NAMA TAnDem:
NAMA de Transporte Activo y Gestión de la Demanda

NAMA for Active Transport and Travel Demand Management in Colombia

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NAMA TAnDem: Active Transport and Travel Demand Management in Colombia, 2017, GIZ, http://transferproject.org/

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List of acronyms and abbreviations

AFD	*Agence Française de Développement* French Development Agency
AFOLU	Agriculture, forestry and other land use
ANDI	*Asociación Nacional de Empresarios de Colombia* National Business Association of Colombia
ANSV	*Agencia Nacional de Seguridad Vial* National Agency for Road Safety
APEC	Asia - Pacific Economic Cooperation
AT	Active Transport
BAU	Business As Usual
BID	*Banco Interamericano de Desarrollo* Inter-American Development Bank
BMUB	*Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit* Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of Germany
BMZ	*Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung* Federal Ministry for Economic Cooperation and Development of Germany
BRT	Bus Rapid Transit
CAF	*Corporación Andina de Fomento – Banco de Desarrollo de América Latina* Development Bank of Latin America
CAMACOL	*Cámara Colombiana de la Construcción* Colombian Chamber of Construction
CCAP	Center for Clean Air Policy
CCB	*Cámara de Comercio de Bogotá* Chamber of Commerce of Bogotá
CCMG	Climate Change Mitigation Group

CDM	Clean Development Mechanism
CFF	Cities Finance Facility
CONPES	*Consejo Nacional de Política Económica y Social* National Council for Social and Economic Policy
COP	Colombian Pesos
CIUDAT	*Centro para las Intervenciones Urbanas de Desarrollo Avanzado al Transporte* Center for Urban Interventions of Advanced Transport Development
DANE	*Departamento Administrativo Nacional de Estadística* National Administrative Department of Statistics
DCC	*Dirección de Cambio Climático* Directorate of Climate Change
DEUT	*Dirección de Espacio Urbano y Territorial* Directorate of urban and territorial space
DNP	*Departamento Nacional de Planeación* National Planning Department
ECDBC	*Estrategia Colombiana de Desarrollo Bajo en Carbono* Colombian Low Carbon Development Strategy
EF	Emission factor
ESC	Emerging and Sustainable Cities Program
FENALCO	*Federación Nacional de Comerciantes* National Federation of Merchants
FINDETER	*Financiera de Desarrollo Territorial* Financial Entity for the Territorial Development
GAADS	*Grupo de Asuntos Ambientales y Desarrollo Sostenible* Group for Environmental Issues and Sustainable Development
GCF	Green Climate Fund
GDP	Gross Domestic Product
GdT	*Gestión de la Demanda del Transporte* Travel Demand Managment

GEF	Global Environment Facility
GHG	Green House Gas
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH* German Agency for International Development Cooperation
GTU	*Grupo de Transporte Urbano* Urban Transport Group
IBRD	International Bank for Reconstruction and Development
ICA	*Impuesto de industria y comercio* Commerce and industry tax
ICONTEC	*Instituto Colombiano de Normas Técnicas y Certificación* Colombian Institute for Technical Norms and Certification
IDEAM	*Instituto de Hidrología, Meteorología y Estudios Ambientales* Institute of Hydrology, Meteorology and Environmental Studies
IFC	International Finance Corporation
INMLCF	*Instituto Nacional de Medicina Legal y Ciencias Forenses* National Institute of Legal Medicine and Forensic Sciences
IPPU	Industrial Processes and Product Use
IVE Model	International Vehicle Emissions Model
KfW	*Kreditanstalt für Wiederaufbau* German development bank
KMI	Key Monitoring Indicator
LAC	Latin America and Caribbean
LAIF	Latin American Investment Facility
LCMT	APEC Low Carbon Model Towns
LCRDP	*Programa Desarrollo Resiliente y Bajo en Carbono* Low Carbon Resilient Development Programme Latin America and Caribbean

LEZ	Low Emission Zone
MADS	*Ministerio de Ambiente y Desarrollo Sostenible* Ministry of Environment and Sustainable Development
MinTransporte / MdT	*Ministerio de Transporte* Ministry of Transport
MinCultura / MdC	*Ministerio de Cultura* Ministry of Culture
MinEducación /MdE	*Ministerio de Educación* Ministry of Education
MinSalud	*Ministerio de Salud* Ministry of Health
MinVivienda	*Ministerio de Vivienda* Ministry of Housing
MRV	Monitoring, reporting and verification
NAMA	Nationally Appropriate Mitigation Action
NBI	*Necesidades Basicas Insatisfechas* Unsatisfied Basic Needs
NMT	Non-Motorised Transport
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organisation
O&M cost	Operating and maintenance cost
OMGI	Multilateral Investment Guarantee Agency
OMU	*Observatorio de Movilidad Urbana* Urban Mobility Observatory
ONSV	*Observatorio Nacional de Salud* National Health Observatory
OTA	*Oficina Municipal Transporte Activo* Municipal Department for Active Transport
PAS	*Plan de Acción Sectorial* Mitigation Action Plan for the Transport Sector
PBS	Public bicycle System

PDM	*Plan de Desarrollo Municipal* Municipality Development Plan
PEMPS	*Planes Especiales de Manejo y Protección* Special management and protection plans
PDDAB	*Plan Decenal de Descontaminación del Aire de Bogotá* Decenial Plan for Decontamination of Bogotá's Air
PMU	Programme Management Unit
PND	*Plan Nacional de Desarrollo* National Development Plan
POT	*Plan de Ordenamiento Territorial* Land use master plan
RUNT	*Registro Único Nacional de Tránsito* Sole Registry of National Transit
SDB	Sustainable Development Benefits
SDM	Sustainable Development Mechanism
SDP	*Secretaría Distrital de Planeación* District Planning Secretariat
SENA	*Servicio Nacional de Aprendizaje* National Learning Service
SETP	*Sistemas Estratégicos de Transporte Público* Strategic Public Transport System
SIAC	*Sistema de Información Ambiental de Colombia* Environmental Information System of Colombia
SINA	*Sistema Nacional Ambiental* National Environment System
SISETU	*Sistema de Información, Seguimiento y Evaluación del Transporte Urbano* Information, Monitoring and Evaluation System of Urban Transport
SITM	*Sistemas Integrados de Transporte Masivo* Integrated Massive Transport Systems
TAnDem	*Transporte Activo y Gestión de la Demanda*

	Active Transport and Travel Demand Management
TDM	Travel Demand Management
TEEMP	Transport Emissions Evaluation Models for Projects
TOD	Transit Oriented Development
TUD	*Technische Universität Dresden*
	Dresden University of Technology
UE	*Unidad Ejecutora*
	Executing Unit
UMUS	*Unidad de Movilidad Urbana Sostenible*
	Sustainable Urban Transport Unit
UNFCCC	United Nations Framework Convention on Climate Change
UPME	*Unidad de Planeación Minero Energética*
	Unit for Mining and Energy Planning
USAID	United States Agency for International Development
WB	World Bank
WRI	World Resources Institute

Exchange rates

COP	EUR	USD	Date
1000 COP	0.328 EUR	0.348 USD	12.04.2017

Executive Summary

In its *Nationally Appropriate Contributions* (NDC), Colombia has pledged to reduce 20% of its *Greenhouse Gas* (GHG) emissions until 2030 respective to a *Business-As-Usual* (BAU) scenario (30% with international support). In 2012, the transport sector has been responsible for about 38% of energy-related emissions (equivalent to 29 $MtCO_2$) and it is expected to emit about 48.6 $MtCO_2$ /a in 2030. Due to the rapid growth of cities and individual motorized transport, the sectors emissions are on the rise. Already today, Colombian cities are characterized by extremely high congestion levels, severe air pollution and high accident rates.

Colombia has started to address its problems in urban mobility with a national programme to co-finance the implementation of integrated and formalized bus networks in larger and medium-sized cities (SITM/SETP programme, currently 17 cities). The TOD NAMA, a NAMA on *transit-oriented development,* addresses the integration of sustainability aspects into spatial and mobility planning, and some pilot projects and support instruments for electric mobility are in place. While the current situation offers a good starting point for a transformation towards sustainable mobility in Colombian cities, only a truly integrated system based on public and non-motorized modes can achieve the coverage, quality and cost-efficiency necessary to generate and maintain a significant shift from private motorized modes. While the Colombian Government has recognized the potential and necessity to promote non-motorized transport *(*manifested recently by the adoption of Law 1811 on the promotion of cycling), the currently existing infrastructure is not fit to accommodate cyclists in a secure and comfortable manner, lacks connectivity or is missing at all.

The overall goal of the ***NAMA* for *Active Transport and Travel Demand Management*** (NAMA TAnDem for its initials in Spanish) is to increase the modal share of cycling by 9% in all cities subject to the NAMA by 2030, thereby contributing to climate change mitigation and improving the quality of life of urban citizens (e.g. improved air quality and access to mobility, reduced accident rate). The NAMA employs 7 direct mitigation measures in the Colombian cities, based on a **Push and Pull Approach**. While some measures incentivize active transport (Pull), others disincentivize individual car use (Push):

M1: Parking management schemes for automobiles

M2: Low-speed zones

M3: Bicycle parking facilities in multimodal knots

M4: Bicycle parking facilities (on- / off- street)

M5: Construction and rehabilitation of bicycle lanes

M6: Public bicycle schemes

M7: Formal bicycle taxi services

M8: Electrically assisted bicycles

The implementation of the direct mitigation measures is facilitated by a component of technical assistance and capacity building provided by the National Government to the municipalities.

NAMA TAnDem complements the National Bus Programme and the TOD NAMA. It is an integral part towards a holistic strategy for sustainable and equitable, low carbon transport in Colombian cities.

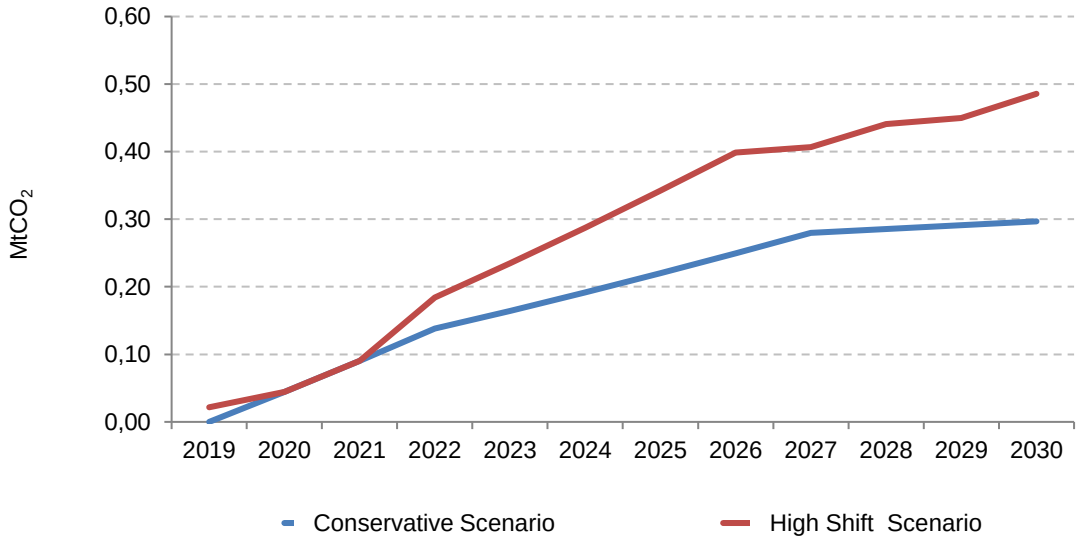
National implementing entity and involved stakeholders	**Institution:** CIUDAT – Center for Advanced Urban Transport Interventions, Findeter National Development Bank **Name of contact person:** Juan Manuel Robledo, Director CIUDAT **Involved national partners:** Ministry of Transport, National Planning Department, Ministry of Environment and Sustainable Development, Ministry of Housing **Involved supporting organizations:** German Agency for International Cooperation (GIZ) GmbH
Scope	**Geographical:** 17 Colombian cities with planned or existing formal bus system (SITM / SETP cities)[1] **Type of approach:** Shift to low carbon modes **Subsector:** Passenger (potentially freight to a small degree) **Transport modes:** • Active transport: conventional and electrically assisted bicycles and tricycles • Travel Demand Management: cars and motorcycles
Main mitigation measures	**M1:** Parking management schemes for automobiles **M2:** Low-speed zones **M3:** Bicycle parking facilities in multimodal knots **M4:** Bicycle parking spaces (on- / off- street) **M5:** Construction and rehabilitation of bicycle lanes **M6:** Public bicycle schemes **M7:** Formal bicycle taxi services **M8**: Electrically assisted bicylces
Timeframe	**Phase 1:** Pilot projects in Ibagué, Pereira and Bogotá (2017) **Phase 2:** Full NAMA implementation (2018 – 2030)

[1] The Colombian Government co-finances bus networks in Colombian cities within the frame of the National Policy for Urban and Mass transport (CONPES 3260 and 3833). According to the size of the city an integrated mass transit system, *SITM*, (currently in Pereira, Cali, Bucaramanga, Medellín, Cartagena, Barranquilla, Soledad, Bogotá, Soacha) or a strategic public transport system, *SETP*, (currently in Armenia, Montería, Pasto, Valledupar, Sincelejo, Popayán, Santa Marta, Neiva) is built.

The **emission reductions potential** of the NAMA has been calculated in a bottom-up approach against a BAU scenario for an implementation period of 13 years (2018-2030) for the 17 Colombian cities that currently have or plan a formal bus network in the frame of the governmental bus programme. Two scenarios have been calculated based on different ambition levels. While the Conservative Scenario assumes an increase of 5.5% in the mode share of bicycles and more than 800 million additional trips by bicycle in 2030 compared to BAU, the mode share in the High Shift Scenario increases by 9% and more than 1,300 million additional trips by bicycle in 2030.

Accumulated over the implementation period, the NAMA reaches a GHG emission reduction impact within a **range of 2.55 $MtCO_2$ (Conservative Scenario) - 3.88 $MtCO_2$ (High Shift Scenario)** relative to a BAU scenario. According to the NDC, the reduction commitment of the transport sector rises up at 9.7 $MtCO_2$ in 2030. The estimations should be considered rather conservative, as some measures have not yet been included in the calculations due to time constraints, among these M8 – the promotion of electrically assisted bicycles, which can be assumed to lead to significant additional reductions, as assisted bicycles have the potential to replace longer trips (up to 12 km) typically made by car or motorcycle. Annual emission reductions are visualized in Figure 1. The graphic shows that emission reductions rise with a rising degree of implementation of the NAMA measures. The reduction impact will continue even after the implementation period of the NAMA.

Figure 1: Yearly emission reductions of NAMA implementation in NAMA cities

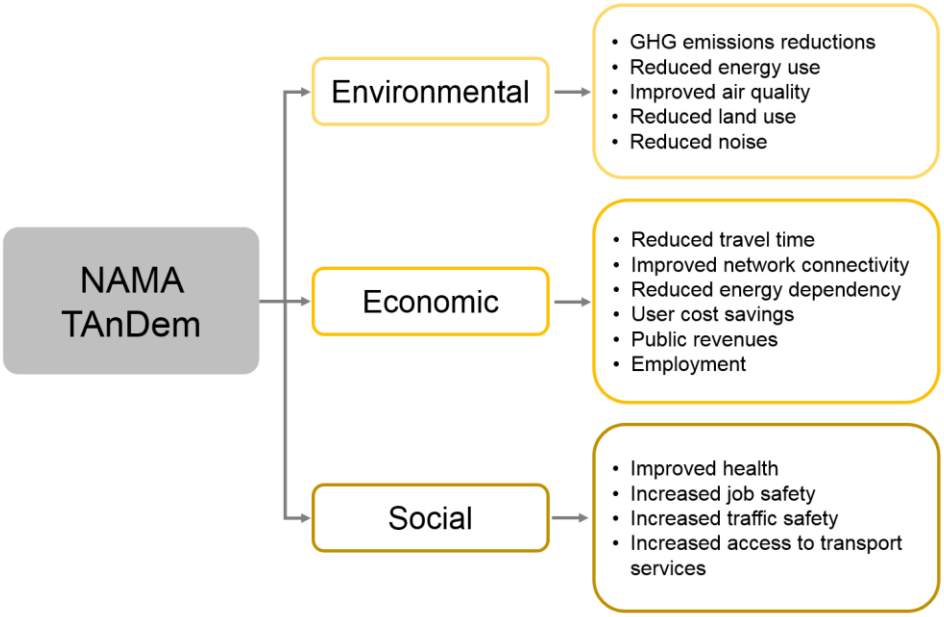


Source: own illustration.

NAMA implementation also has significant local **Sustainable Development Benefits**, such as the improvement of local air quality, and decrease in subsequent health costs, a decrease in congestion and improved access to public transport, to name just a few. In the course of NAMA

implementation, a *Monitoring, Reporting and Verificati*on (MRV) system will be set up to monitor emission reductions as well as sustainable development benefits at city level.

Figure 2: Overview of expected sustainable development benefits



Source: Own compilation

The implementation of the NAMA leads to transformational change. NAMA TAnDem works towards higher attractiveness of AT by building comprehensive, safe and comfortable cycling infrastructure on the one hand (Pull), and by desincentivizing motorized modes on the other hand (Pull). As sustainable modes become the more attractive transport option the vicious circle of deteriorating public transport, higher transport costs and increasing private motorization can be broken, resulting in transformational change.

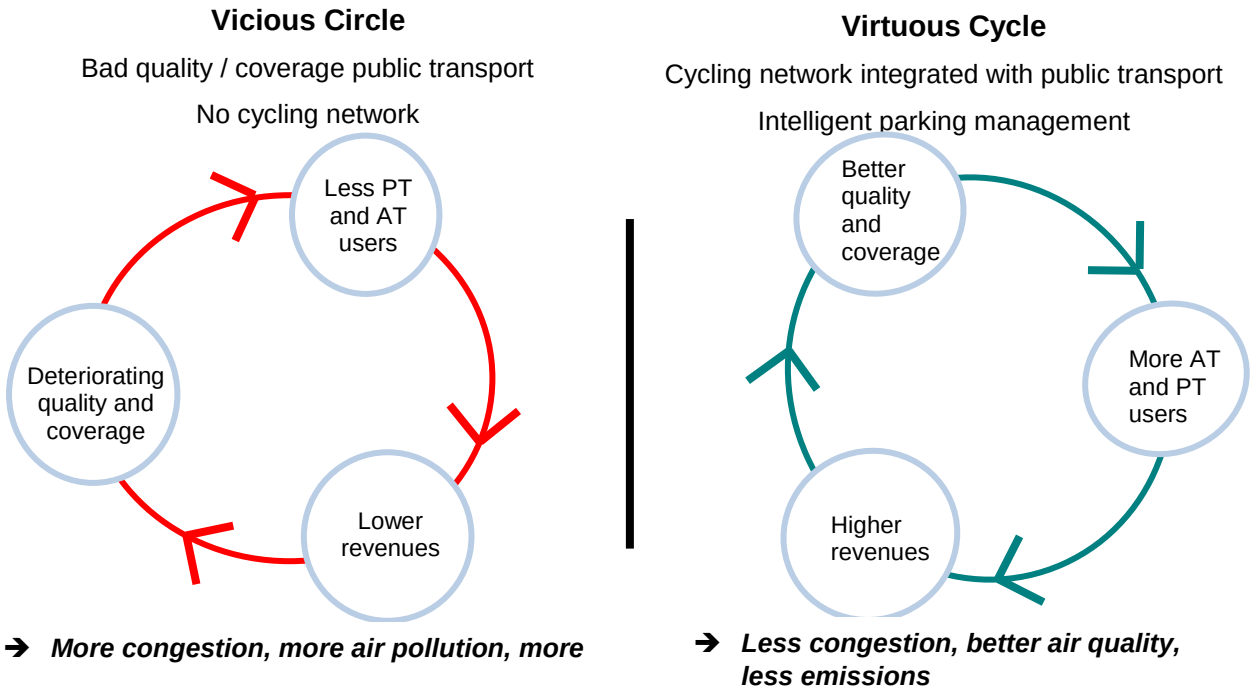


Figure 3: Vicious and virtuous cycles of urban transport policies

Source: based on Despacio, XXX

Costs for NAMA implementation can be differentiated into costs that arise at the local and national level. While at the national level a minimum of 500,000 USD per year will be needed for the implementation of the technical support component, the local level is responsible for financing the implementation of the eight mitigation measures, which was calculated to amount to approximately 0.5%-1.2% of local household budgets (depending on size and starting situation of the respective city). While some measures are more cost-intensive, others even have net profits and can be used to cross-finance the more cost-intensive measures. It is important however to **implement the measures as a comprehensive package** and not focus on the more cost-efficient measures, as only a sound and comprehensive infrastructure and policy framework can yield a significant shift towards non-motorized (and public) modes.

Given the comparably low investment needs and high social, environmental and economic benefits, it is assumed that large parts of the measures can be implemented by the cities without financial support from the national level if technical assistance and capacity building is provided. Still, finance from multilateral banks and private enterprises is necessary to kick-start implementation and reach a higher ambition level. Also, financing for the technical support component is not yet secured.

1 Introduction

In 2012, Colombia was the 6th largest emitter of *greenhouse gas* (GHG) in the *Latin America and Caribbean* (LAC) region and ranked 46th on a global scale. Since the early 1970s, Colombia's emission levels have been increasing steadily (WB, 2016d). The transport sector today is responsible for about 16% of the country's total and 38% of energy-related GHG emissions.

Even though motorization rates in Colombia are still low (251 vehicles per 1000 inhabitants, 104 excluding motorcycles), Colombian cities are characterized by high congestion levels, severe air pollution and high accident rates. A trend that is projected to further increase with rising motorization (Acevedo et al., 2009). The motorization trend poses significant challenges to Colombia in achieving its goal to reduce GHG emissions by 20% until 2030 against a *business-as-usual* (BAU) scenario (30% with international support), that has been pledged by the National Government in its *Nationally Determined Contribution* (NDC). The Colombian Government has prioritized the transport sector in its NDC and the mitigation action plan for the sector includes *active transport* (AT) as well as *travel demand management* (TDM) measures. In order to actually comply with the NDC goals, ambitious action is needed also in the transport sector.

Before this background, the Government, in cooperation with GIZ, developed a *Nationally Appropriate Mitigation Action* (NAMA) to increase the cycling share in Colombian cities: NAMA TAnDem[2]. The NAMA follows a ***Push and Pull approach*****,** that combines measures to improve the attractiveness of AT modes (e.g. through improved infrastructure) and measures to discourage the use of individual motorized transport (e.g. through parking management). The **overall goal** of the eight mitigation measures of the NAMA is to improve the quality of life in cities and mitigate climate change by incentivizing active transport and discouraging individual car use. NAMA TAnDem complements the national bus programme (SITM / SETO Programme) as well as first efforts to decarbonize the public transport fleet and integrated transport planning (NAMA TOD). It therefore is an integral part of Colombia's holistic strategy for sustainable urban transport which fosters an attractive urban transport system at low costs and high coverage.

Various studies have been carried out to define mitigation measures, assess the GHG mitigation potential and determine costs and financing opportunities for the NAMA. In 2017, NAMA TAnDem entered its pilot phase, with the objective to obtain first results in the pilot cities and refine NAMA design according to lessons learned during the pilot phase.

[2] NAMA TAnDem – Nama for Active Transport and Travel Demand Management for its initials in Spanish.

2 Overview of the Colombian transport sector

This chapter provides an overview of the Colombian transport sector. After providing general information on the relevance and status quo of AT and TDM (2.1), it sheds light on related Government policy and programmes as well as donor activity in the field (2.4). It further gives some insight into the general financing situation of the sector in the municipalities (2.2). This information will provide the basis for a comprehensive understanding of NAMA TAnDem.

2.1 Relevance and status quo of AT and TDM

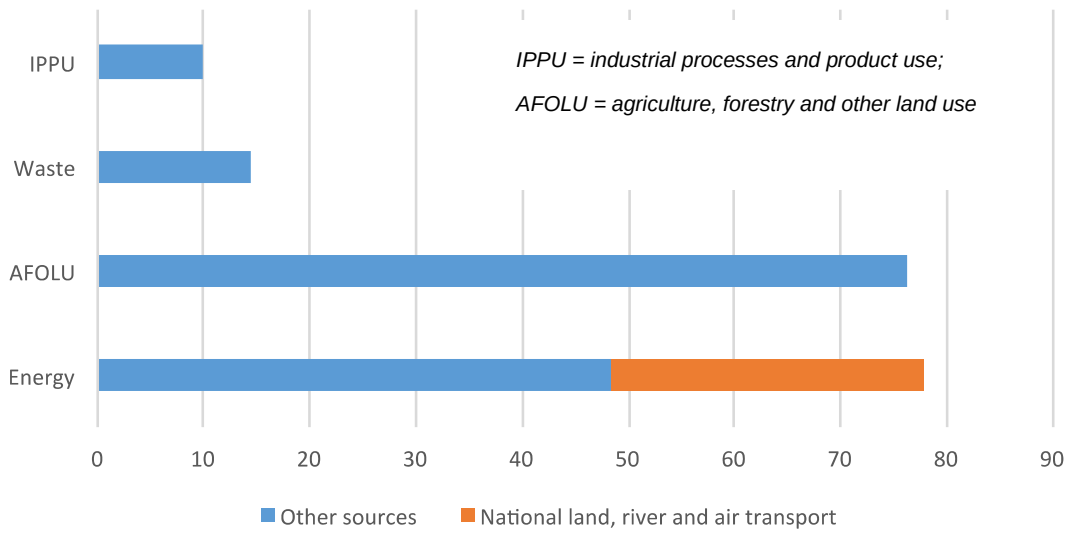
Table 1: Key background data for the Colombian transport sector

Population (2014)	47,661,787	**Total emissions (2012)**	178 Mt CO_2
Urban population (2014)	76.3%	**Total energy-related emissions (2012)**	77 Mt CO_2-
Population growth rate (2014)	1.07%	**Transport emissions (2012)**	29 Mt CO_2
GDP (2014, 2005 prices)	222.6 Mrd. USD	**Increase in CO_2 emissions in transport over the last 5 years (2007 - 2012)**	25.8%
GDP per capita (2014, 2005 prices)	4,671 USD	**Motorization rate (2015)**	251 vehicles / 1,000 inhabitants
Real economic growth (2014)	4.6%	**GHG per capita (2012)**	3.7 t CO_2
		GDP per GHG emissions (2012)	1.25 USD per t CO_2

Source: (IDEAM, PNUD, MADS, DNP, & CANCILLERÍA, 2015; Index Mundi, 2015; MinTransporte, 2015; WB, 2016b).

With about 29 Mt CO_2, the transport sector was responsible for about 38% of Colombia's energy-related emissions and for about 16% of Colombia's total GHG emissions (see Figure 4), which amounted to 178 Mt CO_2 in 2012 (IDEAM et al., 2015). A large share of transport emissions results from urban transport.

Figure 4: Relevance of emissions from transport in Colombia (2012)



Source: Own illustration based on (IDEAM et al., 2015)

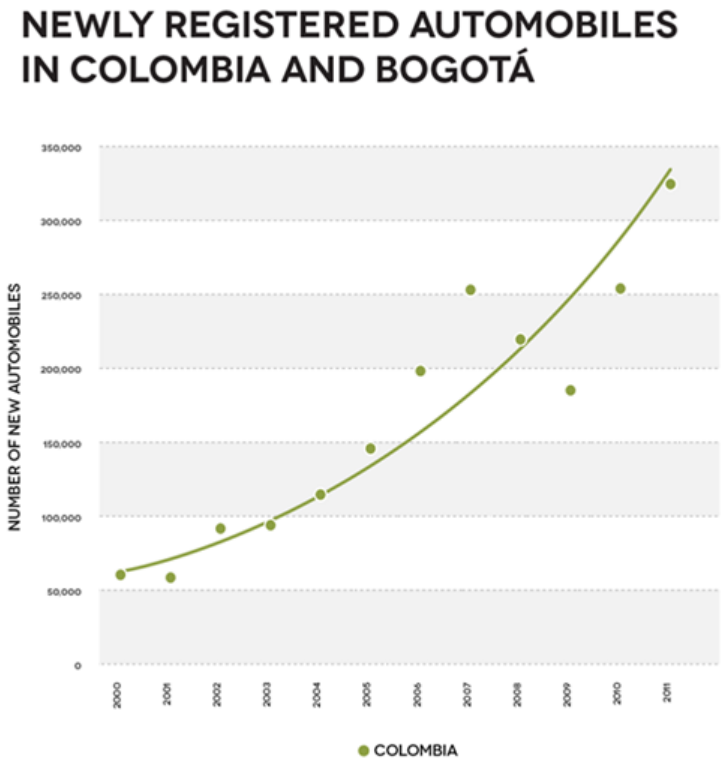
According to national projections, emissions in Colombia will rise to 335 $MtCO_2$ until 2030 in a BAU scenario, equivalent to an increase by 50% relative to its 2010 emissions (WWF-Colombia, MADS, & Fundación Natura, 2015). In its NDC Colombia has pledged to reduce 2030 emissions by 20% compared to BAU (30% with international support respectively) (Gobierno de Colombia, 2015). The transport sector is expected to contribute with at least 9.7 $MtCO_2$ to this reduction (equivalent to roughly a third of current annual emissions from transport). In order to achieve these ambitious goals, single measures will not suffice but a transformation of urban transport towards a sustainable development track based on low carbon intermodal transport networks will be necessary.

