This national-scale price increase is leading users to switch to smaller more fuel-efficient vehicles, car-pooling and greater use of public transport, and could be a good fit for TCAF's core priorities.

3.2 Transit Oriented Development (TOD) and Non-Motorized Transportation (NMT) Development

TOD is a fast-growing trend in creating vibrant, livable, sustainable communities by creating compact, walkable, pedestrian-oriented, mixed-use communities centered around high-quality light rail, metro or BRT systems. Its main characteristic is a walkable design centered around pedestrians, not cars. Typically, successful TOD has the mass-transit station as prominent feature with public space around it. It will have a high density, walkable district within 10-minute walk circle containing a mixture of uses in close proximity (office, residential, retail, civic) and usually designed with easy use of bicycles and scooters as ancillary support transport[22]. This brings substantial benefits to people and can also avoid a lot of travel, reducing CO_2 emissions as a consequence shown by below Table 2.

[22] See http://www.tod.org

Perceived benefits of TOD	Percent respondents
Reduced dependence on driving	57%
Allow residents to live, work and play in the same area	46%
Reduce the area's carbon footprint and negative impact on the environment	44%
Provide better access to life services	43%
Stimulate the local economy	43%
Provide better access between urban and suburban areas	42%
Provide access to better entertainment services	39%
Provide access to better jobs	37%
Revitalize urban areas	30%

Table 2 - Perceived benefits of Transit Oriented Development (Source: HNTB Companies 2016)

Non-motorized transportation (NMT) development offers the truly green (zero-emissions), sustainable and pro-poor mobility option to urban cities by encouraging walking and cycling trips. The key to reversing the trend towards more private vehicle use is make walking and cycling attractive, together with improving public transport. Having extensive, connected and safe NMT infrastructure networks are key to NMT development. This can be done by a range of activities including sidewalks and bike lanes infrastructure construction, bike sharing and parking program, bicycle intergration in mass transit system, urban planning and pedestrian-oriented development. It is increasingly recognized that NMT is a highly cost-effective transportation strategy and brings about large health, economic and social co-benefits, particularly for the urban poor.

Here, TCAF may be able to see ER results generated in a short term by selecting TOD and/or NMT projects which are half-way through their development cycle, where for example a BRT has already been built as part of city's overall transit strategy implementation, however the government is still making progress in further optimization or adjustment of TOD and/or NMT policies to achieve the goals or to maximize the impacts.

A similar example could be Vietnam which had been implementing its own energy efficiency scheme for ten years, however it wasn't as successful as expected and was discontinued after 2016. Here carbon finance is being use to reboot the sector in line with newly issued energy efficiency circulars. Because of the previous ten years awareness raising and sector experience, the carbon finance program was able to trigger the sector improvement and generate the ERs in a short term (e.g. 2 years).

In Mexico, most of the BRT transportation projects have been planned in isolation, only as corridors and for a great majority of these, complementary policies linked to TOD/NMT could increase the environmental impact. Very few routes have parking management policy in their perimeter of influence, few have integration with public bicycle systems, none are linked to inclusive housing policy. In Mexico City, the "Sistemas de Actuación por Cooperación" (SAC) have included four modal transfer centers[23] with a private trust that is generated with the developers and used to rehabilitate the polygon around the terminals. This moves action outside of the political timetable and enables things to get done.

3.3. Energy efficiency or CO_2 emissions standards for vehicles

Many cities in developing countries suffer chronic air quality problems caused by the emission of local pollutants[24] from vehicles. This is often also associated with severe congestion; however private vehicle ownership is seen as a positive effect of economic development which should not be overly restricted. This has led to the realization that strengthening vehicle emissions standards is a necessary step to maintain urban vitality.

Vehicle manufactures have developed their products to meet these increasingly severe emissions standards. The current (best) technology level for most manufacturers meets the European EURO 6/VI emissions standards or the US EPA Tier

[23] Tacubaya (CETRAM), Chapultepec (CETRAM), Observatorio (CETRAM + Toluca Train), and Vaqueritos in the polygon near the Tec de Monterrey del Sur University

[24] CO, VOC, NOx and PM

2/2010 emissions standards. At the same time the EU and USA are requiring greater fuel economy[25] leading to concurrent development that intermingles the two desired results. However, fewer developing countries have yet realized the benefits of requiring new vehicles sold in the country to meet both emissions and fuel economy standards developed together to meet EU or USA requirements to resolve similar issues.

