



# **Case study of a transport MRV NAMA: TDM Measures in Jakarta, Indonesia**

Applicability of Post 2012 Climate Instruments to the Transport  
Sector (CITS) Project

**by Holger Dalkmann**

**FINAL REPORT**



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**by Holger Dalkmann**

**Prepared for: Project Record:   Applicability of Post 2012 Climate Instruments to the Transport Sector (CITS)**

**Client:                               Asian Development Bank  
   Jamie Leather**

May, 2010

This Final Report has been prepared for the Asian Development Bank.

The views expressed are those of the author(s) and not necessarily those of the Asian Development Bank.

## Acknowledgements

This report was prepared by Holger Dalkmann engaged through the UK Transport Research Laboratory (TRL) for the Asian Development Bank (ADB), who in cooperation with the Inter-American Development Bank (IDB) has undertaken the study “Applicability of Post 2012 Climate Instruments to the Transport Sector (CITS)” as a first step to help ensure that the transport sector can benefit from the revised/new climate change mitigation instruments under a post-2012 Climate Change Agreement.

The CITS project is a contribution to the Partnership on Sustainable, Low Carbon Transport (SLoCaT Partnership).

The author of the report would like to thank the core team at the ADB, including Jamie Leather, Sharad Saxena and Cornie Huizenga for making this work possible. Appreciation also goes to our Indonesian project partners Prof. Dr. Bona Frazila Russ and Dr. Muhammad Nanang Prayudyanto of the Institut Teknologi Bandung (ITB).

The report is based on a number of stakeholder discussions within Indonesia, including national and local policy makers, whose support has been gratefully received by the author. A list of the stakeholders consulted is provided in Appendix 2.

Whilst every effort has been made to ensure the accuracy of the contents, all outstanding errors are the sole responsibility of the author.

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## Glossary of terms and abbreviations

ADB	Asian Development Bank
AFD	Agence Française de Développement
BAPPENAS	National Development Planning Agency
BAPPEDA	Regional Development Planning Agency
BAU	Business as Usual
BRT	Bus Rapid Transit
CDM	Clean Development Mechanism
CIF	Climate Investment Funds
CITS	Applicability of Post 2012 Climate Instruments to the Transport Sector Project
CNG	Clean Natural Gas
COP	Conference of Parties (to the UNFCCC)
CTF	Clean Technology Fund
DEPHUB	Departemen Perhubungan (Indonesian Ministry of Transportation)
DG	Directorate General
DINASPU	Regional Public Works Agency
DISHUB	Regional Transport Agency (Dinas Perhubungan DKI Jakarta)
DISPENDA	Regional Budget Agency
DKI	Capital Region of Jakarta
DNPI (NCCC)	National Council for Climate Change
EC	European Commission
EMBARQ	WRI Center for Sustainable Transport
EPA	US Environment Protection Agency
ERP	Electronic Road Pricing
ETS	Emissions Trading Scheme
EU	European Union
GEF	Global Environment Facility
GHG	Greenhouse Gases
GTZ	German Technical Cooperation
IBRD	International Bank for Reconstruction and Development
ICCTF	Indonesia Climate Change Trust Fund
IDB	Inter-american Development Bank
IDA	International Development Association
IDR	Indonesian Rupiah
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
ITB	Institut Teknologi Bandung
ITDP	Institute for Transportation and Development Policy
ITS	Intelligent Transport Systems
JI	Joint Implementation
JICA	Japan International Cooperation Agency
KPBB	Committee for the Phasing-out of Lead-Containing Fuels

LRT	Light Rail Transit
MoE	Ministry of Environment
MoF	Ministry of Finance
MRT	Mass Rapid Transit
MRV	Measurable, Reportable, Verifiable
NAMA	Nationally Appropriate Mitigation Action
NAP	National Action Plan
NGO	Non Governmental Organisation
NMT	Non Motorised Transport
ODA	Official Development Aid
PFI	Private Finance Initiative
PoA	Programme of Activities
PPP	Public Private Partnership
PRC	People's Republic of China
PU	Ministry of Public Works
RPJM	Mid-term Development Plan
R&D	Research and Development
SITRAMP	Integrated Transport Masterplan
SMC	Social Marginal Cost
TATACOTA	Regional Urban Planning Agency
TDM	Transport Demand Management
TRL	Transport Research Laboratory (UK)
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nations Convention on Climate Change
USD	US Dollars
WRI	World Resources Institute
VTPI	Victoria Transport Planning Institute
WB	World Bank

Currency Unit = Indonesia Rupiah (IDR)

US\$1 = IDR 9300<sup>1</sup>

US\$0.000108 = IDR 1

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<sup>1</sup> Exchange rate is harmonised to those used in the Climate Investment Fund (May, 2009)

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## Executive summary

### **Mitigation actions in the transport sector: *The importance of considering transport NAMAs at a local level***

The transport sector currently accounts for a fifth of global carbon dioxide (CO<sub>2</sub>) emissions, and transport energy-related CO<sub>2</sub> emissions are predicted to increase by 1.7% a year from 2004 to 2030 (IEA, 2006). Much of the expected increase is due to the rapid motorisation seen in developing countries, particularly in their urban areas.

To ensure that developing cities are placed on a low-carbon growth path, and to realise the full benefits of a sustainable transport system including lower air pollution and less congestion, it is imperative that actions at the local level are fully supported by the Post-2012 climate framework centring upon the notion of Nationally Appropriate Mitigation Actions (NAMAs).

### **Transport Demand Management in Jakarta as a NAMA: *Contributing to meeting voluntary targets at local and national level***

To provide a working example of how a local-level NAMA in the transport sector may be realised, this study examined Transport Demand Management (TDM) in Jakarta, Indonesia and its potential to contribute to the voluntary targets set domestically (at the national level, -26% below BAU by 2020 unilaterally, and -41% with international support, and -30% below BAU by 2030 at the local level in the capital region of Jakarta). Reflecting existing local priorities, three specific elements of TDM were examined, namely Electronic Road Pricing (ERP), parking restraint and Bus Rapid Transit (BRT). The TDM NAMA was studied in light of the three potential types of NAMAs, i.e. unilateral, supported and tradable.

### **MRV, Institutions and Financing: *Crucial elements to realising the TDM NAMA***

In laying out a template for the future implementation of TDM as a NAMA, three main issues central to NAMAs were examined, namely Measurement, Reporting and Verification (MRV), institutional framework and financing.

With regards to **MRV**, the study highlighted that;

- MRV is crucial in ensuring the **transparency** of mitigation actions, to allow both the accurate estimation of mitigation efforts in meeting domestic targets, as well as the matching of mitigation efforts to international support.
- The TDM NAMA could be seen as an element of a city-wide approach to measuring mitigation actions, which would enable the contribution of TDM to the meeting of mitigation targets at the city level to be explicitly made.
- The measurement of CO<sub>2</sub> mitigation and associated co-benefits would be made possible by utilising a bottom up methodology that combines a transport demand model (driven by data from household surveys and traffic counts) with information on the vehicle fleet (e.g. emission factors). This could be cross-checked using top-down methods utilising (regional) fuel sales data, to improve the robustness.
- The lack of and poor quality of data is a major constraint in the accurate measurement of the mitigation potential (and co-benefits) of the TDM NAMA. Capacity building in the area of data collection, database development and management is seen as a key priority in ensuring MRV of mitigation actions in the future, particularly in allowing TDM to be implemented as a tradable NAMA. Such types of capacity building could be provided as part of supported NAMA, or through other channels such as development aid.

With regards to the **institutional framework**, extensive consultations with local, national and international stakeholders revealed that;

- The **planning and implementation** of TDM activities could fall upon the local level, whereby the overall policy direction would be set by the Governor/Deputy Governor of Jakarta in close coordination with the Regional Transport Agency (DISHUB) and other implementing agencies.
- The **MRV** of the TDM NAMA could be coordinated by the Regional Environment Agency (BPLHD), based on a city level GHG inventory and possibly guided by the Ministry of Environment to allow it to be compatible with the national approach.

There would be a clear benefit in developing methodologies to measure transport emissions in close coordination with the Regional Transport Agency, as well as the (National) Ministry of Transportation to ensure that the approach is compatible with the characteristics and practical requirements of the transport sector. Such methodologies and associated data should be openly shared to allow maximum transparency and to invite continuous improvement by e.g. third parties.

- **Financing** under a unilateral or supported NAMA could mainly involve the local budgetary process, with partial support potentially coming from national sources for e.g. capacity building support. International funding could be matched against local actions through the national government. Direct support to the local government is also not ruled out, particularly for non-UNFCCC mechanisms such as bilateral/multilateral climate funds and ODA channels. Under a tradable NAMA, Jakarta as a city could be expected to become the market entity, receiving from either the UNFCCC administered trading mechanism (e.g. CDM+) or non-UNFCCC carbon markets financing in return for MRVed emission reduction. In pursuing a city-wide tradable NAMA (and potentially also for supported NAMAs), consideration could be given to the establishment of a coordination office that overlooks efforts on MRV.

Furthermore, an analysis of the **financial requirements and the supporting financial framework** revealed that;

- In general, TDM measures (and particularly those being considered under this particular case study) were shown to be generally revenue positive and possess very short payback periods.
- However, the current lack of adequate TDM measures suggests the large possibility for international support to be useful, particularly if targeted at “bottlenecks” including the transfer of key technologies (e.g. for ERP), infrastructure for BRT, technical assistance, and capacity building on MRV. The support for such elements would be required ex-ante.
- The way in which the TDM NAMA is financed depends greatly on the type of NAMA assumed. As a unilateral NAMA, the majority the financing for TDM is thought to be financed through the general budget of Jakarta. As a supported NAMA, funds may either flow directly from a non-UNFCCC donor (i.e. multilateral/bilateral development agencies), through the national level (e.g. the Indonesia Climate Change Trust Fund), through a nationally administered NAMA registry, or a combination of the three. Under a tradable NAMA approach, the city could receive funding against carbon credits generated by its mitigation actions.

### **A roadmap for the future: *Tangible steps towards implementation***

Based on the analysis of the current situation, a roadmap for the future was developed, which suggests that in the short term, TDM would be most appropriate as a supported NAMA, whereby upfront support could be provided to reduce several “bottlenecks” to implementation, including the transfer of key technologies (e.g. for ERP), infrastructure for BRT, technical assistance, and capacity building on MRV.

Such ex-ante support may also be provided by development agencies including the Asian Development Bank, particularly in the areas of data collection, further pilot projects and

capacity building. Such actions can commence prior to the NAMA framework being fully in place, and would serve an important, transitional role to enable transport NAMAs.

This would allow TDM to move increasingly towards;

- A unilateral NAMA, whereby TDM becomes financially self-servicing, and “graduates” from international support, or
- A tradable NAMA, whereby the MRV is robust enough for TDM to generate credits for the local government as a component of a city-wide programme.

By providing a realistic and tangible example of a local-level NAMA in the transport sector, it is hoped that this study will contribute to the further development of the NAMA concept to ensure its inclusiveness to actions at all levels and sectors.

# 1 Introduction

## 1.1 Rationale

The transport sector currently accounts for a fifth of global carbon dioxide (CO<sub>2</sub>) emissions, and transport energy-related CO<sub>2</sub> emissions are predicted to increase by 1.7% a year from 2004 to 2030 (IEA, 2006).

The IPCC (2007) states that global cuts in GHG emissions of up to 50% in developing countries and over 80% in developed countries will be required by 2050 to keep climate change at non-dangerous levels. Without actions in the transport sector, such levels of emission reductions are practically impossible to achieve.

The UNFCCC Kyoto Protocol, which was enacted in 2005, introduced three flexible mechanisms to support developed countries in meeting emissions reductions targets; Emissions Trading Scheme (ETS), Joint Implementation (JI) and the Clean Development Mechanism (CDM) (UNFCCC, 2009). However, the transport sector has not benefited from these international instruments and it is now widely recognised that none of the three flexible mechanisms introduced by the Kyoto Protocol represent viable options for the realisation of low carbon mobility. Only 2 of the 2,062 registered CDM projects are in the transport sector (as of April, 2010; excluding biofuels) (UNEP Risoe, 2010). The transport sector, with the exception of aviation, is also currently not covered by any major Emissions Trading Scheme, including the EU-ETS.

Transport and climate change experts, policy makers and transport practitioners have attributed the lack of inclusion of transport in the UNFCCC mechanisms to a range of factors; most notably challenges in relation to methodology development, data collection and verification of GHG emissions from the transport sector (Dalkmann et al., 2009).

A reform of the current patterns of international support and cooperation is therefore urgently needed in order to support low carbon mobility; taking into account improved financing mechanisms, technology and knowledge transfer, capacity building and the development of measurable, reportable and verifiable (MRV) Nationally Appropriate Mitigation Actions (NAMAs) under a post-2012 framework. Such reform is being discussed at the UNFCCC level, albeit at a generic, non-sector specific level.

In this context, the Asian Development Bank, in cooperation with the Inter-American Development Bank (IDB) has undertaken the study "Applicability of Post 2012 Climate Instruments to the Transport Sector (CITS)" as a first step to help ensure that the transport sector can benefit from the revised/new climate change mitigation instruments under a post-2012 Climate Change Agreement. The CITS project is a contribution to the Partnership on Sustainable, Low Carbon Transport.

The project centres around four case studies conducted by research institutions across the world, including;

- **Transport Policy NAMA, Belo Horizonte, Brazil** - EMBARQ, WRI conducted a case study to test the concept of a transport NAMA consisting of activities on public and NMT transport
- **Transport Policy NAMA, Mexico** - ECOFYS, in consultation with local stakeholders developed a transport NAMA for Mexico which combined technological with non-technological approaches to reduce GHG emissions.
- **Programmatic CDM, Hefei, PRC** - The Wuppertal Institute conducted a case study to develop a CDM project consisting of a bundle of activities focusing on strengthening public transport
- **TDM NAMA – Jakarta, Indonesia** - Implemented by the Transport Research Laboratory, the case study attempted to develop a NAMA around the concept of Transport Demand Management.

Furthermore, the project members commonly contributed to the review and synthesis of;

- Information on greenhouse gas emissions reductions to be accomplished through transport-related measures,
- Information on applicability of existing climate instruments or related mechanism, and
- Existing thinking on the instruments under development.

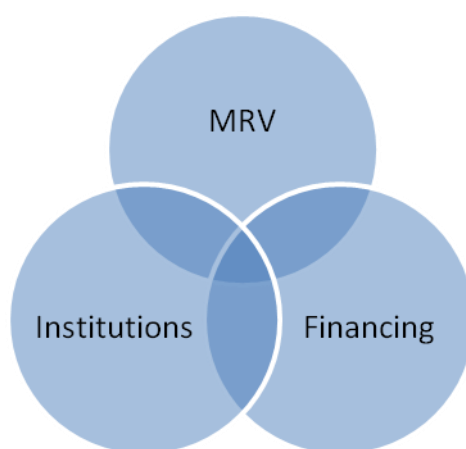
## 1.2 Aim and objectives

In contribution to the overall study, this report provides the key findings from the case study conducted by TRL in Jakarta Indonesia, around the concept of Transport Demand Management (TDM).

Taking into account the ongoing discussions with respect to the future structure of NAMAs, the report aims to;

- Outline the **MRV methodology** for the assessment of baseline and impact of programs and projects in terms of global and local benefits.
- Indicate how the **funding needs** for the proposed program can be determined.
- Outline the manner in which **external NAMA funding** can contribute to the financial sustainability of the project or program, by e.g. linking with, or complementing other financing from private and public, domestic and international sources.
- Understand the **institutional framework** under which the NAMA would be allowed to work.
- Assess the **scalability** of the program to other parts of Indonesia and ways and how this can lead to either replication of NAMAs and/or the development of more large scale NAMAs covering several cities in Indonesia.
- Summarize the **implications for the formulation of guidelines** for use of NAMAs and their MRV in the post 2012 period.

The foci of the report can be summarised as mirroring three specific areas thought to be of central concern to the development of NAMAs, namely MRV methodology, institutional structure and the financial framework (see Figure below).



**Figure 1: MRV, Institutions and Financing as the three core foci**

### 1.3 Scope

The report is based on information obtained in late 2009 and early 2010, regarding the domestic policy context and the status of the international developments on climate change. In this regard, the report is to be seen as a snapshot of the current situation, details of which are subject to change.

Although a key aspect of the report is to assess the transferability and scalability of the particular case study in question (i.e. TDM in Jakarta), it is not intended to provide a one-answer solution to the whole of Indonesia, nor to TDM measures across the world.

Finally, the messages contained within this report are not intended to bias the outcome of any domestic efforts or priorities, noting that NAMAs must ultimately be domestically driven.

### 1.4 General Methodology

The ideas and concepts contained within this report have been put together through a range of tasks, including but not limited to;

- A visit by a member of the study team to Institut Teknologi Bandung (ITB) in Indonesia, involving joint work with ITB staff to assess the model and data used to estimate the impact of TDM on future emissions.
- A second visit by members of the study team to Jakarta, Indonesia in March 2010, to discuss institutional and financial aspects of the study with key stakeholders at national and local levels.
- A consultation of the aforementioned stakeholders, where the final draft report was shared and further comments sought.
- Further desk-based analyses of key documents relevant to the subject.