Colombia is a country of medium-sized cities. In the last decades, the country has transformed into a highly urbanized country, with approximately three quarters of the population living in cities (CONPES 3819, 2014). While in other countries, population growth and urbanization focus on a small number of very large cities, Colombia's medium-sized cities are booming, and the country counts 27 cities with a population of >250,000 inhabitants. According to Government projections, the number of medium-sized cities with a population of > 100,000 inhabitants will grow to 69 until 2050 (CONPES 3819, 2014). The medium-sized cities are therefore of high importance for climate change action.

The number of motorcycle registrations is skyrocketing in Colombian cities. Parallel to economic growth, individual motorization has increased steadily over the last 15 years, resulting in the quadrupling of the total number of vehicles (see Figure 5). Particularly, the number of motorcycles has increased at an unprecedented speed. In 2015, out of a total of 12.1 million vehicles on Colombian roads, 3.2 million were cars, while 6.5 million were motorcycles (MinTransporte, 2015). About 200,000 additional cars and 450,000 additional motorcycles enter Colombian roads every

year, a trend that is projected to continue in the future and that will further worsen congestion and accident rates if not reversed.

Figure 5: Development of motorization rate in Colombia



Source: Illustration based on (Wessels, Pardo, & Bocarejo, 2012)

Already today, Colombian cities face serious problems resulting from motorization:

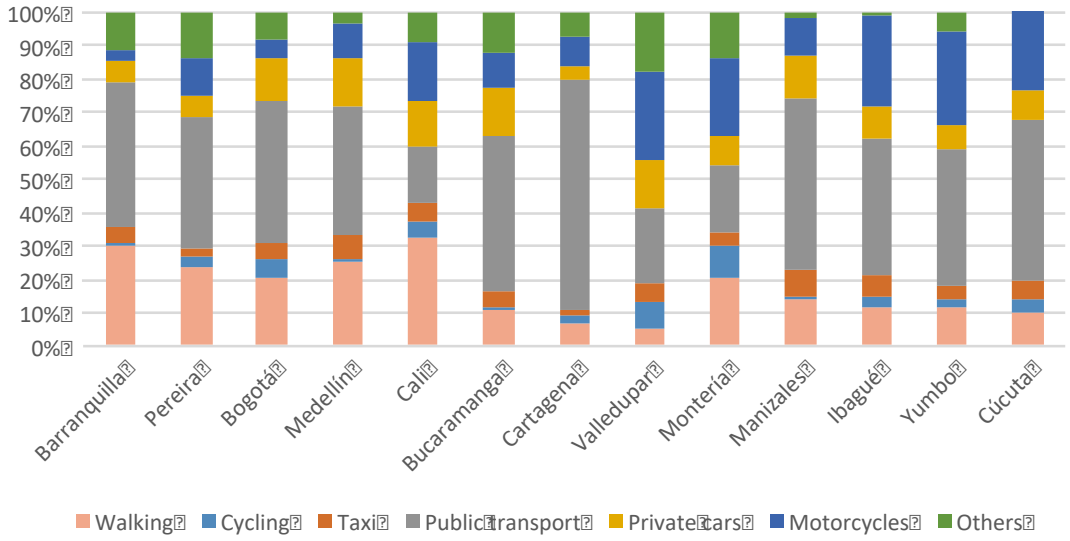
- **Congestion** consuming tens of millions of hours per year: In Bogotá alone, inhabitants spend about 7 million hours in traffic per year and traffic flow in the capital city has dropped by 15% during the last seven years resulting in an average speed of 19.3 km/h during peak hours. (DNP, 2014)
- Nearly 177,000 **traffic accidents** on Colombian roads per year (2015) causing more than 6,800 deaths (MinTransporte, 2015) and making traffic accidents the second most important cause of violent deaths, where cyclists are particularly vulnerable (e.g. 50 deaths and 268 injured in Cali in 2014). The fact that 80% of accidents involving cyclists happen on roads without cycling infrastructure (BID, 2015) shows the importance of suitable infrastructure.
- **Air and noise pollution**: Per year, Colombia counts approximately 6,000 fatalities attributed to air pollution, which are made responsible to an annual economic loss of 1.9 billion USD. For instance, annual exposure to PM10 in Bogotá has reached 53 µg/m^3, and in March 2017, the city of Medellin had to issue a red alert and temporarily extent their vehicle restrictions because of very high PM25 levels.
- With about 5.4 million USD, already today costs of congestion are associated to **economic losses** of 2% of Colombia's GDP, surpassing the total of the capital's annual household budget of 2015 (DNP, 2015).

The consistent implementation of the AT and TDM measures contained in NAMA TAnDem has the potential to significantly mitigate these negative externalities.

2.1.1 Status quo of AT and TDM in Colombian cities

Currently, motorization rates are still comparably low in most Colombian cities, while the modal share of bicycles is not to be underestimated, especially in several smaller cities. This, in general, provides a great foundation for further increases in AT and the adoption of a pioneering role in this topic. However, considering some European cities with a modal share of bicycles of up to 35%, there is still significant potential to be tapped. Also, it is assumed, that economic growth will lead to rising motorization rates and a further decrease in cycling and walking. Figure 6 shows the modal splits for selected Colombian cities. In these cities, the modal share of cycling varies from 0.6% to 9.2%.

Figure 6: Modal split in selected Colombian cities[3]



Source: Own illustration based on various sources

Colombia has started to address the challenge of increasing individual motorization and bad quality, informal public transport with a national programme to support the implementation of formalized bus networks in larger and medium-sized cities (SITM/SETP programme[4]). With the

[3] Year of data: 2015: Bogotá, Bucaramanga, Cali, Cartagena, Cúcuta, Ibagué, Manizales, Montería, Yumbo; 2014: Valledupar; 2012: Barranquilla, Medellín; 2008: Pereira

[4] SITM: *Bus Rapid Transit Systems*, in areas with more than 600,000 inhabitants; SETP: *Strategic Public Transport Systems*, in cities with between 250,000 and 600,000 inhabitants.

help of this programme, formalized bus networks have been established in 17[5] Colombian cities and implementation is currently being negotiated with four additional cities[6].

However, in the last couple of years public transport has lost passengers due to low service quality and coverage (compare Table 2), as well as the availability of other modes of transport at low cost, especially motorcycles, but also the so-called *moto-taxis*. These motorized two- and three-wheelers operate as informal extensions or in parallel to public transport systems, particularly in less wealthy neighbourhoods, in smaller cities and at the outskirts of public transport systems. As a result of the informal character, missing regulation and very small business units, the service has thin profit margins and is mostly based on unsecure and old vehicles. The drivers face poor working conditions, and the service is characterized by a lack of safety for both drivers and passengers (WB, 2016c). The lack in attractiveness of the public transport systems in combination with the availability of low-cost alternatives result in a vicious circle of ever increasing prices for public transport and/or the finalization of less profitable routes, which in turn leads to more and more passengers switching to less sustainable modes as soon as they are able to do so. This situation is most severe in smaller and medium-sized cities where informal transport has shown to sometimes displace public transport completely (Consorcio Movilidad DNP, 2014)

Table 2: Coverage of public transport systems in Colombian cities

	Bogotá (SITM and SETP)	**Barran-quilla**	**Pereira** (incl. Dosquebradas)	**Cali** (Incl. Metropolitan Area)	**Bucara-manga**	**Medellín** (Incl. Metropolitan Area)
Coverage	85%	12%	39%	53%	39%	13%

Source: (MinTransporte, 2015)

The build-up of integrated cycling infrastructure as foreseen by NAMA TAnDem, in addition to allow for full cycling trips, has the potential to increase passenger numbers of public transport as it increases the catchment area of the stations. However, infrastructure for AT in Colombian cities is currently not only not integrated with public transport, it also is scares in general, especially in medium-sized cities (compare Table 3 on current and planned cycling lanes km for some Colombian cities).

[5] SITM: Pereira, Cali, Bucaramanga, Medellín, Cartagena, Barranquilla, Soledad, Bogotá, Soacha. SETP: Armenia, Montería, Pasto, Valledupar, Sincelejo, Popayán, Santa Marta, Neiva.

[6] Buenaventura, Ibagué, Manizales and Villavicencio.

Table 3: Cycling infrastructure in Colombian cities (current and projections)

Cycling lanes (km)	Bogotá	Barranquilla	Pereira	Cali	Bucaramanga	Medellín
2015	405	0	2	26	0	58
% of total road km	4.5%	n/a	0.2%	1.1%	n/a	3.2%
2020	120	7,5	30	192	20 (2019)	130
2030	400	n/a	n/a	n/a	n/a	400

Sources: (CAF, 2016a), (CAF Observatorio de Movilidad Urbana, 2016)

Even where it exists, cycling infrastructure lacks connectivity and often does not meet safety standards in terms of minimum widths, the design of intersections, or the segregation from road traffic. Also illumination is often missing and cycling lanes lack regular maintenance, resulting in unattractive conditions for cyclists. In 2016, the Ministry of Transport published technical design guidelines for cycling infrastructure. While these are a great tool to promote safety standards, they are not yet legally binding.

Figure 7: Bad practice examples of current cycling infrastructure

Source: Carolin Capone, 2016

While the capital city Bogotá is currently carrying out an extensive study on parking management and the National Government is developing a tool to calculate parking tariffs, parking management is still underdeveloped in medium-sized Colombian cities. While most cities do not have formal parking systems, an informal private market has emerged, where vehicle owners pay informal operators to guard their vehicles. Some cities have established so-called *blue zones,* managed

by private concessionaires. These zones mark public parking areas, however, they are in general not positioned strategically, only cover certain zones and do not employ a differentiated tariff structure to manage demand in especially congested zones, nor do they generate an income for the city government. Also enforcement is not executed effectively resulting in rates as high as 40% of vehicles parking in no-parking zones slowing down traffic and impeding the use of on-street cycling lanes (Santander & Manizales Cómo Vamos, 2016). As a matter of fact some cities have already reversed their on-street parking management schemes. Further barriers towards effective parking management, are the maximum tariffs for on- and off-street parking and the minimum amount of parking spaces to be established in new buildings, established by the National Government.

Many cities employ "*Pico y Placa*" regulation, a rotating restriction for circulation of private vehicles depending on registration plates. The system, which was first introduced in Bogotá in 1998, allows either odd or even license plate numbers on certain days of the week. While this measure surely had some positive effects on the congestion level in the city, it has shown to favour wealthier citizens which can afford a second car. In the light of a financial crisis of public transport systems in many Colombian cities, currently, the possibility of an exception to the "*Pico y Placa*" scheme against payment is discussed which may be understood as a kind of permeable congestion charge. The income of these schemes are thought to be fed into public transport and the promotion of active transport means.

In 2016, the Secretariat for Mobility of Bogotá has established a group to work on parking management strategies for the city. While both, Bogotá and Medellín have put forward proposals for congestion charging schemes, congress has dismissed them twice.

2.2 Colombian transport policy in the context of climate change

National policies

Colombia is a party to the *United Nations Framework Convention on Climate Change* (UNFCCC) and has submitted its NDC on 7 September 2015. In its NDC, Colombia has pledged to reduce 20% of its GHG emissions until 2030 respective to a BAU scenario (30% with international support) (Gobierno de Colombia, 2015). While the NDC does not refer to specific transport measures, transport is named as a prioritized sector for mitigation action. However, this sector aims to improve urban public transportation, including promotion with alternative modes (non-motorized transport) (WWF-Colombia et al., 2015).

Colombia's *National Development Plan* (PND) 2014-2018 sets the political foundation for NAMA TAnDem. It includes suggestions regarding parking management (e.g. congestion charges, parking surcharge) on the one hand, and aims at stimulating sustainable modes, including bicycles and tricycles, on the other hand. The PND sets the goal to increase trips made by sustainable transport modes, including public transport and active transport, from 27% (2014) to 40% by 2018 in 8 cities. Furthermore, the PND requires the sector ministries to pass mitigation plans based on the Sector Mitigation Action Plans (Plan de Acción Sectorial, PAS) (DNP, 2014).

The *Mitigation Action Plan for the transport sector* (PAS) was developed in 2015 under the *Colombian Low Carbon Development Strategy* (ECDBC) of 2011. Inter alia, it prioritizes the

construction of bicycle lanes, parking lots for bicycles and PBS in large cities. Furthermore, it introduces congestion charges and demands the regulation and formalization of bici- and mototaxis. NAMA TAnDem directly addresses these aspects and is therefore in line with sector and national policy. The implementation of the measures in the PAS is estimated to reduce about 9.7 million t CO_2 between 2016 and 2030. In 2012, the transport sector is responsible for about 29 Mt CO_2. However, estimations are rather rough and are planned to be revised. The promotion of active modes of transport and strategies regarding demand management form part of the actions proposed in the action plan.

Most major cities in Colombia are currently updating their POT's, which define urban development and growth models for urban development over the next 12 years, which often contain measures for AT and TDM. The plans are not binding, however, provide a good option to entrench active transport in the institutional memory.

Currently, a new *Urban Mobility Policy is being developed by the DNP*, its objective being to enhance the framework conditions for AT and TDM in Colombian cities and shift transportation to these more sustainable modes. The policy forms a political long-term instrument that prioritizes the establishment of sustainable mobility including a modal shift towards active and public transport. NAMA TAnDem is in line with the goals of the policy and will support its implementation.

Table 4 provides an overview of further related policies, programmes and initiatives in Colombia in the field of AT and TDM at national level.

Table 4: National policies, programmes and projects in Colombia relevant for AT and TDM

Year	Policies, programmes and projects	Relevance
National laws		
2003	National policy for urban and mass transport (SITM) CONPES 3260	A program offering financing and technical assistance to larger cities with the aim to implement high-quality public transport in the form of integrated massive transport systems.
2015 (SETP)	National policy for urban and mass transport (SETP) CONPES 3833	A program offering financing and technical assistance to larger cities with the aim to implement high-quality public transport in the form of strategic public transport systems. It includes the general option for transit agencies to invest in intermodal transport systems, active transport and TDM measures.
2006	Sustainable Urban Planning Law (Law 1083)	The Sustainable Urban Planning Law defines the leading principles for urban mobility planning, including a prioritisation of non-motorised modes over motorized modes, the use of clean fuels, and the provision of discrimination-free transport. It further obliges municipalities to develop *Mobility Plans* (MP). These have

		been adopted in 6 cities so far: Yumbo, Palmira, Manizales, Bogotá, Medellín, Cali, Barranquilla, Ibagué, Pasto, Floridablanca, Rionegro, Tunja, Dosquebradas.
Enacted in 2016	Law 1811on the promotion of bicycle use	The law encourages the use of bicycles and their integration with public transport by obliging public transport operator to grant one PT ticket for each 30 combined trips (bike and PT) and the public sector to reserve 10% of parking space for bicycle parking. Further, public sector personnel receive half a day off for 30 days commuting by bicycle.
National initiatives		
2013	TOD NAMA	The National Government, with the support of the *Center for Clean Air Policy* (CCAP), developed the TOD NAMA, a NAMA for transit oriented development and urban planning. In the frame of a NAMA Support Project, financed by the British-German NAMA Facility, 5 pilot projects will be implemented starting 2017. The TOD NAMA, as NAMA TAnDem is implemented by CIUDAT as both approaches are complementary.
2016	Public Bicycle Pilot of the MdT	In 2016, MdT implemented a pilot program with the aim to promote active transport in Colombian cities. The pilot entails the provision of overall 876 bicycles for a total of 24 cities. While the Government bears the investment costs, the city is responsible for the maintenance and operation. The programme is going into a second phase in autumn 2017.
Relevant local initiatives taking place in various cities		
In Bogotá since 1998	License plate restriction *"Pico y Placa"*	Different municipalities (a.o. Bogotá, Medellín, Pereira, Cartagena, Bucaramanga, Barranquilla, Cali and Armenia) have enacted a license plate restriction, granting access to the city for only 50% of all vehicles (either even or odd numbers) at peak hours. Currently a buy-out option is discussed e.g. in Bogotá in order to generate funding for public transport means.
Since 1976 (every Sunday)	Ciclovías in many cities	An initiative, first implemented in Bogota, and nowadays regularly taking place in 9 larger Colombian cities, that closes part of (main) streets are on Sundays mornings to motorized transport, allowing access only to active transport modes. The Ciclovía is a public health strategy implemented by the local sports departments.

Source : (IDEAM et al., 2015; Pattiasina & Pinzón, 2015; Olga Sarmiento, Enrique Jacoby, & Thomas L. Schmid, 2010).

2.3 Finance for the Colombian transport sector

The Colombian Government has set up its most ambitious infrastructure investment plan in history in 2015 and has set up an infrastructure agency to oversee its implementation. The plan has an overall budget of $70 billion and includes a total of 101 road projects covering more than 12,500 kilometers, 52 projects aimed at regional integration as well as 31 airport expansions and port development projects until 2015. The major objectives of the investment plan are to foster regional development by improving accessibility and boost the national economy.

The Transport Ministry has an overall budget of 1,784 million USD for 2017, which is lower than the annual budgets from 2012 to 2015 but still higher than the historic average from 2011 -2016 and before. While a share of 17% of the overall budget is destined towards construction and maintenance of roads, 6% will go into sustainable transport, mainly into the co-financing of the SITM and SETP systems in the cities (see below). The most significant budget increase has been attributed to the newly established National Agency for Road Safety (162% increase from 12 million USD in 2016 to 32 million USD in 2017), a subordinate body to MdT that is relevant to the NAMA as its objective is to reduce the currently very high number of 6,000 fatalities in road traffic in the country.

Financing of the SITM and SETP systems

In 2002, the Colombian government adopted its National Urban Transport Policy (NUTP) to improve public transportation in Colombian cities > 600,000 inhabitants with Integrated Mass Transport Systems (SITM for its initials in Spanish). Next to support in transport planning and management, the NUTP grants 40 -70% of investment costs of the PT projects in the cities. Most of the funding comes from loans by developing banks, such as Corporación Andina de Fomento (CAF), the Inter-American Development Bank, and the World Bank (CONPES 3657, 2016; CONPES 3833, 2015),. Additionally, public-private partnerships play an integral part of the national policy, where the public sector is principally in charge of the delivery of infrastructure, bus corridors, and stations, as well as the planning and control of operations, while the private sector is primarily responsible to acquire and operate the vehicles, including the maintenance of yards, fare collection, etc. The program was amended in 2016 to include cities >300,000 < 600,000 inhabitants and support these with so-called Strategic Public Transport Systems (SETP for its initials in Spanish). The amendment further included the possibility to also co-finance measures to improve intermodality and integration of active transport. (CONPES 3657, 2016).

Up to now a total of 17 Colombian cities have establishes SITM or SETP systems with the help of the programme and approx. 7 billion USD have been invested by the National Government, while the local share of investment costs (minimum of 30%) mostly is covered by a gasoline tax. Still, most Colombian cities face difficulties in the financing of the operation of the SETP and SITM systems, as the programme does only support investment costs and does not subsidize operation and maintenance. As a matter of fact, in a search for cross-financing means, Bogotá is currently trying to open its license plate limitation scheme “Pico y Placa” to a buy-out option to generate

financial resources, while other cities have tried to introduce congestion charges (until now denied by the municipal councils) or ambitious parking schemes to cross-finance the public transport systems.

In general, the Colombian municipalities' household budgets are fed by national transfers on the one hand and various local income sources, one the other hand. National transfers are not calculated on a per capita basis, but are based on the so-called Unsatisfied Basic Need Index (NBI for its initials in Spanish), a measure reflecting urbanization and degree of development. The most important income sources on the local level are the property tax, the commerce and industry tax (ICA, for its initials in Spanish), a locally collected fuel levy and royalty payments or resource rents paid to the municipality by companies extracting minerals. On average, local income sources make up approximately half of the total budget, however, local income shows high disparities resulting in significant differences in the fiscal capacities of Colombian municipalities. Currently there is no effective horizontal equalization mechanism in place. Table 5 gives an overview of the fiscal capacities of some Colombian municipalities.

Table 5: Examples for financing for sustainable mobility in the Municipality Development Plans (PDM) 2016 – 2019

City (population)	**Municipal Overall Budget 2016-2019**	**Programs relevant for NAMA TAnDem**	**Budget for TA and TDM / Sustainable Mobility 2016 - 2019**
Medellín (2 million)	**5,929 million USD**	Mobility, thereof: • Strengthening of multimodal integration • NMT • Safety • Air Quality Public space Mobility and public space in the old city centre Climate change	**543 million USD** • 484 million USD • 33 million USD • 21 million USD • 6 million USD 6 million USD 63 million USD 3 million USD
Manizales (358,000)	**480 million USD**	Towards efficient, secure and environmentally friendly mobility: Cable car, public transport, autonomous transport, road safety culture Public space and sustainable city	**66 million USD** (on average 17 million USD / year including own financial resources, as well as credit) **1.5 million USD** (350,000 USD per year)

Cali (2.4 million)	**4,104 million USD**	Sustainable, secure, healthy and accessible mobility (intermodal public transport, NMT, signage)	**611 million USD** (no further differentiation)
Ibaqué (421,000)	**653 million USD**	Inclusive and sustainable mobility (incl. SETP, cycling infrastructure, road safety culture)	n/a
Pereira (440,000)	836 million USD	Sustainable mobility for development program • Infrastructure • Management Public space	**89 million USD** • **81 million USD** • **8 million USD** 5 million USD

Source: (Alcaldía de Manizales, 2016; Alcaldía de Medellín, 2016; Alcaldía de Pereira, 2016; Alcaldía de Santiago de Cali, 2016; Alcaldía Municipal de Ibagué, 2016)

2.4 International cooperation in TA and TDM in Colombia

Selected programmes and projects in the Colombian transport sector involving international cooperation are displayed in Table 6.

Table 6: International cooperation in active transport and travel demand management in Colombia

Programme / Project	Supporting international agencies	Relevance for TA and TDM	Budget
FINDETER			
The Emerging and Sustainable Cities Program (ESC)	Implementing agency: FINDETER, in the frame of the BID Initiative Allies: CAF, AFD[7]	Interdisciplinary approach towards addressing the most urgent challenges of medium-sized cities. Following a thorough analysis of the needs of participating cities, the program defines an action plan and prioritizes topics, one of them	500 million USD

[7] CAF supports the programme by realization of studies; AFD co-finances projects under this initiative via the French Global Environment Facility.

		being mobility. Example activities include: • Urban Mobility Master Plans • Studies and technical designs that includes cycle-infrastructure and parking schemes	
TOD NAMA	CCAP and KfW; implementing agency: FINDETER Allies: AFD	National Government initiative for transit-oriented planning approaches and innovative financing. The NAMA will start to work in the following cities: • Cali: transformation of rail corridor into a pedestrian-friendly zone; study on value capture (AFD) • Medellín: PPP for TOD around a new metro station in a former industrial area • Manizales: pedestrian-oriented redevelopment of its historical town center	15.6 million USD AFD: 1.5 million EUR
CAF			
Observatory of sustainable urban mobility		The aim of the observatory is to support subnational and national governments in Latin America by sectoral analysis, identification of data gaps, and knowledge transfer on best practices in public policy. In Colombia 6 cities (Bogotá, Barranquilla, Cali, Medellín, Montería and Pereira) have been analyzed. The data include among others available cycle-infrastructure, modal share, travel time, road accident.	
Dutch embassy			
Strategic Plan to promote the use of bicycles as urban	Funded by the Embassy of the Netherlands in Colombia	The Dutch cycling Embassy is supporting Cartagena in the design of a strategic plan for promoting bicycles, based partly	56,677 USD

transport In the city of Cartagena		on information gathered via the "*Biko"* mobile application.	
USAID			
Low Carbon Resilient Development Programme (LCRDP)		In the course of preparation of NAMA TAnDem, USAID implemented some pilot activities in Valledupar, i.a., the concept for an awareness raising campaign and the technical design for a cycling path. The project runs until March 2017.	71,186 USD for technical assistance
C40 / GIZ			
Quinto Centenario – 25 km Cycling Highway in Bogotá	Implemented by GIZ and C40 Cities Climate Leadership Group (C40); financed by the British and German Governments	The project aims to support Bogotá in accessing finance for 25km cycle highway and develop capacities among municipal institutions in the city, and catalyze this experience to implement new actions in other cities. BID supports the C40 and CFF Secretariat by providing technical assistance.	3.8 million USD for technical assistance

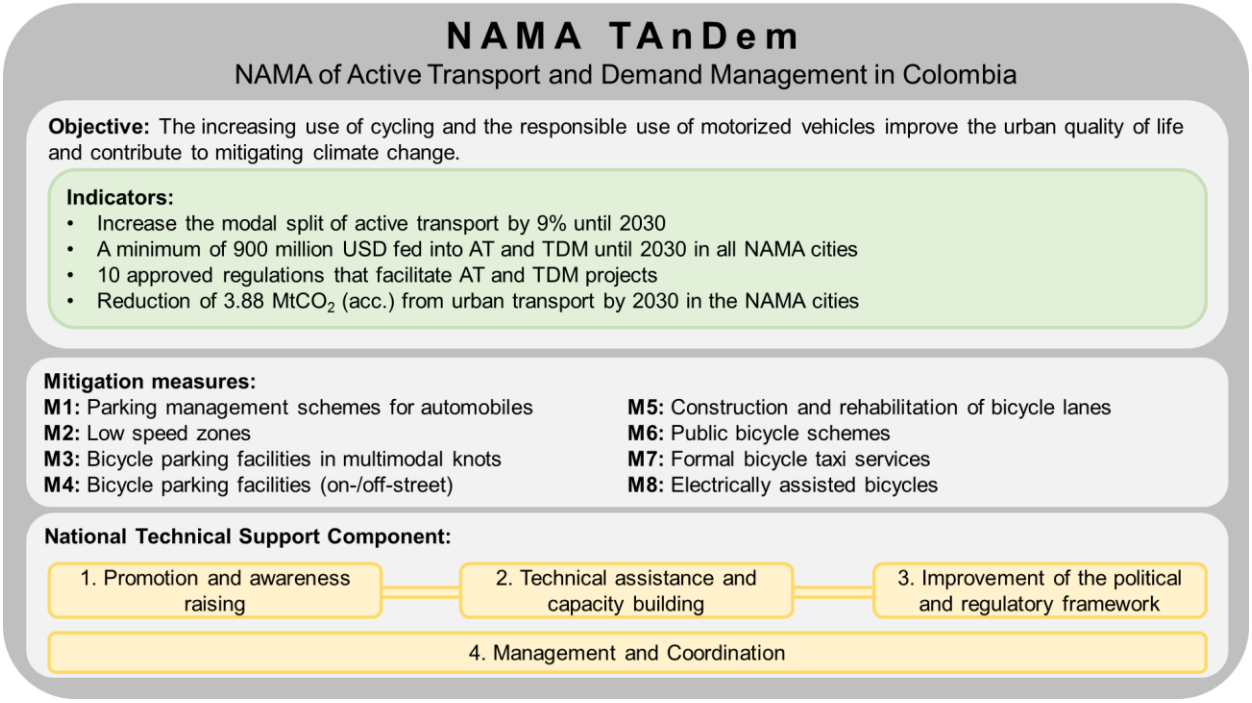
Source: (AFD, 2014, 2015, CAF, 2014, 2016b, 2016a; CCAP, 2013; FINDETER, n.d.; IDB, 2015, n.d.; IDB & UniAndes, n.d.; NAMANews.org, 2016; WB, 2016a)

3 The NAMA: Objectives, measures and impacts

3.1 The general concept of the NAMA

The **overall objective** of the NAMA is to increase the use of cycling and to rationalize the use of private motorized modes, thereby improving the quality of life of the urban population and contributing to mitigating climate change.