In 2014, the G20 Energy Efficiency Action Plan established a Transport Task Group (TTG) to promote cooperation among participating G20 countries to develop domestic policies that improve the energy efficiency and environmental performance of motor vehicles. The TTG currently includes Australia, Brazil, Canada, China, the European Union[26], India, Japan, Mexico, and Russia. The status of fuel economy standards within the TTG are shown in Table 3. For the three developing countries, Mexico has legislation under development that more advanced than India or China. All need continuing assistance for these proposed standards to be finally enacted.

	Light Duty			**Heavy Duty**		
Region	**Current**	**Adopted but not yet implemented**	**Under development**	**Current**	**Adopted but not yet implemented**	**Under development**
Australia			Standards under discussion			
Brazil	Inovar-Auto; Vehicle labeling (PBEV)					
Canada	Phase 1 [2012-2016]	Phase 2 [2017-2025		Phase 1 [2014-2018]		Phase 2 [2019+]
China	Phase IV			Phase 2		Phase 3
EU	PV - Regulation 443/2009; LCV – Regulation 510/2011		Regulations relating to cars and vans beyond 2020			Legislation on mission certification, monitoring, & reporting and standards
India		113 gCO2/km in 2021				
Japan	Top runner	Top runner		Top runner		
Mexico	NOM-163-SEMARANT-ENER- SCFI-2013		Aligned with U.S. LDV 2017- 2025			Aligned with U.S. HDV 2018-2027
Russia						
USA	Phase 1 [2012-2016]	Phase 2 [2017-2025]		Phase 1 [2014-2018]	Phase 2 [2019+]	

Table 3 - Status of light- and heavy-duty vehicle fuel efficiency regulations in G20 TTG members. (Countries/regions are ordered alphabetically.) Adapted from Du et al. (2017).

If and when the more advanced standards are implemented across the G-20, nearly 90% of new LDVS and HDVS sold worldwide will meet world-class emissions standards, compared to only half of new vehicles sold today. The direct CO_2 emissions from light- and heavy-duty vehicles in TTG-participating countries have been evaluated under three scenarios for new vehicle efficiency and CO_2 standards[27]:

- "baseline" scenario assumes no further improvements in new vehicle efficiency after 2005
- "adopted policies" scenario includes all policies adopted as of September 2016, including those taking effect in the future.

[25] EU: PV - Regulation 443/2009; LCV – Regulation 510/2011, and USA: Phase 1 (2012 – 2016) fuel efficiency standards

[26] With individual participations of Germany, Italy, and the United Kingdom

[27] Source: Impacts of world-class vehicle efficiency and emissions regulations in select G20 countries: Josh Miller, Li Du, Drew Kodjak ICCT, January 2017

- "world-class" scenario models the impacts of all TTG participating countries developing new vehicle efficiency standards consistent with the objectives of the G20 Energy Efficiency Leading Program (EELP). These aspirational targets include a 50% reduction in LDV fuel consumption compared to a 2005 base year by 2030 and a 30% reduction in HDV fuel consumption compared to a 2010 base year by 2030 (G20, 016).

The "adopted policies" scenario is estimated to avoid 2 billion tons of carbon dioxide ($GtCO_2$) in 2040, whereas new world-class LDV and HDV efficiency standards applied in all TTG member countries could mitigate direct emissions from fuel combustion by an additional 2.4 $GtCO_2$ in 2040 (Figure 6). The magnitude of emission reductions achievable with continued vehicle efficiency standards—roughly evenly split between light- and heavy-duty vehicles— indicates the importance of continued activities to promote these policies among TTG-participating countries.