### 1.5 Structure

The report structure is listed below, whereby;

- Chapter 2 provides further **background** on NAMAs and their potential application to transport, as well as the domestic developments in Indonesia (both national and local level) regarding transport and climate change policy.
- Chapter 3 introduces the nature of the **TDM** NAMA in Jakarta, as a potential part of city-wide actions to mitigate emissions.
- Chapter 4 focuses on the issues surrounding the **measurement, reporting and verification (MRV)** of the TDM NAMA.
- Chapter 5 outlines the **institutional framework** that surrounds the NAMA
- Chapter 6 provides an overview on the **financing framework** that would allow the TDM NAMA in Jakarta to become more viable.
- Chapter 7 sets out the **outlook and next steps** in the form of a small roadmap.

Further information on the details of the model, as well as a list of domestic stakeholder consultations are provided in the appendices.

## 2 Background

### 2.1 Nationally Appropriate Mitigation Actions (NAMA) as a framework to support sustainable low-carbon transport

The ongoing negotiations on the global climate change framework post-2012 generally recognise the need for a comprehensive set of actions in both developed and developing countries to mitigate emissions.

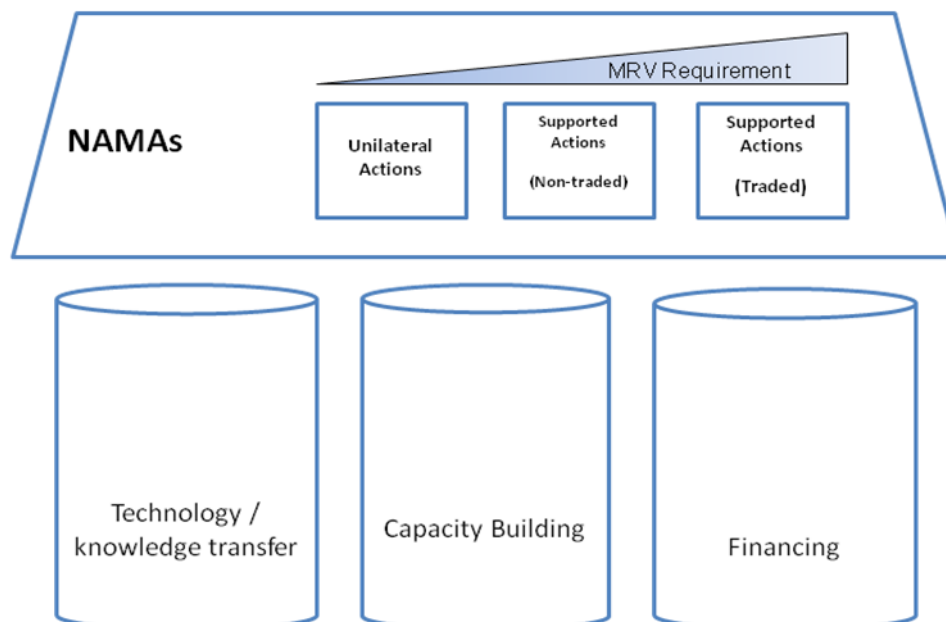
Mitigation efforts by developing countries generally centre on the concept of Nationally Appropriate Mitigation Actions (NAMAs), which are voluntary measures that can be reported by national (developing country) governments to the UNFCCC.

According to CCAP (2010) and others, NAMAs can be viewed as three distinct types, depending on the level and type of support received;

- Actions that are undertaken by developing country Parties and are not enabled or supported by other Parties (**Unilateral NAMAs**);
- Actions that are supported by developed country Parties that could include additional financing support for capacity building and knowledge/technology transfer and is likely to be supported by fund-type instruments (**Supported NAMAs**), and;
- Actions that are undertaken to acquire carbon credits that would be enacted through a crediting scheme (**Tradable NAMAs**).

The latter two types of NAMAs are likely to require appropriate international support vis-à-vis technology transfer; capacity building and financial assistance (see Figure 2).

The transparent monitoring of emission reductions realized through NAMAs would be through a so-called MRV (Measuring, Reporting and Verification) framework. The MRV requirements are expected to increase as NAMAs move from unilateral towards supported, and further towards tradable NAMAs. At the same time, the responsibility for MRV would also widen from being focused on national stakeholders, towards involving international institutions such as the UNFCCC.



**Figure 2: NAMAs and their supporting pillars**

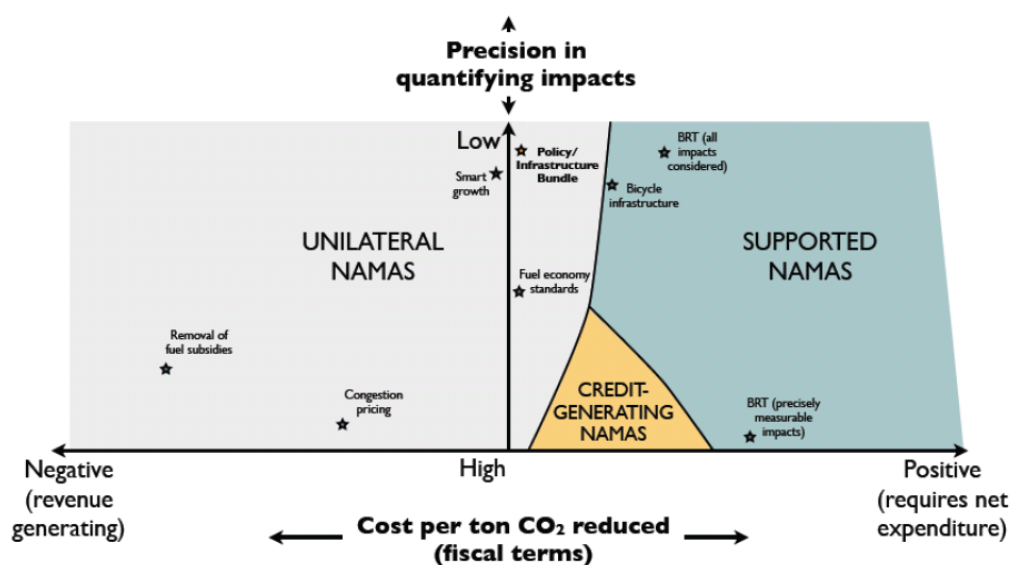


The concept of NAMAs is continuing to evolve. Although the so-called “Copenhagen Accord” which resulted from Copenhagen Climate Summit (COP15) in December 2009 was legally non-binding and merely “taken note of” by the Conference of Parties (COP), it concretely asked developing countries to submit a list of their NAMAs by the end of January 2010<sup>2</sup>. This is with the view that NAMAs seeking international support will be recorded in a registry along with relevant technology, finance and capacity building support, and subject to international MRV (see Binsted et al, 2010).

Although NAMAs are not specific to one sector, a recent analysis of the NAMA submissions to the UNFCCC for inclusion in Annex 2 of the Copenhagen Accord reveals that 16 out of the 25 countries who made their submissions by the 4<sup>th</sup> of February identified transport as a sector in which action is required (see Dalkmann et al, 2010). In mirroring this strong appetite by developing countries for action in the transport sector, there is a need for the NAMA framework to be fully compatible with the characteristics of the sector.

As the general concept of NAMAs is continuing to evolve, so too is thinking on potential formats for transportation NAMAs. For example the Center for Clean Air Policy (CCAP) has published a report proposing a framework for transportation NAMAs in which it argues that transport projects which would generate revenue (e.g. congestion charging) would be suited as a unilateral NAMA, whereas those involving significant investment (e.g. BRT) would be suited as a supported NAMA (see Figure 3 below). The report, whilst noting the methodological difficulties involved, also highlights several possibilities for tradable NAMAs, including for example sectoral crediting under a no-lose target (see CCAP, 2010 for further details).<sup>3</sup>

This case study examines all three types of NAMAs and their potential application for TDM in Jakarta.



**Figure 3: Transport in the NAMA framework (Source: CCAP, 2010)**

<sup>2</sup> Actions included in national, bi-annual communications are to be added to the list. In the communications, developing countries will also report more frequently about GHG emissions and provide verification (through international consultation and analysis to be defined) of supported NAMAs, whereas unsupported NAMAs will be MRVed domestically.

<sup>3</sup> CCAP, 2010. Transportation NAMA's: a proposed framework  
<http://www.ccap.org/docs/resources/830/CCAP%20transport%20NAMAs%20paper%20FINAL%20DRAFT.pdf>

## 2.2 The importance of considering transport NAMAs at city level

Cities are a natural unit for the planning and implementation of urban transport projects and programmes, including for example the provision of public transport services, coordination of multiple transport modes, and transport demand management.

With more than 50% of the world's population living in urban areas (and expected to increase further in the future), it is imperative that cities and municipalities work to deliver a high quality of transport supportive of citizens' needs while minimising their impact on climate change.

Even though Nationally Appropriate Mitigation Actions (as the name implies) are thought to involve the national governments of developing countries in their implementation, it is important to note that transport NAMAs must incorporate local-level actions as shown below, to catalyse the full potential of the transport sector to mitigate its emissions.

**Table 1: Potential transport NAMAs (adapted from Bongardt & Sakamoto, 2009)**

	Technology	Infrastructure/Behaviour (reduced distances/trips and shift to low carbon modes)
<b>National level</b>	Energy efficiency policy package (e.g. fuel efficiency standards, fuel taxation, vehicle standards)	Long distance Avoid and Shift policy package (Freight/Passenger) (e.g. national transport network planning, multimodal integration)
<b>Local level</b>	Vehicle and fuel standards/requirements specific to a city/region (e.g. phased introduction of Euro 4, preferential treatment for electric vehicles)	Support programs for local Avoid and Shift policies, e.g. urban transport plans; (e.g. including parking policy, road tolls, local public transport provision, infrastructure for non motorized modes)

Empowering the city to take mitigation actions is beneficial for several other reasons, including for example;

- The relatively closer link between concept and implementation, whereby actions can be kick-started at shorter time spans compared to national initiatives, provided the city has enough judiciary, political and economic autonomy.
- The ability to deliver strong local co-benefits, whereby carbon reduction measures would also bring tangible benefits to citizens in the form of e.g. air pollution reduction.
- The possibility of scaling up TDM measures piloted in one city to a national level

Given the above, a main challenge is to ensure that the Post-2012 framework surrounding NAMAs is inclusive of local-level actions.

## 2.3 Climate Change Mitigation Actions in Indonesia

Apart from the influence of the international climate negotiations, mitigation actions in Indonesia are currently driven by several domestic drivers at both national and local level. Some of these drivers are described in detail below.

### 2.3.1 National level

At the highest level, the Indonesian President Susilo Bambang Yudhoyono has recognised climate change as a national priority, committing his country to a voluntary 26 percent reduction below the baseline by the year 2020 unilaterally, and a further 15

percent (total 41 percent reduction) with international support (Indonesian Ministry of Finance 2009)<sup>4</sup>.

A Presidential Decree is currently being formulated to provide the legal basis for taking actions to meet the aforementioned targets.

Indonesia has associated itself to the Copenhagen Accord, noting in its submission<sup>5</sup> to the Appendix 2 of the Accord on 30 January 2010 that its NAMAs would comprise;

1. Sustainable peat land management
2. Reduction in rate of deforestation and land degradation
3. Development of carbon sequestration projects in forestry and agriculture
4. Promotion of energy efficiency
5. Development of alternative and renewable energy sources
6. Reduction in solid and liquid waste
7. Shifting to low-emission transportation mode.

Of these, particular emphasis is given to deforestation and peat land management, reflecting the large level of emissions currently attributed to these sectors.

Indonesia is also in the process of submitting its 2<sup>nd</sup> National Communication to the UNFCCC outlining its actions to meet its commitments, which is expected to be published shortly.<sup>6</sup>

Various national-level institutions are involved in the formulation and (future) implementation of the actions required to materialise the mitigation of GHGs. These include for example;

- A National Action Plan (NAP) on climate change published in 2007, setting out the key strategies for taking action on mitigation and adaptation.
- The establishment of a National Council on Climate Change (NCCC, or DNPI), aimed at facilitating amongst the relevant authorities and non-government bodies issues surrounding climate change mitigation and adaptation.
- The formulation by the National Development Planning Agency (BAPPENAS) of sectoral roadmaps in all key sectors including transport.
- The creation of the Indonesia Climate Change Trust Fund (ICCTF) to support domestic mitigation and adaptation activities and coordinate international donor contributions in this regard (see Box 1 in Chapter 5).
- Inclusion of climate change, low carbon growth and energy security as emphases in the mid-term development plan (RPJM), where energy efficiency and cleaner transport is expected to feature prominently (CTF, 2010)
- Publication by the Ministry of Finance of a Green Paper on Economic and Fiscal Policy Options for Climate Change Mitigation (November, 2009), including proposals to impose a carbon tax/levy on fossil fuel use, coupled with access to international carbon markets facilitated through a “no-lose” target (CIF, 2010).

Further details of these initiatives are provided in succeeding chapters of this report.

### **2.3.2 Local level with focus on Jakarta**

Domestic actions taken by Indonesian stakeholders are also seen at local level, and in particular the capital city region of Jakarta (Provinsi DKI Jakarta)<sup>7</sup>. Whilst these actions

<sup>4</sup> See <http://www.fiskal.depkeu.go.id/webbkkf/siaranpers/siaranpdf%5CGreen%20Paper%20Final.pdf>

<sup>5</sup> See [http://unfccc.int/files/meetings/application/pdf/indonesiacphaccord\\_app2.pdf](http://unfccc.int/files/meetings/application/pdf/indonesiacphaccord_app2.pdf)

<sup>6</sup> See [http://unfccc.int/national\\_reports/non-annex\\_i\\_natcom/items/2979.php](http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php)

<sup>7</sup> The focus of this report will be placed on Jakarta, in line with the TDM NAMA being suggested.

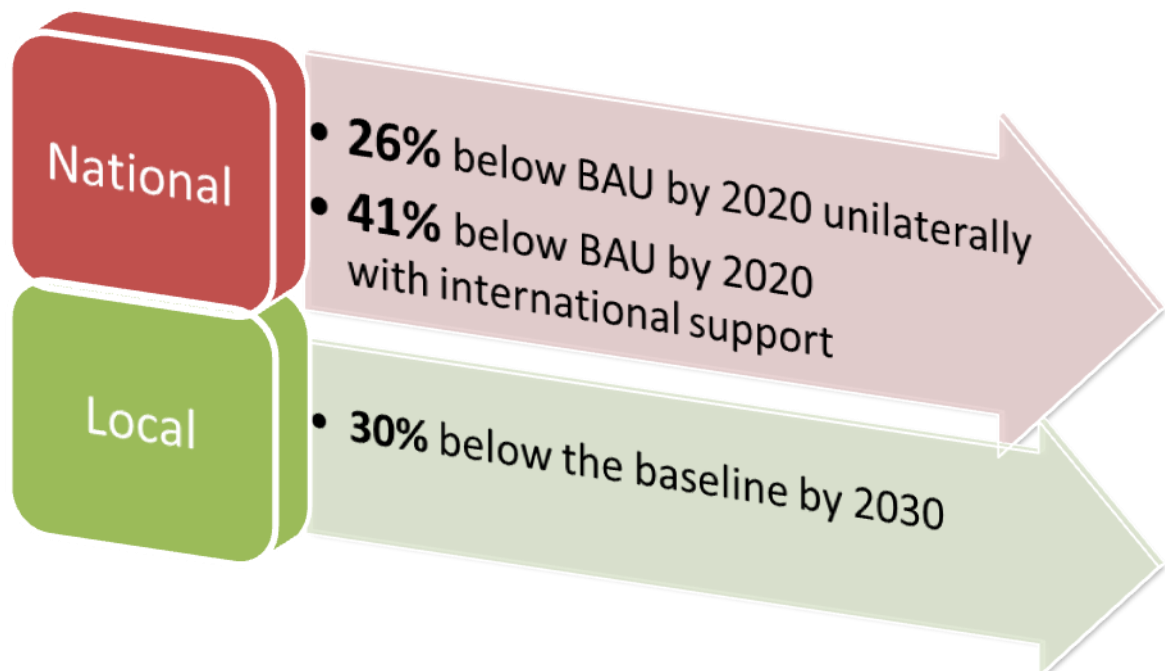
are influenced by national level commitments, Jakarta is also taking proactive steps on its own, in reflection of its strong autonomous political situation.

At a political level, the Governor of Jakarta Fauzi Bowo has reportedly set a 30% reduction target by 2030 in the Jakarta region (compared to BAU). This follows the Governor's active participation in the C40 initiative, as well as attendance at the Local Leaders Meeting during COP15<sup>8</sup>.