Figure 8: Objectives, indicators and measures of NAMA TAnDem



Source: Own illustration

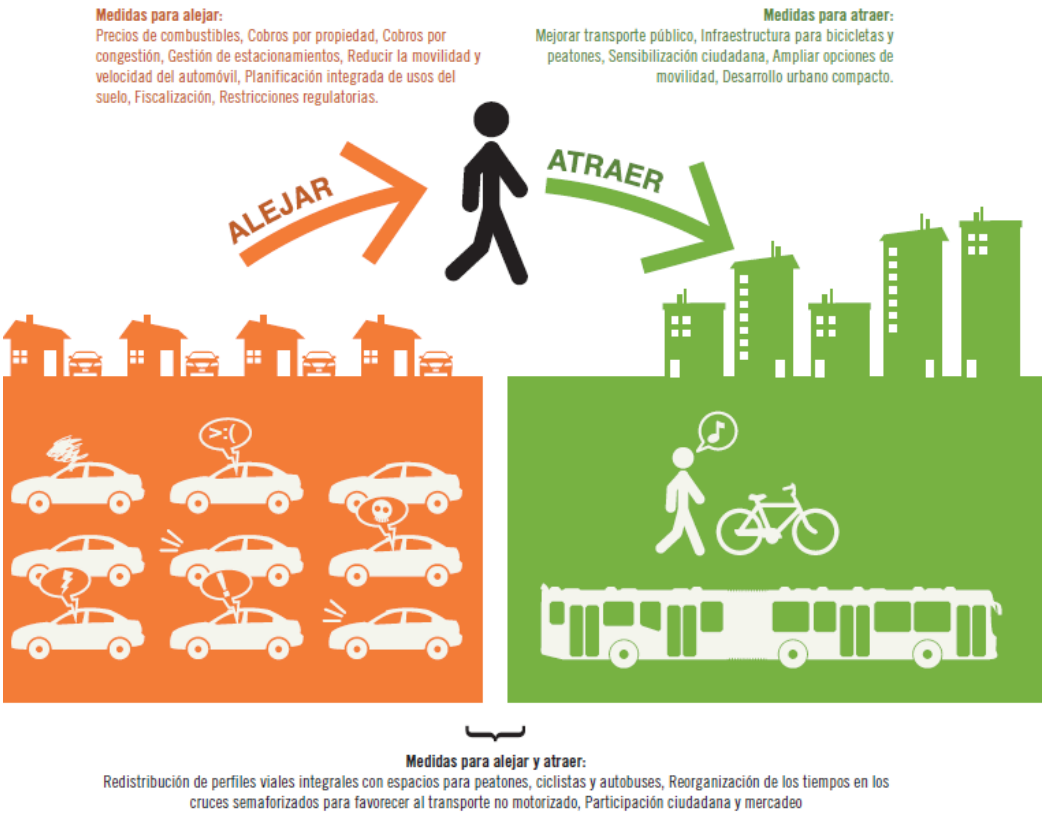
Main indicators for achieving these goals are: 1) an increase in modal share of cycling by 9% until 2030 in the cities subject to the NAMA, 2) a total accumulated investment (public and private) into AT and TDM in all NAMA cities of 900 million USD until 2030, 3) significantly improved regulatory framework conditions, indicated by at least 10 changes in regulation facilitating projects in AT and TDM, and 4) the reduction of at least 3.88 $MtCO_2$ from urban transport accumulated over the period 2017 - 2030.

The NAMA comprises **eight direct mitigation measures** in the field of AT and TDM (see chapter 3.2 for further detail), to be implemented by the local level, as well as a **Technical Support Component** to be implemented by the national level, which provides capacity building, technical advisory and promotion activities to the cities (see chapter 4 for further detail) and improves the overall regulatory framework. It is assumed that the implementation of the Technical Support Component alone will yield a significant increase in the implementation of AT and TDM measures in Colombian cities, as the major hurdle towards the implementation of the NAMAs mitigation measures is seen in the lack of local capacities and know how on benefits and technical aspects, as well as gaps in the regulatory framework. Financial support by third parties to the local level will further facilitate and speed up the implementation of the eight mitigation measures. Figure 8

provides an overview of the objectives, indicators and actions (direct mitigation measures and supportive measures) of NAMA TAnDem.

In order to achieve a significant modal shift towards cycling, the NAMA employs a comprehensive **Push and Pull Approach**. On the one hand, it aims at incentivizing active modes, such as conventional and electrically assisted bicycles and tricycles, e.g. by providing an adequate infrastructure or other benefits to cyclists, and thereby attracts additional AT trips ("*Pull*"). On the other hand, it discourages the use of individual motorized modes, e.g. by constringent parking policies and thereby pushes demand from motorized modes towards the more sustainable, non-polluting active modes ("*Push*"). Figure 9 illustrates the Push and Pull approach employed by NAMA TAnDem.

Figure 9: The Push and Pull Approach of NAMA TAnDem



Source: own illustration

3.2 Direct mitigation measures of NAMA TAnDem

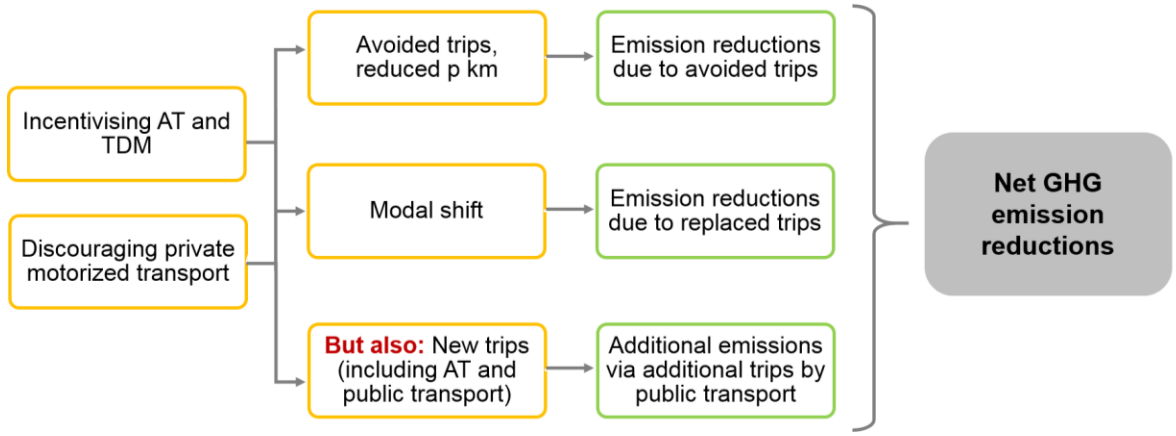
NAMA TAnDem employs seven direct mitigation measures, which together form a comprehensive package to create a significant modal shift towards active and intermodal trips:

- **M1:** Parking management schemes for automobiles
- **M2:** Low-speed zones
- **M3:** Bicycle parking facilities in multimodal nods

- **M4:** Bicycle parking facilities (on- / off-street)
- **M5:** Construction and rehabilitation of bicycle lanes
- **M6:** Public bicycle systems (PBS)
- **M7:** Formal bicycle taxi services
- **M8:** Electrically assisted bicycles

As mentioned in chapter 4.1 the NAMA follows a **comprehensive Push and Pull Approach** for the promotion of active transport modes. Figure 10 shows the general logic of the GHG emission reductions to be expected from the implementation of NAMA TAnDem. The implementation of the NAMA's mitigation measures leads to the replacement of trips conventionally made by motorised individual modes (motorcycles, cars) with active modes, namely (electrically assisted) bicycles and tricycles, as well as with combined AT and public transport trips. As bicycles, electrically assisted bicycles and public transport have less specific emissions when compared to individual motorized modes, overall emissions are reduced. The discouragement of private motorized trips by e.g. stringent parking schemes further shifts trips to a combination of PT and AT, resulting in additional emission reductions. It has to be noted that NAMA implementation may also lead to some new trips made by individual motorized mode, as the implementation of the 8 measures leads to less congested roads, what may encourage new drivers to buy and use a car.

Figure 10: Impact chain of the NAMA TAnDem



Source: Own illustration

3.2.1 Push Measures

M1: Parking management schemes for automobiles

Measure 1 concerns the smart management of parking space within a city. Currently, many cities establish a ceiling price for private parking. In a like manner, new buildings have to meet minimum parking requirements. Enforcement of on-street parking is poor, resulting in a vast quantity of cars

being parked in no-parking zones (e.g. 40% in Manizales according to Manizales Cómo Vamos, 2016). While some cities have implemented on-street parking policies denominated *Blue Zones* (e.g. in Medellin, Pereira or Manizales), these schemes, operated by private entities, have seen various difficulties with corruption, negotiation of alternative tariffs and a general lack of enforcement. Further, they mostly do not employ differentiated tariffs to lead demand to less congested zones or incentivize less polluting modes. With other words, the current policies, in their majority, do not deter trips by car or motorcycle (prices are reasonable, parking space is abundant, tariffs are not differentiated according to demand) nor do they incentivize trips by active modes (e.g. no lower tariffs for bicycle parking).

Figure 11: Examples parking management

Source: (Barter et al., 2016), Capone, 2017

Measure 1 has the objective to improve parking policies with the aim to reduce travel demand by private modes and incentivize active transport (in combination with public transport). Example elements of a sound parking management scheme include (ITDP, 2014):

- Elimination of minimum parking requirements
- Establishment of parking caps to control total supply
- Reduction of inner-city parking near public transportation stations
- Charge for on-street parking based on market conditions and occupancy rates
- Creation of districts with parking benefits, in which fees collected from parking meters could be re-invested in the community
- Integration of technology into parking to offer both consumers and policy managers the greatest possible flexibility
- Re-purposing of street spaces from cars to more social uses, such as bicycles, bus-only lanes, wider sidewalks, or mixed-use spaces
- Incorporation of parking policies into metropolitan transportation plans

- Inclusion of innovative parking management in government "*livability*" initiatives, transit management policies, air pollution control strategies, climate change measures, and innovative financing programmes
- Strengthen enforcement of on-street, off-street, illegal, informal, and legal/formal parking designations

Smart parking management has the potential to reduce trips by car and motorcycle, as others transport modes become comparatively more attractive. It may further reduce trips by car and motorcycle induced by parking search traffic, which is responsible for up to 30% of overall traffic/energy use (Barter et al., 2016). Smart parking schemes further generate income for the city which can then be re-invested into the promotion of active transport and provides local employment.

3.2.2 Pull Measures

M2: Low-speed zones

Measure 2 addresses the implementation of low speed zones, with the aim to create cycling- and pedestrian-friendly streets and reduce traffic accidents. In Colombia, speed limits are mainly determined by traffic signals but not by streets design, making it easier for drivers to ignore the limits. A lack of enforcement by the police adds to the exceedance of speed limits. While some cities, like Bogotá, Medellín and Montería have worked on the implementation of traffic calming zones and shared streets, most cities do not yet employ such approaches. Also local commerce tends to oppose the conversion of streets to pedestrian streets in the fear of losing customers.

Figure 12: Examples of a Low Speed Zones

Source: Patricia Calderón, Montería 2016

To address the above named issues, measure 2 may include, based on the local necessities, a variety of measures, including engineering measures as well as enforcement and educational measures. Engineering measures include, e.g. the:

- narrowing of street lanes by means of: curb extensions, re-dedication of lanes towards other uses such as cycling or parking, pedestrian refuges or small islands in the middle of a street,
- horizontal deflections such as speed humps and cushions, raised pedestrian crossings, changing the surface material to e.g. cobblestone or highlighting with color the priority of cyclists and pedestrians, or
- blocking through traffic, e.g. by creating dead ends or closing streets to motorized traffic by creation of pedestrian zones.

Enforcement and educational measures may include, e.g.:

- reducing speed limits near schools and hospitals,
- implementation of vehicle active signs that show a message to drivers if an exceedance is recorded by a camera, and
- the deployment of watchmen and speeding cameras, which, as an additional benefit, can generate significant revenues for the cities.

M3: Bicycle parking facilities in multimodal nods

Measure 3 aims to facilitate combined trips by public transport and active transport by providing a smooth transfer from one mode to another. As combined trips have a considerably larger reach than sole bicycle trips, they have the potential to replace car and motorcycle trips. Also, the integration of both modes will increase the demand for public transport systems, that in many cities face a decreasing ridership (and consequently economic problems), as more and more passengers shift from public to private modes.

In terms of bicycle parking in public transport stations, at the moment, Bogotá is the only Colombian city which has implemented a significant infrastructure (2,532 spaces integrated with *Transmilenio,* Bogota's public mass urban transport service(TransMilenio, n.d.)). Also, it is allowed in Bogotá, to take folding-bicycles onto articulated buses, while in Medellin and Manizales it is allowed to take bicycles along in the cable cars. Measure 3 of the NAMA aims to mainstream these approaches and complement them with further measures such as the:

- installation of safe and easy-to-use bicycle parking facilities within the public transport stations,
- introduction of reduced fares for combined trips,
- the use of bicycle carriers on trams, buses or metros, or the possibility to take the bicycle on bord, and
- improved cycling infrastructure within a radius of 2km around the public transport stations.

Figure 13: Bicycle access to Cable car in Manizales (left) and bicycle parking at train station in Hamburg, Germany (right)

Source: Carolin Capone, 2016 (left) and Nahverkehr Schleswig-Holstein, 2016 (right)

M4: Bicycle parking facilities (on- / off-street)

Measure 4 seeks to increase the number of bicycle trips by providing safe and easy-to-use bicycle parking facilities in public space as well as typical travel destinations (public as well as private), such as educational institutions, office buildings, shopping centers, and restaurants. Up to now, only Medellin and Bogotá enacted a law on bicycle parking, establishing the requirement of implementing one bicycle parking space for every 10 car parking spaces. The measure includes the planning of strategic positioning and construction of public parking facilities, the reallocation of car parking space to bicycle parking space in public institutions, awareness raising campaigns on the benefits and necessity of bicycle parking facilities and capacity building on suitable technologies and positioning for private actors, as well as enhancing the local regulatory framework on parking requirements.

Figure 14: Different types of private bicycle parking facilities. Examples from Medellin (left) and Berlin (right)

Source: Patricia Calderón, 2016 (left) and Carolin Capone, 2016 (right).

M5: Construction and rehabilitation of bicycle lanes

The objective of measure 5 is to build and maintain comprehensive networks of cycling lanes. This may include:

- the construction of new cycling lanes following a cycling master plan (including segregated cycling lanes, painted cycling lanes, shared roads designs as well as cycling highways according to master plan),
- the modernization and maintenance of existing lanes, which do not meet safety standards, or do not allow for secure and comfortable travel, e.g. by removing obstacles, improving illumination and signage, or increasing widths,
- the re-design of streets at accident hot spots: e.g. by dedication of road lanes to cycling, segregation of cycling lanes from road traffic, signalization, etc.

Figure 15: Good practice examples of current cycling infrastructure

Source: Patricia Calderón, 2016

M6: Public bicycle systems

Public bicycle systems (PBS), in general, have the potential to remove different barriers to cycling, such as not owning a bicycle, fear of theft when leaving the bicycle at a public transport station, or not being able to take the bicycle on the train or bus for longer, intermodal trips. PBS further have the potential to increase the visibility and the image of cycling. They have worked well as an option for last-mile connectivity or for inner-zonal trips in several cities in Latin America (e.g. Mexico City, Buenos Aires, Rio de Janeiro, Medellín) and are becoming especially popular around the world as dock-less and app-based systems are becoming available.

Figure 16: Case study on modal shift induced by PBS

In 2010, the PBS Ecobici started operation in Mexico City with 84 bicycle stations and 1,200 bicycles. An analysis of the system and its effects in terms of modal shift has shown that 54.1% of users replaced motorized modes by trips done with the PBS, one forth of these replacing private cars (Centro de Transporte Sustentable EMBARQ México & Secretaría de Medio Ambiente del Gobierno del Distrito Federal, 2013). Due to its large success the system was able to grow 400% and today counts 452 bicycle stations and more than 6,000 bicycles. The Ecobici programme is today the second largest system in Latin America with more than 35,000 trips per day.

In Colombia, until today, Medellin is the only city that has implemented a well-working PBS with 53 stations, 1,200 bicycles and 52,053 users (Área Metropolitana del Valle de Aburrá, n.d.; ElTiempo.com, 2016). In 2015, the Ministry of Transport started an initiative to implement public bicycle pilots in 28 cities, providing 28 cities with either a certain number of bicycles or financial resources for the set-up of such a system. However, due to a lack of technical capacities in the cities, next to further constraints, such as a limited number of bicycles and time constraints, none of the systems was implemented in a sound manner until today (April 2017).

Figure 17: Examples of Public Bicycle Schemes

Source: Patricia Calderón, 2016,

Before this background, measure 6 includes the implementation and operation of soundly designed and strategically positioned PBS, based on a mobility master plan and in accordance with the state of existing cycling infrastructure.

M7: Bicycle and electric taxi services

While there are no official figures, an increasing number of informal bicycle taxis has been recorded in recent years in Colombian cities. These services can be found mostly at the outskirts of the formal public transport systems, where they serve as an informal extension or in neighborhoods where no formal public transport service exists. Non-motorized bicycle taxis

currently compete with so-called mototaxis, motorized two- and three-wheelers, that given their average age and use of technology, are a rather unsustainable option. Partly, mafia-like organizations are controlling “routes” and own a larger number of vehicles that are rented out to drivers in shifts. As the service is informal, there are no social services for the employees and labour conditions are poor. Most vehicles are old and unsecure, given the insufficient financial power of the small business entities.

Measure 7 seeks to formalize bicycle taxi services and form small business units, following the model of Copenhagen, New York and London, thereby providing a low-cost sustainable option for public transport in more secluded neighborhoods, where conventional feeder lines would not be viable, creating regular labor, and improving security of the vehicles. As a result, residents of these mostly poorer neighborhoods receive better access to mobility and trips with mototaxis may be replaced by non-motorized modes, reducing GHG emissions and contributing to better air quality in the neighborhoods. Measure 7 comprises the following direct mitigation measures:

- Design of bicitaxi services (integrated in public transport system), including business models, definition of routes, service standards, etc.
- fleet formalization:
    - retrofitting of bicitaxis
    - replacement of mototaxis with electrically assisted bicitaxis
- construction of parking stations at intermodal hubs

Figure 18: Bicycle taxis service

Source: Patricia Calderón, 2016 and MdT, 2015

M8: Electrically assisted bicycles

Electrically assisted bicycles are already a reality in many regions of the world that policy makers and urban planners have to react on, as higher user numbers and higher speeds pose new

requirements for a suitable infrastructure. The promotion of electrically assisted bicycles, if done in a sensible way, can have a high potential for climate protection, in combatting local air pollution, and in the reduction of congestion, as they allow for a shift from motorcycles, which show especially high growth in Colombian cities, but also from private cars or taxis, as many international studies have shown.

Electrically assisted bicycles allow to carry heavier loads, enable people with lower fitness levels to cycle and allow for cycling in mountainous terrain, that various Colombian cities face. It further allows for a significant cost reduction compared to a car or motorcycle. Table 7 shows the economic and ecologic benefits of electrically assisted bicycles as compared to private cars, while Figure 19 compares average speeds of different transport modes in city traffic (example of Berlin), showing that electrically assisted bicycles (also called Pedelecs) show only slightly lower speeds in urban traffic as cars and higher speeds when compared to all other modes of traffic.

Table 7: Benefits of electrically assisted bicycles

	Energy consumption (100km)	**CO_2 emissions (100km)**	**Energy costs (100 km)**	**NOx emissions (100km)**	**PM_{10} emissions (100km)**
Car (petrol)	7,9 litres	22,08kg	12,008€	30,64g	0,36g
Car (diesel)	6,7 litres	19,14kg	9,447€	69,40g	2,69g
E-cycles	1kWh	0,564kg	0,253€	0,52g	0,02g

Source: UBA 2011

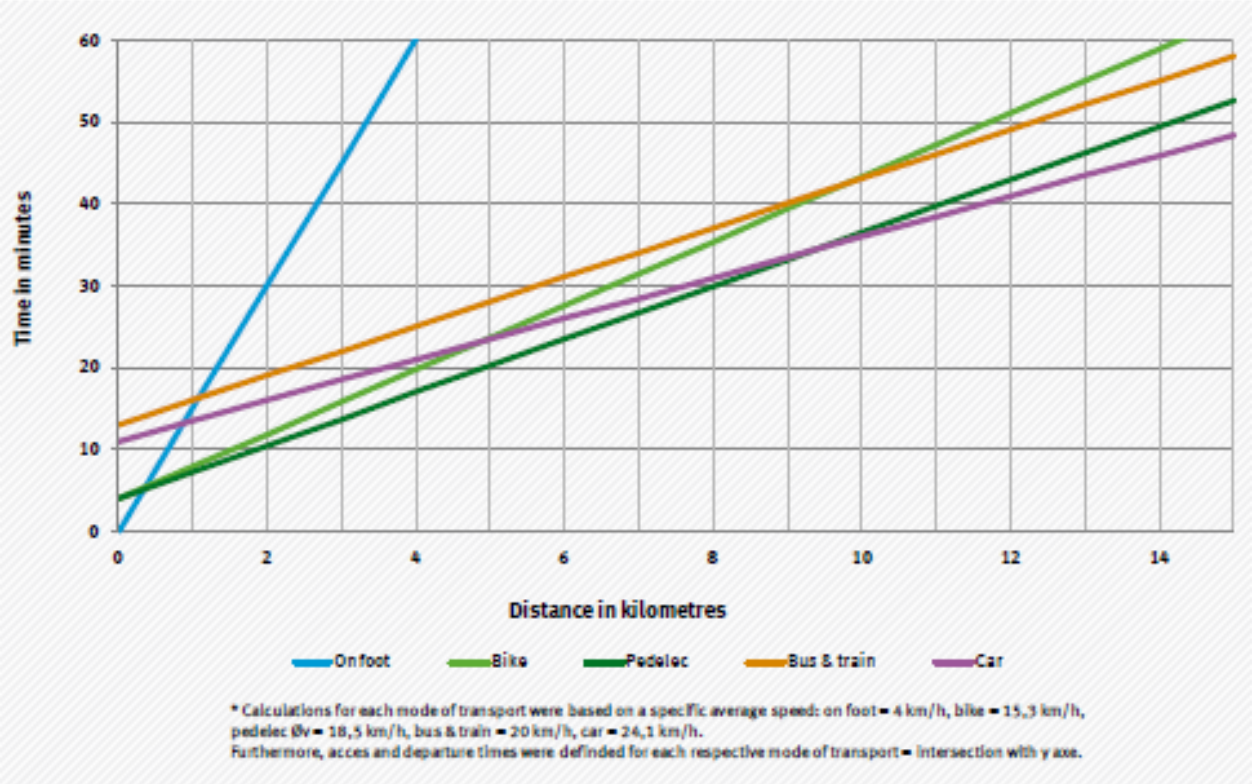


Figure 19: Comparison of speeds by mode in city traffic

Source: UBA, 2014

Actions under M8 include:

- The construction of a network of high-speed cycling lanes / cycling highways
- The integration into planning the necessary adjustments to current cycling infrastructure standards (minimum widths, larger curve radius, etc.)
- The elaboration of incentives for electrically assisted bicycles
- The provision of charging infrastructure
- The implementation of shared electrical bicycle systems
- The introduction of electrically assisted cargo bikes e.g. for postal delivery or bicycle taxis
- The promotion the use of electrically assisted bicycles as company cars

3.3 Scope of the NAMA

The eight direct mitigation measures will be implemented in **17 Colombian cities** that have been selected according to demographic growths, economic situation and motorization growths. The NAMA uses the same selection criteria as the national bus programme, thus, all 17 cities count with a formal public transport system (SITM or SETP) or are currently in the course of developing one.

SITM *(>600.000 inhabitants)*	**SETP** *(between 250,000 – 600,000 inhabitants)*
• Bogotá • Medellin • Cali • Barranquilla • Pereira • Bucaramanga • Cartagena	• Pasto • Santa Marta • Armenia • Popayán • Sincelejo • Montería • Valledupar • Neiva • Ibagué* • Manizales*

*This cities have advanced in conceptual designs but have not reached yet the degree of maturity necessary to be co-financed by the National Government

Source: own elaboration

All of these cities share the characteristics of a significant size in terms of inhabitants (all cities have more than 250,000 inhabitants), rapid population growth, high motorization rates and the existence of a formal public transport network. With the formal public transport network serving as a basis for the creation of intermodal low-carbon transport networks, the selected cities have the potential for a significant modal shift and will improve the overall livability for a significant number of urban dwellers.

The scope of implementation of each mitigation measure depends on the scenario (9% modal share increase or 5,5% modal share increase) as well as on the size of the city and has been defined based on previous projects and expert interviews as pictured in Table 8. M8 (electrically assisted bicycles) has not been part of the analysis as its inclusion was only decided after the development phase.

Table 8: Scope of implementation of each measure according to scenario

Cali (representing larger cities)				Villavicencio (representing medium-sized cities)	
Measure	**Scenario**	**Scope**		**Scope**	
M2	Conservative	1.5	Km^2 low speed zones	0.3	Km^2 low speed zones
	High Shift				
M3	Conservative	9,000	Bicycle parking facilities (intermodal knots)	200	Bicycle parking facilities (intermodal knots)
	High Shift	12,000	Bicycle parking facilities (intermodal knots)	1,000	Bicycle parking facilities (intermodal knots)
M4	Conservative	5,000	Bicycle parking spots (on- and off-street)	300	Bicycle parking spots (on- and off-street)
	High Shift	7,000	Bicycle parking spots (on- and off-street)	500	Bicycle parking spots (on- and off-street)
M5	Conservative	300	Km cycling lanes	120	Km cycling lanes
	High Shift	450	Km cycling lanes	200	Km cycling lanes
M6	Conservative	4,000	Bicylces	500	Bicylces
	High Shift	8,000	Bicylces	1,000	Bicylces
M7	Conservative	3,500	Bicycle taxis	Not assessed as no bicycle taxis are currently available	
	High Shift	5,000	Bicycle taxis		
M8	Conservative	Not yet part of the estimation			
	High Shift				

In terms of **transport modes**, NAMA TAnDem covers conventional and electrically assisted bicycles and tricycles in terms of AT measures, including PBS, bicycle taxis as well as conventional bicycles. In terms of TDM measures, cars and motorcycles are addressed.

Implementation of the NAMA in all 17 cities is planned for a period of 13 years starting in 2018 (2018 -2030). In 2017, two pilots will be implemented in the cities of Ibagué and Pereira[8], The pilots will be evaluated and lessons learned integrated into the final concept.

[8] The cities were selected based on a nation-wide competition according to their ambition level, previous achievements, and alignment of plans with TAnDem goals.

3.4 Stakeholder analysis

Successful NAMA implementation calls for the integration of the needs of all relevant stakeholders. This section summarizes a stakeholder analysis carried out in the development of the NAMA, describing all relevant actors that will be involved in NAMA implementation, as well as their respective roles in the process. Stakeholders are differentiated according to four categories:

- **Key stakeholders:** partner institutions that are essential for the implementation, that are directly involved in decision-making, and can directly influence the implementation
- **Primary stakeholder:** actors that will be directly affected by the implementation
- **Secondary stakeholders:** actors that are indirectly affected or are involved in the project only temporarily.
- **Veto players:** actors that can block the implementation of the NAMA and without which the hoped for impacts of implementation cannot be reached.