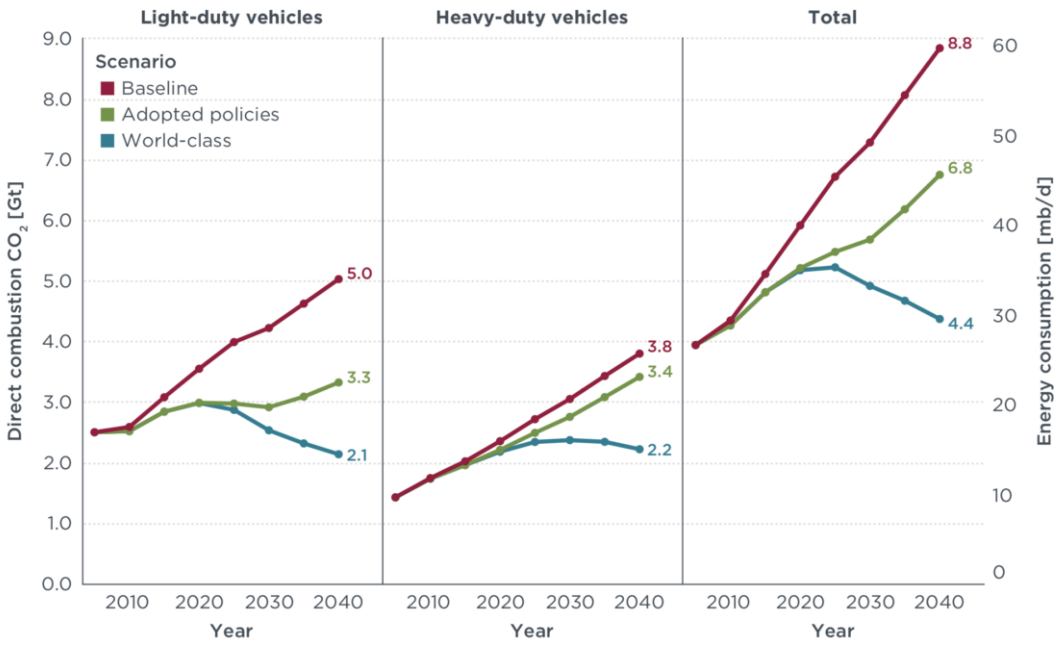


Figure 6 - Direct combustion CO2 emissions of light- and heavy-duty vehicles in TTG+EU member states under baseline, adopted policies, and world-class efficiency scenarios, 2005–2040. Figure shows historical and projected emissions for Australia, Brazil, Canada, China, the EU-28 (including TTG members Germany, Italy, and the United Kingdom), India, Japan, Mexico, the United States, and Russia [27]

This also indirectly implies that most other developing countries that are not members of the TTG and whose fuel economy standards are non-existent or do not meet the "Baseline" shown above will also exhibit substantial mitigation opportunities if they can be assisted in aspiring to the "adopted policy" level or better. TCAF could play an important role in helping this come about.

3.4 Congestion Charge Zones

Whilst TCAF would not look to credit ERs from a developed country, London's congestion charge zone provides a well-documented experience of the emissions reductions that can be achieved by this type of policy.

London's central area congestion charging scheme led to a 20% reduction in four-wheeled traffic within the charging zone during charging hours, cutting an estimated 40-50 million liters of vehicle fuel consumption inside the zone and a total 100,000 tons CO_2 emissions annually across London. Approximately half of this is due to 75,000 fewer vehicles daily and half due to the remaining traffic experiencing less congestion.

Congestion charging consists of a daily charge of £8[28] for driving or parking a vehicle on public roads within the congestion zone between 0700 and 1800 on Monday to Fridays, (excluding public holidays and weekends). The original zone cost £160m to set up, with annual operating costs of £90m. The charge raises £122 M surplus revenues over

[28] This is the initial charge in the original zone which went into effect in February 2003, and was extended to a larger área in 2007.

operating costs annually which is then spent on improving transport, including providing more buses, improving road safety and implementing energy efficiency in transport.

A TCAF involvement in such a program could provide a useful rallying flag for the different involved local and national stakeholders and provide the impetus to get it off the ground. In particular, monitoring the impact of congestion charge zone emissions performance is often inadequate and TCAF funding dedicated to improve this could provide a significant source of new information to other cities to enable its use.

4. Proposed Key Design Features for TCAF Transport Crediting Methodology

TCAF may consider a phased approach to defining the Crediting Methodology. Each phase will have different advantages and complications.