The strong political commitment is currently being translated into implementation of actions, whereby the following key steps are being taken, principally by the Regional Environment Agency (BPLHD);

- Calculating the baseline (BAU) scenario, from which the 30% reduction can be measured, and
- Developing a roadmap to achieve the target.

Coupled with the aforementioned national mitigation target, the dual domestic drivers for actions on climate change can be summarised by the figure below.



**Figure 4: The dual drivers of mitigation actions**

<sup>8</sup> See <http://www.fauzibowo.com/berita.php?id=1884>

## 2.4 The challenges facing transport in Indonesia

### 2.4.1 National level

In view of meeting the aforementioned domestic targets, Indonesia faces a particular challenge in taking mitigation actions in the transport sector due to a rapid rate of motorisation.

Based on a study by ADB (2006), vehicles in Indonesia are predicted to grow by more than 2-fold between 2010 and 2035, with the growth expected to be largest in two wheelers and light duty vehicles (cars).

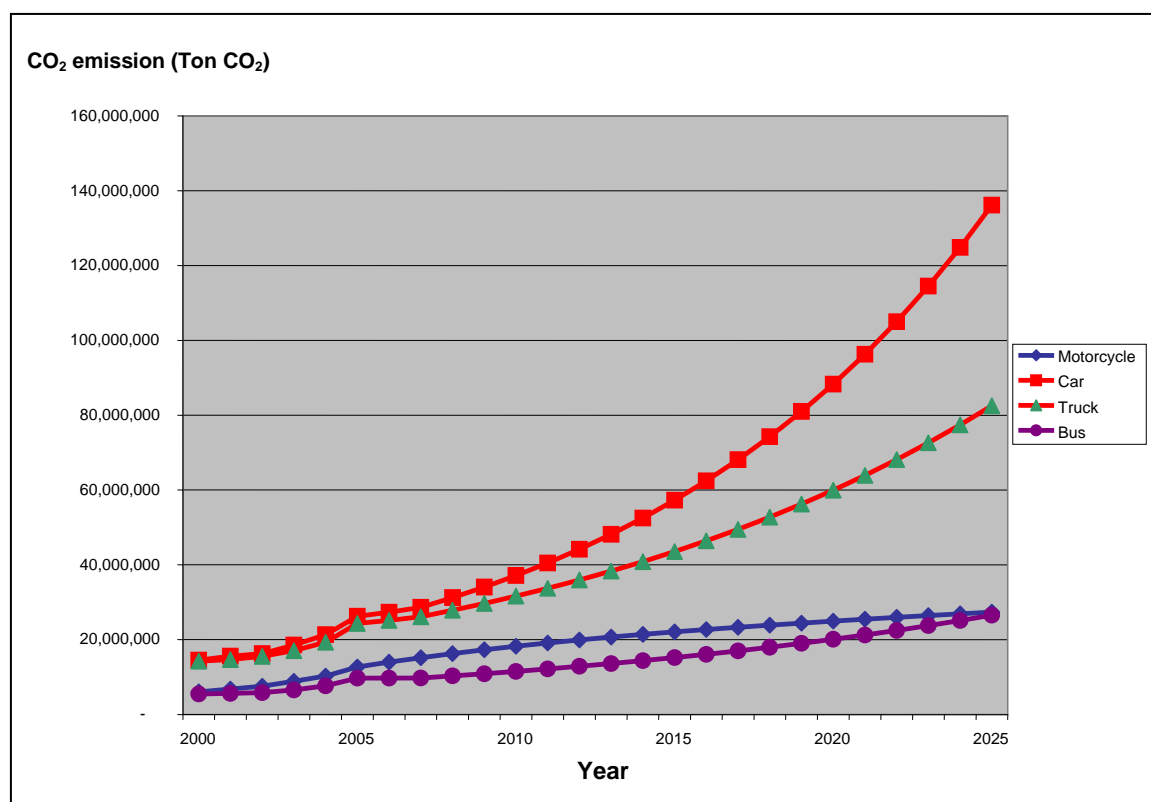


**Figure 5: Population of vehicles in Indonesia by class of vehicle in millions (Source: ADB, 2006 in BAPPENAS, 2010)**

This rapid growth is occurring because new cars are becoming affordable to an increasing portion of the population, whilst fuel prices are kept artificially through subsidies. The age of private cars in the vehicle fleet currently spans a wide range, but there is a general trend towards younger vehicles as more, new, cars are purchased. Accompanying this trend is a move towards cars with larger engines.

The road transport fleet in Indonesia includes a high proportion of motorbikes when compared to developed countries but also to a number of other developing countries. The majority of these are small engined scooters and motorbikes.

According to BAPPENAS (2010), transport (with annual emissions of 67.68 million tons CO<sub>2</sub> equivalent) made up 23% of the total CO<sub>2</sub> emissions of the energy sector in 2005, ranking third after industry and power plants. Transport emissions are expected to increase roughly three-fold over the next 20 years (Figure 6).



**Figure 6 Indonesian transport emissions projections<sup>9</sup>**  
(Source: TNA, 2009)

Comparing with other sectors, IEA (2004) in BAPPENAS (2010) states that transport is responsible for 23% of fossil fuel based CO<sub>2</sub> emissions, closely following the industry and electricity sectors in third place. The growth of emissions between 1994 and 2004 was an estimated 74%.

**Table 2: Indonesian fossil fuel emissions in MtCO<sub>2</sub>e by fuel source and sector (Source: IEA, 2004 in BAPPENAS, 2010)**

By Consumption Group	By Fossil Fuel Source				Share of Fossil Fuel Emissions	Emissions growth '94-'04
	Coal	Oil	Gas	Total Emissions		
Industry	31.9	35.4	50.7	118.0	35%	48%
Electricity	54.9	25.2	9.9	90.0	27%	170%
Transport	-	78.0	-	78.0	23%	74%
Residential	-	41.0	9.0	50.0	15%	71%
Total	86.8	179.6	69.6	336.0	100%	80%

In answer to these growing challenges, Indonesian policy makers at the national level have initiated a number of initiatives to move the country's transport sector towards a more low carbon, sustainable path.

For example, the Government of Indonesia has placed standards on vehicle and fuel efficiency; although CIF (2010) notes that these have not been upgraded and improved over time. Furthermore, the Ministry of Transport (DEPHUB) is working with the National Development Planning Agency (BAPPENAS) to construct a roadmap for the transport

<sup>9</sup> Note that these figures rely heavily on a simple extrapolation of current growth trends (due to lack of data). In reality, the growth of emissions depends on various factors, and the actual future emissions may vary.

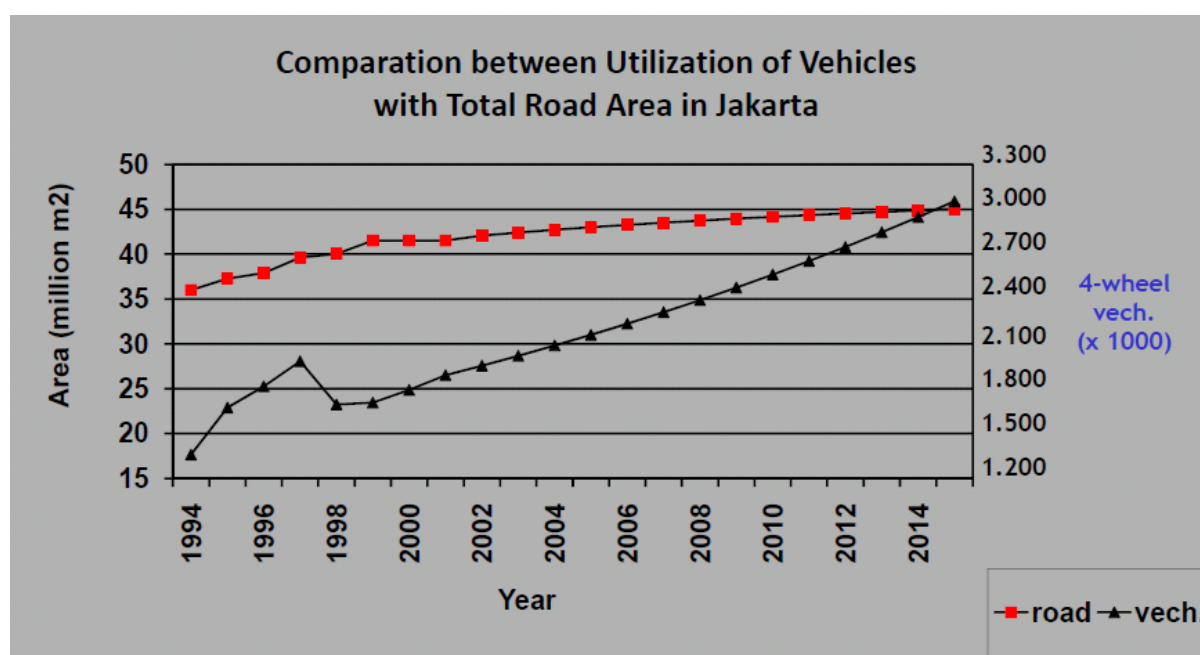
sector in terms of its contribution to tackling climate change (both mitigation and adaptation), including the identification of key policies.

#### 2.4.2 Local level

The challenges posed by the rapid growth in transport activity are seen most prominently in the urban areas of Indonesia, including its capital region of Jakarta.

According to Soehodho (2010), the number of motorised vehicles has grown at a pace of roughly 9.5% per annum for the last 5 years, to reach roughly 5.5.million vehicles. This consists of 98% private vehicles serving 44% of all trips, and 2% of public transport vehicles serving 56% of all trips. The consequences of this rapid motorisation include for example;

- Chronic congestion, particularly in the peak periods where the total cost of traffic congestion is estimated at Rp12.8 trillion per annum (approximately USD 1.4 billion) (Based on time value, fuel consumption and health costs)
- Degradation of local air quality, with air quality hotspots throughout the city
- Large levels of noise and vibration
- Reductions in road safety, particularly for vulnerable street users such as pedestrians and cyclists



**Figure 7: The road network in Jakarta predicted to reach saturation in 2014 (Source: Soehodho, 2010)**





**Figure 8 Heavy air pollution and congestion witnessed in Jakarta**

In an attempt to address these issues, stakeholders in the Jakarta capital region have initiated a number of measures under a so-called “Transportation Masterplan”, including the three core aspects of;

- **Public transport development**, including MRT<sup>10</sup>/subways, LRT/monorails, BRT/busways and waterways
- **Traffic restraint**, including high occupancy vehicle zoning (3-in-1 policy<sup>11</sup>), parking restraint, and plans to introduce electronic road pricing.
- **Network capacity improvement**, including park and ride, road network optimisation, pedestrianisation and promotion of non-motorised transport (NMT) as well as signalling/intelligent transport systems.

The formulation of this Masterplan continues to be supported by Japanese Official Development Assistance<sup>12</sup>.

The current state of these measures is described further in Chapter 3. It is worth noting that elements of the TDM NAMA being sought in this report, namely BRT, parking restraint and electronic road pricing feature already within this Masterplan.

<sup>10</sup> A 14 kilometre MRT route is planned for 2016, financed partially by Japanese ODA.

<sup>11</sup> A part of the central business district is restricted (in peak hours) to vehicles containing more than three people.

<sup>12</sup> The support programme is known as SITRAMP, which also includes O-D data collection. The third phase of SITRAMP is currently being undertaken.





**Figure 9: Elements of the Jakarta Transportation Masterplan  
(Source: Soehodho, 2010)**

In sum, a range of domestic drivers are existent to move towards a more sustainable transport regime, encompassing both climate and transport policymakers and processes. The next chapter explains how these drivers relate to the NAMA being proposed in this report (i.e. TDM), as well as the main barriers that need to be overcome for its effective implementation.

### 3 Transport Demand Management (TDM) in Jakarta as a NAMA

#### 3.1 What is TDM?

In the context of achieving the aforementioned domestic mitigation targets, Transport Demand Management (TDM) – the NAMA proposed in this paper – offers one of many approaches to taking action in the transport sector.

TDM is a general term for “strategies that result in more efficient use of transportation resources, as opposed to increasing transportation system supply by expanding roads, parking facilities and other motor vehicle related facilities.” (Litman, 2004) It is based on “a strategy which aims to maximise the efficiency of the urban transport system by discouraging unnecessary private vehicle use and promoting more effective, healthy and environmental-friendly modes of transport” (Broaddus et.al., 2009).

There are various elements which are often considered under TDM. These generally fall under supply-side (pull) measures such as dedicated bus corridors, cycle routes and pedestrian areas, as well as demand-side (push) measures including congestion pricing, parking restraint, and zone restrictions (see table 3). Crucially, TDM is often implemented as a package of measures, comprising the aforementioned individual measures.

**Table 3: Potential TDM Measures**

Supply-side Measures	Demand- side Measures
Dedicated bus corridors	Congestion pricing
Cycle routes	Parking policies
Pedestrian areas	Zone restrictions
Improve roads	Travel planning information
Improve bus service	Teleconferencing
Improve rail service	Land use allocations

Adapted from Broaddus et.al., 2009

### 3.2 TDM in Jakarta, Indonesia

As noted in Chapter 2, Jakarta experiences severe traffic-related problems associated with the exponential growth in traffic activity. There is growing recognition by policy makers, academics and civil society alike, of the importance of TDM measures to stem these problems.

This is shown by the fact that TDM has already been implemented to some extent in Jakarta, for example;

- **The development of a network of Bus Rapid Transit** (Transjakarta), whereby the initial corridor was conceptualised in 2002 and rapidly made operational within two years. The number of corridors has since increased to 10 by 2010, run by 5 different private operators (coordinated under the public agency Transjakarta). Transjakarta was the first successful implementation of BRT in Asia, and has brought significant reductions in travel time across the city, as well as estimated carbon savings of more than 37,000 tonnes CO<sub>2</sub>e per year across its 10-corridor network (ITDP, 2010).
- **Limiting access to a part of the central business district** (during peak hours) to cars containing more than 3 people (the 3-in-1 policy)

**Figure 10: Transjakarta BRT System**

Year	Construction Completed			Operated Corridors			
	Corridors	Km	No of Shelters	Corridors	Km	No of Shelters	No of Passengers
2004	1	12.9	20	1	12.9	20	15,942,423
2005	1	12.9	20	1	12.9	20	20,798,196
2006	1-3	45.9	53	1-3	45.9	53	38,828,039
2007	1-7	97.4	114	1-7	97.4	114	61,761,573
2008	1-10	172.3	170	1-7	97.4	114	74,619,995
2009	1-10	172.3	170	1-8*	123.6	145	82,377,655

\*Corridor 8 started to operate in February 2009

**Figure 11: BRT development in Jakarta (Source: ITDP Indonesia)**



**Figure 12: Entrance to the 3-in-1 zone in central Jakarta**

However, these measures have not been sufficient to counteract the rapid growth in motorisation, which can be witnessed by the heavy congestion and air pollution as shown in Chapter 2.

With regards to BRT, ITDP Indonesia (2010) notes that despite its overall success, various constraints are holding back the further effective implementation of its development. This includes imbalances between authority and responsibility, weak legal bases, pressures on cost (e.g. due to lack of competitive bidding), limited infrastructure (particularly fuel stations and bus depots) and low level of service quality.

With regards to the implementation of the 3-in-1 policy, young children are now observed earning cash by accompanying drivers within the zone who would otherwise be

subject to a fine. This anecdotally suggests that enforcement of the 3-in-1 policy has been met with challenges.



**Figure 13: Side effects of current 3-in-1 policy**

In this context, a number of additional and/or improved TDM measures are gaining acceptance by local policy makers as options for implementation in the near future. These include;

- **Electronic road pricing (ERP)** – which charges drivers “at the point of use”, thereby creating incentives to rationalise the usage of their vehicles. ERP has been implemented in other parts of the world (including Singapore and London) mainly to reduce congestion levels.
- **Parking restraint** – which is generally found in the form of increased parking charges, physical restrictions in the number of parking space available, or both. By controlling the availability and affordability of parking, road users are encouraged to rationalise their vehicle use and consider alternatives to driving their private vehicles into the city centre (such as public transport).
- **Further improvements in public transport (particularly BRT)** to encourage a shift to forms of transport that are more efficient and result in lower greenhouse gas emissions per passenger kilometre.

By reducing the number of trips/distances travelled by private modes, the above three collectively contribute to the reduction of transport emissions.