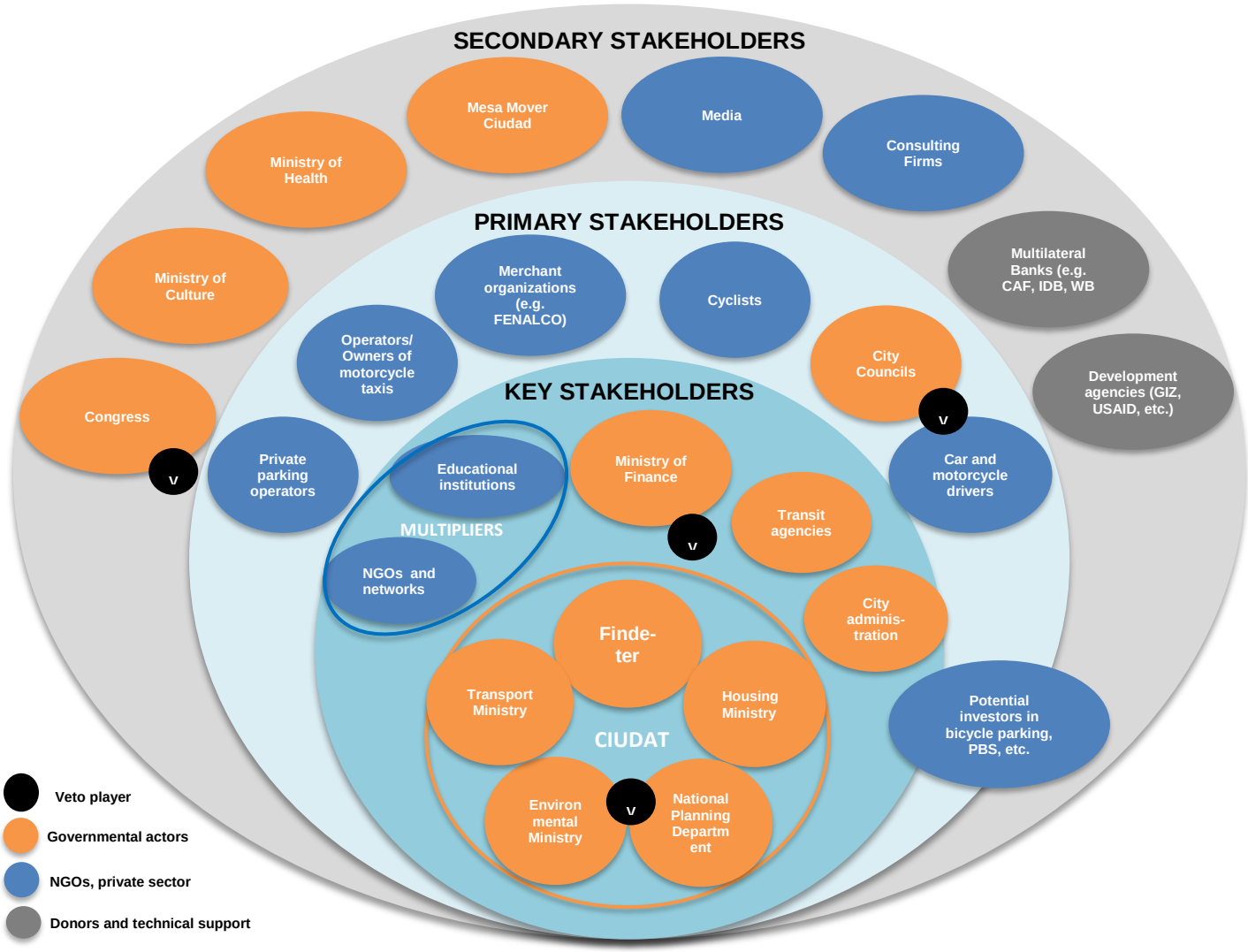


Figure 20: Stakeholders relevant for NAMA TAnDem
Source: Own illustration

Table 9: Stakeholders and their roles and responsibilities with regard to the NAMA TAnDem

Stakeholder	Roles and responsibilities with regard to the NAMA
Key stakeholders	
Ministry of Transport (MdT) *Group for Environmental Issues and Sustainable Development* (GAADS) *Sustainable Urban Transport Unit* (UMUS)	The MdT is responsible for transport policies on the national but also partly on the urban scale. It is responsible for the SITM/SETP systems, the TOD NAMA and the inter-ministerial coordinating body *Mesa Mover Ciudad,* which coordinates mitigation measures on the urban scale. The MdT departments GAADS and UMUS initiated the development of the NAMA, together with the National Planning Department. In the implementation phase GAADS and UMUS will form part of the technical coordination team of NAMA implementation under the *Center for Urban Interventions of Advanced Transport Development* (CIUDAT) structure, while the Vice-Minister will form part at board level of CIUDAT. The *National Agency for Road Safety* (ANSV), an independent entity from an administrative and finance point of view but policy sub-ordinated to the MdT, will be involved in NAMA implementation by providing financial as well as human resources to the cities for the implementation of measures aligned with road safety goals.
National Planning Department (DNP) *Urban Transport Group* (GTU)	DNP is responsible for defining a strategic vision of the country in the social, economic and environmental sectors through the design of public policies allocation of public investment. It draws up the DNP and is currently working on a public policy on urban transport. The DNP, together with MdT, initiated the development of the NAMA and the DNPs GTU was involved actively in NAMA preparation. During the implementation phase, the DNP will form part of the steering structure of NAMA TAnDem in the frame of CIUDAT on technical and board level.
Ministry of Environment and Sustainable Development (MADS)	MADS is the national focal point for climate policies and responsible for the coordination of inter-ministerial activities with regard to climate mitigation and adaptation, inter alia, the sectoral mitigation action plans and NDC development. MADS has been involved in NAMA preparation and will be one of the board members of CIUDAT.
Financial Entity for the Territorial Development (FINDETER)	FINDETER is the national development bank of Colombia, which recently has changed its mission towards becoming a sustainable development bank and has been accredited for the GCF. FINDETER is implementing various urban mobility projects in several cities in the frame of the *Sustainable and Competitive Cities*

	Initiative. FINDETER also chairs CIUDAT, the steering body for the TOD NAMA and NAMA TAnDem. The bank was involved in NAMA preparation and in the frame of CIUDAT, functions as its implementing body. It will further be responsible for channelling additional financial resources into NAMA implementation.
Ministry of Housing	The Ministry of Housing is responsible for formulating the policy framework on urban development, including land use planning (e.g. formulation of Land use master plans (POTs)) and regulation on aspects such as parking facilities and cycling infrastructure. The Ministry is further a member of the directive committee of CIUDAT and will be involved in the decision making process on NAMA TAnDem.
City Administration	The city administrations will be responsible for the implementation and financing of the seven direct mitigation actions and are the recipients of technical assistance and capacity building measures provided via the NAMA's National Program for Technical Assistance. The city governments have so far not been involved in NAMA preparation, however have been interviewed in the frame of a capacity needs assessment. During the pilot phase, the concept of the National Program will be validated in two cities, Pereira and Ibagué, which were selected in a contest by the members of CIUDAT.
Transit agencies or planning departments of city administration	The transit agency of each city is a public holding conformed by different public bodies and responsible for planning, implementing, and controlling the operation of the SITM and SETP bus systems of each city. Via their co-financing agreements with the national government, they can channel national funding into local transport projects connected to the bus systems (including cycling infrastructure). Among others, the transit agencies are responsible for assuring the overall economic viability of the systems, which proved to be difficult in the past due to low demand and may be a starting point for the implementation of the NAMA as the integration of cycling infrastructure will increase coverage (and subsequently demand) and increase operation speeds of buses when reducing road occupation with cars. The NAMA working group has had a first contact with the transit agencies to identify their challenges and needs, being a loss of passengers due to low coverage, missing integration of other

	modes, and cheap alternatives (motorcycle and mototaxismo[9]). It has to be taken into consideration that the transit agencies are thought to be 'phased out' and merge with the city administrations at some point.
Potential multipliers for promotion and awareness campaigns	The NAMA aims at strengthening interested cycling unions, such as the national cycling union BiciRed, to develop towards a resource base for the National Government as well as the cities. These unions have played a prominent role in the development of the capital Bogotá towards a comparatively cycling-friendly city and have undertaken first steps in organizational development. Cycling unions and other networks concerned with quality of life in cities or sustainable urban mobility, such as the network CiudadesCómoVamos, and NGOs, active in the field of AT and TDM, will be involved in NAMA implementation to serve as multipliers for the implementation of awareness raising campaigns and promotional activities, and promote regulatory changes.
Potential multipliers for capacity building measures	Educational facilities, such as universities (e.g. Grupo Sur Universidad de los Andes), National Learning Service (SENA), and NGOs will be involved in NAMA implementation and serve as multipliers for capacity building measures. The NGO Fundación Despacio has been involved actively in NAMA preparation and may contribute in the course of NAMA implementation with capacity building measures, the preparation of technical guides and manuals as well as the creation of awareness raising campaigns.
Primary stakeholders	
Potential investors and operators for *public bicycle systems* (PBS)	The investment into PBS is especially interesting for transit agencies (intermodality), municipal administrations, private banks and other private actors, who want to use them for marketing purposes. The NAMA will try to attract these actors to invest in NAMA implementation and support them with capacity building to facilitate their engagement into AT and TDM.
Potential investors in bicycle parking lots (public and private)	The NAMA will address the different actors having an interest in installing bicycle parking, such as public administrations (these are obliged under the Law Pro-Bici), shopping centres, supermarkets, educational institutions, real estate companies and bus system operators with the aim to leverage financial resources for the installation of parking facilities. The NAMA will target these actors

[9] Mototaxismo: informal transport provided by motorcycles or motorized tricycles, often at the outer skirts of the formal public transport system.

	with capacity building measures, as in the preparation phase of the NAMA it was found that private actors often perceive their lack of technical knowledge on how to install bicycle parking as the most relevant barrier towards the installation of bicycle parking.
Private parking operators	Current operators of private parking facilities for cars and motorcycles may be affected by measure 1 of the NAMA, as it aims at reorganizing current parking schemes towards a demand management approach, e.g. incorporating differentiated tariffs or an obligation to take in bicycles and electrically assisted bikes for a reduced rate. The NAMA will involve the operators, as all relevant stakeholders, in the decision making process and design measures to mitigate potential negative side effects of NAMA implementation – if necessary.
Merchant associations and other potential opponents of NAMA measures	In some cases, merchant and other associations such as the *National Federation of Merchants* (FENALCO), the *Colombian Chamber of Construction* (CAMACOL) or the *National Business Association of Colombia* (ANDI) have lobbied against traffic calming, parking restrictions and the construction of cycling routes in city centers as they fear to lose business by reduces through traffic or a perceived worse accessibility of the central districts. The NAMA will address the fears of these actors with capacity building and awareness raising measures, e.g. demonstrating lessons learned from other countries and benefits from the NAMA measures.
Associations of informal motorcycle-taxis and cycling rickshaws (operators and owners)	Associations of informal motorcycle-taxis and cycling rickshaws have not been involved so far in NAMA development, however, their involvement will be crucial for the successful implementation of measure 7 – Formal bike taxi services: *the regulation and formalization of motorcycle-taxis and bike taxis*, as this may affect the social well-being of the vehicle owners and drivers directly and opposition is pre-programmed. As a consequence, measures have to be found to absorb potential negative side-effects, such as capacity building measures or credit lines to facilitate the investment in more secure and environmentally friendly vehicles.
Potential users (car owner, motorcycle owner, cyclists, general public)	Current and potentially future cyclists, car-drivers and public transport users, as well as the general urban population will be directly affected by NAMA implementation and will therefore be involved in NAMA implementation in a stakeholder integration process. The urban population, first of all, school children, form the target audience for the awareness raising campaigns planned by the NAMA and also for part of the capacity building measures. Last but not least, the general urban population are the main benefitting party of NAMA implementation. They might therefore be

	involved in the monitoring of effects of NAMA implementation, such as surveys on the quality of life in urban environments.
Secondary stakeholders	
Ministry of Culture (MinCultura)	This Ministry is responsible for approving planning and designing projects that affect heritage urban areas as Special management and protection plans (PEMPS), road infrastructure, public spaces, and street furniture between others. Might be involved in the NAMA implementation, e.g. in approving and designing projects in historical urban centres which are the most potential areas for implementing traffic calming zones (measure 2) and parking management schemes (measure 1) as well as cycle infrastructure (measures 4,5 and 6).
Ministry of Health (MinSalud)	The MinSalud has not been involved so far in NAMA preparation, however it may play a role in the future, e.g. in awareness raising campaigns and capacity building, given their role in promoting public health and existing indicators on public health and physical activity, which also include the promotion of cycling.
Ministry of Education (MinEducación)	Might be involved in the NAMA in the future, e.g. in awareness raising campaigns, school programmes, benefit calculations etc.
Mesa Mover Ciudad	The Mesa Mover Ciudad is an inter-ministerial working group that has the aim to coordinate and discuss policies and investment projects in the area of urban mobility and make sure that strategies are aligned and synergies are exploited. It further has the role to support local governments by providing guidelines and best practice examples. The working group is led by the Ministry of Transport. Further members include: the National Planning Department and Ministries of Housing, Finance and Culture (mobility in historical centres).
USAID (United States Agency for International Development)	USAID was involved in NAMA preparation and has developed some pilot activities in Valledupar during the second half of 2016, among which an awareness raising campaign and the design for a cycling path. The results and lessons learned from working with the city government will be fed into the design of the programme. USAID will not be able to further support NAMA implementation due to a restructuration of intervention areas.
Multilateral banks and international cooperation agencies	Different multilateral banks and international cooperation agencies are implementing projects in AT and TDM, however in an isolated manner. The NAMA will engage in coordinating the different technical assistance -activities in the field of AT and TDM under the umbrella of the programme to be established under the NAMA, and channels funding form multilateral banks into NAMA

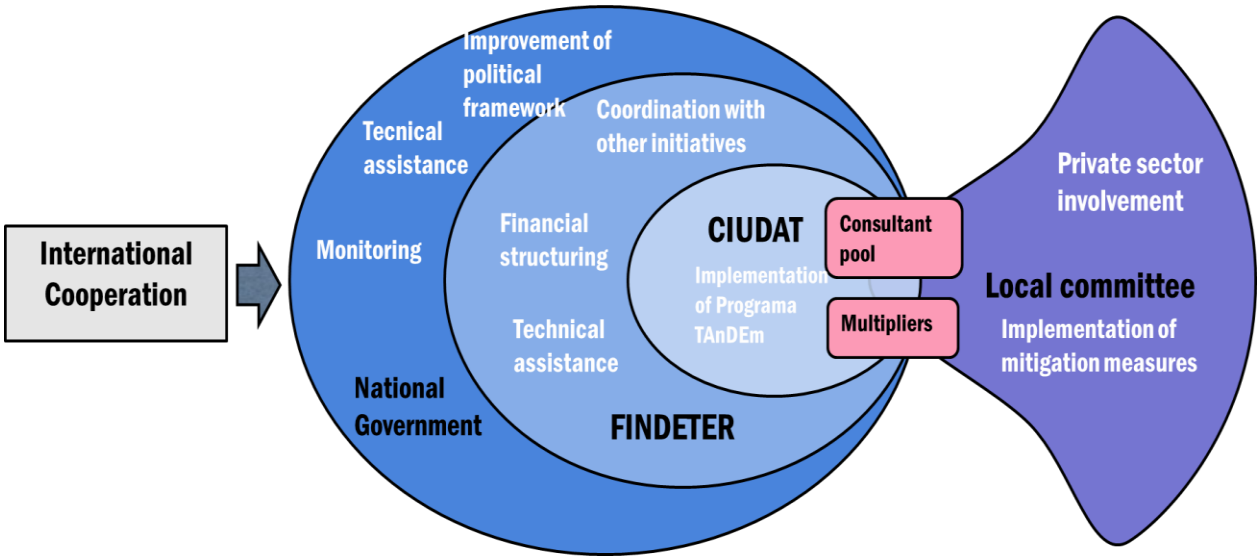
	implementation. Different donor organizations have expressed their interest in such a coordinating approach during the preparation phase of the NAMA. See chapter 2.4 for further information on donor activities in the field of TA and GdT in Colombia.
Media	Different forms of media will be involved in NAMA implementation, especially for the execution of awareness raising campaigns and for the generation of visibility for activities and their impact (e.g. articles in newspapers, interviews on the radio, etc.)
Consulting firms	With the implementation of the program more experts and consultant capacity in the field of active transport and travel demand management will become necessary. Currently expertise on active transport and travel demand management in Colombia is focused on the major cities like Bogotá and Medellin, however is scarce in smaller cities. For NAMA implementation a pool of consultants will be build up, which can be accessed by the municipal governments.
Veto Players	
City Councils	The City Councils, among others, have the function to approve projects presented by the mayor. The vital role that these bodies may play in the implementation of the NAMA can be seen in the rejection of congestion charging regulation that, e.g. the mayors of Bogotá and Medellin, had presented. Further, they play an important role in the decision making on income allocation from parking management schemes and congestion charging.
Ministry of Finance	The Ministry of Finance and Public Credit leads, designs and executes public finances, and establishes the country's fiscal policy. As the national central budgetary authority, it manages financial management through the General Budget of the Nation. This is the most important financial management instrument of fiscal policy, in which public expenditure is financed and rules for programming and recording are established. The role of this Ministry is vital for the future and stability of projects carried out by the Ministry of Transport, since they are the ones who annually approve the budget allocated to the investment projects presented.
Congress	The Congress of the Republic, within the framework of its legislative function, is in charge of elaborating, interpreting, reforming and repealing the laws and codes in all branches of the legislation. In this sense, the challenge is to have Senators motivated to generate and approve the necessary legislation to facilitate the implementation of the NAMA measures.

3.5 Steering Structure of the NAMA

The steering structure of NAMA TAnDem has three levels: The **High Level Committee**, composed of the vice ministers of all relevant ministries, namely the Ministry of Transport (MdT), the National Planning Department (DNP), the Ministry of Environment (MADS), the Ministry of Housing and Construction (MinVivienda) and Findeter, meets twice a year and takes all major decisions for NAMA implementation. These decisions are prepared by an **Inter-ministerial Advisory Committee**, composed by technical staff of the same ministries that meets on a monthly basis to prepare decisions, monitor advances and coordinate government action.

Implementation of the technical and financial support provided by the Government or tertiary parties to the NAMA cities is done by the Center for Advanced Urban Transport Interventions, CIUDAT (*Centro para Intervenciones Urbanas de Desarrollo Avanzado al Transporte*), a governing body located within the premises of Findeter, the Colombian National Development Bank for Regional Sustainable Development. CIUDAT employs technical staff that implements technical assistance, capacity building and promotional measures and coordinates with the city administrations. Further, local committees are established in the partner cities that govern the implementation of the 8 mitigation measures and report to CIUDAT.

Figure 21: Steering structure of NAMA TAnDem



Source: Own illustration.

In addition to CIUDAT staff, a pool of international and local consultants and experts in AT and TDM will be established and a **network of multipliers**, including cycling unions, NGOs and associations of civil society, universities and think tanks active in the field of AT and TDM will be formed. While the **pool of consultants** serves to provide prompt technical assistance to the local level and utilize synergies resulting from similar topics and tasks in all 17 cities subject to the NAMA, NGOs and think tanks will be involved especially for the dissemination of awareness raising campaigns, but also for policy advisory. In the pilot phase of NAMA implementation,

CIUDAT will engage in capacity building and institutional development for these multipliers to facilitate the formation of an external resource base for NAMA implementation. Table 10 gives an overview on the major tasks and responsibilities for each actor involved in the steering structure of the NAMA.

Table 10: Tasks and responsibilities of each actor in the steering structure of NAMA TAnDem

Actor	Main tasks
High Level Committee of Vice Ministers and Vice President of Findeter	• Take final decisions • Monitor the implementation of the NAMA • Meet twice a year
Advisory Committee of Ministries	• Prepare political decisions • Mainstream AT and TDM needs in national policy documents, regulation and guidance documents • Coordinate direct technical assistance by ministries to the local governments with CIUDAT and other relevant ministries • Meet on a monthly basis
Findeter	• Manages the financial resources for NAMA implementation • Coordinates with other related initiatives in the cities • Coordinates with donors • Lead and prepare the technical and political meetings of CIUDAT • Accommodates CIUDAT staff
CIUDAT	• Provides technical assistance to the cities (own staff and consultant pool) • Manages the pool of consultants and experts • Coordinates with multipliers • Administrates the Bicycle Academy (logistics for seminars and e-learning) • Reports monitoring results to the national bodies
Multipliers	• Give feedback to the national government on necessities in regulation • Implement awareness raising campaigns • Give advice to the local governments • Engage with the private sector
Local committee	• Coordinate the implementation of the 8 mitigation measures on the city level • Inquire and coordinate technical assistance from the national level • Involve the private sector • Monitor implementation and report to CIUDAT

The choice of CIUDAT as the executing body of NAMA TAnDem has various advantages: Findeter has the mission to promote sustainable development in the Colombian territory and has long term experience in the cooperation with the cities in the frame of other projects. The national development bank is more flexible in terms of administrative procedures and is independent of political cycles. As the bank as well as CIUDAT have no sector affiliation, cross-sector cooperation

can be facilitated. Last but not least, CIUDAT is also implementing the TOD NAMA, which brings along important synergies and allows for close coordination. In the long run, CIUDAT plans to establish itself as the national implementing body for all NAMAs and other initiatives that address the urban sphere, bringing along further synergies.

3.6 Expected benefits from NAMA implementation

3.6.1 GHG mitigation impact (ex-ante)

The emission reductions potential of the NAMA has been estimated in a bottom-up approach against a BAU scenario for an implementation period of 13 years (2018 - 2030) for the 19 Colombian cities subject to the NAMA. Next to the BAU Scenario, two mitigation scenarios have been calculated based on different ambition levels:

Table 11: Ambition levels of the two mitigation scenarios

	Mode share of bicycles in 2030 compared to BAU	Additional trips by bicycle in 2030 compared to BAU[10]
Realistic Scenario	+5.5%	900,000,000
High Shift Scenario	+9%	1,400,000,000

Source: own illustration

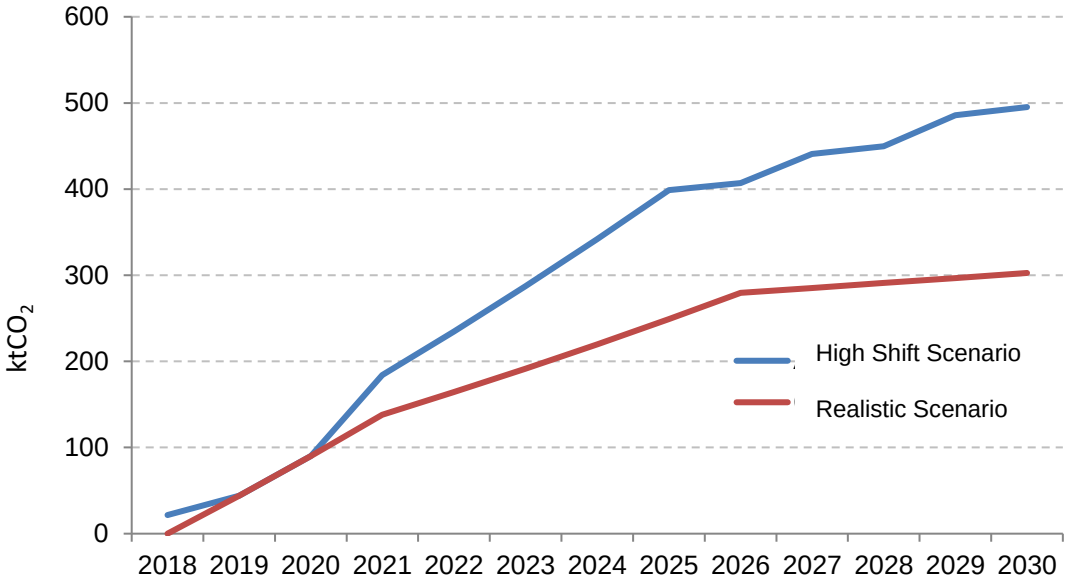
Accumulated over the implementation period (2018 - 2030), the NAMA achieves a GHG mitigation impact within a range of **2.55 - 3.88 $MtCO_2$** relative to the BAU scenario. In comparison, Transmilenio, Bogotá's highly praised Bus Rapid Transit system in a city of 8 million inhabitants reduces 0.57 Mt CO_2 per year.

It has to be noted that the **estimation should be considered conservative**, as it does not yet include emission reductions from improved parking management (M1) or the establishment of traffic calming zones (M2). The estimation further does not yet account for a shift towards electrically assisted bicycles (M8) nor for intermodal trips resulting from connected public transport and cycling infrastructure. It can be assumed that the inclusion of electrically assisted bicycles alone can lead to much higher reductions, as other studies (e.g. UBA, 2014) have shown that trips of a length of up to 12km (and therefore mainly car and motorcycle trips) can be replaced by electrically assisted bicycles.

Annual emission reductions of NAMA TAnDem are visualized in Figure 22. As becomes apparent from the graph, **emission reductions will be higher in the long run**, as the implementation of the measures leads to the creation of a comprehensive and connected cycling network. Only a truly integrated urban transport network, based on public transport, AT and TDM, has the power to attract a significant number of passengers who would otherwise have used private transport. Details on emission calculations are provided in chapter 5.3.

[10] Total for all NAMA cities

Figure 22: Annual emission reductions of NAMA implementation in the 17 NAMA cities



Source: own illustration

3.6.2 Expected sustainable development benefits

Next to GHG emission reductions, a shift towards AT has significant local sustainable development benefits, such as the improvement of local air quality and decrease in subsequent health costs, a decrease in congestion and improved access to public transport, to name just a few. While in the course of NAMA preparation we only carried out a qualitative analysis for these benefits, some international cases have been reviewed to provide some examples on orders of magnitudes of local benefits for the NAMA measures. Table 12 shows a qualitative assessment of the major expected benefits associated with NAMA implementation.

Table 12: Qualitative assessment of sustainable development benefits of the NAMA

Sustainable Development Benefit	Impact	Justification
Environmental		
Reduction in energy use	High	A shift from individual motorized transport to AT (and PT) as well as congestion reductions both lead to reduced energy consumption per passenger km.
Improvement of air quality	High	A shift from individual motorized transport to AT and a reduction of park search traffic reduce the tailpipe emissions of CO, NO_x and soot (PM) per passenger km.
Reduction of noise pollution	High	AT generates much less noise than motorized modes.

Reduction in land use	Medium	For the same number of passengers, AT and public transport take up less space than individual motorized transport. Shifting people from individual motorized transport to AT (and PT) reduces the required space for transport infrastructure. Parking space can be freed up to make room for cycling lanes or recreational uses.
Social		
Health benefits	High	Improved air quality and reduction of PM and other air pollutants reduce lung diseases and improve the conditions for cyclists. Physical activity improves overall fitness and promotes a healthier lifestyle.
Improvement of working conditions for bicycle taxi drivers	High	Formalisation of *bicitaxi* services leads to increased earnings for drivers (no "*informal*" levies), higher vehicle safety and inclusion of drivers and vehicle owners in the social security system.
Improvement of traffic safety	High	Reduction in traffic accidents with cyclists through reduced individual motorized transport, low speed zones and safe cycling infrastructure.
Increase in access to transport services	High	The population in more secluded areas as well as low income groups that are currently not reached by PT receive access to PT stations as bicycle infrastructure is improved and integrated into PT systems to allow for intermodal trips.
Economic		
Increased revenues for public transport operators	High	PT becomes more attractive as an intermodal system and coverage is extended by integration of active modes, which may lead to a higher passenger count and higher revenues.
Job creation	High	Formalisation of working conditions for bicitaxis as well as the establishment of parking management schemes will lead to a significant increase in formal jobs and a potential increase in annual earnings. Construction of low-speed zones, bicycle parking spaces, bicycle lanes and PBS will create additional jobs.
Improvement of network connectivity	High	Inter-modal hubs improve the network connectivity of public transport.
Reduction of dependency on fossil fuels	High	AT does not consume fossil fuels and electrically assisted modes with the current electricity mix consume much less fossil fuels compared to motorized modes. The combination of AT and

		TDM has an even higher potential to reduce individual motorization.
Cost savings to users	Medium	The creation of a PT and AT alternative to individual motorized transport enables users to switch to a more cost-efficient system, saving them transport costs.
Increase of public revenues	Medium	Increased revenues from parking fees, fines for speeding (electric foto detection) and additional tax income from formal jobs.
Reduction of travel times	Medium	Reduced congestion and the better integrated public transit system with intermodal hubs leads to time savings, which increases productivity.