Phase one: Intervention- or policy-specific crediting: This is one step back from sector-wide crediting but may be necessary to reduce measurement and modeling uncertainties to levels that are manageable with respect to the expected levels of emissions reductions. The methodology used to define an Intervention- or policy-specific credit compares transport and vehicle activity in a historic crediting period with what could be expected to have occurred if the intervention or policy had not been enabled. It can use an engineering approach to determine the GHG mitigation contribution of technical changes and use econometric analysis to determine the impact of consumer choice on transport mode, vehicle type, and activity. It often requires additional field measurements to fully quantify this activity. The methodology determines the GHG emissions of both scenarios ("with-policy" operation compared to the counterfactual "without –policy" scenario) and applies considerations to reduce leakages. The difference between the two resultant emissions values represents the mitigation for the year in question due to the application of the policy or intervention. The TCAF crediting volume for that year, results from subtracting the mitigation amount that is needed to meet NDC targets and other commitments from this total.

Phase two: Transport sector-wide crediting: The methodology used to define a Transport sector-wide credit basically compares the transport-sector emissions inventory in a historic crediting period with the sector's NDC unconditional target for that year. Additional considerations are applied to reduce leakages and then the difference between the two resultant emissions values represents the TCAF crediting volume for that year.

The advantages and complications associated with different phases are summarized in the below table 4.

	Transport sector-wide crediting	Intervention- or policy-specific crediting
Ease of application	X	
Requires that the transport sector share of NDC target emissions be defined	X	
Less additional data collection required	X	
Beat suited to large multi-policy interventions	X	
Calculates emission reduction in target year	X	X
Calculates emission reduction forecast for subsequent years		X
Best suited to specific policy or intervention analysis		X
Forecasts GHG mitigation from that policy change in future years		X
Best suited to policies and interventions that have outcomes with long response times		X
Allows flexibility in the application of the crediting volume		X
More robust causality		X

Table4 – Comparison of advantages of the different methodologies

TCAF crediting can follow ex-post impact analysis associated with discrete policies and other interventions which are under-implementation. This analysis design should be to minimize uncertainties so that the buyer of each VER[29] has full confidence that there is no double-counting or other artifact that reduces the value of the ton of CO_2 reduction that is traded. At the same time, an excess of conservativeness is to be avoided, since this can reduce the value of the traded VERs to the seller to a point that makes the exercise unmanageable.

Following the rational that each of the policies/interventions has a direct/indirect impact channel that leads to caused GHG mitigations, a counter-factual "without-policy" scenario can be developed as part of a MRV methodology. This signifies that the with-policy operation will be measurable in historic years, and the emissions mitigation due to the enactment of this policy will be determined by comparison to a counter-factual scenario that portrays what would have happened if the policy changes had not been enacted.

5. Proposed steps for moving forward

Based on the above analysis, TCAF could be a useful instrument to be explored and integrated into the technical assistance and lending operations to support development and implementation of transport sector mitigation program in the client countries. The TCAF seeks to collaborate with the transport GP to identify a pilot crediting program that the host country is interested in pursuing based on a suite of mitigation policies/interventions already in advanced planning and preparation stage. Resources are available to support both preparation and implementation of such crediting programs.