Indeed, as shown in Chapter 2, these measures comprise a core component of the Governor’s Transport Masterplan, and are currently being pursued as follows:

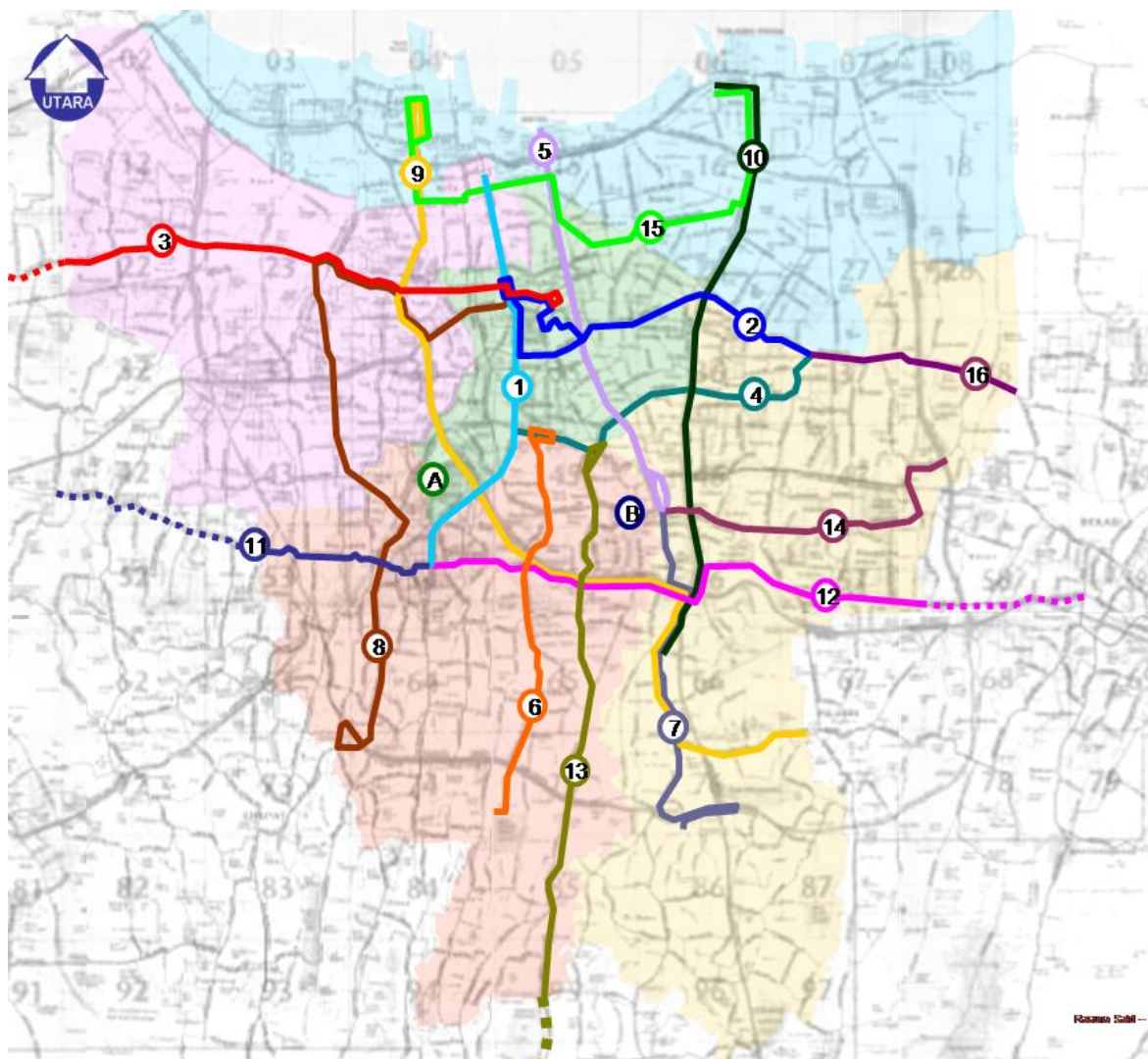
**ERP** is currently considered as a replacement to the 3-in-1 policy. A pre-feasibility study has been conducted utilising Japanese ODA funding. However, the study concluded against the provision of an ODA loan due to the fact that the pay-back period would be a mere 4 years. This anecdote reinforces the fact that TDM strategies are often revenue generating and self-funding, and that once in place are likely to bring sustained benefits to the region in financial terms as well (see Chapter 6). ERP is in principle allowed by the current National Traffic Act from 2009. However, the detailed regulation and legislation remains lacking, posing a barrier to its practical implementation. This highlights the potential role of the national government in providing the appropriate legislative framework to support such local-level TDM policies.

**Parking restraint** concerns both off-street and on-street parking, whereby the former is currently subject to a cap in the price that parking operators may charge in the inner city. The latter is enforced mainly by private traffic wardens, who are given permits by the local government to operate. Details of how the current situation is to be improved



remains unknown, although a common recognition for the need for the appropriate pricing of parking space and their proper enforcement is existent.

**BRT** is currently planned for extension to 15 routes by the year 2015, from the current 10. This is supported by a GEF project, implemented by ITDP Indonesia, to further enhance routing, integration of ticketing, competitive bidding, public awareness, as well as synergies with non-BRT and feeder systems including pedestrian and NMT facilities.



**Figure 14: Envisaged expansion of the BRT network by 2015**  
(Source: Jakarta Transportation Masterplan)

In sum, whilst proposals are already on the table for the further development of TDM measures, several barriers are also foreseen in their further development, including (amongst others);

- **Regulatory/legislative** – whereby regulations concerning traffic activity (including at national level) act against the implementation of certain elements of TDM.
- **Institutional** – whereby a complex structure of institutions may provide a challenge against coordination of the various TDM elements.

- **Financial** – whereby improvements are desired in the ways in which the private sector is involved in e.g. the procurement of services, to avoid unsustainable cost overruns and in particular for BRT to reduce the level of subsidies to sustain services.
- **Technical** – whereby key technologies to enable TDM, particularly related to Electronic Road Pricing (such as technology for automatic plate recognition), is currently lacking domestically.

### 3.3 TDM as a NAMA

In light of the above situation, and reiterating the importance of ensuring that a future NAMA framework is inclusive of local level actions, the applicability of TDM to the NAMA framework is hereby assessed, with a view towards;

- Acknowledging and estimating its potential contribution to meeting domestic (voluntary) mitigation targets.
- Linking the further development of TDM to international support which may be offered through the NAMA framework, in the form of financing, technology transfer and capacity building.

To these ends, the following three chapters examine three core components of the NAMA framework, namely;

- **MRV** – the measurement, reporting and verification of emissions
- **Institutions** – and how they can be supported through NAMAs
- **Financing** – how (international) financial resources could best support the implementation of TDM.

Whilst these three components are vital for all types of NAMAs, their role and nature will obviously depend on whether a unilateral, supported or tradable NAMA is being pursued. The following chapters will explore these dimensions in full. Based on this, Chapter 7 provides an overall assessment on the applicability of TDM to the three types of NAMAs.

## 4 The Measurement, Reporting and Verification (MRV) of the TDM NAMA

### 4.1 Why the need to MRV mitigation actions

The Copenhagen Accord states that for supported NAMAs, countries will be asked to report their GHG emissions and be provided verification, through international consultation and analysis to be defined (see Binsted et al, 2010), whereas unsupported NAMAs will be MRVed domestically. Tradable NAMAs are expected to be associated with the highest level of rigour with respect to MRV.

As noted by Ellis (2010) and elaborated further by Chung (2010), the main role of MRV in a developing country context is to ensure the **transparency** of mitigation actions, to allow;

- An accurate and comparable estimation of mitigation efforts in meeting domestic (voluntary) targets
- The matching of mitigation efforts to international support, i.e. ensuring that the international support being provided is leading to measurable reductions in greenhouse gas emissions.

This contrasts with the role for MRV in a developed (Annex-I) country context, where its main function is **compliance** with mandatory targets.

For TDM in Jakarta, ensuring its MRV is a prerequisite for it to be acknowledged as a NAMA in all of the three suggested forms, i.e. unilateral, supported and tradable.

The required robustness of MRV is thought to differ between the three types of NAMAs. The details of the potential MRV methodology outlined below presuppose (as indicated in Chapter 3) the TDM NAMA to be potentially applied to all three types of NAMAs. Whilst the overall methodology is not differentiated by NAMA type, areas/issues which are specific to a type of NAMA will be highlighted wherever applicable.

### 4.2 The MRV of transport NAMAs at city level

#### 4.2.1 A city-wide approach to MRV

As TDM is implemented at local (city) level, it is firstly imperative to understand the wider approach to achieving MRV at this wider level.

It is important to recognise the existing and expanding initiatives aimed at serving this purpose, for example ICLEI (2008), World Bank (2010) and UNEP (2010).

A crucial first step is the establishment of inventories of GHG emissions, in other words, knowing the level of emissions that are existent within a city boundary. This then allows the estimation of future emissions (BAU) as well as the monitoring of changes to actual emissions after the implementation of policies and measures.

For example, UNEP, UN-HABITAT, and the World Bank (2009) note that;

*"While measurement should not delay action, a critical requirement to support policy and access to finance is the establishment of an open, global and harmonized protocol for quantifying the GHG emissions attributable to cities and local regions."*

There are several challenges associated with the establishment of inventories at city level. As noted in Kennedy and Mohareb (2009) and Ramaswami et al (2008), this includes;

- The lack of full life-cycle perspective
- Problems with defining the spatial and temporal context
- Issues of assigning emissions by political jurisdiction
- Ensuring consistency between cities

As noted in UNEP (2010), leakage is a particular issue of concern, where care must be taken to include in GHG inventories *inter alia*;

- Out-of-boundary emissions from the generation of electricity and district heating which are consumed in cities (including transmission and distribution losses);
- Emissions from transport vehicles carrying passengers and freight away from cities;
- Out-of-boundary emissions from waste that is generated in cities.

#### **4.2.2 The MRV of TDM within a city-wide approach**

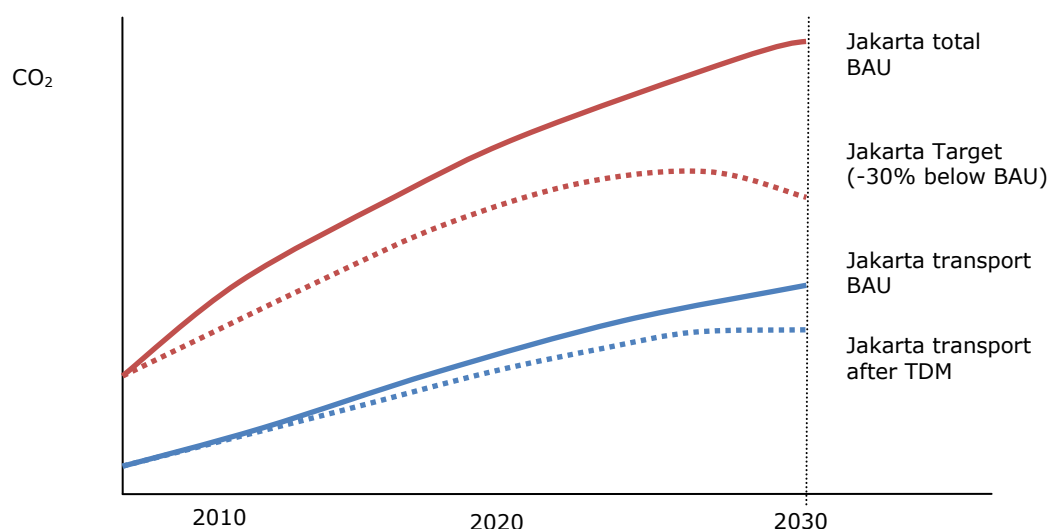
A city-wide approach to tackling GHGs would encompass all relevant sectors at this level, including (amongst others) transport, domestic housing, waste, industry, energy, water, and agriculture. The emission inventory would record the emissions from each of these sectors, further split down into sub-sectors as appropriate.

Transport Demand Management as a NAMA can be considered within this context. As shown in the figure below, TDM is generally expected to reduce (from BAU) the transport emissions within the city, thereby helping Jakarta meet its overall reduction targets of -30% by 2030 (see hypothetical case in the figure below). In other words, it is to be considered as a component of an overall mitigation plan for the transport sector, combined with other important components such as;

- Fuel economy improvements – e.g. mandating fuel efficiency standards for vehicles within the city.
- Fleet management to ensure optimal usage of e.g. freight and corporate vehicles
- Improving the maintenance levels of vehicles

Furthermore, TDM would contribute (particularly when duplicated in other cities in Indonesia) to the reduction target set forth by the national government, i.e. that of -26% unilaterally, and -41% with international support, relative to BAU in the year 2020. The hypothetical relation of TDM to the transport and city-wide baseline is illustrated in Figure 15.





**Figure 15: TDM as an element of the city-wide approach to help Jakarta meet its 30% reduction target by 2030<sup>13</sup>**

It must be noted that for any comparisons between a business as usual scenario and a “do-something” scenario to be credible and comparable across cities or countries, one must have a robust methodology for calculating the baseline. Due to data and methodological constraints, this is often a daunting task for developing countries. Uncertainties surrounding the baseline make the ex-post assessment of the impacts of policy interventions very difficult. As will be described in later sections, this one major reason why capacity building on MRV is a fundamental element in opening up the option of implementing TDM under e.g. a tradable NAMA approach, which requires stringent MRV.

The measured mitigation effects from TDM (combined with those from other transport and non-transport policies) could then be reported to and verified by either the national government (in case of unilateral NAMAs), or the UNFCCC (in case of supported or tradable NAMAs). Further details of potential reporting and verification procedures are provided in Chapter 5 on institutions.

## 4.3 Measuring the impacts of Transport Demand Management

### 4.3.1 Methodologies for measurement in the transport sector

Under the city-wide approach, each sector would be subject to an appropriate methodology with regards to the measurement of its emissions.

With regards to transport, Kennedy (2010) mentions the particular difficulty in developing consistent methodologies, noting that emissions are often estimated in multiple ways, including;

- Regional fuel sales data
- Modelled vehicle activity multiplied by emission factors
- Scaling up/down emission estimates made at smaller/larger geographical level for which inventories are already available

<sup>13</sup> Trajectories are hypothetical and do not represent particular assumptions on e.g. changes to policy, social preferences and economic trends.

The applicable methodology to a certain city/context is often dictated by the level of data availability.

In the case of the Jakarta TDM NAMA in question, the second approach (modelling vehicle activity multiplied by emission factors) has been taken as the overarching approach, on the basis of existing data and model availability.

More specifically, a traffic model was used to estimate current and future levels of traffic activity within the Jakarta region, as well as the associated CO<sub>2</sub> emission reductions and other co-benefits.

Based on this approach, an assessment of the availability/quality of input data has also been conducted. This has led to a gap analysis, including the development of ideas on how to deal with uncertainties. These aspects are explained in full below.

#### **4.3.2 The TDM model**

Based on previous work conducted with assistance from the Japanese Government, the University of Bandung has applied a transport model to assess the impact of TDM measures in the city of Jakarta. The approach utilises an “equilibrium flow” model which assesses the demand for travel by collating origin and destination information, and then distributing these journeys across the existing network.

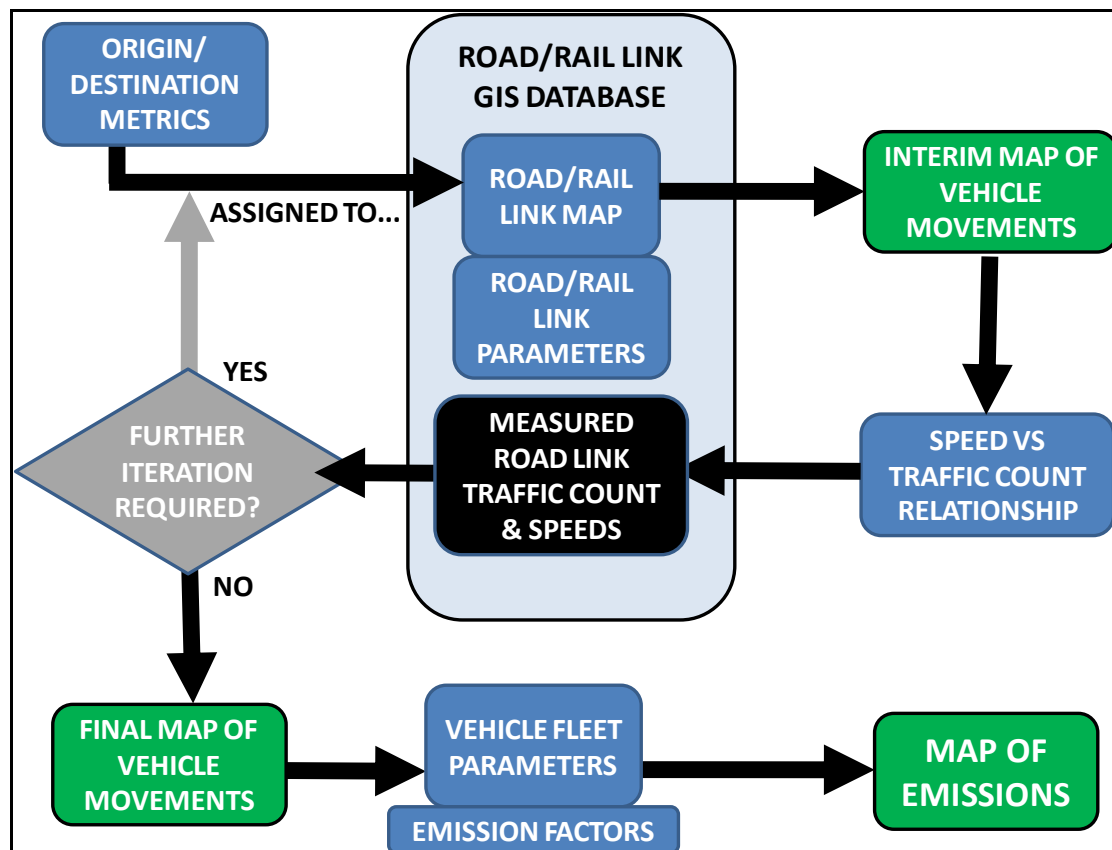
The equilibrium flow approach assigns travel to the different modes of transport as required to equalise the pressures across the different sections of the network.