Source: Own compilation

Figure 23: Examples of sustainable development benefits from AT and TDM measures

Cycle Friendly City Copenhagen: • *6,000 new jobs* • *Reduction of health costs 268 mill €/a* • *Reduction of noise and accidents*	***On Street-Parking Management Prenzlauer Berg Berlin*** (area with 140,000 inhabitants) • *Profit of 572,000€/a* • *14 - 21% less parked cars* • *70 new jobs*
Public Bicycle Scheme Ecobici México • *54.1% of users replaced another mode of transport with the system; 25% replaced a car or taxi trip.*	***Bicycle parking facilities and Ciclorruta[11] Bogotá*** • *1 USD invested resulted in 2.8 USD reductions of health care costs* • *Attraction of new users: 23% of users did not use a bicycle before*

3.7 Potential for transformational change

The implementation of the NAMAs measures creates new and more sustainable mobility patterns in the Colombian cities as it makes active transport a true alternative to private motorized modes. As active transport (in combination with public transport) becomes the more attractive option in terms of travel costs, commuting time, and the potential to use commuting time in a sensible way, the vicious circle of increasing private motorization and deteriorating public transport at high costs

[11] Ciclorruta: A programme implemented in many Colombian cities were main roads are closed down for some hours on Sunday for bicycle use.

can be broken, resulting in transformational change, an effect that has been demonstrated in various cities throughout the world.

NAMA TAnDem works towards higher attractiveness of AT by building comprehensive, safe and comfortable cycling infrastructure on the one hand (Pull), and by desincentivizing motorized modes on the other hand (Pull).

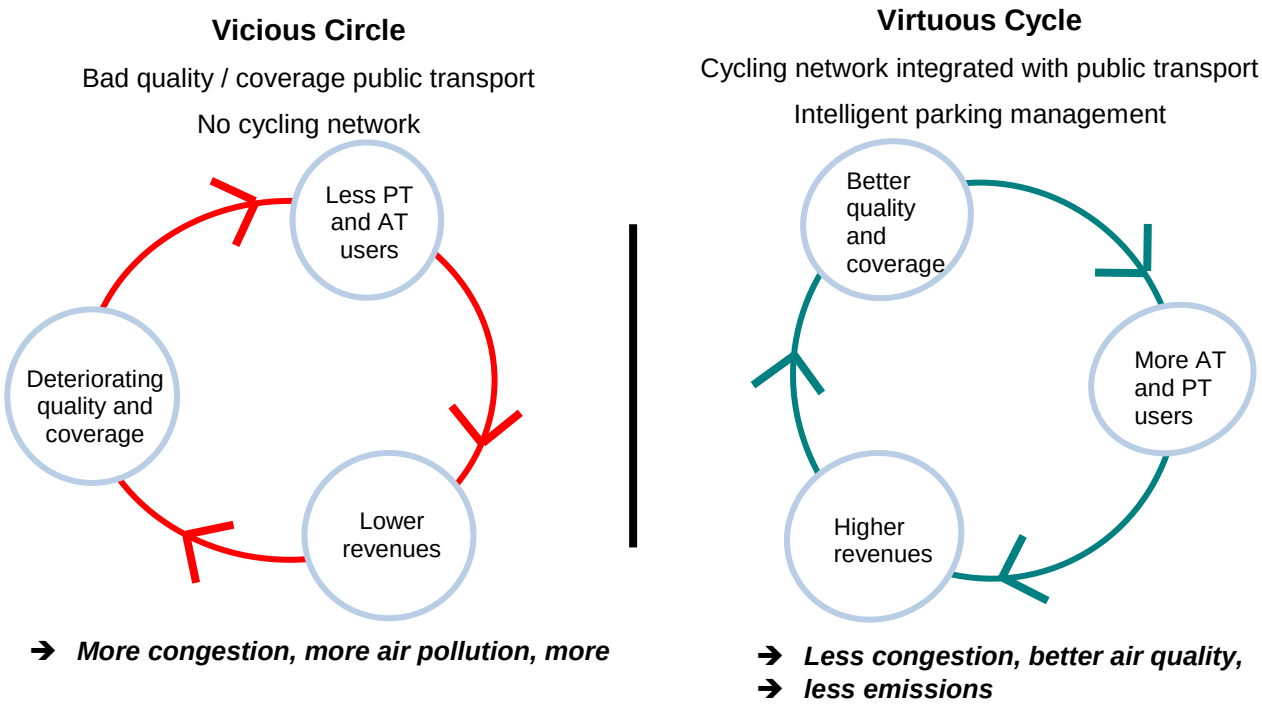
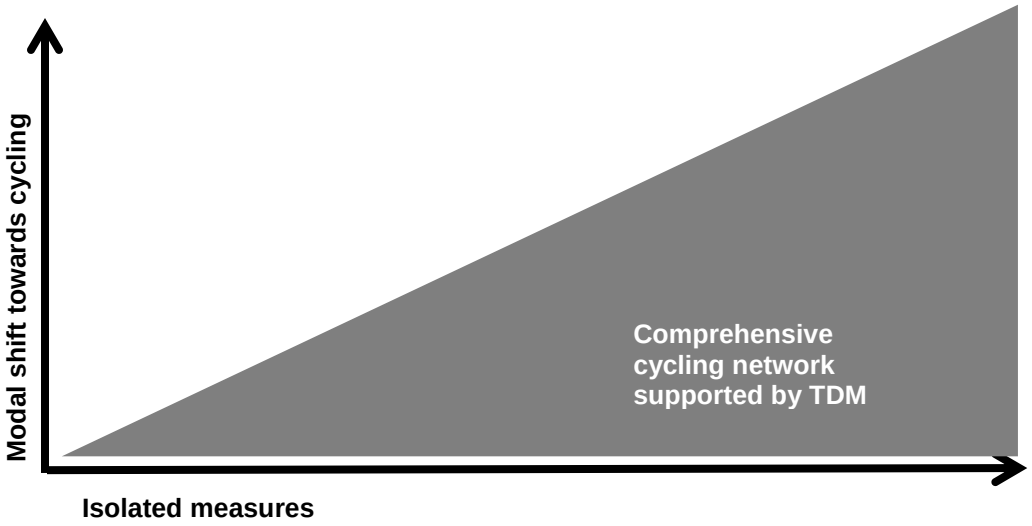


Figure 24: Vicious and virtuous cycles of urban transport policies

Source: based on Despacio, XXX

While cities are currently implementing isolated measures to promote AT or TDM, NAMA TAnDem emphasizes the **need for comprehensive implementation of all eight NAMA measures**, which is crucial to reach the necessary coverage as well as quality of AT networks to attract a significant number of commuters. The technical support provided by the National Government in the form of CIUDAT assures the comprehensiveness of implemented measures and aims at embedding awareness and capacities into the institutional memories of the local governments to facilitate a continuous improvement process of urban mobility


Modal shift towards cycling
Comprehensive
cycling network
supported by TDM
Isolated measures

4 Technical assistance to facilitate NAMA implementation

4.1 Barriers and risks to NAMA implementation

An analysis of barriers and risks that may impede or slow down NAMA implementation or result in unwanted side effects was conducted in order to identify and address these by suitable countermeasures. The most essential ones are summarized below.

Political and regulatory barriers

Most political decision makers fear to reduce space and velocities of car traffic or to increase prices for parking as these measures tend to be unpopular with the voters. Many citizens feel that they depend on their car as a means of transport, as public transport does not have sufficient coverage, or they do not want to give up the comfort of private space while commuting (as commutes tend to be long). By creating low-speed or pedestrian zones, car owners fear that traffic will further slow down and congestion becomes unbearable. To overcome this barrier, a strong overarching policy that shows the long term strategy of building a reliable and comfortable public transport network can help to make citizens understand the necessity of these measures and the greater good in the long run. It also gives a clear guiding framework and confidence to decision makers.

Next to car owners, interest groups of merchants and industry, such as CAMACOL, FENALCO or ANDI, in some cities have lobbied against traffic calming, pedestrianization and the reduction of on-street parking, especially in the city centres. Shop owners in the Colombian cities fear less business by decreasing through traffic, even though many case studies have proven that smart parking policies and traffic calming tend to have positive effects on business activities (compare e.g. GIZ, XXX). Stakeholder consultations and raising awareness on the benefits of such measures can help to remedy these barriers and facilitate implementation.

Currently, three-wheeler taxis operate as informal extensions of the formal public transport system, particularly in poor neighbourhoods and at the outskirts of the cities. Regulation of these services may face resistance by owners and operators as these fear to lose their livelihood. The process of formalization will therefore have to be accompanied by a stakeholder integration process, to alleviate the fears of owners and operators and understand their situation. On this basis, further accompanying measures may be necessary to secure the improvement of both, labour- and safety conditions, and avoid negative social effects. Owners and operators of informal three-wheeler taxis and cycling rickshaws are a heterogeneous group of individuals without a clear organizational structure. Thus, reaching out to them will prove difficult.

For a secure and environmentally sound introduction of electrically assisted bicycles as an alternative to sharply increasing numbers of motorcycles in the Colombian cities, a suitable regulation of these will be necessary. Currently, electric and assisted bicycles are not regulated in terms of vehicle category, maximum velocities, battery standards, as well as recycling of these. As a consequence, electric bicycles with high velocities running on cycling lanes have resulted in an increasing number of accidents and face some rejection by road users and local administration. In order to overcome the barrier of rejection among road users and remedy the risk of rising road

accidents and potential environmentally adverse effects, electrically assisted bicycles will have to be regulated in terms of maximum velocities, allowance of circulation on cycling lanes and technologies used.

Currently, local regulation regarding vehicle parking mostly establishes minimum parking spot requirements for new developments (1 per housing unit), often with rising minimum requirements in higher social strata, which contradicts a stringent demand management policy. While some municipalities have identified this barrier towards stringent demand management (e.g. the mayor of Bogotá has recently announced that the he wants the new POT to allow for new developments without parking facilities), most municipalities still follow the "*minimum parking requirement*" paradigm. In a like manner, regulation establishes maximum price level for private off-street parking (e.g. in Bogotá the maximum price is 0.03 USD/minute for cars and 0.009 USD/minute for motorcycles), and there are no preferential tariffs for electrically assisted and conventional bicycles. In order to allow for an effective travel demand management via the management of parking space and generate a push towards active and public transport, parking tariffs have to be deregulated and minimum parking requirements have to be abolished.

Awareness, cultural and social barriers

Even though Colombia has a significant sportive cycling culture, in terms of commuting, cycling is still largely seen as a means of transport for the poor. Particularly in medium-sized cities, owning a car is still an important status symbol. Whereas a change in this perception is recently becoming more apparent in Colombia's principal cities like Bogotá and Medellín, this is not yet the case in most cities of the country. To overcome this barrier, marketing campaigns and branding can help to improve the image of cycling and make it more visible in the city. Also, the promotion of cycling applications such as the Bogota-based application BIKO, that provide incentives for cyclists by cooperating with local stores can help to see cycling in a different light. A further incentive might be to take part in competitions, on the local, national or even international scale (e.g. city indices, such as *Copenhagenize*). Of course the establishment of a secure cycling infrastructure has to be the basis for such activities.

The full range of benefits of improved cycling infrastructure and travel demand management is not known in many medium-sized cities, and therefore does not get the attention it deserves neither by policy makers (see above under "political and regulatory barriers") nor by the general public. Also, public transport operators have not yet realized the potential of integrating cycling infrastructure as a means to improve their service, expand their coverage and reach more customers at low cost. In fact, some operators even fear that electrically assisted bicycles may steal customers from public transport systems, making them even less profitable in an already tense economic situation. In terms of travel demand management measures, such as parking management or congestion charging, the main barrier for successful implementation is the rejection of the community, as these would have to pay (more) for parking or road use, while the use of the road is considered a right, that should not be paid for. Also, there is considerable headwind towards parking management, as in previous systems tendered out to private concessionaires, different cases of corruption, illegal collection, negotiated rebates, bribes, and extortion had occurred (Barter, GIZ, & SUTP, 2016). For successful NAMA implementation, awareness has to be raised among policy makers for the benefits of NAMA implementation, and

public transport operators as well as city planners have to be trained in the design of comprehensive mobility networks in order to not create competing but rather complementary PT and AT infrastructures. Local governments further will have to be advised on how to soundly design and manage parking schemes in order to avoid previously occurred problems. Implementation should be accompanied with measures to counteract corruption.

Lack of knowledge and capacities

Technical capacity on how to build safe cycling and parking facilities is currently not sufficiently developed in many medium-sized cities, the same being true for the integration of cycling infrastructure into public transport systems and the build-up of parking management systems that serve a demand management function. This is becoming apparent e.g. in a recent attempt by the National Government to support cycling in the cities by the donation of overall 869 bicycles to 24 cities to be used in pilot bike sharing systems. After a year, only very few of the cities managed to establish a bicycle sharing system of any kind within the pilot year, and while various factors come into play in creating this result, a general lack of capacity is surely one of them. A lack of technical know-how also became apparent among other actors, such as owners of shopping centres, universities or real estate developers, which have shown to be interested in providing cycling infrastructure, such as parking facilities, however do not have the necessary know how and contacts to do so.

In a like manner, knowledge on the design of sound parking management schemes is missing. While some cities have established so-called blue-zones for on-street parking, these are not sophisticated enough to have the power to manage travel demand in congested areas or generate funds to cross-finance other sustainable transport measures. The NAMA, by means of the technical support component, will engage in capacity building and training measures to overcome these barriers and embed the necessary knowledge for the transformation of mobility sector into local institutional memories.

Another important barrier is the non-existence of appropriate data and monitoring schemes to monitor transport activity as well as impacts and success of implementation of NAMA measures. Data on transport activity is currently not collected in a comprehensive and transparent manner in many cities, which complicates sound planning, monitoring and evaluation of policies and projects. In order to be able to track progress and account for unwanted side effects, the technical support component of the NAMA will advise local governments on consistent travel data gathering and the set-up of sound monitoring systems while keeping the additional effort at an adequate level.

The worldwide trends of digitization and electrification have important impacts also on AT and TDM measures. While the introduction of electrically assisted bicycles to urban mobility systems bring along new requirements for cycling lanes (higher speeds, more users, different locations), parking facilities (higher security needs), and regulation, digitization may offer more efficient means of data gathering for the planning of cycling networks via the use of cell phone tracking data, render parking meters unnecessary as mobile parking payment is introduced, or enable free floating public bicycle schemes, without need for personal administration. As these trends and technologies are rather new, however offer high potential to reduce costs and improve efficiency,

the technical support component of the NAMA will direct attention especially to these measures and demonstrate their effectiveness in pilot projects.

Institutional barriers

An important barrier for the implementation of NAMA TAnDem and the creation of the technical support component at national level are frequent changes in personnel on decision making level in the relevant ministries. These changes may lead to considerable delays in NAMA implementation and missing continuity in the implementation process due to changing political priorities. It has therefore been decided to delegate NAMA implementation to CIUDAT, the Center for Advanced Urban Transport Action, hosted by the national development bank Findeter and supervised and advised by an inter-ministerial steering committee composed of representatives of all relevant sector ministries (more information in chapter 3.5).

Most Colombian medium-sized cities have no administrative department dealing with sustainable urban transport, let alone non-motorized transport and travel demand management and personnel dealing with AT and TDM in general is scarce. Without a sufficient number of well-trained city officials delegated for planning and implementation of AT and TDM measures, and improved coordination within local administration, but also between the local and the national level, an effective and efficient implementation of the NAMA at local level will be difficult. The technical support component analyses specific needs and supports local governments in the set-up of AT and TDM units and capacity building for staff members.

Given their first-hand experience in the cities, cycling activist groups, so-called *colectivos*, and local NGOs provide significant potential to promote AT and TDM and advice the government on policy and regulation needs. However, these groups currently lack a clear organizational structure, vision and strategy, as well as the necessary financing to employ full time capacity that would be needed to drive concerted and comprehensive action and engage in policy making (e.g. by submitting position papers). The technical support component of the NAMA will try to involve the different knowledge carriers as multiplicators for promotion, awareness raising and capacity building measures and support their institutional development by means of technical assistance.

Financial barriers

Municipal household budgets for transport are tight and are spent mostly on road construction projects. In most cities, budget allocation for AT and TDM is minimal (compare also chapter 2.3). While there is a mechanism to co-finance public transport systems by the national level, there is no programmatic means to financially assist municipalities in their efforts to implement AT and TDM measures. The lack of financial support by the National Government is not considered the major barrier, however, as AT and TDM measures are rather inexpensive (and partly even cost-efficient) as compared to conventional transport investment projects and should in principle be financed by the local governments. It is assumed that a re-allocation of municipal budgets would be economically feasible, however the lack of knowledge on the benefits and costs of AT and TDM measures at political level hinders this re-allocation. While working towards rising awareness in this matter, the NAMA support component will also advise local governments on how to access innovative financing means and engage in acquiring additional financial support from multilateral banks or the private sector in order to incentivize early action and speed up overall NAMA implementation.

The National Government faces severe budget cuts due to the peace process in the country which poses a severe risk to the establishment of the technical support component of the NAMA, which is considered key for successful implementation. In the development phase of the NAMA, it was found that the lack of technical capacities and awareness are the main barriers towards NAMA implementation, while a lack of financial means for infrastructure investments in the local municipalities is assumed to pose only a short term barrier that can be overcome by provision of technical support and awareness raising. It is thus of utmost importance to secure the financing for the technical support component provided by the National Government to the 17 cities.

Financial barriers further exist on the level of individual measures, e.g. for Measure 7: formalized bicycle and electric taxis. As owners and operators of three-wheeler taxis operate in very small and dispersed business units, they will face economic bottlenecks in the acquisition of new (safe and eco-friendly) vehicles, even if these may be cost-efficient in the long run. In order to overcome this barrier, innovative financing mechanisms have to be set up, which allow to absorb initial investment costs and bridge the redemption period. Another financial hurdle that has to be overcome is the financing of PBS. While these are partly financed by advertisement in many cities of the world, current concession contracts for public transport systems in Colombia grant the right for all publicity within a certain radius of transport stations to the public transport operator. As revenues from publicity provide a major income source for PBS, concession contracts may have to be revised in order to account for the need of building intermodal public transport networks.

The barriers analysed in this chapter are summarized in Table 13. The measures of the technical support component of the NAMA specifically address each of these barriers and risks to help overcoming and alleviating them (see chapters 4.1 for more details).

Table 13: Barriers and risks of NAMA implementation

Political barriers	Rejection of unpopular projects by municipal council and civil society Lobbying of industry and merchants against pedestrian areas, low-speed zones and parking management	**Regulatory barriers**	Missing regulation of 3-wheeler taxis Missing regulation for electrically assisted bicycles Need for deregulating parking tariffs Counterproductive minimum parking requirements
Awareness, cultural and social barriers	Car as status symbol and perception of the bicycle as a means of transport for the poor Lack of awareness of overall benefits of AT and TDM among PT operators, policy makers	**Lack of knowledge and capacity**	on technical requirements for cycling infrastructure on the design and management of parking schemes on innovative technologies

			on data gathering and monitoring schemes
Institutional barriers	Lack of unit responsible for AT and TDM at local level Lack of well-trained personnel Frequent changes of staff in Ministry of Transport Lack of institutionalization of activist groups	**Financial barriers**	Tight municipal budgets Budget cuts on national level for technical support component Lack of knowledge on innovative financing on the local level Counterproductive regulation (e.g. advertisements around bus stations)

Source: Own elaboration

4.2 Support measures to facilitate NAMA implementation

It is expected that in general the eight direct mitigation measures of the NAMA mentioned in chapter 3.2 can (and should) be implemented by the municipalities without financial aid from the National Government as costs are rather low when compared to other transport infrastructure investments (compare chapter 6 on costs of NAMA implementation) and some measures even generate a net profit. During the preparation phase of the NAMA it was found that the most significant barriers to a shift towards non-motorized modes are not of financial nature but are rather a mixture of: 1) a lack of awareness on the measures' benefits, 2) a lack of technical and institutional capacities at local level, and 3) a missing enabling regulatory and political framework (compare barriers to NAMA implementation in chapter 4). Based on these findings, the NAMA at national level establishes a technical support component with four work streams to address the most significant barriers and facilitate the implementation of the direct mitigation actions:

4.2.1 Work stream 1: Promotion and awareness raising

With the aim to raise awareness and create a better understanding of the costs and benefits of cycling and travel demand management, campaigns and promotional activities will be carried out in a strategic manner. Awareness will be raised especially on aspects that are essential to achieve a significant cycling share in Colombian cities. To name one example, it will be crucial to create recognition of cyclists as equal participants in urban transport and road usage in order for potential cyclist to shift from the private car to the bicycle. Table 14 shows example activities to be developed under work stream 1 in order to achieve the most essential awareness raising goals.

Table 14: Example activities under work stream 1: promotion and awareness raising

Main target group	Main awareness raising and promotion aims	Example activities

Potential future cyclists	• Personal benefits from cycling as a mode of transport (e.g. health, exercise, fun, status, additional time, financial incentives)
	• Benefits for the city as a whole / general society
	• Higher general visibility of cycling and cyclists
		• Marketing campaigns to create a better image for cycling
		• Involving prominent figures in the promotion work
		• Branding of all cycling activities to create higher visibility
		• City challenges or comparison by means of international cycling ease indices to create a sense of reward and motivate
		• Highly visible, temporary activities in the city:
		  ○ blocking of streets for cycling
		  ○ re-design of a crossing that is especially prone to accidents
		  ○ creation of an intermodal transport hub
		• Gamification approaches such as mobile applications demonstrating the individual benefits from each trip by bicycle (calories burnt, pollution avoided, etc.)
		• Incentivizing cycling by means of mobile applications that reward cycling, such as BIKO

Children	• Familiarization with the bicycle as a transportation mode • Responsible traffic behavior and general traffic rules	• Organized and accompanied school routes • Traffic safety events in schools • Distribution of reflectors or reflecting vests • Bicycle reparing workshops in schools
Car and motorcycle drivers	• Respect for cyclists as equal road user • Personal benefits of parking management and from increased shares of cycling (less congestion) • (electrically assisted) bicycles as alternatives for commutes	• Events for the general public to educate on the benefits of cycling for society • Stringent enforcement of parking violations • Critical mass events • Informative events and fairs with demonstrations of best practices in parking, road safety, etc. • Car free days
Private companies and local institutions	• Costs and benefits of installing cycling infrastructure or PBS • Technical aspects of cycling infrastructure	• Information events, bilateral meetings, webinars. • City challenges or competitions among different institutions.

	• Support offered by the government • Existing regulation	
Owners of small local businesses and respective associations	• Demonstrate the positive effects of pedestrian areas, traffic calming and comprehensive parking management for business.	• Information material: factsheets, best practice examples • Local events or roundtables.
City officials, local and national administration	• Costs and benefits (incl. benefits for general society and traffic situation, marketing potential, etc) from the promotion of cycling and TDM. • Benefits and implications of increased use of assisted bicycles. • Support and regulation from the national level.	• Webpage for synthesizing and dissemination of relevant information. • Showcasing best practices from other cities/ countries. • Conference on parking with demonstration of technology and best practices. • Webinars and seminars. • Newsletters.

In order to increase the impact and reach of the activities, natural multipliers such as the national cycling association BiciRed or the independent information platform CiudadesComoVamos will be involved in the dissemination of the campaigns. During the pilot phase of NAMA implementation (2017), first activities will be tested in the pilot cities.

4.2.2 Work stream 2: Technical assistance and capacity building

The objective of work stream 2 is to strengthen institutional, professional and financial capacities at local level to facilitate the implementation of AT and TDM measures in the most effective way. On the one hand, the technical support component of the NAMA will support city administrations in their efforts to improve the AT and TDM situation in their cities by providing **technical backstopping and advisory** e.g. for the development of mobility master plans, technical concepts, feasibility studies and funding strategies. For this, a **pool of consultants and experts** on the relevant topics (see table below) will be created in order to be able to react promptly and specifically on the cities necessities. In addition, a capacity building programme **– the Bicycle Academy -** will be established at national level with the aim to build up local capacities on key aspects via **seminars, webinars and the elaboration of guiding material.** Essential topics to be addressed by the capacity building measures include technical, financial and regulatory aspects of e.g.:

- **PBS:** best practice examples, private sector involvement and business models, positioning and structuring, technological and operational options, regulatory barriers and solutions, etc.
- **Parking management:** design of goal-oriented parking management schemes, stakeholder integration and communication strategies to increase acceptance, enforcement strategies, technological options incl. digital approaches, tariff structuring, etc.

- **Cycling infrastructure including parking infrastructure and cycling lanes:**
  - Comprehensive planning of cycling infrastructure (incl. the use of digital solutions).
  - Options for the integration of different modes of transport (planning, technology).
  - Technical standards and implications of a potential increased use of cargo cycles, bicycle taxis and electrically assisted bicycles.
  - Cycling highways as a solution for high mode shift.
  - Options for private sector engagement.
- **Traffic calming:** costs and benefits of different measures including engineering measures, enforcement and educational measures, technological options, etc.
- **Bicycle taxis:** formalization and regulation, vehicle safety aspects, potential for the creation of a local industry, etc.
- **Electrically assisted bicycles:** Implications of increased use for the cities, potential for increased livability in cities (air quality, etc.), potential for the creation of a local industry, use in cargo transportation, electric cargo cycle rent systems, etc.
- **Promotion:** best practices in the promotion of cycling, electrically assisted bicycles, respect for cyclists, acceptance of parking management measures, etc.
- **Financing:** Costs and financing options of the implementation of a comprehensive set of measures in AT and TDM.

Next to city administrations, transport authorities and planners, also the private sector should be addressed by the capacity building measures, as these often dispose of the necessary funds to implement measures (especially bicycle parking infrastructure), however, mostly lack the technical capacities to do so as interviews during the preparation phase of the NAMA have shown.

In a similar approach as in work stream 1, work stream 2 will put emphasis on the training of local trainers and multipliers to replicate the capacity building measures. This could involve universities, the SENA (Servicio Nacional de Aprendizaje), a national public training facility ascribed to the Ministry of Labour, bicycle associations, as well as NGOs working to promote AT or sustainable transport. In an attempt to build up the national bicycle association BiciRed to become a well-organized advisory body to the local as well as national governments, the association will be supported in their institutional set up and strategy building.

4.2.3 Work stream 3: Improvement of the political and regulatory framework

Under work stream 3, the programme will work towards strengthening active modes and travel demand management in national sector policies and improve the local political and regulatory framework to facilitate the implementation of the seven mitigation measures of the NAMA. In a first assessment of the political and regulatory framework conditions during the preparation phase of the NAMA, the following activities have been identified (subject to amendment during the pilot phase of the NAMA):

- Design, elaboration and implementation of a national master plan for AT and TDM.
- Reformulation of the code of transit to facilitate the implementation of the seven measures (e.g. the implementation of traffic calming zones).
- Creation of binding technical standards for cycling lanes.

- Establishment of priority for cycling on intersections or shared roads.
- Formalization and regulation of the bicycle taxi services.
- Regulation of the market and the transit of electric assisted bicycles.
- Changes in the building code, regarding the minimum requirements for parking in new constructions.
- Changes in the regulation of maximum parking fees.