[29] Verified Emissions Reduction

Annex I Details of listed interventions of Figure 3

	#	Policy	Description	Activity and emissions impact	Possible revenue impact	Type of Intervention			Mitigation Potential	
						Avoid	Shift	Improve	Abatement Potential	Ease of Implementation
Pricing and regulatory measures to reduce private car usage	1	**Road Tolls and time-of-day pricing**	These charge the user for access to roads that give lower travel time. Charge may vary by time of day or road utilization	Can enhance investment in more efficient transport modes which could reduce emissions, or fund roadway expansion which could increase emissions.	Provide funding for transport improvement		X		M	L
	2	**Congestion or low emission zone charging**	Limit access to a geographical area based on the number of vehicles operating in the area and/or on the vehicles emissions	Reduce vehicle usage in the zone and promote usage of mass transit. Can increase travel outside the zone	Provide funding for transport improvement	X	X		M	M
	3	**Parking restrictions and pricing**	These charges increase the variable cost per trip	Reduce private vehicle usage and promote usage of mass transit. Can cause other destinations to be preferred.	Increased local govt funding can be invested to reduce local traffic problems	X	X		M	H
	4	**Distance-based vehicle insurance and registration fees**	These charges reduce the fixed cost of vehicle ownership and increase the variable cost per trip	Reduces vehicle travel and emissions	Generally, revenue neutral			X	H	L
	5	**Transit-oriented urban planning**	Transit-oriented development (TOD) maximizes the amount of residential, business and leisure space within walking distance of public transport	Reduces the need to travel, reduces vehicle activity and emissions	Can increase local government funding by increasing land-use tax on transit corridors	X			H	L
Pricing and regulatory measures to reduce/control vehicle ownership	6	**Vehicle import duty**	These charges reduce vehicle ownership but can cause older vehicles to be employed	Reduces vehicle travel but can increase emissions per vehicle	May flow through to a general kitty, or target specific uses	X			H	L
	7	**Vehicle special sales tax**	These charges reduce vehicle ownership but can cause older vehicles to be employed	Reduces vehicle travel but can increase emissions per vehicle	May flow through to a general kitty, or target specific uses			X	L	H
	8	**Vehicle Quota systems**	Limits number of vehicles	Reduces on-road vehicle activity and emissions	Requires strong national governence	X		X	H	L
Pricing and regulatory measures to promote modal shift to mass transit and other low emission motorized modes	9	**Mass-transit fare reform and integration**	Can include reduced fares, free transfers, universal transit passes (trip integration) and more convenient payment systems (such as electronic payment cards, or mobile telephone payment.	Promotes the use of mass transit and reduces private vehicle usage	Generally, revenue neutral or reduces government take.		X		H	H
	10	**Development of intermodal hubs for freight**	Infrastructure that promotes mode shift to a lower carbon intensity means of freight transport	Reduces on-road vehicle activity and emissions	Additional investment may have a long payback period	X	X		H	L
	11	**Development of rail links**	Infrastructure that promotes mode shift to a lower carbon intensity means of passenger or freight transport	Reduces on-road vehicle activity and emissions	High investment may have a long payback period		X		M	L
	12	**Modal shift of freight from road to rail**	Give incentives to companies to use rail instead of road tranmsport	Reduces on-road vehicle activity and emissions	May require govt funding for improvements and subsidies		X		H	L
	13	**Modal shift of freight from road to waterways**	Give incentives to companies to use inland waterways instead of road transport	Reduces on-road vehicle activity and emissions	May require govt funding for improvements and subsidies		X		H	L
	14	**Formalize and improve standard bus services**	Improve a mass transit system with better service quality	Reduces on-road vehicle activity and emissions	Requires strong governence of municipal authorities		X		H	H
	15	**Development of BRT lines**	Infrastructure that promotes mode shift to a lower carbon intensity means of passenger transport	Reduces on-road vehicle activity and emissions	Medium investment. Can be built in political timeframe		X		M	H
	16	**Intelligent Transport Systems**	Makes it easier for passengers to use mass transit and give priority to mass transit operation	Promotes modal shisft	Can be built in political timeframe		X		H	H
	17	**Development of metro lines**	Infrastructure that promotes mode shift to a lower carbon intensity means of passenger transport	Reduces on-road vehicle activity and emissions	High investment may have a long payback period		X		H	L
	18	**Promotion of Bike share programs**	Improver usage of NMT for short trips	Reduces on-road vehicle activity and emissions	Can be enabled in political timeframe		X		M	L