The model operates with passenger kms (and tonne kms), rather than vehicle kms. Therefore, parameters such as occupancy levels, or vehicle fleet parameters (which determine fuel consumption, and therefore carbon emissions) are extremely important in subsequently calculating accurate emissions to air. For example, occupancy levels in private cars will have a direct relationship with the carbon emissions. Also, vehicle speeds become very important, because at the very low speeds typically observed in Jakarta, fuel economy becomes significantly worse. These are areas of high uncertainty, and are considered in more detail in the sections below.

The model incorporates the road transport network (with a mode resolution of cars, motorbikes, buses, and lorries). Inclusion of trams or monorail types systems are considered under the different scenarios, but may be achieved by simply adding links to the network with the appropriate properties (such as flows across the relevant network links).

Whilst the model is best suited to transport management and assessing congestion, it can also be used for estimating vehicle kilometres and emissions of both carbon and air quality pollutants (such as CO and NO<sub>x</sub>). The output of the model is provided by road link, giving a very high spatial resolution.

An overview of the model and its inputs/outputs are shown in the figure below.



**Figure 16: A Schematic Diagram of the Jakarta Transport Model**

#### 4.3.3 Estimating the impacts of TDM measures

The transport model provides “business as usual” projections, against which the impacts of the implementation of a range of different mitigation measures, both individually, and combined into suites of measures (i.e. scenarios) can be calculated. In modelling the impacts of the three TDM measures, the model is run firstly assuming no changes to policy (business as usual), and then against scenarios which include different levels of applications of the TDM measures, represented in the model as changes to;

- The origin/destination metrics,
- The road/rail network, or
- Vehicle fleet parameters.

Changes to the origin/destination metrics are associated with scenarios which affect the demand for travel (either in a spatial sense, or absolute levels).

In the case of the three TDM elements, this applies to ERP and parking restraint, whereby their implementation would essentially increase the price of travelling between point A and B. Figure 17 shows how this is done in practice, whereby various ERP and parking charges are combined, and run against the model.

Scenarios	Year	ERP (Rupiahs)	PARKING (Rupiahs)
DO NOTHING	2010	0	0
	2020	0	0
DO SOMETHING	2010	5.500	0
		5.500	4.000
		16.500	0
		16.500	4.000
		16.500	8.000
		27.500	4.000
	2020	5.500	0
		5.500	4.000
		16.500	0
		0	4.000
		16.500	8.000
		27.500	4.000

**Figure 17 : Illustration of different combinations of tariffs for road pricing and parking charges**

Changes to the road/rail network may be small, or very large. At the smaller scale, it would be possible to e.g. change a two-way road link to a one-way link, to investigate the changes to the traffic flows. At the larger scale, it is possible to investigate the impacts of introducing an entire network of BRT.

Changes to the vehicle fleet parameters are typically made to investigate scenarios such as discounting the price of newer vehicles to promote fleet turnover.

It is clear that the model is very flexible, allowing it to reflect the details associated with the introduction of a wide range of very different measures.

#### **4.3.4 Modelling and tracking the expected CO<sub>2</sub> benefits and associated co-benefits**

Scenario work using the TDM model has demonstrated that a typical combination of the three TDM policies leads to a sustained reduction of total transport demand (in vehicle kilometres, below the baseline<sup>14</sup>) by approximately 4-5%, all other policies being equal. Note that this is an illustrative scenario under a specific combination of TDM combining a IDR 5,500 (USD 0.6) entry price in the ERP zone, a parking charge of Rp. 4,000 (USD 0.43) and a network of BRT lines<sup>15</sup>. The impact was shown to be much higher when focusing on the central business district of Jakarta (where ERP would come into effect), which would experience a sustained 40% drop in transport demand, compared to business as usual. This demonstrates the highly location-specific impacts of TDM policies.

Expected CO<sub>2</sub> reductions could be calculated using specific data provided by the modelling, including km-travelled, with vehicle characteristics. This was not done directly in the modelling process, however estimations of fuel consumption - a direct proxy for

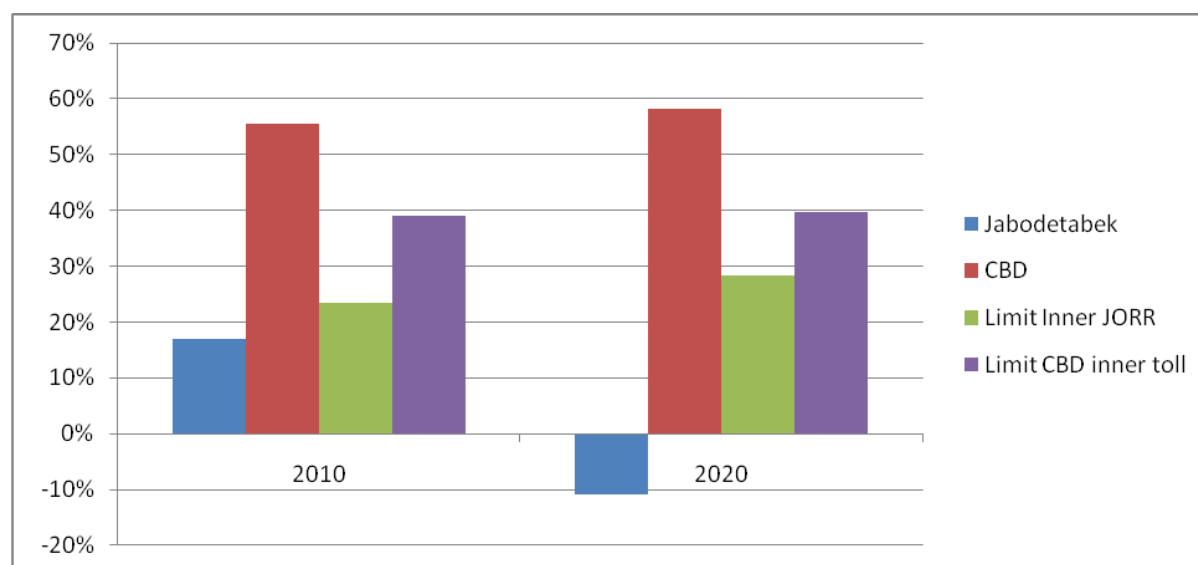
<sup>14</sup> Two points in time were modelled; 2010 and 2020, each comparing the do nothing scenario (BAU) and the do something scenario (see footnote below).

<sup>15</sup> Several other combinations of TDM policies were modelled, with different assumption on the ERP and parking charges. Most of the combinations returned roughly the same level of changes.

carbon emissions - were made. The results are shown in the figure below, depicting changes to fuel use, under four different boundaries – Jabodetabek (Jakarta and surrounding satellite towns), central business district (CBD), area within the Jakarta Outer Ring Road, and the area within the CBD inner toll road.

A sustained reduction of between 20 and 30% compared to BAU was shown for an area within the Jakarta Outer Ring Road (JORR), and even larger for the CBD. The results need to be treated with a degree of caution, especially with regards to the large level of reduction assumed for the CBD. This may be due to limitations in the quality of input data (see following section) and the large number of assumptions which dictate the final outcome. Nevertheless, the results are shown to provide an indication that (given improvements in the data and model);

- Carbon emissions can be quantified using this approach, and;
- Such savings could reach substantial levels.



**Figure 18 : Percent reduction in fuel consumption (compared to BAU) under different boundaries**

Taking the area within the Jakarta Outer Ring Road as a representative case, and assuming the GHG emission profile of Jakarta to be close to the national split, whereby transport emissions make up 23% of fossil-fuel based emissions, a 20-30% reduction in transport emissions would translate into approximately 4-7% saving of the entire city's carbon profile relative to the baseline, for both 2010 and 2020. This demonstrates how TDM (especially when coupled with other measures such as fuel economy improvements) would assist in meeting the local target of -30% by 2030.

Furthermore, a number of associated co-benefits have been considered in the Jakarta TDM modelling, including;

### **Congestion**

This is the main focus of the modelling work to date, and so the model has been designed to assess congestion in a detailed way. Results are available at the individual road link level in the form of average speeds.

### **Air Quality Pollutant Emissions**

CO, NO<sub>x</sub>, SO<sub>x</sub>, and PM<sub>10</sub> emission estimates are all included in the existing model at the road link level. Whilst the results are available at a very fine spatial scale, it is thought that there are very large uncertainties associated with most of these emission estimates. This is mainly due to the vehicle fleet currently represented in a simplistic manner.

The model would need to be developed in a number of different ways to allow accurate estimates of air quality pollutants to be made. For example, the fleet would need to be better characterised, and more detailed emission factors included in the model. This is relatively straightforward model improvement, and even obtaining the input data should not be difficult.

### Noise and Road Safety

Neither parameter is currently considered in this model, however there was a large study undertaken in Jakarta in 2004. It may be possible to develop the existing road transport model to deliver information on both of these parameters.

In sum, the changes in the CO<sub>2</sub> emissions, as well as the co-benefits can be directly tracked from the outputs of the model and expressed as **indicators**, including;

- **Vehicle movement** (which can be translated into carbon emissions by examining the assumptions on the vehicle stock and emission factors)
- **Congestion levels**, expressed as e.g. average speeds on the network
- **Air Quality Pollutant Emissions**, expressed as e.g. average level of pollution within a designated zone

### 4.3.5 Data requirements of the model

Whilst the previous sections noted the ability of the model to effectively model and track carbon emissions as well as co-benefits, the current main barrier towards the tracking of progress lies in the lack of adequate data, in terms of volume and quality.

The table summarises the types of data that are currently fed into the model. Based on an extensive review of the model conducted during a visit to Indonesia by a member of the study team, it also shows a qualitative assessment of the data quality under the current situation, and identifies priorities for improvement. The details of this assessment are provided in Appendix 1.

**Table 4: Assessment of current data quality**

	Current data quality/extent	Priority for Improvement
Vehicle Fleet Data	☆☆☆☆☆	★★★★★
Emission Factors	☆☆☆☆☆	★★★★★
Origin/Destination Metrics	☆☆☆☆☆	★★★★☆
Road Link Traffic Count	☆☆☆☆☆	★★★★☆
Vehicle Occupancy	☆☆☆☆☆	★★★★☆
Road Link Flow/Speeds	★★★★☆	★★★★☆
Taxis	☆☆☆☆☆	★★★★☆
Road Link Dataset	★★★★☆	★★☆☆☆
Spatial Resolution, Geographical Extent and Boundaries	★★★★★	★★☆☆☆

In general, it is shown that data surrounding the vehicle fleet of Jakarta and their associated emission factors are a major data gap, hindering the accurate estimation of emission levels.

### 4.3.6 Dealing with data imperfections and uncertainty

Given the imperfect nature of the data, it is imperative to devise ways in which the created uncertainty is reduced.

The study team has therefore developed a number of alternative ways in which changes to the carbon emissions from the transport sector caused by the implementation of a specific measure in Jakarta could be monitored. Three examples include:

- Conducting surveys to ask people about their travel habits;

- A bottom up approach involving evaluating vehicle movements, by measuring and collating road traffic count, and rail passenger count data;
- A top down approach of collecting fuel sales from petrol stations in the Jakarta area.

Focusing on the last of these options, if the petrol sales in the Jakarta area could be compiled across a timeline<sup>16</sup>, it would be possible to make an evaluation of how the transport demand (and resulting carbon emissions) have been changing with time- the assumption being that “border” and similar issues are not significant. Furthermore, a dataset like this could be extrapolated to give a simple assessment of the projected levels of activity in the transport sector as a base case.

The introduction of mitigation measures, or significant steps changes to the transport sector would also be evident in these key indicator datasets. This then allows the impacts on carbon emissions from mitigation measures to be tracked in a simple, but transparent way.

Further ideas relating to reducing uncertainty in the modelling process are provided in Appendix 1.

#### 4.4 Key messages for MRV

This chapter outlined the key issues relating to the MRV of Transport Demand Management. Most importantly, it was highlighted that;

- MRV is crucial in ensuring the **transparency** of mitigation actions, to allow an accurate estimation of mitigation efforts in meeting domestic (voluntary) targets, as well as to ensure accountability of the impacts of international support received.
- The TDM NAMA could be seen as an element of a city-wide approach to measuring mitigation actions, which would enable the contribution of TDM to the meeting of mitigation targets at the city level to be explicitly made (in the case of Jakarta, 30% below BAU by 2030)<sup>17</sup>.
- The challenge of creating robust MRV methodology, which was seen as a barrier for transport CDM projects, remains for the design of a transport NAMA. The ability to clearly define baselines and timescales, gather GHG emissions transport data and incorporate the monitoring of co-benefits (to strengthen the political acceptability of mitigation actions and seek synergies between other important transport policy objectives such as congestion relief and air quality improvement) will be critical for the success of developing a TDM within developing countries.
- The measurement of CO<sub>2</sub> mitigation and associated co-benefits would be made possible by utilising a bottom up methodology that combines a transport demand model (equilibrium flow model) with data on the vehicle fleet (e.g. emission factors).
- The measurement of carbon could be cross-checked using top-down methods utilising (regional) fuel sales data, to improve the robustness.
- The lack of and poor quality of data is a major constraint in the accurate measurement of the mitigation potential (and co-benefits) of the TDM NAMA. For example, assigning traffic flows to the entire road network in Jakarta requires

<sup>16</sup> This is a feasible option once the appropriate accounting procedures are in place to e.g. allow petrol suppliers to report on their sales on a regular basis.

<sup>17</sup> TDM may be justified as a policy even without the quantification of its positive impacts on carbon, due to the various co-benefits it would bring to Jakarta. However, an explicit link between TDM and climate change mitigation efforts would allow transport to be recognised as a crucial sector in mitigating emissions at city level, and may trigger further actions by policy makers..

very extensive and detailed traffic count information, supplemented by origin and destination data. The available data could be substantially improved by measuring the traffic flows in considerably more locations than the current situation, as well as better information on the vehicle fleet.

- Capacity building in the area of data collection, database development and management is seen as a key priority in ensuring MRV of mitigation actions in the future, particularly in allowing TDM to be implemented as a tradable NAMA. Such capacity building efforts could be conducted as part of a supported NAMA, or through other means of (international) support such as Official Development Assistance.



## 5 Institutional setting

In allowing the full and effective implementation of TDM as an MRV-NAMA, it is vital that the roles of institutions are fully considered. This chapter firstly provides an overview of the current institutional framework and relevant activities of individual institutions. In the latter half of this chapter, an attempt is made to map out how these institutions may share and coordinate their roles under a future NAMA framework, in fully enabling TDM.

### 5.1 The Current Institutional Framework

The institutions relevant to the TDM NAMA for Jakarta are thought to comprise;

- **Local institutions**, whose legislative mandate is focused on the Jakarta capital region. These institutions are of particular relevance to the TDM NAMA, which is to be implemented at the local level.
- **National institutions**, who provide a national framework (i.e. policies, legislations and regulations) on climate change and transport policy, and are responsible for communicating the climate mitigation actions to the international climate community (UNFCCC).
- **International institutions**, who currently provide external assistance in climate and transport policy e.g. via Official Development Assistance or as multilateral institutions, and are increasingly active in providing assistance on climate change.