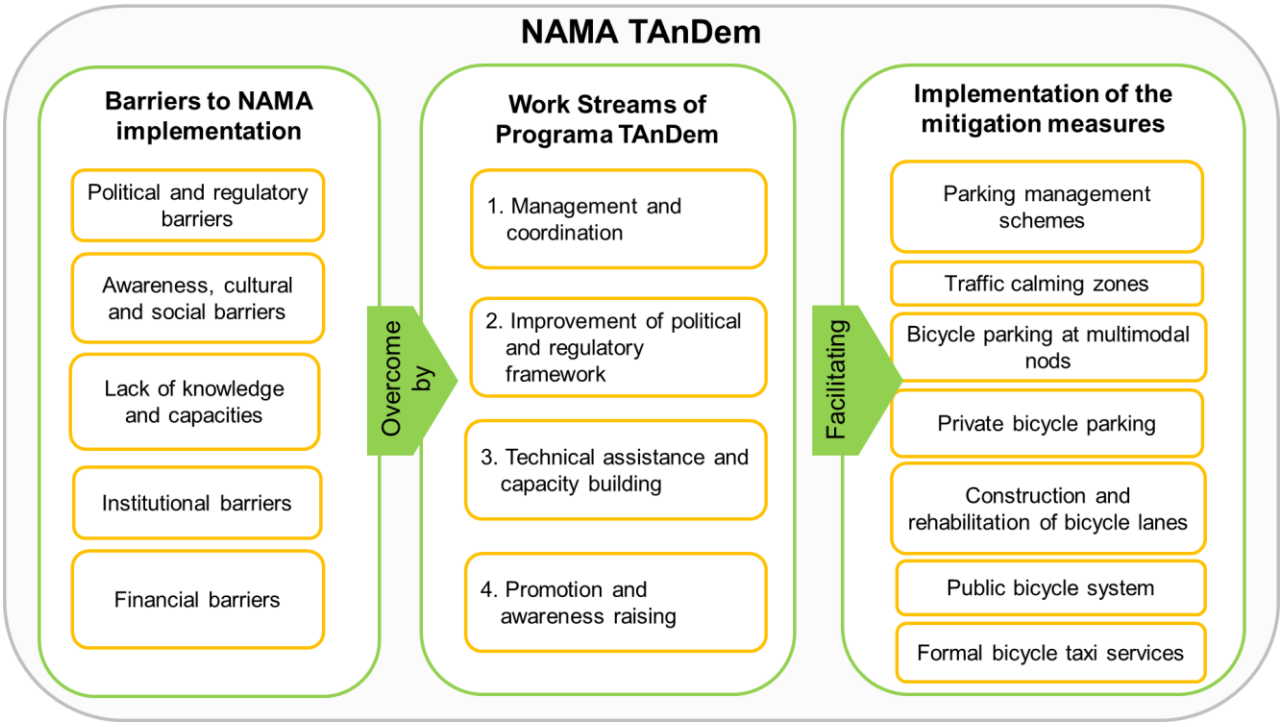
4.2.4 Work stream 4: Management and coordination

Work stream 4 contains all management and coordination activities for NAMA implementation, including coordination of activities with the cities, inter-ministerial coordination as well as coordination with multiplicators and expert pools. Management and coordination will mainly be carried out by CIUDAT. CIUDAT organizes monthly inter-ministerial technical meetings, biannual inter-ministerial meetings on decision making level and establishes communication channels with city governments and multiplicators. The technical team seated in CIUDAT implements and monitors the activities of the cities and reports back to the inter-ministerial committees (technical and political). The ministries are the main responsible entities for the implementation of work stream 3 (political and regulatory framework). Activities in work stream 4 include:

- Regular meetings with all institutions involved in the implementation of NAMA TAnDem on technical as well as decision making level
- Establishment and coordination of a donor roundtable for TAnDem measures
- Coordination of activities under work stream 1 and 2 (seminars, webinars, work assignments to consultants, etc.)
- Establishment and management of the pool of consultants
- Coordination with multiplicators in promotional and awareness raising activities as well as in capacity building
- Creation and operation of the NAMAs website
- Monitoring, evaluating and reporting of implementation progress and impacts as well as need for regulation

Figure 25 explains the correlation of identified barriers for NAMA implementation and measures of the technical support component.

Figure 25: Overcoming barriers towards more AT and TDM of the NAMA TAnDem



Source: Own illustration.

5 The MRV approach: Monitoring, Reporting and Verification

5.1 Introduction

For the design of the NAMA, an ex-ante assessment of the mitigation impact has been carried out and a MRV system set-up was designed, in five steps:

- assessment of status quo and necessities in TA and TDM in different Colombian cities,
- qualitative analysis of the mitigation potential and sustainable development benefits for different measures (causal chains) and selection of the measures to be considered under the NAMA,
- an assessment of data availability and different methodologies for the ex-ante estimation,
- selection of assessment methodology and estimation of the GHG mitigation potential of the NAMA,
- suggestions for an institutional set up for the MRV system.

The following sections provide a summary of the findings of these studies.

5.2 Qualitative analysis of GHG impacts

In general, transport policies induce GHG emission reductions by:

- **A**voiding and shortening trips (reducing the need to travel),
- **S**hifting trips to less carbon-intensive modes such as walking, cycling or public transport, or by
- **I**mproving the energy and carbon efficiency of the currently used modes, e.g. by introducing efficiency standards[12].

The main effect intended with AT and TDM policy measures is shifting trips from high-emitting transportation modes to non- or less-emitting modes. The environmental benefit of the measure is then determined by the modal shift achieved. A **shift** of e.g. a car trip to cycling will have large benefits, while a shift from public transport to cycling will have smaller benefits, and a shift from walking to public transport will have negative effects on total GHG emissions. Improving conditions for AT (and subsequently public transport) may shift car trips to a combination of public transport and AT, however, it may also animate people to use these modes who otherwise wouldn't have been travelling at all (so called **induced traffic**). While this may have positive impacts in terms of accessibility of jobs and reduction of poverty, GHG emissions will rise as traffic demand is increased. Since AT is basically emission-free, the GHG impact of induced cycling and walking demand is negligible. However, induced demand in the area of public transport or other electrically assisted bicycles has to be taken into account.

Discouraging motorized private transport may also lead to a shift of car and motorcycle trips to more favourable modes, but users may also decrease trip frequency (**discouraged demand**) or **change trip destination**. This impact is more probable with localized policy measures. It could

[12] A-S-I- Approach

imply more or less GHG emissions depending on whether the new destination is closer or farther from the origin of travel.

Quantifying the GHG emission impacts of the mentioned effects therefore needs robust information or estimates on the following:

- Amount of induced traffic (trip number and distance per mode),
- Amount of discouraged traffic (trip number and distance per mode), and
- Modal shift achieved (trip number and distance per mode).

The main impacts of NAMA implementation are presented as a causal chain in Figure 26. Detailed causal chains for the seven direct mitigation measures under the NAMA are presented in Annex 1.

Rebound effects

As mentioned above, the proposed measures also increase the **attractiveness of multimodal trips** (most of all public transport and active transport). This can result in both, the desired reduction of GHG emissions as individual car trips are shifted to PT and AT, as well as in an unintended increase of emissions because additional public transport trips are induced. This potential negative effect can, however, be considered of less importance considering the fact that improving AT and public transport jointly may slow down overall individual motorization. If cycling and public transport are brought together, they deploy the potential to allow for a convenient, sustainable and car-free mobility. Cycling might on the one hand replace shorter public transport trips, but combined cycling and public transport trips on the other hand might replace longer car trips. In the long run, good conditions for AT and public transport reduce the need to own a car. This leads to less car trips, which can be seen as the main leverage for GHG emission reductions in passenger transport.

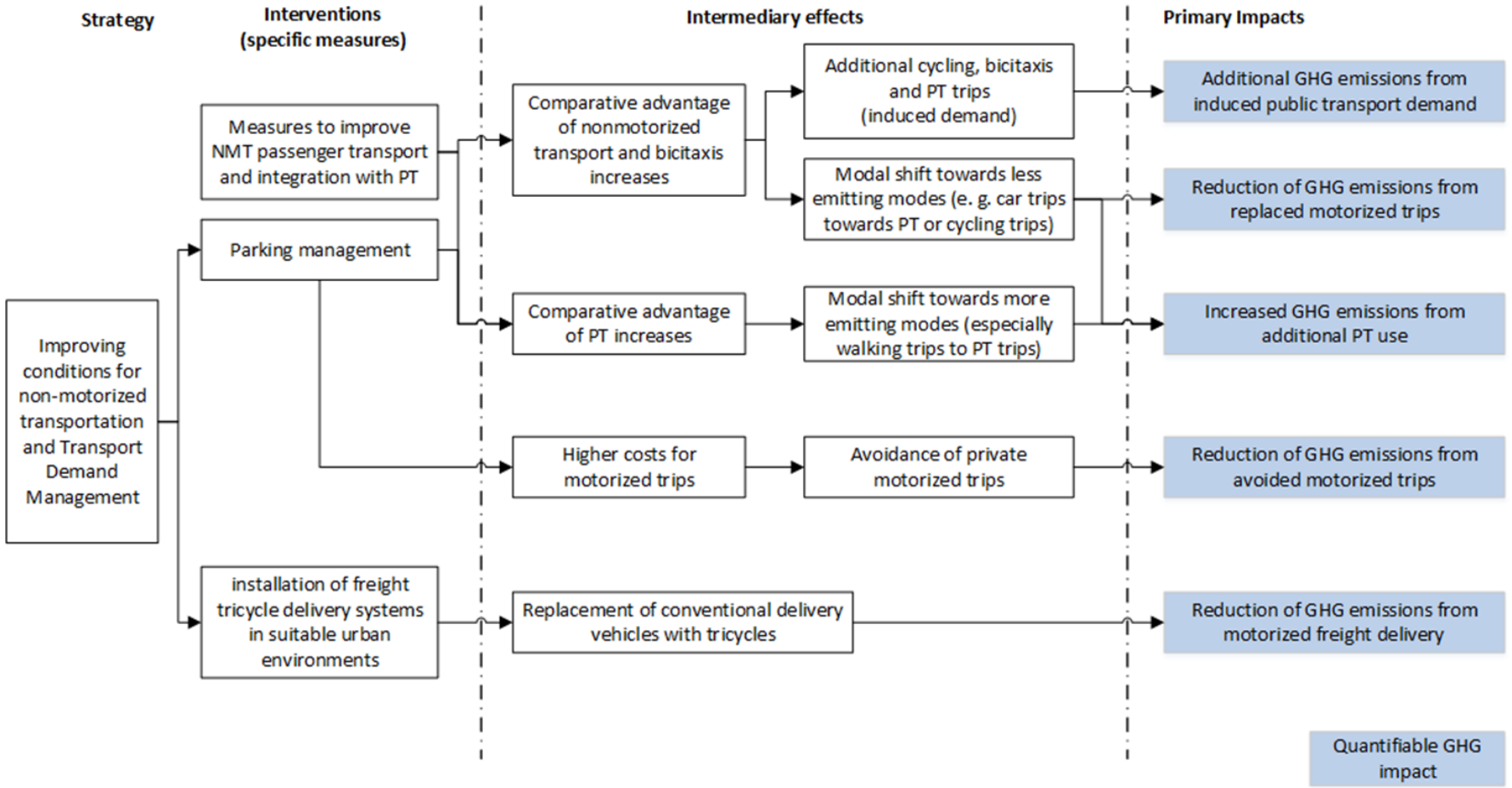
Finally, all the six measures have in common that they shift trips from motorized transport to AT and thus reduce congestion. **Less congestion** gives an incentive to increase car use again and hence increases GHG emissions (rebound effect). While this effect is considered to be only marginal, it nevertheless stresses the **importance of additional measures discouraging car travel**, such as a more stringent parking management. However, the final impacts of parking management on motorized private transport mileage and the related GHG emissions are not as clearly quantifiable as it seems at a first glance. These effects heavily depend on the specific circumstances within the city and the chosen design of the parking management scheme. As the stringency of parking management increases the costs for parking, it can be expected that some users react to these, leading to avoided car trips. Besides, the following (positive or negative) effects might also play a role:

- Influence of traffic generated through users searching for a parking space,
- Influence of increased car rotation on the existing parking space, and
- Influence of changes in the choice of destinations.

In summary, parking management represents for various reasons a useful and necessary traffic planning measure. A consistent implementation of the management strategies is therefore necessary in order to secure the individual awareness of drivers. However, the GHG reduction

potential is difficult to quantify. Reductions by parking measures are therefore not considered in the estimation of GHG reduction potential.

Figure 26: GHG impacts of AT and TDM measures



Source: own illustration

5.2.1 Data sources and availability

The estimation of TAnDem's impact on GHG emissions requires demographic data, transport related data, and data on environmental impacts associated with each vehicle type. On the national level, there are two major information systems to feed the estimations: the *Sole Registry of National Transit* (RUNT) and the *Information, Monitoring and Evaluation System of Urban Transport* (SISETU), which provide a good base for the estimations. While the former provides data regarding Colombia's vehicle fleet, the latter includes data like average distances travelled per trip, travel time, average occupation rate in public transport, as well as data on accidents. As of July 2017, all cities will have to report common transport indicators to the SISETU that are gathered using the same methodology and frequency[13]. Nevertheless, a lack of capacities on data collection methods on the local level has traditionally compromised the quality of the data.

Emission factors have been obtained from C*lean Development Mechanism* (CDM) projects in four major cities: Medellin, Cali, Bogotá and Bucaramanga as these reported the most detail. Further potential data sources include the Ministry of Energy and Mining's Planning Unit for Energy and Mining (*Unidad de Planeación Minero Energética, UPME*) that reports the official emission factors for combustibles as well as emission factors differentiated per vehicle type and cities, however did not currently provide the same amount of details as the CDM studies.

Data gaps as well as a lack of institutional capacity to handle available data exist especially at local level (also see chapter 4). While for some cities[14], data on transport can be provided via the Colombian observatory network *CiudadesCómoVamos* (modal split, development of travel time over a period of time, customer satisfaction, etc.), as well as from municipal mobility master plans and mobility surveys where these have been carried out, others have no comprehensive data at all. Table 15 provides an overview of potential sources of information.

Table 15: Sources of data and included parameters relevant for MRV of TAnDem

	Parameters relevant for transport and mobility										**Parameters relevant for emissions and air quality**				
Information system / data source	**Demographic parameters**	**Vehicle fleet**	**Characteristics of vehicle fleet**	**Number of trips**	**Travel time**	**Distance travelled**	**Modal split**	**Occupation rate**	**Passengers**	**Reason for travel**	**Fuel consumption**	**Characteristics of fuel**	**Emission factors**	**Emission inventory**	**Air quality**
RUNT		X	X												
SISETU			X	X	X	X		X	X						X
Municipal master plans							X	X		X					

[13] Full set of indicators can be found here:
http://legal.legis.com.co/document?obra=legcol&document=legcol_4c3a94d35cd14e819bcbb421e870ff88

[14] Bogotá, Cali, Medellín, Barranquilla, Cartagena, Bucaramanga, Manizales, Pereira, Ibagué, Valledupar, Yumbo.

Surveys on mobility					X	X	X	X		X					
Observatories for mobility		X		X	X	X	X			X					
Ciudades Cómo Vamos		X		X	X	X	X	X		X					
DANE	X														
SIAC														X	X
UPME											X	X	X		
PDDAB													X	X	X
IVE Model													X	X	
CDM Projects		X	X			X	X		X		X	X	X		

Source: own table

5.3 Quantitative estimation of GHG emissions

General calculation methodology and scenario description

Calculation of GHG emissions is limited to CO_2 emissions, as it is the main GHG from transport activity. Emissions have been calculated tank-to-wheel. The spatial boundary of NAMA TAnDem is confined to the 19 cities subject to the NAMA.

GHG calculations follow a scenario approach, where the GHG mitigation impact of two mitigation scenarios are compared to a BAU scenario. As the 19 cities differ substantially in size between SITM and SETP cities, two reference cities were chosen for each scenario. While Cali represents a SITM city (with a population of approximately 1 - 2 million), *Villavicencio* represents a SETP city (with a population of between 250,000 - 600,000). The definition of the mitigation scenarios follows the established targets for each mitigation scenario (Additional mode share of 5.5% for the Conservative and 9% for the High Shift Scenario respectively). Based on available, evidence-based data for each of the seven direct mitigation measures and assumptions on replaced modes as well as emission factors, the extent of NAMA implementation necessary to fulfil the target of the respective scenario was determined.

In a second step, to show an order of magnitude for the impact of total NAMA implementation (19 cities), results have been extrapolated to NAMA level, based on population data for each city and trip development according to trip development in the model cities. It has to be mentioned however, that this extrapolation can only serve as a rough estimate, as Colombian cities vary significantly in terms of current state of cycling infrastructure, economic, geographical and climatic, as well as cultural conditions. As a matter of fact, actual emission reductions will depend on exact project design in the cities.

The three scenarios are described in the following:

BAU Scenario: continuation of current trends, resulting in a doubling of trips done by car and motorcycles (+100%), and a drastic decrease in the use of public transport and cycling (>50%). While the BAU scenarios for both cities are based on local data sources, including mobility surveys and local mobility plans, population data is based on national statistics and projections until 2020

(DANE), linear growth is expected after this. Figure 27 and Figure 28 show the mode share assumptions for both reference cities.

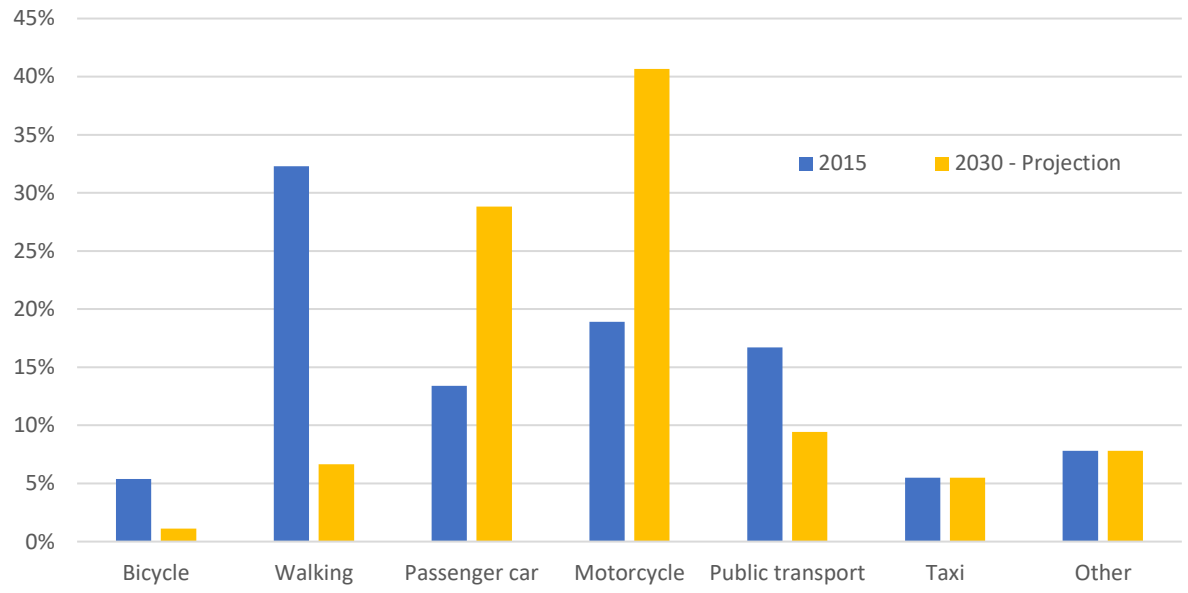


Figure 27: Mode share in BAU scenario for Cali

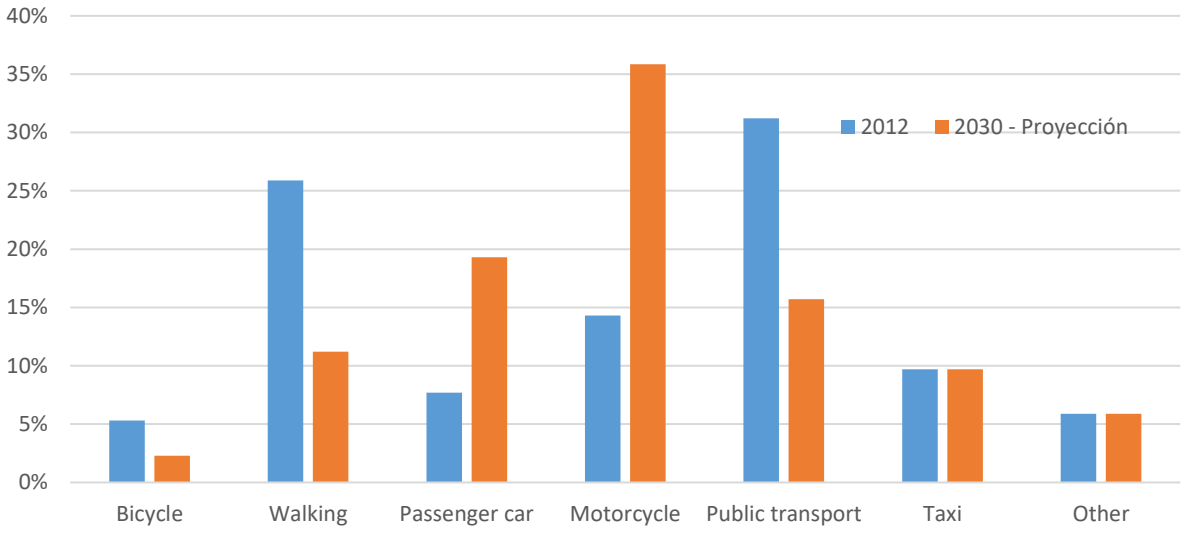


Figure 28: Mode share in BAU scenario for Villavicencio

Conventional scenario: describes the extent of implementation of NAMA measures necessary to reach 5.5% of additional modal split of cycling in 2030 against BAU.

High Shift Scenario: describes the extent of implementation of NAMA measures necessary to reach 9% of additional modal split of cycling in 2030 against BAU.

Table 16: Description of the mitigation scenarios

Cali				Villavicencio	
Measure	**Scenario**	**Extension**		**Extension**	
M2	Conservative	1.5	Km^2 low speed zones	0.3	Km^2 low speed zones
	High Shift				
M3	Conservative	9,000	Bicycle parking facilities (intermodal knots)	200	Bicycle parking facilities (intermodal knots)
	High Shift	12,000	Bicycle parking facilities (intermodal knots)	1,000	Bicycle parking facilities (intermodal knots)
M4	Conservative	5,000	Bicycle parking spots (on- and off-street)	300	Bicycle parking spots (on- and off-street)
	High Shift	7,000	Bicycle parking spots (on- and off-street)	500	Bicycle parking spots (on- and off-street)
M5	Conservative	300	Km cycling lanes	120	Km cycling lanes
	High Shift	450	Km cycling lanes	200	Km cycling lanes
M6	Conservative	4,000	Bicylces	500	Bicylces
	High Shift	8,000	Bicylces	1,000	Bicylces
M7	Conservative	3,500	Bicycle taxis	Not assessed as no bicycle taxis are currently available	
	High Shift	5,000	Bicycle taxis		

Calculation Steps

GHG emission reductions were estimated on a trip-based approach, based on the following equation:

Emission CO_2 = $\Sigma_{passenger}\Sigma_{trips}\Sigma_{modes}$[EF CO_2] x [vehicle / passengers] x [distance of trip]

Where:

- $\Sigma_{passengers}$ refers to the average number of passengers transported
- Σ_{trips} is the average number of trips per passenger,
- Σ_{modes} refers to the different transport modes used, and
- EF is the emission factor

Calculated emission reductions result from the number of replaced and avoided trips by motorized modes, including cars, motorcycles and public transport. The calculation was done in 4 steps:

1. Estimation of additional cycling trips per measure
2. Estimation of avoided or replaced trips by other modes
3. Estimation of avoided km per travel mode (multiplication of trips per mode with average trip lengths per mode)
4. Multiplication of km per mode with emission factors.

Key assumptions for the calculations

Key assumptions include expected behavioural changes, especially regarding trip frequency, distance and modal choice. The assumptions made for the estimation are derived from statistical data, similar projects that have been carried out in the local context and of which the results in terms of modal shift or additional trips, trip lengths etc. have been assessed by means of surveys, and expert judgement. Table 17 shows the major assumptions underlying the estimations.

Table 17: Major assumptions for the GHG emission reduction estimations

<table>
<tr><td>Replacement of trips by other modes</td><td>12% of new cycling trips substitute a trip by car, 48% a trip by PT, 6% replace a trip by motorcycle and 6% a trip by taxis. Due to time and budget constraints a variation of the substitution rate over time could not be considered. Also, electrically assisted bicycles have not been considered, the inclusion of which can be assumed to yield higher substitution rates from motorcycles and cars. It has to be noted that the creation of well-designed cycling infrastructure interconnected with public transport also increases the possibility to realize combined trips by bicycle and public transport. This has not been taken into consideration in the calculations however, it can be assumed that this will yield a significant increase in cycling and public transport trips substituting car trips.
<table>
<tr><th>Modes / Replaced by</th><th>Cycling</th><th>Walking</th><th>Cars</th><th>Motorcycles</th><th>Buses and minibuses</th><th>Massive transport</th><th>Taxis</th><th>Others (e.g. bicycle taxis)</th></tr>
<tr><td>Cycling trips and PBS</td><td>0.95</td><td>0.24</td><td>0.12</td><td>0.06</td><td>0.00</td><td>0.48</td><td>0.06</td><td>0.00</td></tr>
<tr><td>Bicycle taxis</td><td>0.00</td><td>0.50</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.40</td><td>0.10</td><td>0.00</td></tr>
</table>
</td></tr>
<tr><td>Average length of trips per mode</td><td>5.5 km for whole cycling trips, 2.5 km for feeding trips interconnected with public transport, 1.5 km for bicycle taxi trips, and 4 km for PBS. It has to be noted that a recent study using mobile phone tracking data carried out in Cartagena found that the average trip distance by bike is 7km. This finding could have impacts on the assumptions on replaced modes.</td></tr>
<tr><td>Emission factors</td><td>Emission factors were deducted from average emission values reported in BRT projects in four major cities (Cali, Medellin, Bogotá and Bucaramanga). While these can be assumed to serve as a good proxy for SITM cities, emission factors are probably a little higher in the considerably smaller SETP cities. As for a lack of data, the same emission factors have been used for all cities. Also, emission factors have not been adapted over the implementation period of the NAMA to account for more advanced technologies.
<table>
<tr><th></th><th>Emission factors (g CO_2 / p km)</th></tr>
<tr><td>Cars</td><td>168</td></tr>
<tr><td>Motorcycles</td><td>57</td></tr>
<tr><td>Taxis</td><td>238</td></tr>
</table>
</td></tr>
</table>

	Public buses	93
	Bicycles*	0
	electrically assisted bicycles were not considered in the estimations, thus no emission factor was assigned.	

Limitations of the estimation result from assumptions regarding

- The use of constant emission factors over time despite expected technology improvement and fleet renewal may lead to slight overestimations in the reduction potential.
- A constant substitution rate of modes is used, yet one could expect that as the network becomes more complete and interconnected with public transport, more and longer car trips may be substituted by public transport and cycling.
- Electrically assisted bicycles are not included in the estimation. It can be assumed that their inclusion will yield the substitution of PT, car and motorcycle trips.
- For reasons of data availability, calculation of impacts was done for individual measures based on empirical data. It can be assumed, however, that an estimation for the implementation of the package of measures as a whole will yield a higher shift towards cycling.
- The effects of the establishment of stringent parking management schemes have not been considered. While the direct GHG impact is difficult to be estimated, it can be assumed that this measure has additional indirect impact as it discourages motorized transport and may reduce rebound effects.

Overestimation of emissions due to the constant emission reduction factor is assumed to be balanced out by underestimations due to the constant substitution rate. The consideration of electrically assisted bicycles can be assumed to yield higher substitution rates especially for motorcycles and cars but also for conventional bicycles. Last but not least, it can be expected that an estimation of the package of measures would yield higher emission reductions as a comprehensive network of cycling infrastructure in combination with parking measures attracts more trips from other modes than isolated projects. A rough estimation using the *Teemp Bike* model, which estimates the GHG reduction impact for infrastructure improvement on an aggregated basis supports this assumption. See (Hill Consulting, 2016) for details on Teemp calculations.

5.4 Monitoring

The goal of monitoring is to understand whether policies or actions are effective and efficient in delivering the intended results and to adjust the design and focus of the measures accordingly. In general, the MRV system should provide information on the following NAMA aspects (ADB & IDB, 2010; GIZ, 2014):

- the progress and quality of implementation,
- the climate finance received and spent for the NAMA,
- the contribution of the NAMA towards a sustainable national development (SDBs), and

- the GHG emission reductions achieved.

The NAMA uses the following indicators to monitor the desired overall project outcomes:

- Increase the modal split of active transport by 9% until 2030
- A minimum of 900 million USD fed into AT and TDM until 2030 in all NAMA cities
- 10 approved regulations that facilitate AT and TDM projects
- Reduction of 3.88 $MtCO_2$ (acc.) from urban transport by 2030 in the NAMA cities

As progress and quality of implementation will be monitored along the output indicators described in the logical framework of the NAMA (compare Annex) and monitoring of additional funding is rather straight forward, the subsequent chapters will focus on the monitoring and quantification of GHG emission reductions and reduction of air pollution by implementation of the NAMA.