	#	Policy	Description	Activity and emissions impact	Possible revenue impact	Type of Intervention			Mitigation Potential	
						Avoid	Shift	Improve	Abatement Potential	Ease of Implementation
Pricing and regulatory measures to promote non-motorized transport (NMT)	19	**National regulations that promote pedestrians and bicyclists and infrastructure use**	Clear regulations in national strategy for NMT facilitate framework for local plans	Provide a clear framework for local authorities to expand NMT facilities and usage	Requires strong national governence	X	X		H	L
	20	**Provision for bicyclists and pedestrians in new road infrastructure design**	Planning procedures of municipal authorities to include explicit formulation of local plans for NMT	Changes focus from vehicle management to movement of people	Usually low/medium investment	X	X		M	M
	21	**Incorporation of responsibilities for provision for NMT in urban and road fund statutes and procedures**	Clear requirements for improving NMT and funding provision	Integrate NMT into normal transport planning to reduce vehicle usage	Increasing funding for NMT can reduce funding for vehicle transport and provoke opposition	X	X		H	M
	22	**Cycling and pedestrian infrastructure**	Dedicated infrastructure promotes more use of bicycles and walking	Reduces on-road vehicle activity and emissions	Usually low/medium investment	X			M	M
	23	**End-of-trip facilities**	Provision of secure bike parking, showers, lockers etc for users	Promotes increased use of NMT and reduces vehicle usage	Usually low/medium investment	X			M	M
	24	**Development of interchange facilites from NMT to motorized modes**	Improving passenger transfer from NMT to other modes in integrated trip design to allow seamless travel	Intergates NMT into trip design and promotes greater mass-transit use	Usually low/medium investment	X	X		M	M
Pricing and regulatory measures to improve vehicle efficiency and reduce emissions	25	**Reduce Fuel Subsidies**	Removal or reduction of subsidies that reduce the price of vehicle fuel below its fair-market end-user price (including production, transport and retail)	Leads to reduced vehicle travel and can promote switching to more efficient and alternative fueled vehicles or travel in other modes	Frees-up public funds. May be used to reduce government fiscal deficit, or to reduce taxes and/or increase investment in government services		X	X	L	H
	26	**Increase tax on fuels**	These can increase government income. Tax amount may vary by fuel type which can promote fuel switching	Leads to reduced vehicle travel and can promote switching to more efficient and alternative fueled vehicles or travel in other modes	May flow through to a general kitty, or targeted to specific uses, such as poverty alleviation or transport sector improvements.		X	X	L	H
	27	**Carbon taxes**	Carbon taxes are proportional to a fuel's carbon content. Increase fuel prices, with higher increases for the more carbon intensive fuels	Can provide a large change in emissions by rewarding low carbon energy alternatives compared with traditional vehicular fuels. Can lead to reduced vehicle travel and promote switching to more efficient and alternative fueled vehicles or travel in other modes	Can be used to reduce other taxes and to fund energy efficiency programs		X	X	M	H
	28	**Vehicle feebate based on emissions**	Increases taxes on high emitters and provides subsidies (rebate) to clean vehicles	Reduces vehicle emissions	Generally, revenue neutral			X	H	H
	29	**Vehicle registration fees based on emissions**	These charges reduce vehicle ownership and promote use of more efficient vehicles	Reduces vehicle travel and move to cleaner vehicles	May flow through to a general kitty, or target specific uses			X	M	M
	30	**Strict efficiency and emissions stanards for new vehicles**	Regulations to ensure continusl improvement from new vehjivles entering the in-use fleet	Requires lower emission vehicles	Through national regulations			X	H	H
	31	**Introducing Low-Emission Vehicles to Commercial Vehicle Fleets**	Gives incentives to fleets to adopt cleaner vehicles (removes travel restrictions etc)	Promotes low emission vehicles	Requires increase in private investment			X	H	H
	32	**Reduce max age of in-use vehicles**	Regulation and scrappage program	All vehicles. Can take >10 years to get full impact of policy. Easy to get registration but difficult to get change in activity	May require govt funding for scrappage program			X	M	H
	33	**Use of Biofuels in all vehicles**	Regulation on min biofuel mix	Reduces vehile emissions but care needed not to increase agricultural emissions	May require subsidies to biofuel producers			X	H	H
	34	**Electric vehicle charging infrastructure**	Promotes more electric vehicles	Reduces emissions	Requires additional investment			X	H	M