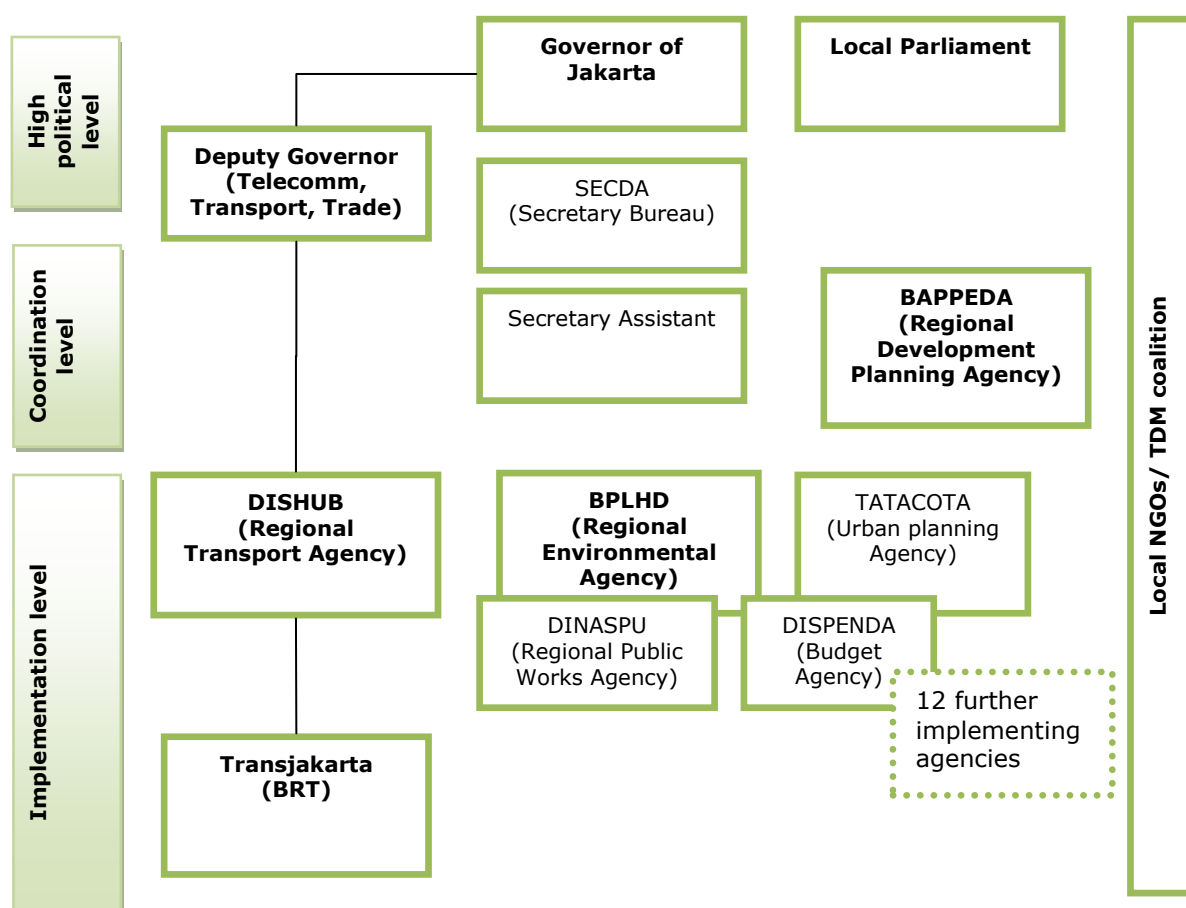
The decisions taken by these institutions impact on a number of wider stakeholders, including private operators of public transport services.

These institutions and their respective current roles and priorities are provided below.

#### 5.1.1 Local institutions

In recent years, Indonesia is continuously moving in the direction of devolved decision making, whereby many of the legislative and financial powers have been shifted to the local (provincial) level. Most prominently, the capital region of Jakarta (DKI Jakarta) possesses a higher level of devolved decision-making power compared to the other provinces.

In this context, there are a wide range of local-level institutions, ranging from high political level through to implementation level, which are thought to be relevant to the NAMA in question. These are depicted in the diagram below, and detailed further (with focus on those most prominent to the TDM - highlighted in bold) below.



**Figure 19 : Overview of local level institutions relevant to the TDM NAMA**

- Governor and Deputy Governor of Jakarta** - At the highest political level, the Governor of Jakarta (Dr. Fauzi Bowo), who is accountable to the Parliament of Jakarta, sets the overall policy direction for the capital region. Policy making by the Governor is assisted by the Secretary Office (SECDA) and the Secretary Assistant. As explained in Chapter 2, the Governor has committed his government to aim for a 30% reduction of GHGs by 2030, compared to BAU. This overall target is currently trickling down to the implementation level as will be shown below.
- Local Parliament** – As many of the actions proposed would require changes in legislation, the support of Jakarta’s local parliament is often of key importance for their implementation. As noted by Sutomo (2007) winning the rapid support of the local parliament was a key success factor for the rapid development of the BRT system.
- Deputy Governor of Trade, Industry and Transportation Telecommunications, Transport and Trade** - As Deputy Governor of Trade, Industry and Transportation, Dr. Sutanto Soehodho provides overall directional guidance in the transport sector, e.g. in the form of formulating a Transport Masterplan (see Chapter 2). The Deputy Governor is likely to be tasked with outlining how the sector may contribute to the 30% reduction target. The Deputy Governor understands the importance of measuring the impacts of the transport sector on GHGs, as well as other impacts such as health and air pollution. Here, it

is worth noting the existing efforts that are being undertaken with the US EPA to develop a monitoring system for air pollution<sup>18</sup>.

- **The Regional Environment Agency (BPLHD)** – is responsible for the implementation of environmental policy in the Jakarta capital region. In relation to transport, it is responsible for setting policies surrounding emission standards for vehicles. More recently, in the context of the mitigation targets set by the Governor, the Agency is seen as a key player in the MRV of mitigation actions. In this regard, the Agency is currently investigating ways of setting a baseline at the Jakarta regional level, and consequently aiming to provide a roadmap of mitigation actions to meet the aforementioned target. It is expected to work with the other implementing agencies (including DISHUB – see below) to this end.
- **The Regional Transportation Agency (DISHUB)** – is tasked with the implementation of transport-related policies in the Jakarta capital region. It employs roughly 1000 people, most of whose duties concern traffic management. There is currently no environmental responsibility within DISHUB. Its current main strategies are driven by aspects of the Transport Masterplan explained in Chapter 2, with a key consideration being the tackling of congestion.
- **Transjakarta** – the BRT operator, is a specialist agency under DISHUB tasked with the operation of the BRT system. It is responsible for the day-to-day running of the BRT system, including procurement issues, management of staff etc.
- **The Regional Development Planning Agency (BAPPEDA)** – is responsible for coordinating land use and transportation planning, helping to ensure that Jakarta's transport plan is consistent with and reinforces the objectives of the region's land use plan (Soehodho, 2008<sup>19</sup>). BAPPEDA are also responsible for the (budgetary) coordination of various implementing agencies in the Jakarta capital region. For example, BAPPEDA receives budgetary proposals for transport projects from DISHUB, and influences decisions on project priorities.
- **Local NGOs and civil society** – are playing an increasingly large role in shaping local transport policy. Prominent initiatives include a coalition of a number of NGOs (including ITDP Indonesia, Pelangi, WWF, Instran, and the Committee for the Phasing-out of Lead-Containing Fuels (KPBB)) advocating the further and effective implementation of TDM measures in the capital region<sup>20</sup>. Furthermore, Swisscontact have also been active in the field clean air policy, including for example the provision of eco-driving training<sup>21</sup>. The Clinton Foundation also operates in Jakarta, assisting the Governor's office on issues relating to climate change.

In practice, these institutions interact in often complex ways, as can be highlighted through the two examples of BRT and parking policy below.

With regards to BRT, although the direct operation of the BRT system is the responsibility of the specialist agency (Transjakarta), the construction of BRT stations fall under the jurisdiction of its mother organisation (DISHUB). Furthermore, the construction and maintenance of the buses themselves are conducted by the Regional Public Works Agency (DINASPU), whilst the sidewalks (which obviously interact with bus shelter facilities) are managed by a separate agency responsible for parks and cemeteries.

<sup>18</sup> As air pollution monitoring focuses on the measurement of *concentrations* of local pollutants such as particulate matter, carbon dioxide (whose negative impact depends on the *cumulative* level of emissions) is not measured under the same system.

<sup>19</sup> See: [http://www.thredbo.itls.usyd.edu.au/downloads/thredbo6\\_papers/Thredbo6-theme4-Soehodho.pdf](http://www.thredbo.itls.usyd.edu.au/downloads/thredbo6_papers/Thredbo6-theme4-Soehodho.pdf)

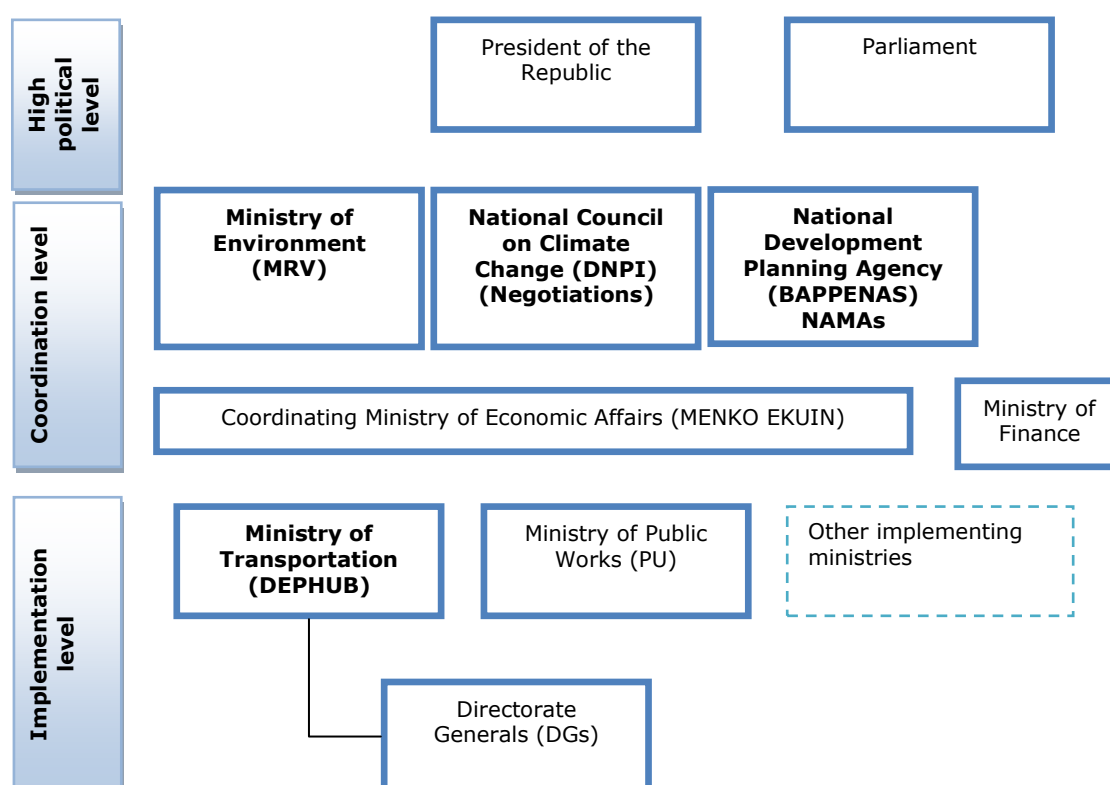
<sup>20</sup> See [http://www.itdp-indonesia.org/index.php?option=com\\_content&task=blogcategory&id=45&Itemid=98](http://www.itdp-indonesia.org/index.php?option=com_content&task=blogcategory&id=45&Itemid=98) and <http://www.pelangi.or.id/programs.php?pid=4&sid=16>

<sup>21</sup> <http://www.swisscontact.or.id/projects/past-project/cap-clean-air-project/>

With regards to parking, The Deputy Governor sets the overall policy on charges. In implementing these policies, DISHUB, the Transport Agency is responsible for on-street parking (provision of permits), whereas a separate Regional Budget Office (DISPENDA) manages charging policies for off-street parking. Planning for parking space is conducted by yet another agency, TATAKOTA – the Regional Urban and Landscape Agency.

### 5.1.2 National institutions

In addition to the local level institutions mentioned beforehand, there is a range of national level institutions relevant to mitigation actions in the transport sector, and therefore to the proposed TDM NAMA. An overview of such institutions is provided in the figure below;



**Figure 20 : Overview of national level institutions relevant to the TDM NAMA**

With regards to climate change policy, there are three key institutions which have been given central mandate on this policy issue, namely;

- **The National Council on Climate Change (DNPI)** - tasked to coordinate all relevant stakeholders regarding climate change in Indonesia, and lead on the international negotiations on behalf of the Republic. DNPI also conducts high-level analyses on mitigation actions, including multi-sector emission modeling as well as the quantification of the cost effectiveness of policy interventions (utilizing the McKinsey approach).
- **The Ministry of Environment** – who is responsible for the formulation of the National Communications, and more recently has been tasked with the overall coordination of MRV efforts in Indonesia.

- **The National Development Planning Agency (BAPPENAS)** – who provide long term (20 year) strategic planning. In the context of climate change, BAPPENAS is responsible for the **formulation of NAMAs**, and have coordinated the development of sectoral roadmaps. Furthermore, BAPPENAS has also been central to the Indonesian Climate Change Trust Fund (see box below).

### **Box 1: The Indonesian Climate Change Trust Fund (ICCTF)**

The Government of Indonesia has developed a national trust fund mechanism (the Indonesian Climate Change Trust Fund - ICCTF) to facilitate harmonised international financial support for climate change mitigation and adaptation.

The ICCTF is currently administered by BAPPENAS, and has three priority windows;

- Energy (including transport)
- Forestry/peatland
- Resilience (e.g. in agriculture, water resources and coastal zones)

In the initial stages, the ICCTF will focus primarily on national-level actions, although in the future it may move towards including actions at local level and those conducted by NGOs.

A key aspect of the ICCTF is the coordination of donor efforts. The Department for International Development of the UK has been the single largest donor to date, already pledging firm support of roughly 9 million USD to the Fund, and a 50 million USD in a second phase. It is hoped that the ICCTF will grow to mobilise 100-200 million USD per annum.

A Steering Committee has been set up, consisting of representatives from BAPPENAS, the Ministry of Finance, National Council for Climate Change and foreign donors.

A Technical Committee is to support the Steering Committee on selection and evaluation of proposals and activities, based on key criteria such as cost effectiveness, the ability to generate co-benefits, and the feasibility of implementation by the relevant (sectoral) ministries.

The current Trusteeship is held by UNDP, and is expected to be transferred to a domestic body in the near future.

The involvement of other key stakeholders including civil society is yet to be detailed.

Source: BAPPENAS (2010)

With regards to the implementation of transport policy and projects;

- **The Ministry of Transportation (DEPHUB)** - formulates and implements transport policy at a national level, and oversees the actions taken in individual cities. The Ministry consists of various Directorate-Generals (DGs) for each of the main modes of transport (road, rail, maritime, and air). The DG for road transport is further split by function (urban, inter-city and rural transport).
- **The Ministry of Public Works (PU)** – is responsible for infrastructure development (including those for transport) at national level. However, in the case of Jakarta, almost all transport infrastructure is provided by local institutions (see previous section).

Financial institutions, which play a role in coordinating the budgets of various sectors include;

- **The Ministry of Finance** – who coordinates the overall budget of the Republic, and has launched a Green Paper on economic and fiscal policy strategies for climate change mitigation, focusing amongst others on the role of carbon taxes to increase the efficiency in the energy sector<sup>22</sup>.
- **The Coordinating Ministry of Economic Affairs** which coordinates mid-term budgeting (5 year periods);

In addition to the above ministries, large changes to regulation involving legislative changes at national level would require the approval of the parliament.

### 5.1.3 International institutions

In addition to the domestic stakeholders listed in the earlier sections, it is also imperative to consider the current and future role of international institutions with presence in Indonesia.

These include bilateral and multilateral aid agencies including;

- **The World Bank**, who in association with the Swiss Government, is providing training to local stakeholders on the issue of carbon finance. With respects to its Climate Investment Fund (CIF), transport has been identified as an area of importance, which, “if additional resources are available, a second phase of the Investment Plan is expected to address”.<sup>23</sup>
- **The Asian Development Bank (ADB)** – which focuses its transport support in the Republic mainly in the form of regional road development. Climate change (not specific to transport) is becoming an increasingly important aspect of its country support programme.<sup>24</sup>
- **The German Technical Cooperation (GTZ)** – who provides technical assistance and project implementation on both transport and climate change policy. A team of GTZ staff is working closely inside the Ministry of Transportation (Urban Transport Directorate), providing assistance in the form of the Sustainable Urban Transport Implementation Project (SUTIP). Furthermore, GTZ is working with BAPPENAS and MoE to strengthen capacity in climate policy.
- **The Japan International Cooperation Agency (JICA)** – who are extremely active providing technical and financial assistance in the Jakarta region. Their ongoing efforts include supporting the development of the Jakarta Transport Masterplan (SITRAMP), development of MRT as well as a pre-feasibility study on electronic road pricing.
- **AUSAID** – who (since recently) are supplying staff support within the Ministry of Transportation.
- **USEPA** – who are currently working with the Jakarta regional environment agency in supporting the monitoring of air pollution in the region.
- **AFD** - which provides since 2009 a Climate Change Program Loan, in the form of budgetary support to sustain Indonesian driven policy reform for dealing with climate issues and assist in the implementation of agreed policy targets/actions stated in the three year “policy matrix”. Key targets of the policy matrix consist of

<sup>22</sup> See <http://www.eastasiaforum.org/2009/12/09/indonesia-climate-green-paper-towards-carbon-pricing-geothermal-power-and-regional-incentives/>

<sup>23</sup> See <http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/CTF%20Investment%20Plan%20for%20Indonesia2.pdf>

<sup>24</sup> <http://www.adb.org/Documents/CPSs/INO/2009/COBP-INO-2010-2012.pdf>

mitigation, adaptation and cross-sectoral issues. It remains to be seen what proportion of this loan would be attributed to the transport sector.