5.4.1 Monitoring of GHG impacts

For monitoring of GHG impacts, a bottom-up approach based on detailed travel behaviour data is used as causal attribution is not possible for top down approaches. According to the bottom-up approach, the basic formula to calculate GHG emissions through (passenger) transportation activities is (Becker, Winter, & Gerike, 2007):

$$\mathbf{Emissions} = \mathbf{Persons} * \sum_{\mathbf{i=1}}^{\mathbf{n}} \mathbf{trips_i} * \frac{\mathbf{Person\ km}}{\mathbf{trip_i}} * \frac{\mathbf{Vehicle - km}}{\mathbf{Person - km}} * \frac{\mathbf{litre\ fuel}}{\mathbf{Vehicle - km}} * \frac{\mathbf{EF}}{\mathbf{litre\ fuel}}$$

Where,

- *i* represents the transportation mode under consideration
- *trips* means the average number of trips per person
- $Person\ km/trip_i$ stands for the average trip distance per trip
- $Vehicle - km/Preson - km$ is the inverse of the average occupancy rate of the transportation mode
- $Litre\ fuel/Vehicle - km$ and $EF/litre\ fuel$ describe the fuel and emission standard of the considered transportation mode

This formula is quite flexible and can be simplified according to the available data. Since the main objective of NAMAs is to reduce GHG emissions, the central monitoring parameter is:

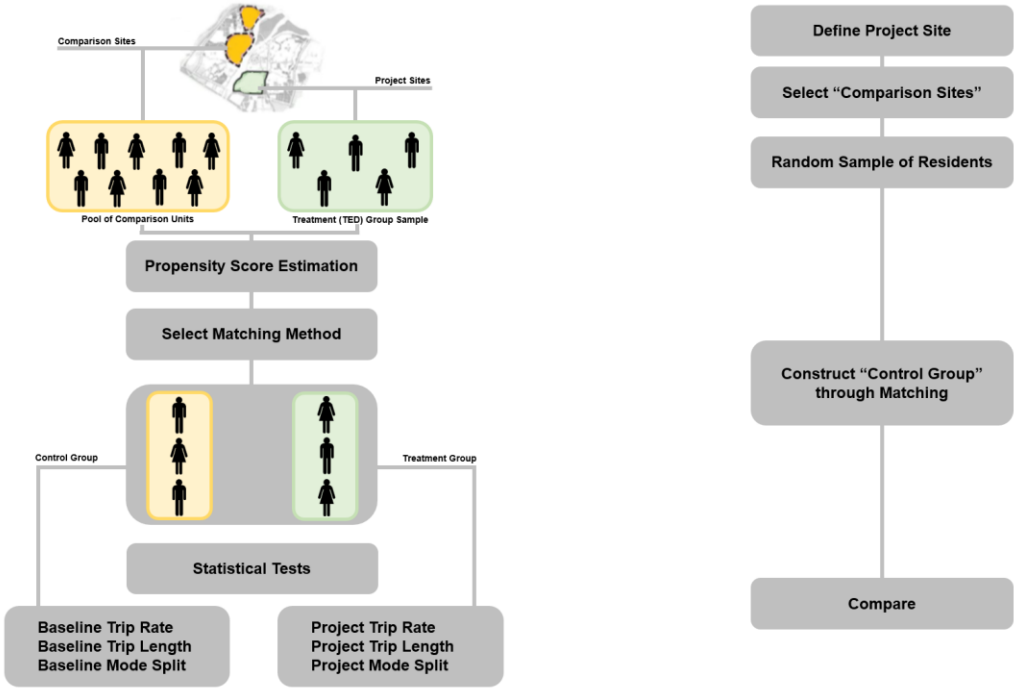
Total emission savings due to the NAMA measures [g CO_2/day or year]

While the ex-ante estimation has been done on the basis of individual measures, this was mainly done because of data availability reasons, and is not a suitable approach for actual impact assessment after NAMA implementation. As explained above, the seven NAMA measures will have overlapping and reinforcing effects, so that the total NAMA impacts will be different from the impacts each individual measure would have if implemented by itself (e.g. cycling infrastructure might only attract a significant number of cyclists once the network is complete). Besides, the problem of double counting or inaccurate effect attribution may occur if mode choice is influenced, both, by AT infrastructure measures and parking management (which will probably be the case for all measures implemented in the same local area). Such interdependencies can be considered to be high especially in cases where a number of larger scale measures are implemented in close

proximity to one another. Monitoring should therefore not be done on the level of the seven individual measures, but in an aggregated form on city level.

For the monitoring so called **control group approach**[15] was chosen, see Figure 29. With this approach, behavioral changes of the people exposed to the NAMA measures (treatment group or area) are compared to behavioural changes of people not exposed. All other things being equal, the differences between the groups should solely account for changes triggered by the implemented measures. This approach implies the collection of travel behaviour data before and after the NAMA implementation both for the treatment group/area and the control group/area. The assessment of the whole package of measures at city level can be carried out with the help of general travel surveys capturing changes in the daily travel behaviour (EMBARQ México, 2013; Jürg M. Grütter, P. Bürgi, & M. Cocco, 2013).

Figure 29: Flow chart for a control group monitoring approach



Source: Based on (Zegras, Chen, & Grutter, 2009, p. 17)

Ex-post monitoring of GHG reduction effect is basically calculated with data similar to that collected for the ex-ante estimation. In general, data on activity (changes), mode choice and vehicle characteristics are necessary, see chapter 5.2 for more detail.

[15] More accurately spoken: two group pre-test-post-test design using an untreated control group based on randomized or non-randomized assignment.

5.4.2 Monitoring of Sustainable Development Benefits

In order to assess the performance of NAMA cities in terms of sustainable development benefits, an index consisting of several performance indicators is established. The following sustainable development benefits will be monitored by the Sustainable Transportation Index:

- **Fuel savings:** *Per capita energy consumption by fuel*. Can easily be calculated or measured on the basis of changes in trip frequency, trip distance, travel time and modal split.
- **Air pollution exposure: CO, NOx and PM** can easily be calculated or measured on the basis of changes in trip frequency, trip distance, travel time and modal split.
- **Travel cost savings** can easily be calculated or measured on the basis of changes in trip frequency, trip distance, travel time and modal split.
- **Health benefits** can be calculated e.g. by the WHO Health Economic Assessment Tool (HEAT), which evaluates the financial returns of investments in cycling infrastructure through reduced mortality due to increased physical activity.
- **Reduction of accidents:** Per capita incidents of road injuries and fatalities
- **Overall transportation system satisfaction rating** (based on objective user survey, e.g. linked to CiudadesComoVamos)

5.4.3 Monitoring of NAMA activity and progress

Monitoring of implementation progress will be done according to the output indicators established in the logframe (compare Annex):

Table 18: Logframe

Output 1: Promotion and awareness raising Local administrations, councils and companies are aware of the benefits of AT and TDM projects. **Indicators:** • X marketing campaigns have been realized in the cities. • X networks are actively involved in promotion and awareness raising campaigns.	**Output 3: Regulatory and political framework** The regulatory framework facilitates the implementation of TA and TDM measures. **Indicators:** • A sector policy strengthening AT and TDM at national level has been approved. • X regulatory documents in TA and TDM have been presented for approval by local or national persons responsible.
Output 2: Technical Assistance and capacity building The improvement of technical, institutional and financial capacities facilitates the implementation of AT and TDM measures at local level. **Indicators:**	**Output 4: Management and Coordination** The *Project Management Unit* (PMU) of the Technical Support Component of the NAMA is working. **Indicators:**

• High quality urban mobility plans with prioritized projects in AT have been adopted by local governments. • X cities have a financing strategy for the AT and TDM projects prioritized in their mobility plans • X% of NAMA cities has an institutional body for AT and TDM with assigned budged and staff. • X strategic projects with high visibility and high impact have been implemented with co-financing from national level.	• The PMU for the Technical Support Component has a min. of 5 staff members with key technical capacities. • The PMU has a clear mandate and defined processes.

Indicator values will be established in the first 6 months after the start of NAMA implementation and a monitoring plan will be set up including milestones along NAMA implementation.

5.5 MRV set-up and process

5.5.1 Institutional Set Up for the MRV system of NAMA TAnDem

Currently, MADS is setting up a national MRV system comprising three pillars:

- MRV of emissions,
- MRV of emission reductions, and
- MRV of financing.

This system will form the frame for reporting. NAMAs will have to report under the component "*emission reductions*".

To secure consistency of data use and data management for the transport sector, the GAADS in the Mdt is responsible for all sector MRV systems and will coordinate MRV activities, such as the definition of quality standards for data sets, of all cities and NAMA measures. Central provision of basic input data reduces the necessary measurement effort for individual cities. For the purpose of TAnDem, GAADs could provide guidance on the selection of appropriate MRV activities and the available input data, and foster best-practice learning as well as knowledge and capacity building.

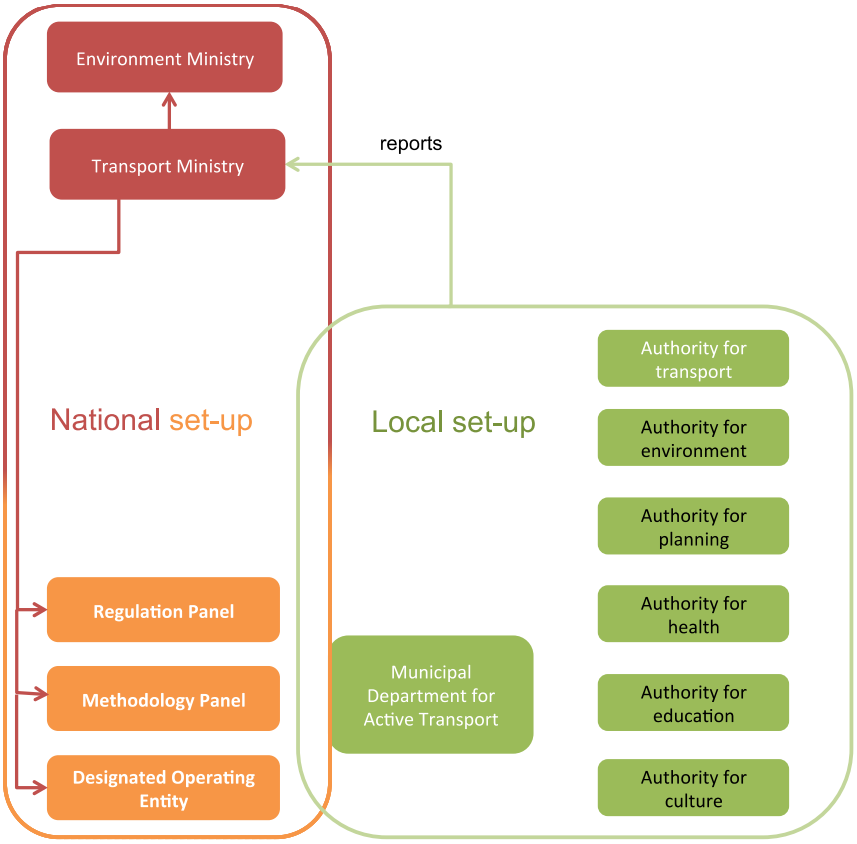
Necessary project-specific MRV activities will take place at the city-level. At this level, *Municipal Department for Active Transport* (OTA) will be the coordination entity. It should be set up in the local authority for transport but integrated horizontally with the planning, environment, health, education and culture sectors to maximize co-benefits. The local coordination entity should have sufficient possibilities to interact with the entities responsible for building and maintaining national information systems like national GHG emission inventories, SISETU or RUNT. This could help to transform these systems, if necessary, so that they are capable to deliver basic input parameters (e.g. local fleet composition). The local municipalities (or other suitable local project partners) should be responsible for collecting project-specific data, e.g. through traffic counts, surveys etc.

In order to secure sound monitoring, the national level will support the OTAs in the following forms:

- **A regulation panel** will define a regulatory framework and take care of institutional arrangements for reporting.
- **A methodology panel** will be able to calculate emissions and draft protocols for collection, validation and reporting of information. Furthermore, it will assist and capacitate municipal entities regarding emissions accounting. It will coordinate closely with the *Institute of Hydrology, Meteorology and Environmental Studies* (IDEAM) which is responsible for Colombia's emissions inventories and national communications.
- **A designated operating entity** will verify the suitability of figures and emission reductions calculations independently. A potential entity to take on this task could be the Colombian Institute for Technical Norms and Certification (ICONTEC).

The institutional set-up for MRV of the programme TAnDem is depicted in the following figure.

Figure 30: Institutional set-up for MRVing TAnDem



Source: Own illustration based on (Hill Consulting, 2016).

5.5.2 Frequency of MRV activities – When to MRV?

The frequency of data collection and reporting needs will be determined jointly with donors, national stakeholders and the institutions involved in the UNFCCC process. A first proposal of reasonable MRV frequencies can be found in Table 19.

Table 19: Proposed data collection frequency

Type of parameters	Data collection frequency
General statistical and time line data	Continuously – annual
Travel behavior data	Every three to five years, as changes will need some time to take effect
Emission factors for GHG and air pollutant emissions	Every three to five years, as changes will need some time to take effect
Emission factors upstream	Average/default values, one-time assessment, as emission changes in this area are not intended/focus of the NAMA
Traffic safety	Continuously
Health	Every three to five years, as changes will need some time to take effect
Access	Every three to five years
Job creation	On an annual basis
Public revenues	Continuously

Source: (TUD, 2015)

6 Financing the NAMA

6.1 Overview of costs and revenues from NAMA implementation

The implementation of NAMA TAnDem involves costs and revenues, both, at the local and the national level. While the municipalities bear the costs for implementation of the seven direct mitigation measures, the national level provides financing for the implementation of the four work streams of the NAMA support package described in chapter 3.3.

This chapter summarizes the results of a financing study carried out in the preparation phase of the NAMA. To obtain sufficiently accurate cost data for the implementation of the seven mitigation measures and take into account the different sizes of NAMA cities, estimations were carried for the two model cities Cali (representing large cities) and Villavicencio (representing medium-sized cities). In a second step, the results were extrapolated to NAMA level. It has to be noted however, that Colombian cities vary significantly in terms of economic, geographical and climatic conditions, and current state of cycling infrastructure. Consequently, the cost data for the model city can only serve as a rough estimate for other NAMA cities and transferability is limited. The same holds true for the extrapolation to NAMA level, which is only able to provide an order of magnitude for the costs of overall NAMA implementation and actual costs will depend on exact project design in each city.

6.1.1 Costs for NAMA implementation at national level (Support package)

At national level, costs accrue for the implementation of the four lines of action of the NAMA support package (compare chapter 3.3). This includes i.a.: the development of guidance documents (e.g. on the design of PBS, parking management schemes, or bicitaxi integration), the development of strategy and policy proposals, the operation of the NAMA's website, which serves as a knowledge management tool for non-motorized transport and travel demand management, as well as the preparation and execution of seminars and webinars for decision makers and planners from city governments. Further, it finances technical assistance to city governments, engages in strengthening of existing networks to serve as multipliers and resource base for the government, and develops awareness raising campaigns. The following table provides an overview of the minimum necessary budget for the implementation of NAMA TAnDem at national level per year.

Table 20: Implementation costs of TAnDem at national level

Item	Implementation cost [USD/year]
Staff (5 persons) for capacity building, technical assistance and coordination	300,000
Consultancy	500,000
Travel costs	100,000
Campaigns and events	100,000
Total costs	**1,000,000**

Source: own estimation

6.1.2 Costs of NAMA implementation at local level (8 mitigation measures)

To estimate the costs of NAMA implementation at local level, a tool has been developed, which includes average unit costs for all seven mitigation measures, derived from previous projects and literature. Overall implementation costs are estimated based on unit costs and the scenario definitions for the two model cities (compare chapter 5.3). Table 21 provides an overview of unit costs and revenues for each of the seven mitigation measures.

Table 21: Average unit costs and revenues of TAnDem's direct mitigation measures[16]

No.	Measure and unit	Investment cost [USD]	Operation and maintenance [USD/year]	Revenues [USD/year]
M1	Parking space management schemes for automobiles (area with 15,000 parking spots)	**1.5 million** (500 parking meters, signage and information systems)	**3 million** (control staff of 70 people and O&M of parking meters)	**4.2 million** from parking fees and fines
M2	Low-speed zones (1 km^2)	**20,000** (including studies, 6 vertical and horizontal signage, 28 plastic speed humps, 10 bicycle parking spaces)	**negligible**	**negligible** (fines from radar control)
		50,000 -100,000 Additional radar control		
M3	Bicycle parking facilities in multimodal knots	**400** (based on larger scale parking facilities typically used in public transport stations)	**negligible**	**Depends** (fee in larger parking facilities e.g. close to public transport stations will finance O&M and staff costs)
M4	Bicycle parking spots off-street / on-street (per unit)	**50** (based on inverted U parking spot)	**negligible**	**None**
M5	Construction and rehabilitation of bicycle lanes (1 km)	**30,000 - 110,000** Range calculated based on two types: 1) cycling lane on the road with physical demarcation and 2)	**4,000**	**None**

[16] These estimates are thought to provide an order of magnitude of costs resulting from NAMA implementation. Exact cost data will depend on detailed project design and technology selection in each city.

		cycling lane with physical separation not on the road (cycling highway type). Painted lanes on the road have not been considered as safety in the Colombian city context is not regarded as sufficient.		
M6	Public bicycle system (PBS)	**4,000 -7,000** (includes investment for bicycle and proportional station costs plus maintenance equipment)	**1,000 - 2,500** (depending on staff and maintenance needs)	**Depends** on the rider base and fees
M7	Formal bicycle taxi services	**300 -700** (includes investment for bicycle taxis and necessary infrastructure such as garages)	**8,000 -11,000** Includes staff costs, O&M)	**cost efficient** (revenues are assumed to cover annual O&M costs and partial investment costs)
M8	Electrically assisted bicycles	**2,000** (on average) Only battery**: 400 -800**	**Negligible** (Depending on social stratus and electricity tariff)	**none**

Source: Own compilation

Cost estimations for the two model cities

Costs have been calculated for two model cities, Cali, representing large cities with a population > 600,000 and Villavicencio, representing medium-sized cities with 250,000 – 600,000 inhabitants. The scope of implementation of each measure (how many units are implemented?) is derived from the NAMAs goals in terms of modal shift (9% increase in the High Shift Scenario and 5.5% increase in the Conservative Scenario) and assumptions based on experience with former projects and interviews with city officials and other experts (see chapter 3.3 for more detail on the scope of each measure).

Box 1: Average cost of NAMA implementation in larger cities – Example of Cali

The total investment costs for the **Conservative Scenario** account for 49 million USD, annual operating and maintenance costs (O&M costs) make up approximately 2 million per year.[17] In the **High Shift Scenario** total investment costs account for 83 million USD, while annual O&M costs make up approximately 4 million per year[18]. In comparison, Cali's overall household budget for 2017 is 1 billion USD and the planned expenditure in sustainable mobility between 2016 -2019 is 611 million USD, meaning that **NAMA implementation costs approx. 0.6 -1.0% of Cali's annual household budget or 3.8 – 6.7% of the 4 year expenditure plan for SUT**. It has to be noted that costs for electrically assisted bicycles and revenues resulting from potential radar speed control are not yet considered in the calculation.

NAMA measures		**Scope of measures (2017 -2030)**	
		Conservative Scenario	**High Shift Scenario**
M1	Parking space management schemes for automobiles	not defined	
M2	Low-speed zones	2 km^2	2 km^2
M3 and M4	Bicycle parking spaces in multimodal nods and Private bicycle parking spaces	14,000 units (5,000 inverted U and 9,000 integrated in BRT system)	19,000 units (7,000 inverted U and 12,000 integrated in BRT system)
M5	Construction and rehabilitation of bicycle lanes	300 Km (only segregated)	450 Km (only segregated)
M6	Public bicycle systems (PBS)	4,000 bicycles	8,000 bicycles
M7	Formal bicycle taxi services	3,500 new units	3,500 new units
M8	E-bikes	not assessed	
Total cost (2018 - 2030)		***49 million USD***	***83 million USD***
Annual O&M cost		***2 million USD***	***3.9 million USD***
Household budget 2017		***1 billion USD***	
Percentage of household budget		***0.6%***	***1.0%***
Percentage of 4 year expenditure plan for SUT (2016 2019)		***3.8%***	***6.7%***

[17] Operation costs for bicitaxi service and parking management schemes are not considered as operation is assumed cost efficient
[18] Operation costs for bicitaxi service and parking management schemes are not considered as operation is assumed cost efficient

Box 2: Cost of NAMA implementation in Villavicencio

The total investment costs for the **Conservative Scenario** account for 11.3 million USD, annual O&M costs make up approximately 315,000 USD / year. In comparison, Villavicencio's overall household budget for 2017 is 170 million USD (XXX, 2017): NAMA implementation would therefore make up approx. 0.7% of the cities' total household budget in 2017. It has to be noted that costs for electrically assisted bicycles and revenues resulting from radar control are not yet considered in the above calculation. Costs for bicycle taxis and parking management schemes have not been considered as they are assumed to be cost efficient.

The total investment costs for the **High Shift Scenario** account for 20 million USD, annual O&M costs make up approximately 598,000 USD/ year, accounting for 1.3% of Villavicencio's total household budget in 2017. Also in the High Shift Scenario the revenues of parking schemes are not yet considered.

NAMA measures		**Scope of measures (2018 -2030)**	
		Conservative Scenario	**High Shift Scenario**
M1	Parking space management schemes for automobiles	not defined	
M2	Low-speed zones	0.3 km^2	0.3 km^2
M3 and M4	Bicycle parking spaces in multimodal nods and private bicycle parking spaces	500 units (300 inverted U and 200 integrated in BRT system)	1,500 units (500 inverted U and 1,000 integrated in BRT system)
M5	Construction and rehabilitation of bicycle lanes	120 Km (only segregated)	200 Km (only segregated)
M6	Public bicycle systems (PBS)	500 bicycles	1,000 bicycles
M7	Formal bicycle taxi services	none	
M8	Electrically assisted bicycles	not assessed	
Total cost (2018 -2030)		***11.3 million USD***	***20 million USD***
Annual cost		***315,000 USD***	***598,000 USD***
Household budget 2017		***170 million USD***	
Percentage of household budget		***0.7%***	***1.3%***

6.1.3 Rough estimation of total NAMA costs

Table 22 summarizes the total costs for Cali and Villavicencio and puts them into context with the total emission reductions as well as the sustainable development benefits in both scenarios.

Table 22: Overview of total costs, emission reductions and SDBs of NAMA TAnDem

NAMA Measures	Total Costs of NAMA implementation (2018-2030)				
Technical support component	A minimum of 4 million for the first 4 years of implementation (1,000,000 USD/a * 4)				
Direct Mitigation Measures	Scenario	Total Investment costs (USD)	O&M costs (USD, ac. over 13 years)	Revenues (USD)	
M1	Conservative	*Not included in the calculation, other studies and existing schemes suggest a net profit for this measure.*			
	High Shift				
M2	Conservative	0.4 million	*negligible*	*negligible*	
	High Shift	0.4 million			
M3	Conservative	33 million		*depends on tariff*	
	High Shift	46 million			
M4	Conservative	2.4 million		*none*	
	High Shift	3.4 million			
M5	Conservative	256 million	38 million	*none*	
	High Shift	396 million	58.8 million		
M6	Conservative	220 million	228 million	*Depends on tariff, it can be assumed that the O&M costs can be covered*	
	High Shift	440 million	455 million		
M7	Conservative	17.3 million	*Depends on tariff, it is assumed that the O&M costs can be covered by ticket fees.*		
	High Shift	17.3 million			
M8	Conservative	*not assessed*			
	High Shift				
					CO_2 reduction
Total implementation cost (17 cities, 13 years)	**Conservative**	**529 million**	*266 million*	*It is assumed that O&M measures can be covered by revenues.*	**2.55MtCO_2**
	High Shift	**903 million**	*514 million*		**3.88 MtCO_2**

6.2 Secured financing and financing gaps

While the implementation and operation of the technical support component is financed at the national level, municipalities are responsible for financing the implementation of the direct mitigation measures at local level.

In general, it is assumed that municipalities should be able to finance the implementation of the 8 mitigation measures from their household budgets, considering that overall costs are rather low when compared to alternative transport infrastructure investments, especially once the longer term returns on investment are considered. Still, the re-allocation of budget lines and exploitation of more innovative financing sources such as financial sources from radar controls or valorization tax, takes political will and hence is time-consuming. Thus, there is a need for financing from third parties, especially in the first years of NAMA implementation, in order to speed up implementation and finance high upfront costs of some measures that only become cost effective in the long run. Also, additional financial resource will be necessary to increase the cities ambition level. As one part of the solution to the problem, the technical support component will provide technical assistance in identifying innovative financing sources and enabling municipalities in the elaboration of financing strategies.

6.2.1 Opportunities for the private sector

It is undebatable that public investment is needed to finance the majority of cycling infrastructure. Still, there are some interesting opportunities for the private sector to engage in NAMA implementation, especially in setting up public bicycle schemes and other new mobility services based on AT and electrically assisted bicycles, but also in the build-up of physical infrastructure, including parking facilities and cycling lanes. Some example opportunities are presented below.

Cycling lanes

Retailers and private foundations are natural financial sources for cycling infrastructure, as cycling infrastructure can revitalize shopping districts and relatively slow cycling through traffic can generate additional business (as opposed to faster and more complicated to park car through traffic). Cycling lanes can also be financed by y mix of private finance and crowd funding initiatives as has been the case e.g. in Memphis, USA. While it is sometimes argued that the build-up of cycling infrastructure should be a government responsibility rather than a private initiative, it has been seen that crowd funding a cycling lane (or even only the feasibility study) can serve as a kick-start or to raise awareness on its demand by local citizens within the local government, which then often engages with more dedication in the further construction of cycling infrastructure. Electricity companies could find an interesting investment option in financing the lighting of prominent cycling infrastructure.

Bicycle parking facilities

Connecting cycling to public transport modes like BRT, buses, subway or cable cars can increase public transport use, what can make the installation of bicycle parking facilities (and sometimes also the directly connected cycling lanes) an interesting investment opportunity for public transport companies. Approximately 6 times more households are within cycling distance (3 km from station) to a public transport station than are within walking distance (500 m from station). One example of such private investment into bicycle parking facilities is the Dutch National Rail that in August 2018 has opened the world's largest underground bicycle parking facility with 12,500 parking places in a joined effort with the Municipality of Utrecht and ProRail, the largest Dutch rail infrastructure provider.

Public Bicycle Schemes

A lot of Public Bicycle Schemes are operated in a Public Private Partnership where a private company pays the major part of the investment and the local government carries the financial risk of the project by provision of guarantees or contributes by provision of land. Sometimes a subsidy by the municipality is needed in order to unlock private investment or fill the gap until the break-even point is reached. Recent advances in technology have reduced the price for PBS, as with advanced communication technology many new PBS operate in a free-floating manner, what makes investment costs for the stations (up to USD 10,000) unnecessary, dramatically reducing overall costs.[19] A public bicycle scheme can also offer an interesting investment opportunity for larger companies as a CSR activity or for advertisement. Last but not least the integration of electrically assisted bicycles to a PBS may be of special interest for electricity companies to invest in.

Mobility Services based on Active Transport

A pilot project of global parcel delivery company DHL in the Netherlands has shown that a shift from 33 motorized delivery vans towards 33 cargo bikes has resulted in a cost reduction of USD 520,000 per year, which resulted in the replication of the project in German cities and shows that shifting to cargo cycles can offer a solid business case for delivery companies and further give these a reason to engage in the build-up of suitable cycling infrastructure. In recent years also more and more privately organized lending systems for cargo-bikes have evolved in most European cities, but also e.g. in Mexico City. The rental service of such vehicles could in principle pose an interesting investment option for shopping centers, which could provide an additional service for their customers and use the vehicles for advertisements or image reasons.

Measure 7 of the NAMA aims at replacing current motorized tricycle taxis (so-called moto-taxis) by cycle taxis or electrically assisted cycle taxis. While the investment in a new vehicle may pose difficulties to current moto-taxi owners, cycle and electric cycle manufacturers together with banks

[19] Of course additional costs of redistributing bicycles from remote spots to spots with higher demand have to be factored in.

or public sector could engage in the design of an innovative financing scheme that allows moto-taxi owners to spread the payment of initial investment costs over a longer period according to savings made over time by use of less (or no) fuel.

Parking management schemes

The provision of parking space for automobiles and motorcycles already is a business model with active private sector involvement, however even a modified parking regime in Colombian cities as planned under M1 with liberalized parking tariffs for off-street parking and tariffs set according to an occupancy target for on-street parking with differentiated tariffs according to demand, abolishment of parking minimums for new real estate development and inclusion of parking space provided by shopping centers will pose a solid business case for the private sector. An analysis of such a parking management system in Berlin has shown e.g. that investment costs for technical equipment, construction and management pay itself off in less than a year if parking is properly enforced.