Annex 2 Overview of World Bank NMT Engagement in LAC cities

—A Potential Pipeline Program for TCAF

The World Bank is supporting the governments of Lima, Perú, and Mexico City, México in the conceptualization of potential integrated NMT interventions with mass transit systems, and more broadly in planning and prioritization activities for connected low-stress bicycle infrastructure networks. In Tijuana, México, the Bank is financing the infrastructure of the Integrated Transit System (SITT) and is exploring last-mile connectivity improvements through NMT interventions. Likewise, the Bank is financing a transport improvement operation in Cuzco, Perú with the development of a Mobility and Public Space Plan, and the strategy to promote urban cycling. In Bogotá, Colombia, the Bank is providing advisory and analytical services to aid in the design and implementation of selected strategies and initiatives included in Bogota's Bike Plan. Details of these engagements are summarized as below from which could potentially lead a pipeline program for TCAF:

a) ***Lima*** is a city with great potential to increase bicycle use and in turn reduce congestion, increase productivity and road safety and livability if properly approached. The World Bank has financed bicycle infrastructure and promotion in earlier decades, in particular the loan operation of TRANSP.RHB (P008045) approved in 1994 for US$ 149 million with a component that financed the first bikeways in Lima, and the GEF grant associated to the PE LIMA TRANSPORT PROJECT (P035740) approved in 2004 for US$ 7.4 million, aiming to double the number of bicycle trips on project-financed bikeways with a component to improve bikeway connectivity and bike safety (i.e,, rehabilitated 33.2 km and extended 6.5 km of bikeways, and built 19.4 km of new bikeways) and to implement a bicycle promotion and education strategy. The GEF grant led to the development of a larger network of cycling infrastructure, a promotion strategy, the update of the infrastructure manual in 2004 and the development of the 2005 Bikeway Masterplan ("Plan Maestro de Ciclovías para Lima y Callao"). Today, various districts of Metropolitan Lima, notably San Borja, San Isidro and Miraflores, have developed their own bikeway plans; have built more than 100 kilometers of bikeways in their districts; and have even implemented a growing public bicycle-shared system that local authorities want to expand in five districts. The current status of cycling policies, political will, citizen engagement and large-scale infrastructure developments is fertile ground for a large investment program in urban cycling infrastructure that can complement existing infrastructure and create a connected low-stress NMT network, integrated with mass transit systems (Metro and Metropolitano BRT) and support the connectivity and accessibility of education and cultural centers, recreational facilities, public space and landmarks, and other key venue developments for the 2019 Pan-American Games to be hosted by the city. The local government has requested Bank's technical assistance support to conduct a revision and update the 2005 Bikeway Masterplan, including the development of a Lima Urban Cycling Strategy and Action Plan for the next two years. The Ministry of Housing will be financing in 2018 the construction of the first group of prioritized bike lanes (85 km), connecting key venue developments for the 2019 Pan-American Games. The Ministry of Housing has expressed interest in Bank technical support to ensure these investments are properly conceptualized and implemented following the Bank recommendations for the Lima Urban Cycling Strategy and Action Plan.

b) ***Mexico City*** has achieved outstanding progress in the development of active mobility programs and infrastructure. The policies enacted in recent years have consolidated the capital city as a regional leader in NMT. During the last five years, authorities have implemented 44 kilometers of protected cycle lanes (there are plans for an additional 60 km by the end of 2018) and three massive bicycle parking sites in mass transit stations. The successful +6,000 bicycle Ecobici bike share system opened 200 additional stations and the next expansion will feature new pedal-assist models in the following months. The metro and BRT access cards may be used on Ecobici stations, and 165 mass transit buses feature new bicycle racks. In terms of

legislation, a new mobility law gave way to a revised traffic code that prioritizes pedestrians and cyclists and toughens restrictions for motor vehicles, including speed limits. Despite the NMT improvements, the city still lacks a low-stress, connected cycling network that is integrated to its vast mass transit systems. Additionally, existing cycling infrastructure mostly consists of separated lanes while other typologies for local streets, like slow traffic zones, have not been widely developed.