- **The European Commission** – who recognises transport as a key element in allowing export-led growth of the Republic, and “in view of the signature of an air services agreement between the Community and Indonesia and of the critical importance of maritime transport in this region, ...[are] ready to provide technical assistance in these domains and to enhance regulatory convergence in the field of civil aviation.

Based on data from the OECD DAC database, the largest bilateral donors in the transport sector between 2004 and 2008 were Japan and Germany (see table below).

**Table 5: Summary of bilateral aid in the transportation sector**  
(Source: OECD, 2010)<sup>25</sup>

Donor	Total between 2004 and 2008 (5 year period, million USD)
<b>Japan</b>	311.68
<b>Germany</b>	217.74
<b>(IDA)</b>	189.02
<b>Australia</b>	24.15
<b>Spain</b>	21.98
<b>United Kingdom</b>	20.85
<b>Netherlands</b>	9.38
<b>United States</b>	3.85
<b>France</b>	3.3
<b>Belgium</b>	1.29
<b>Sweden</b>	1.21
<b>Korea</b>	1.14
<b>Norway</b>	0.4
<b>(EC)</b>	0.16
<b>Denmark</b>	0.14

## 5.2 The future role of institutions under the NAMA framework

The previous sections highlighted the wide range of stakeholders who collectively shape climate and transport policy. The roles of these institutions under a future NAMA arrangement must now be considered, accounting for their numerous existing efforts.

As a first step, it is imperative to spell out the main functions that would need to be fulfilled, in order to realise TDM as a NAMA. In general terms, these functions would include;

- **Planning** – for the TDM
- **Implementation** – of the elements comprising TDM
- **Measurement** – of the mitigation impact of TDM against a baseline
- **Reporting** – the measured mitigation to relevant authorities
- **Verification** – of the mitigation impacts of TDM
- **Financing** – or providing the budgetary resources for TDM

<sup>25</sup> Note: Figures for Asian Development Bank unavailable in the OECD DAC database.

The manner in which these roles are attributed to specific institutions is highly dependent on the type of NAMA being envisaged. In the following sections, three scenarios will be presented, corresponding to the NAMA typology of unilateral, supported and tradable NAMAs.

The information provided is based on a number of consultations held in Jakarta Indonesia in March, 2010 and thereby reflects the most up-to-date developments concerning the institutions named. However, as the topic of NAMAs and the domestic actions concerning mitigation actions are rapidly evolving, the assessment made here is to be considered as a snapshot of the revolving situation.

### **5.2.1 Institutional coordination under a unilateral NAMA approach**

As a unilateral NAMA, TDM would be seen (as described in Chapter 3) as one of many policies that would allow domestic (voluntary) mitigation targets to be met, principally at the local level but also at the national level when duplicated in other cities. In the latter case, an “umbrella NAMA” at national level could be developed, which would incorporate TDM (amongst other appropriate transport measures) as a package for it to contribute to the national mitigation target.

Here, the **planning** and **implementation** of the NAMA would most likely take place via the local-level authorities mentioned earlier, in particular the Deputy Governor and the Regional Transport Agency (DISHUB). This would be undertaken in the context of carrying out the existing Transport Masterplan.

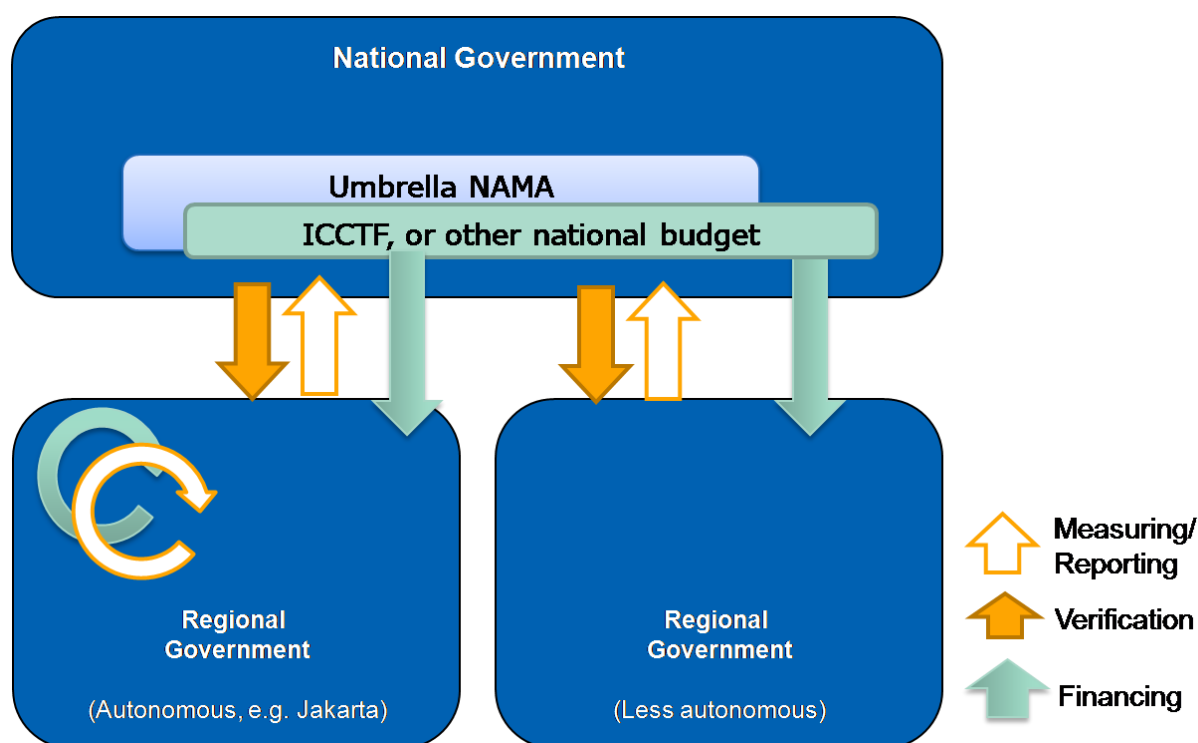
**Measurement** would be conducted with the aim to understand the contribution of TDM to meeting the local mitigation target. Here, the Regional Environment Agency (BPLHD) would play a major role in setting up a city-wide GHG inventory, and work with the (sectoral) implementing agencies including DISHUB to develop methodologies to calculate the baseline scenario as well as the measure the mitigation impacts of policies from that baseline. There is also a case that such methodologies could be provided by the Ministry of Transportation at the national level, so that similar efforts in other cities would remain comparable. This also has the benefit of making use of the transport expertise within the Ministry at the national level.

**Reporting** and **verification** would be conducted domestically, either at a local level (also by the Regional Environment Agency) or at the national level (Ministry of Environment) if efforts at local level were also to be included in a national registry of (unilateral) NAMAs.

**Financing** would originate from domestic sources, i.e. the general budget of the capital region of Jakarta, with potential (future) support from national players including BAPPENAS who administers the ICCTF. Further details on financing will be provided in Chapter 6.

Such a state is summarised in a simplified figure below, showing the relative roles of the national and regional governments. Note that more than one possibility is implied, e.g. one whereby Jakarta (as a highly autonomous region) takes actions relatively independent from the national government, and another whereby actions are coordinated through the national government, via an umbrella NAMA as previously noted, and supported in part by the ICCTF or other national budgetary resources. The latter may apply more in other cities which possess lower revenue raising power.





**Figure 21 : Possible institutional framework for TDM as a unilateral NAMA**

### 5.2.2 Institutional coordination under a supported NAMA approach

In the likely case that some form of international support is required, the coordination of institutions may begin to differ from that outlined above.

Here, the **planning** and **implementation** of the NAMA would remain principally under the responsibility of the aforementioned local-level institutions. However, there may be a large element of knowledge transfer and capacity building from international sources at this level.

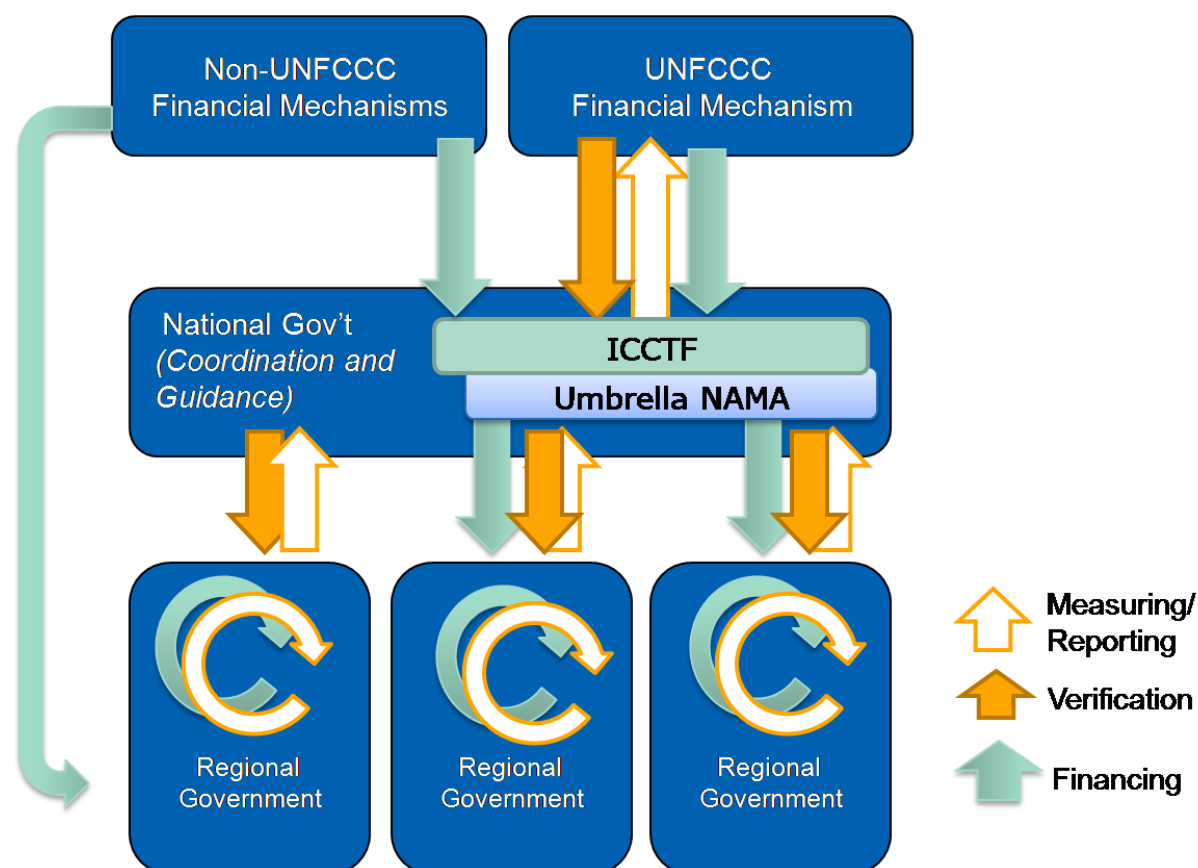
The robustness of **measurement** would need to be strengthened, for the TDM NAMA to be matched up against international support provided through the UNFCCC. To this end, there would be benefit for the national level ministries (MoE and MoT) to provide increased levels of coordination and guidance to their regional counterparts with regards to the methodological approach.

In this context, the Ministry of Transport could play a key role in supporting the actions taken at local level, through the provision, or facilitation of sharing standardized methodologies for the calculation of transport emissions (both for constructing the baseline as well as quantifying changes brought about by policy changes). This would be vital in scaling up good practice found within one city in Indonesia, to other parts of the country.

Similar to the case with the unilateral NAMA, **reporting** and **verification** would need to involve the national institutions (especially MoE and BAPPENAS) for inclusion in the NAMA registry. An “umbrella NAMA” at national level could be developed as was previously mentioned for the unilateral NAMA.

The majority of the **financing** is still likely to come from local sources, but combined with international support, which could be targeted at addressing bottlenecks including the transfer of key technologies (e.g. for ERP), infrastructure for BRT, technical assistance, and capacity building on MRV. NAMAs at local level could be matched up

against UNFCCC administered funding via the national government, where for example the ICCTF would be credited with resources to support an umbrella NAMA comprising TDM from different cities in Indonesia. Alternatively or additionally, non-UNFCCC financial mechanisms (including bilateral and multilateral donors including the Asian Development Bank) could support local efforts directly (e.g. providing a grant to the city government) or again via the ICCTF for further disbursement to local level. These scenarios are summarised in the figure shown below.



**Figure 22 : Possible institutional framework for TDM as a supported NAMA**

### 5.2.3 Institutional coordination under a tradable NAMA approach

Under a tradable NAMA approach, there would be a benefit in providing a high level of autonomy to the regional government, in line with the spirit of the city-wide approach to mitigation to promote actions that are in line with local priorities.

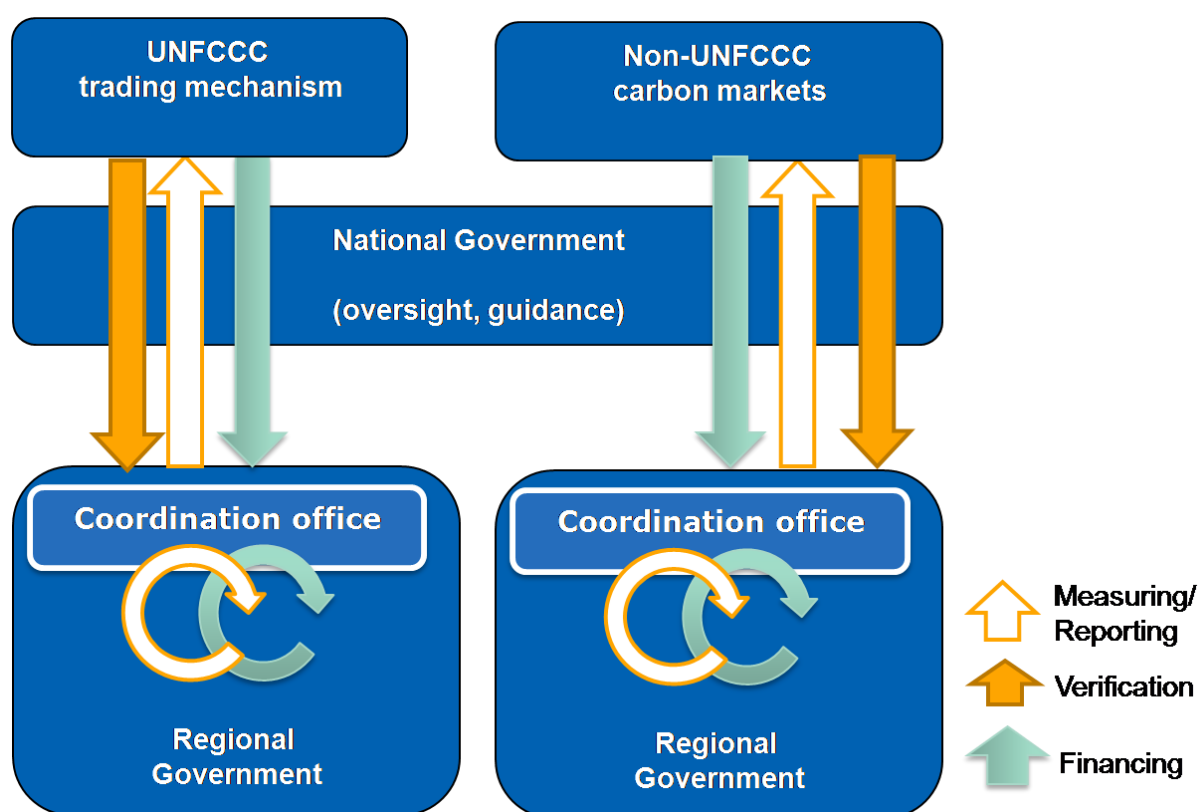
To ensure the strong coordination between sectors required for a city-wide approach, there may be benefit in setting up a coordination office at the highest political or administrative level, possibly under the Governor of Jakarta (see World Bank, 2010). This office would set up a city-wide programme of actions (including TDM) and draw upon key representatives from each appropriate sectoral implementing body (including BPLHD and DISHUB) to **plan, implement** and **measure** the mitigation actions.<sup>26</sup> **Reporting** may be conducted by the same office, to the UNFCCC directly, to be **verified** by the UNFCCC. **Financing** would come in the form of carbon credits, similar to the

<sup>26</sup> Such an office may also be useful to facilitate the coordination of unilateral or supported NAMAs, although care must be taken not to duplicate coordinating functions already served by e.g. the Local Environment Agency.

CERs or VERs under the current CDM and JI respectively. As stated in World Bank (2010) note that the development of a city-wide approach does not preclude the city from joining carbon markets other than the future UNFCCC administered market (e.g. CDM+). For example, Indonesian cities could join a regional carbon market for Southeast Asian cities, were such markets developed in the future.