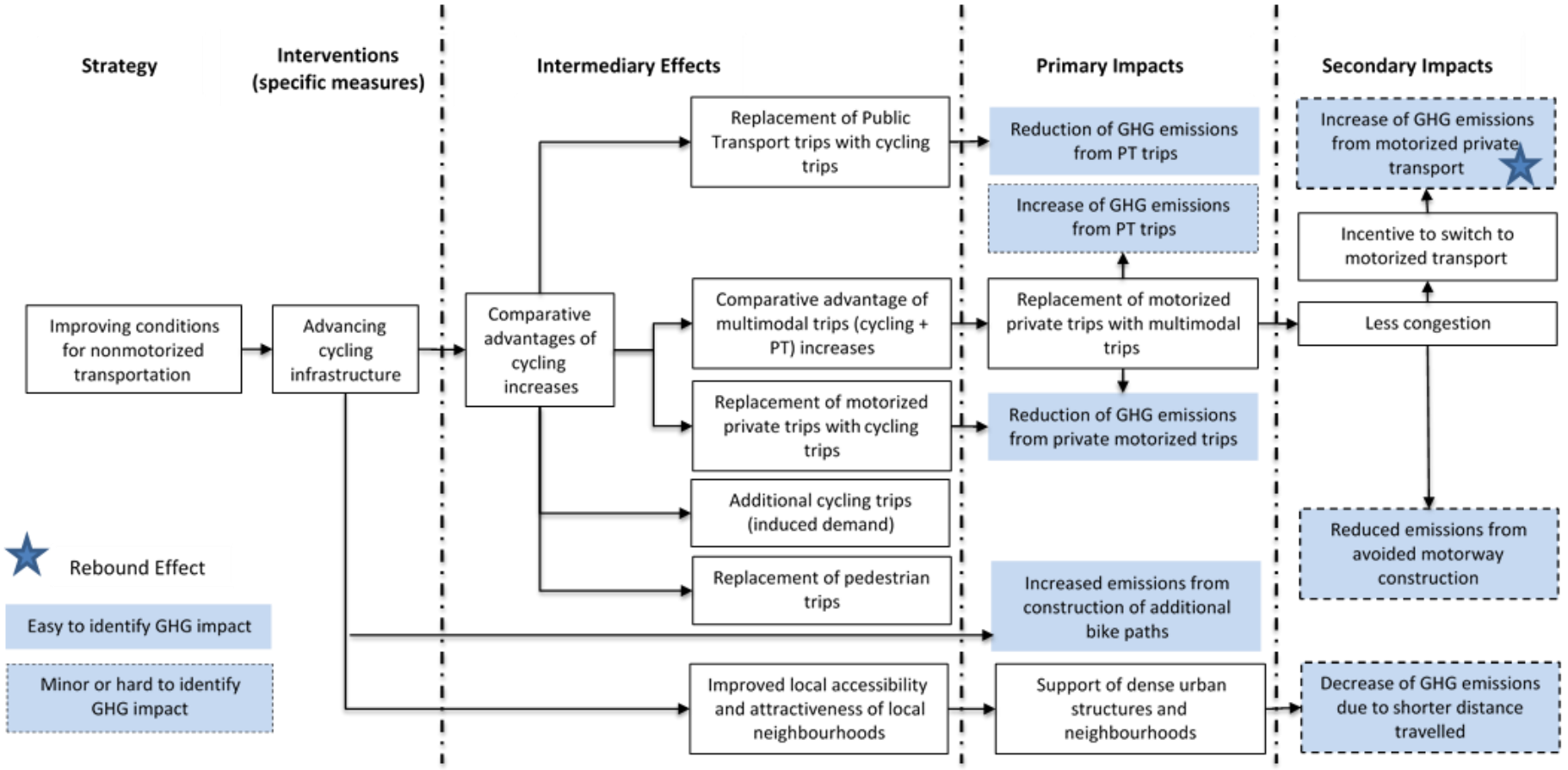
6.2.2 Opportunities for the international donor community

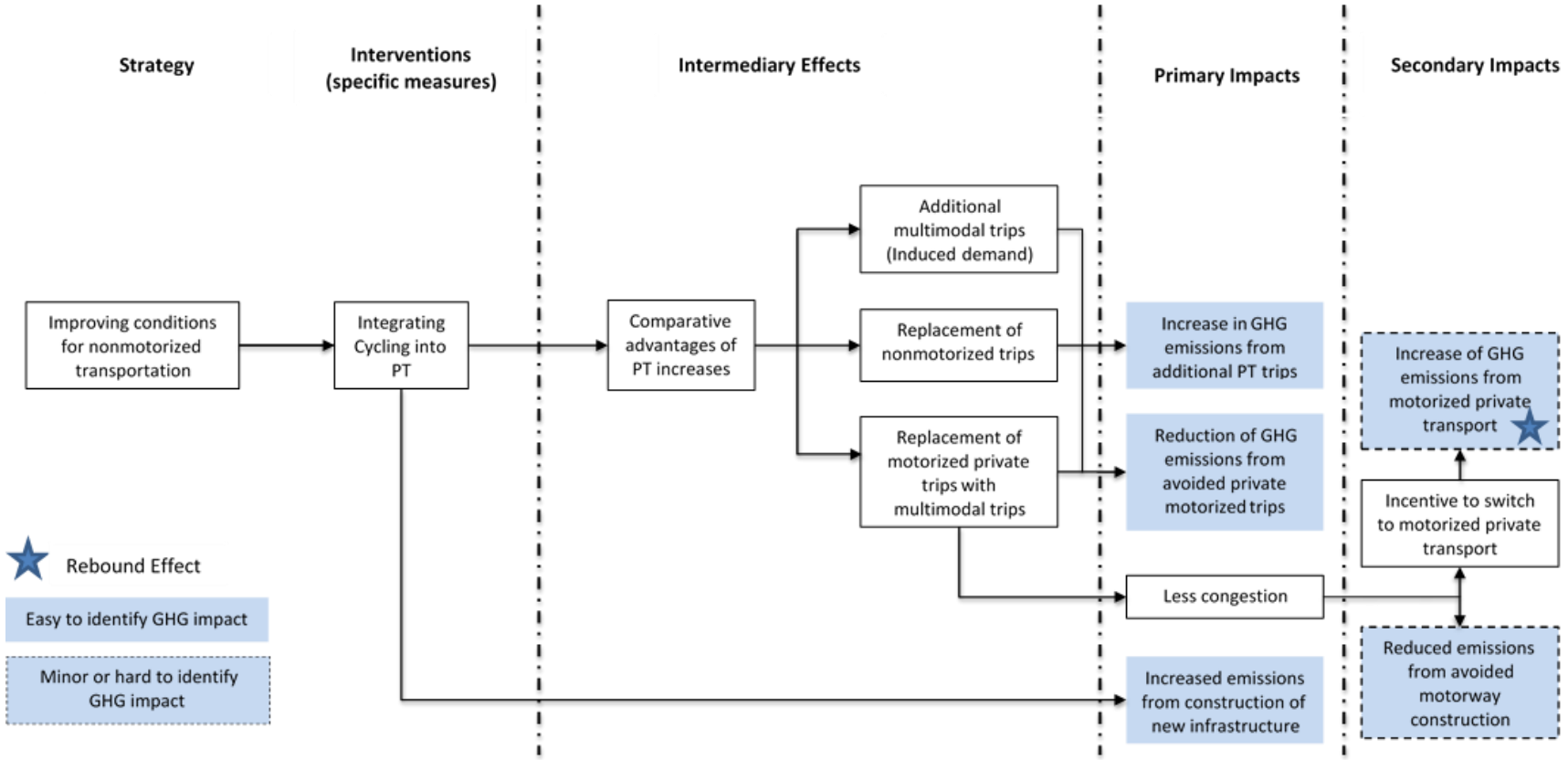
The investment in cycling infrastructure should be of special interest to the international donor community as it will have a high impact in terms of climate protection, local environmental and economic benefits, and has the potential to create a real transformational change at comparably low cost.

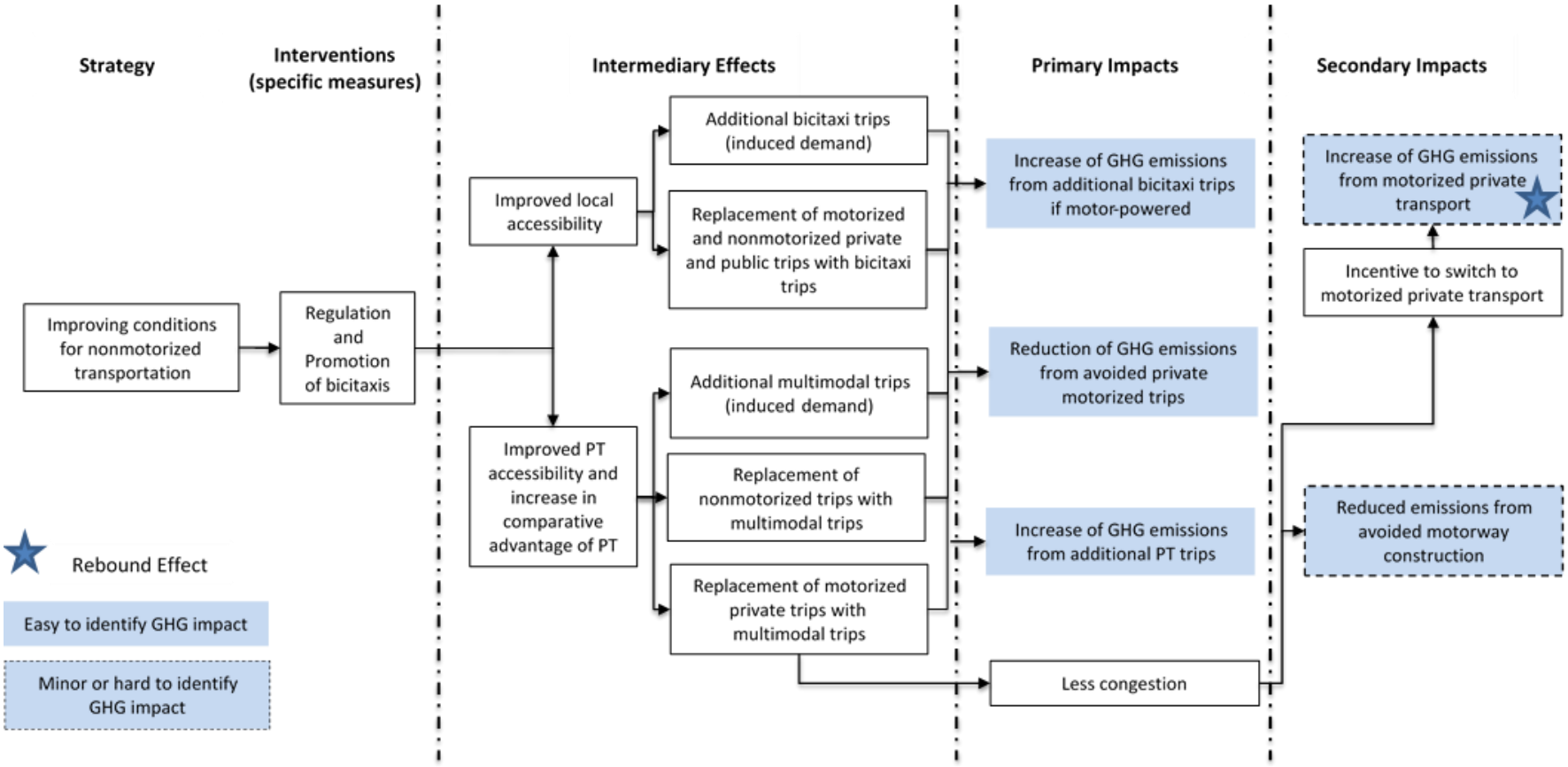
Colombia is a regional front runner in terms of sustainable mobility with organized bus systems present in the 17 major cities, formalized taxi fleets and clean technology pilots in public transport and taxi fleets (e.g. 50 electric taxis and 250 hybrid buses in Bogotá and plans to include 1,300 electric buses in the public transport fleet in the frame of the national bus programme). The bus systems provide the basis for sustainabel transport in Colombian cities. However, a lack of demand of public transport because of insufficient coverage and cheap private transportation alternatives (first of all motrocycles with 700,000 new registrations in 2014 and a total of 10,000,000 motrocycles projected until 2020), lead to cost pressure among public transport companies, often resulting in cost cutting measures that further decrease quality and ecologic performance (longer use cycles per vehicle, usage of out of date technology, etc.). The streghtening of cycling and its connection to public transport is therefore urgently needed and has significant potential to create integrated and attractive sustainable mobility systems in Colombian cities: the basis for a significant and long term shift from private motorized to sustainable transportation modes.

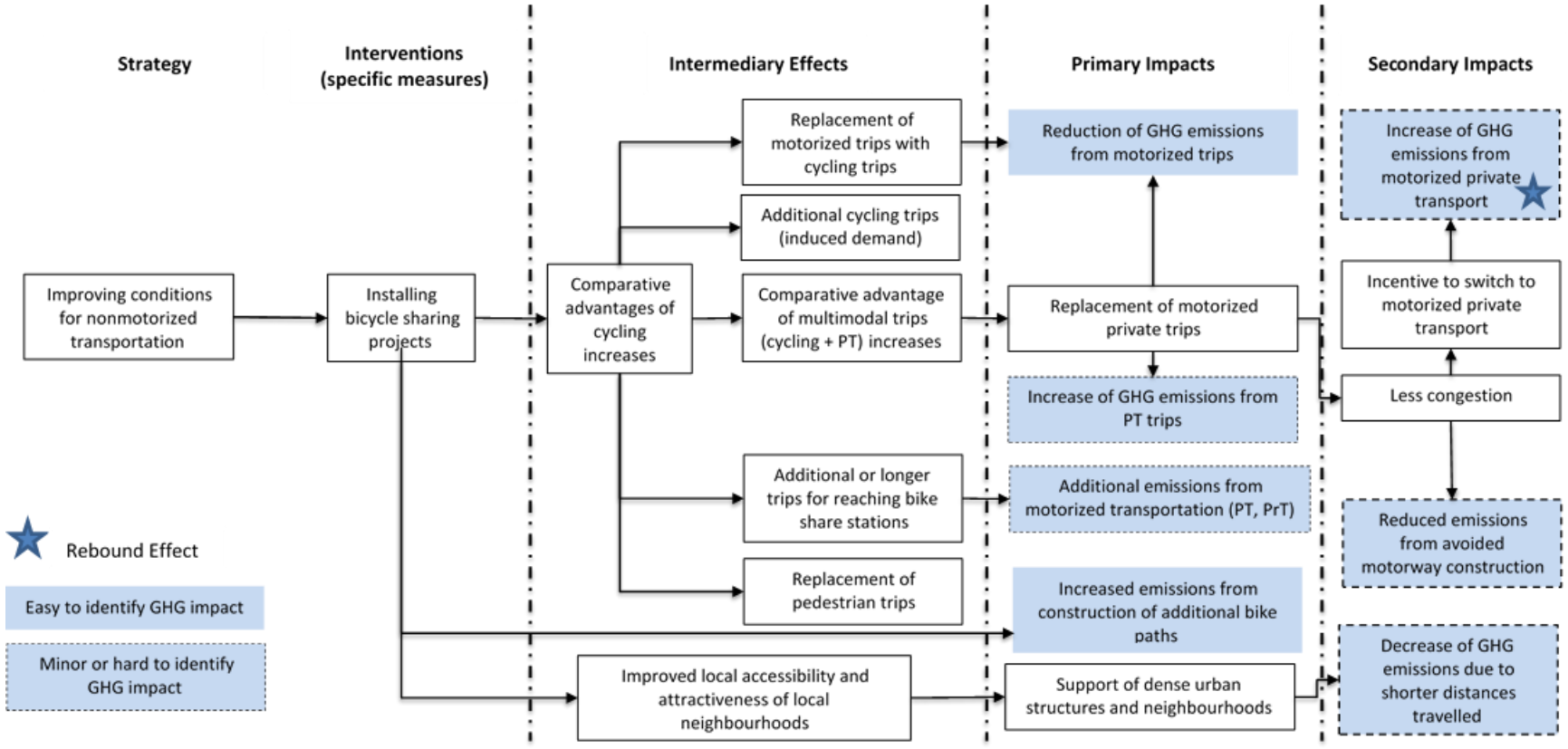
On the national level, international donors could provide grants or personnel for the techncial support component, which facilitates the implementation of measures at local level. Further, credit lines for the built-up of cycling infrastructure or finyncing for first mover projects with high visibility are needed to kick-start and accelerate implementation.

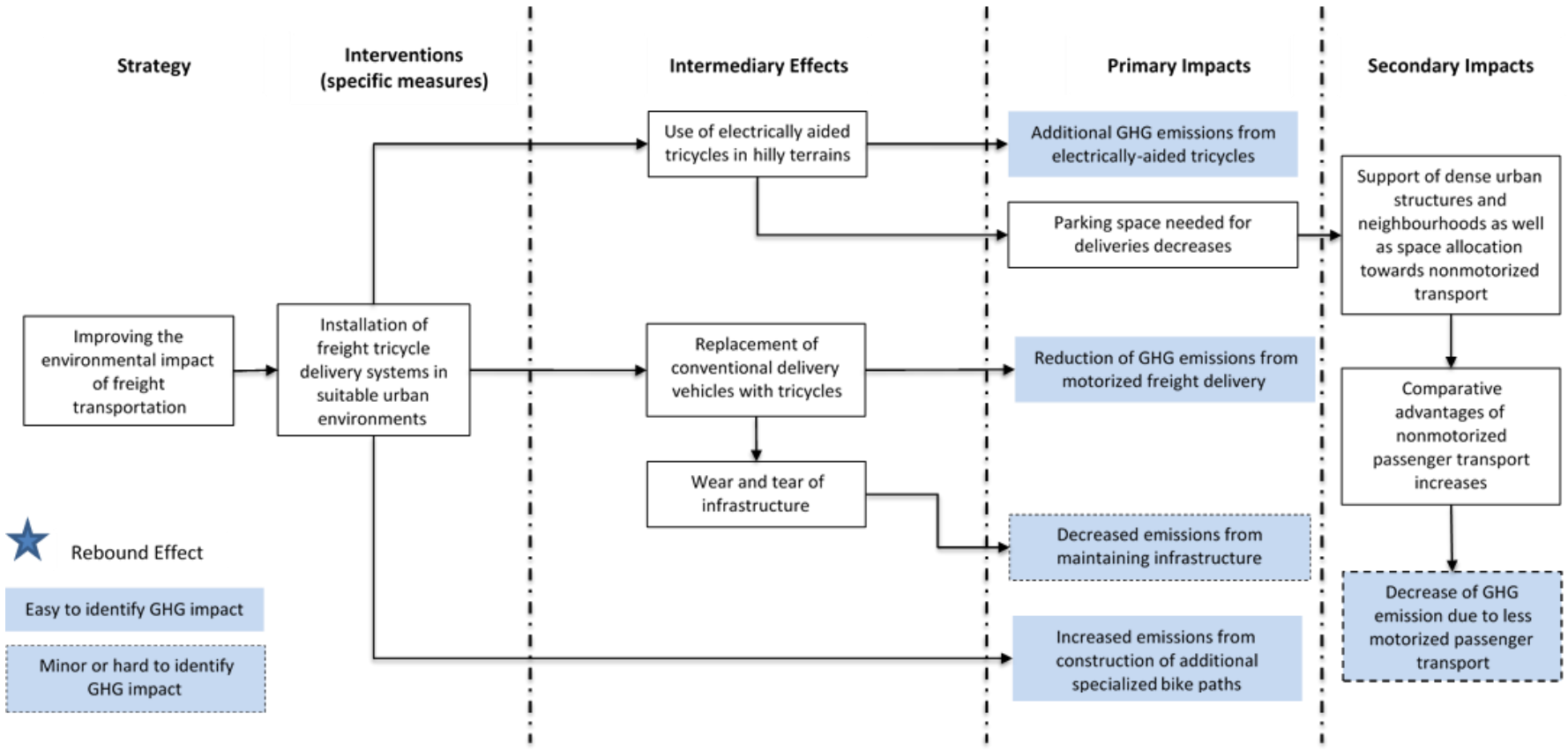
Annex 1 – Causal chains

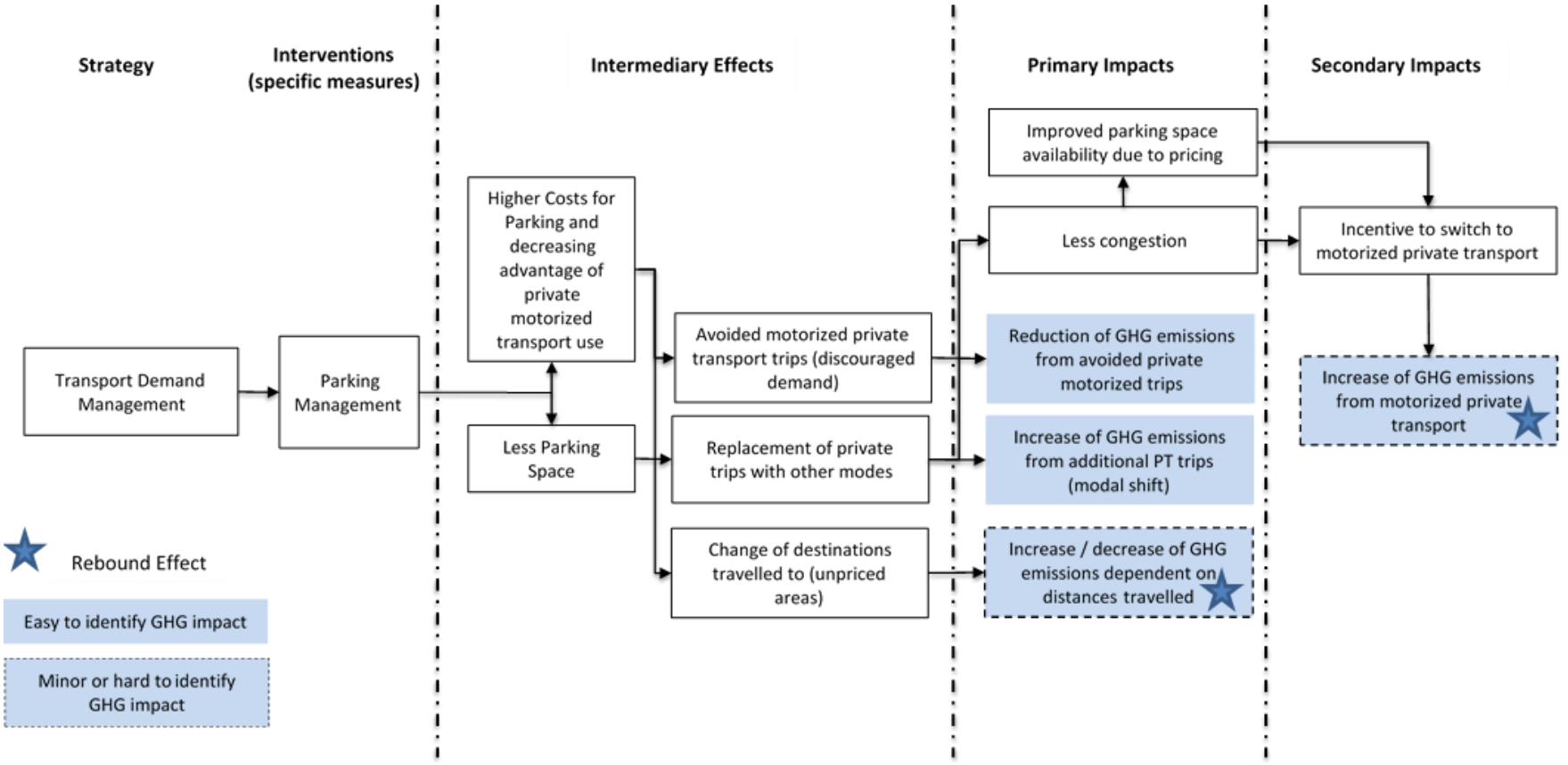



Strategy
Interventions (specific measures)
Intermediary Effects
Primary Impacts
Secondary Impacts
Improving conditions for nonmotorized transportation
Integrating Cycling into PT
Comparative advantages of PT increases
Additional multimodal trips (Induced demand)
Replacement of nonmotorized trips
Replacement of motorized private trips with multimodal trips
Increase in GHG emissions from additional PT trips
Reduction of GHG emissions from avoided private motorized trips
Less congestion
Increased emissions from construction of new infrastructure
Increase of GHG emissions from motorized private transport
Incentive to switch to motorized private transport
Reduced emissions from avoided motorway construction
Rebound Effect
Easy to identify GHG impact
Minor or hard to identify GHG impact


Strategy
Interventions (specific measures)
Intermediary Effects
Primary Impacts
Secondary Impacts
Improving conditions for nonmotorized transportation
Regulation and Promotion of bicitaxis
Improved local accessibility
Improved PT accessibility and increase in comparative advantage of PT
Additional bicitaxi trips (induced demand)
Replacement of motorized and nonmotorized private and public trips with bicitaxi trips
Additional multimodal trips (induced demand)
Replacement of nonmotorized trips with multimodal trips
Replacement of motorized private trips with multimodal trips
Increase of GHG emissions from additional bicitaxi trips if motor-powered
Reduction of GHG emissions from avoided private motorized trips
Increase of GHG emissions from additional PT trips
Less congestion
Increase of GHG emissions from motorized private transport
Incentive to switch to motorized private transport
Reduced emissions from avoided motorway construction
Rebound Effect
Easy to identify GHG impact
Minor or hard to identify GHG impact


Strategy
Interventions (specific measures)
Intermediary Effects
Primary Impacts
Secondary Impacts
Improving conditions for nonmotorized transportation
Installing bicycle sharing projects
Comparative advantages of cycling increases
Replacement of motorized trips with cycling trips
Additional cycling trips (induced demand)
Comparative advantage of multimodal trips (cycling + PT) increases
Additional or longer trips for reaching bike share stations
Replacement of pedestrian trips
Improved local accessibility and attractiveness of local neighbourhoods
Reduction of GHG emissions from motorized trips
Replacement of motorized private trips
Increase of GHG emissions from PT trips
Additional emissions from motorized transportation (PT, PrT)
Increased emissions from construction of additional bike paths
Support of dense urban structures and neighbourhoods
Increase of GHG emissions from motorized private transport
Incentive to switch to motorized private transport
Less congestion
Reduced emissions from avoided motorway construction
Decrease of GHG emissions due to shorter distances travelled
Rebound Effect
Easy to identify GHG impact
Minor or hard to identify GHG impact


Strategy
Interventions (specific measures)
Intermediary Effects
Primary Impacts
Secondary Impacts
Improving the environmental impact of freight transportation
Installation of freight tricycle delivery systems in suitable urban environments
Use of electrically aided tricycles in hilly terrains
Replacement of conventional delivery vehicles with tricycles
Wear and tear of infrastructure
Additional GHG emissions from electrically-aided tricycles
Parking space needed for deliveries decreases
Reduction of GHG emissions from motorized freight delivery
Decreased emissions from maintaining infrastructure
Increased emissions from construction of additional specialized bike paths
Support of dense urban structures and neighbourhoods as well as space allocation towards nonmotorized transport
Comparative advantages of nonmotorized passenger transport increases
Decrease of GHG emission due to less motorized passenger transport
Rebound Effect
Easy to identify GHG impact
Minor or hard to identify GHG impact


Strategy
Interventions (specific measures)
Intermediary Effects
Primary Impacts
Secondary Impacts
Transport Demand Management
Parking Management
Higher Costs for Parking and decreasing advantage of private motorized transport use
Less Parking Space
Avoided motorized private transport trips (discouraged demand)
Replacement of private trips with other modes
Change of destinations travelled to (unpriced areas)
Improved parking space availability due to pricing
Less congestion
Reduction of GHG emissions from avoided private motorized trips
Increase of GHG emissions from additional PT trips (modal shift)
Increase / decrease of GHG emissions dependent on distances travelled
Incentive to switch to motorized private transport
Increase of GHG emissions from motorized private transport
Rebound Effect
Easy to identify GHG impact
Minor or hard to identify GHG impact

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