Mexico City's Metrobus BRT Line 5 which started operating in December 2013 was the first mass transit project that integrated a "complete street" concept, featuring sidewalk widening, universal accessibility to stations and a wide protected cycle lane on each of the two streets that flank the BRT corridor. In 2017, the Mexico City government starts building an extension project with World Bank funds under the UTTP (Urban Transport Transformation Program – P107159). The 17-kilometer BRT extension, the first Bank-supported mass transit project in Mexico's capital, has a strong multimodal profile since it will be linked to Metrobus Lines 2 and 4, and to other mass transit systems including the Metro lines 1, 8 and 9 and the trolleybus. After reviewing the Metrobus Line 5 extension proposal, Mexico City's Environmental Secretary issued an environmental resolution requesting the construction of a protected cycle lane network as a mitigation measure to the project. The network would run parallel to the BRT corridor, and around the southern municipalities of Xochimilco and Tlalpan, areas that lack cycling infrastructure. The resolution also mentions the construction of semi-massive bicycle parking sites at the terminal stations. The construction of the cycling facilities and infrastructure that complement the Metrobus L5 extension project in Mexico City represents an opportunity for the Bank to add development value to this project through conceptual design and assessment of NMT integration inventions in a landmark BRT project.

c) ***Tijuana***'s Bank-supported BRT system SITT would greatly benefit from of transit-oriented development vision along the corridor and of strategies or interventions to improve last-mile connectivity and intermodal integration at stations, particularly from enhanced bicycle- and pedestrian-access facilities. Pedestrian accessibility to stations can be problematic, especially for people with disabilities, women, and the elderly. There is also considerable potential for multimodal trips that complement SITT through investments in selected NMT and public space improvement projects. The Institute for Transportation and Development Policy (ITDP) is currently supporting the design of a bicycle network for the Tijuana's Municipal Planning Institute (IMPLAN) that will feature an ambitious cycling strategy as component of their Sustainable Urban Mobility Plan. The Bank team is exploring different alternatives to design a technical assistance package with Federal agencies and add developmental value to the implementation support of the SITT. In particular, the Bank is interested in combing the regional knowledge and advisory work to be conducted in different cities and leverage this work to provide technical support to integrate the network to the SITT system and evaluating it with NMT last-mile connectivity and integration facilities.

d) ***Bogota*** is an acknowledged leader in transformative urban transportation projects, such as its renowned "Transmilenio " BRT system, and its massively successful recreational open streets initiative, the ciclovías. The city has implemented 440 km of cycling routes with a number of high quality, segregated cycling facilities among them. Cycling is the travel mode with the highest growth rate in the city and, as of 2015, bicycle mode share was approximately 5%. The urban cycling mode strategy proposed and recently adopted under the city development plan includes: (a) construction of over 120 km of new bicycle paths; (b) bringing 100 km of existing bicycle paths to a state of good repair; (c) encouragement of NMT modes and educating citizens about safer, more respectful mobility; (d) integration of bicycle parking with the transit system; (e) fine-tuning of urban design to prioritize pedestrians and cyclists; and (f) institutionalizing and coordinating the management of bicycle policy making, and supporting groups promoting bicycle use, safety and security. Under this strategy, the city expects a 30 percent increase in the number of kilometers traveled by bicycle on a typical day by 2020. The Bank will provide advisory and analytical services (Support the Design and Implementation of Bogota's Urban Cycling Plan - P165592) to: (a) assist in the development of a technology-

based platform for Bogota's urban cycling data collection, management and analytics, and build data analytics capacity for government planning and evaluation activities on urban cycling projects; (b) inform government policy and strategy for the design and implementation of an urban cycling security plan for the city; and (c) inform government policy and strategy for Bogota's bicitaxis (tricycle transit service) under the new regulatory framework adopted by the national government.

The Bank will also include Bogota in a group of cities to conduct regional analytical work to pilot a planning and evaluation framework for NMT interventions. The enhanced collaborative regional framework includes a digital crowdsourced strategy designed to complement the co-creation activities for NMT network planning and to map the bicycle user's subjective perception of NMT infrastructure and level of service. This level of service focuses on the Bicycle Level of Traffic Stress (LTS) methodology and the perception of personal security.

e) In ***Cusco***, the Bank is financing the Cusco Transport Improvement Project -METRA (P132505) with a component to develop the Mobility and Public Space Plan for the whole city, and an activity to develop the strategy to promote urban cycling through education, regulation, and safe and connected NMT networks. The Bank is providing technical assistance to the Municipality of Cusco in the context of METRA supervision activities to support the implementation of these NMT activities.