National institutions can support such initiatives by the city, by providing support in terms of providing guidance on e.g. MRV methodologies.

The figure below depicts this situation in a simplified manner.



**Figure 23 : Possible institutional framework for TDM as a tradable NAMA**

Based on the above analysis, the following table summarises the relative roles of institutions at the various levels according to the type of NAMA being pursued for TDM.

**Table 6: Relative roles of institutions at various levels according to the type of NAMA**

	Local institutions	National institutions	International institutions
Unilateral NAMA	P, I, M, R, F	P, I M, R, V, (F)	-
Supported NAMA	P, I, M, F	I, M, R, (F)	P, I, (M), V, F
Tradable NAMA	P, I, M, R	(M)	P, I, M, V, F

P=planning, I=Implementation, M=Monitoring, R=Reporting, V=Verification, F = Financing

### 5.3 Key messages on Institutions

Based on this scoping analysis of local, national and international institutions, this chapter examined the respective roles and functions of institutions to create a robust and effective framework supportive of the TDM NAMA.

Whilst noting the specificity of the role of institutions for each type of NAMA (i.e. unilateral, supported and tradable), it is thought that;

- The **planning and implementation** of TDM activities would fall upon the local level, whereby the overall policy direction would be set by the Governor/Deputy Governor in close coordination with the Regional Transport Agency (DISHUB) and other implementing agencies.
- The **MRV** of the TDM NAMA would be coordinated by the Regional Environment Agency (BPLHD), based on a city level GHG inventory and possibly guided by the Ministry of Environment to allow it to be compatible with the national approach.

There would be a clear benefit in developing methodologies to measure transport emissions in close coordination with the Regional Transport Agency, as well as the (National) Ministry of Transportation to ensure that the approach is compatible with the characteristics and practical requirements of the transport sector. Such methodologies and associated data should be openly shared to allow maximum transparency and to invite continuous improvement by e.g. third parties.

- **Financial resources** under a unilateral or supported NAMA would mainly be made available through the local budgetary process, with partial support potentially coming from national sources for e.g. capacity building support. International funding would be matched against local actions through the national government, e.g. the ICCTF. Direct support to the local government is also not ruled out, particularly for non-UNFCCC mechanisms such as bilateral/multilateral climate funds and ODA channels. Under a tradable NAMA, Jakarta as a city would be expected to become the market entity, receiving from either the UNFCCC administered trading mechanism (e.g. CDM+) or non-UNFCCC carbon markets financing in return for MRVed emission reduction. In pursuing a city-wide tradable NAMA, consideration could be given to the establishment of a coordination office that overlooks efforts on MRV.

## 6 Financing Approach for TDM in Jakarta

This chapter focuses on the third pillar of the TDM NAMA, namely the envisaged financing approach to support its future implementation. It draws directly on the analysis provided in the previous chapter on institutions, as the way in which financial resources are channelled is directly related to the manner in which roles are shared and coordinated between institutions.

### 6.1 Financing requirements for TDM

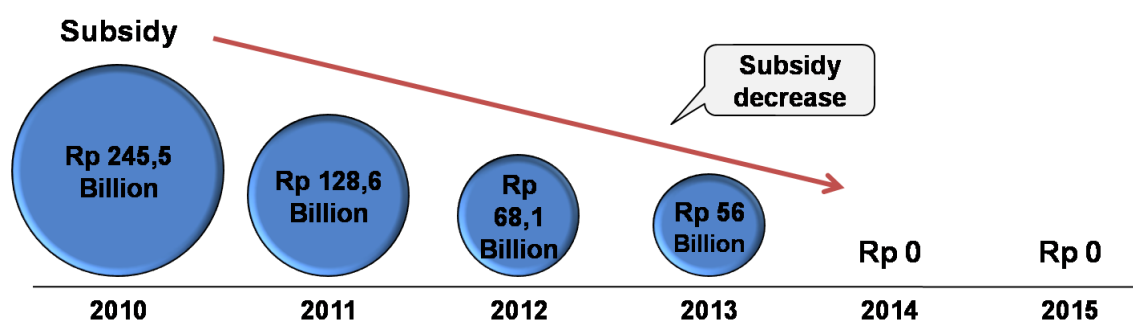
In firstly examining the nature of TDM from a financial (budgetary) perspective, it is firstly important to note that in general, TDM measures (and particularly those being considered under this particular case study) are generally revenue positive and possess very short payback periods (see table below from World Bank, 2010).

**Table 7: Payback periods of transport mitigation actions**  
(Source: World Bank, 2010)

Technology/ Intervention	Short-Term Payback (under 5 years)	Medium Term Payback (5–10 years)	Long Term Payback (10+ years)
Transport	Optimization of traffic signals; Fuel efficiency vehicle standards; Congestion taxes/tolls	Alternative fuels for public buses, taxis; Bus rapid transit systems	Modal shifts; Vehicle inspection and maintenance; Changes in land use patterns

Evidently, both ERP and parking restraint (in the form of parking charges) provide direct and significant revenue for the city. Ironically, as was highlighted in Chapter 3, one key reason for the ERP scheme not to be allowed support by Japanese ODA was due to the payback period being too short.

The BRT service, although currently being subsidised for its operations (14% of the cost per passenger), is expected to become self supporting at least in terms of its operational costs, by the year 2014 (see figure below).



**Figure 24: Transjakarta's plan for subsidy reduction (Source: ITDP, 2010)<sup>27</sup>**

Jakarta, with its relatively strong taxation base, is therefore thought to require low levels of financing, at least in absolute terms.

<sup>27</sup> US\$1 = IDR 9300 as of May, 2009 (Harmonised with CIF figures)

However, as noted in Chapter 3, the current lack of adequate TDM measures suggest the large possibility for international support to be useful, particularly if targeted at “bottlenecks”. For example, capacity building for MRV was highlighted as a key barrier to the implementation of policy.

Furthermore, elements of TDM may also be supported in its initial stages, to overcome short-term shortfalls in budgetary resources, and to incentivise their rapid diffusion. For example, ERP involves significant set-up costs due to its heavy reliance on information technology. Although in a developed country context, the set-up cost of the London Congestion Charge was approximately GBP 161.7 million, or roughly USD 242.6 million.

To provide adequate upfront support for these elements, the financing would ideally be required ex-ante.

With this in mind, it may be useful to outline the core items of the TDM which would require financing. These include both;

- The **hardware**, i.e. infrastructure/technology
- The **software**, including operation, maintenance, enforcement, and MRV

In the context of international support, the former typically takes the form of **loans** and **grants**, whereas the latter is given in the form of **technical assistance/ capacity building**.

The table below shows examples of hardware and software in need of financing for TDM to be realised. Note that most of these elements (even those surrounding hardware) require some form of capacity building or knowledge transfer for their effective deployment and development.

**Table 8: Items subject to financial support**

	Category	Electronic Road Pricing	Parking Restraint	BRT Improvement
Hardware requirements	<b>Infrastructure / technology</b>	<ul style="list-style-type: none"> <li>Set up of the electronic road pricing system, e.g. gantries, payment systems, surveillance cameras, on-board units etc.</li> </ul>	<ul style="list-style-type: none"> <li>Equipment for parking restraint, including payment systems for parking charges, video cameras for monitoring etc.</li> </ul>	<ul style="list-style-type: none"> <li>Public transport vehicles, including BRT, Bus ways, terminals, information systems etc)</li> <li>Bus ways, terminals, information systems etc)</li> </ul>
Software requirements	<b>Operation / maintenance</b>	<ul style="list-style-type: none"> <li>Maintenance of infrastructure of the tolling system.</li> </ul>	<ul style="list-style-type: none"> <li>Salary of traffic wardens</li> </ul>	<ul style="list-style-type: none"> <li>Maintenance of both vehicles and infrastructure for public transport</li> </ul>
	<b>Enforcement</b>	<ul style="list-style-type: none"> <li>Policing to ensure appropriate enforcement of ERP.</li> </ul>	<ul style="list-style-type: none"> <li>Enforcement of the regulations on parking, e.g. by police, providing adequate salaries to reduce corruption.</li> </ul>	<ul style="list-style-type: none"> <li>Enforcing of bus priority etc.</li> </ul>
	<b>MRV</b>	<ul style="list-style-type: none"> <li>Developing local-level GHG inventories</li> <li>Developing methodologies for measurement</li> <li>Setting up data collection systems (OD surveys, traffic count surveys, fuel sales etc) , addressing also co-benefits such as air quality monitoring.</li> </ul>		

		<ul style="list-style-type: none"> <li>Monitoring (ongoing data collection)</li> </ul>
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## 6.2 Financing approaches under the three NAMA types

In considering whether and how the above categories of items could be supported by international support, it is imperative to recognise that (as with institutions), the financing approach is likely to differ according to the three types of NAMAs detailed throughout this report, i.e. unilateral, supported and tradable. This is explained in detail in the following sections.

### 6.2.1 Financing under the unilateral NAMA approach

By definition, TDM when implemented as a unilateral NAMA, would not receive external financial assistance.

In the context of the strong autonomy of the capital region of Jakarta (including in a financial sense), the majority of items previously listed would be financed through the general budget of Jakarta.

As identified in Chapter 3, such a prospect is feasible, particularly in the long run when key barriers have been addressed.

Once TDM is fully in place, the extra revenue generated from e.g. ERP and parking charges would be made available for either;

- Further investment in the transport sector towards realising the Masterplan
- Supporting investments in other crucial sectors.

This is addressed further in the next chapter on future outlook.

### 6.2.2 Financing under the supported NAMA approach

Particularly in the short term, it is thought that TDM could benefit from international support to address the key “bottleneck” issues which have so far limited their implementation in Jakarta. This includes for example;

- **Transfer of key technologies**, for example automatic number recognition systems to implement and enforce Electronic Road Pricing
- **Technical assistance** in areas such as ERP design, BRT routing and integrated ticketing, and setting of optimal parking charges.
- **Capacity building** of staff within local and national institutions on MRV, including the improvement of data collection techniques and the formulation of methodologies. Such support could also encompass the provision of and training for the use of instruments to monitor air quality, which would assist in monitoring the co-benefits of mitigation actions.

There are generally three channels through which such international support could be matched up against these needs.

Firstly, resources could be sought **independent** of the NAMA framework, from bilateral and multilateral donors who already provide such types of support already (see Chapter 5 for support already provided by international institutions in Indonesia). Donors would engage directly with the local level institutions in supporting their needs.

Specific sources of such funding opportunities may include (amongst others);

- The **Climate Investment Fund**, which has designated transport as a key priority to potentially address in its second phase of support in Indonesia.

- **Cities Development Initiative for Asia** (founded by ADB and BMZ), which supports the identification and development of urban investment projects in the framework of existing city development plans that emphasize urban environmental improvement, urban poverty reduction, climate change mitigation or adaptation and good urban governance.
- **The Sustainable Transport Partnership Facility** launched in May 2010 by the Asian Development Bank, to support the implementation of its Sustainable Transport Initiative.
- **JICA**, who already finance a significant portfolio of TDM relevant projects/programmes. These could be re-examined in light of supporting mitigation actions at city level.

Each of these (and any other non-NAMA funding source) is likely to have different criteria to assess the eligibility of the TDM measures to receive funding. However, they would commonly contribute to making TDM work (for the sake of its co-benefits) or to enable it to become a MRV-NAMA. A benefit of the above non-UNFCCC mechanisms is their general ability to provide upfront, ex-ante support.

Secondly, external (donor) funding could be channelled through the Indonesian Climate Change Trust Fund (ICCTF), and more specifically through the Energy Window provided therein. Receiving support through the ICCTF, as shown in Box 1, would require TDM (in line with any other proposed NAMA to be financed by the ICCTF) to demonstrate cost effectiveness, the ability to generate co-benefits, and the feasibility of implementation by the relevant (sectoral) ministries. In future, the development of a separate transport window could also be beneficial in highlighting the importance of mitigation actions in this sector. The ICCTF could provide loans in areas where international donors may not provide them, for example for ERP which was noted as having too short of a payback period to allow loans from JICA. Again, it remains to be seen whether the ICCTF would be expanded in the future to allow the support for local level activities.

Thirdly, if support were to be sought from the envisaged Post-2012 financial mechanism (e.g. the so-called Mitigation Fund, or the Copenhagen Green Climate Fund<sup>28</sup>), there is likely to be a requirement to match these items of support with the NAMA through a registry likely to be maintained at a national level. Whether the ICCTF would become the main mechanism for this matching process remains to be seen. Central to ensuring that the future Post-2012 financing mechanism is supportive of the aforementioned elements, is the ability of such mechanisms to allow upfront, ex-ante financing.

### **6.2.3 Financing under the tradable NAMA approach**

Under a tradable NAMA approach and utilising the aforementioned city-wide approach, financing would be provided against carbon credits which accrue to the city as a result of its programme of mitigation actions.

This contrasts with current crediting schemes such as the CDM, which (despite recent trends towards incorporating actions at programmatic level) are still oriented towards actions on a project level.

It was noted earlier that a prerequisite to TDM measures being considered as part of the city-wide programme is to ensure the appropriate MRV capacity to be developed. Once the current deficit in the methodology and data to allow robust MRV is resolved (e.g. through a phase of capacity building), TDM would become a part of the city-wide approach and start contributing to the generation of carbon credits.

Once this occurs, there will be an automatic incentive for the city to develop TDM even further, so as to generate further carbon credits from it.

<sup>28</sup> This assumes that the Copenhagen Green Climate Fund, noted within the Copenhagen Accord, would through the ongoing negotiations be incorporated into the Post-2012 financing mechanism of the UNFCCC.



### 6.3 Key messages for Financing

The following points summarise the key issues related to financing the TDM NAMA as explored in this chapter;

- In general, TDM measures (and particularly those being considered under this particular case study) are generally revenue positive and possess very short payback periods.
- However, the current lack of adequate TDM measures suggests the large possibility for international support to be useful, particularly if targeted at “bottlenecks” including;
  - **Transfer of key technologies**, for example automatic number recognition systems to implement and enforce Electronic Road Pricing.
  - **Technical assistance** in areas such as ERP design, BRT routing and integrated ticketing, and setting of optimal parking charges.
  - **Capacity building** of staff within local and national institutions on MRV, including the improvement of data collection techniques and the formulation of methodologies, including those surrounding air quality monitoring to track progress of the co-benefits of mitigation actions.
- The way in which the TDM NAMA is financed depends greatly on the type of NAMA assumed. As a unilateral NAMA, the majority the financing for TDM is thought to be financed through the general budget of Jakarta. As a supported NAMA, funds may either flow directly from a non-UNFCCC donor, through the national level (ICCTF), through a nationally administered NAMA registry, or a combination of the three. Under a tradable NAMA approach, the city would receive funding against carbon credits generated by its mitigation actions.



## 7 Outlook and next steps

### 7.1 Overview

This report looked at a package of Transport Demand Management (TDM) measures (Parking restraint, Electronic Road Pricing and further improvement of Bus Rapid Transit) as a potential Nationally Appropriate Mitigation Action, which would contribute to the mitigation of greenhouse gases from the transport sector in the Indonesian capital region of Jakarta. Such actions were shown to contribute to meeting the ambitious voluntary mitigation targets set at both the local level (-30% below the baseline by 2030) and, particularly when transferred across cities in Indonesia, the national level (-26% below the baseline by 2020).

Application of TDM to all three types of NAMAs were considered, including unilateral, supported and tradable.

- **TDM as a Unilateral NAMA** - Because TDM heavily relies on domestic intervention at policy level (e.g. setting up and enforcing regulations, planning entire networks etc), it is thought that TDM may be appropriate as a unilateral NAMA, at least in the long term. In financial terms, many aspects of TDM (including parking restraint and Electronic Road Pricing) are self revenue-generating, and the capital expenditure necessary for the implementation of ERP and BRT are also relatively small compared to larger transport projects such as the construction of a new ring road or a MRT system.

However, the current lack of effective TDM in Jakarta as well as the limited institutional, financial and technical resources to implement TDM measures (as shown earlier) leads to the conclusion that at the moment, Jakarta may benefit from further (international) support to accelerate the implementation of TDM.

- **TDM as a Supported NAMA** - Given the above context, it is thought that there are many ways in which TDM can be supported by the international community, in terms of capacity building, technology transfer and financing. The effects of such types of support can already be seen to some extent – for example, the model adopted by Bandung University was originally developed as part of Overseas Development Assistance by the Japanese Government. The data used in the model was also collected under the same assistance package. It is foreseen that TDM may be an ideal subject for supported NAMAs.
- **TDM as a Tradable (crediting) NAMA** - The level at which the intervention takes place (i.e. a city or district-wide level) would not make TDM inductive to a project-based crediting mechanism, such as the current CDM. Such an approach would need to overcome key challenges which include<sup>29</sup> (but are not limited to);
  - Setting a reliable baseline (business as usual) case for transport emissions from Jakarta
  - Accounting for external factors, such as the growth of the city size, migration, etc
  - Separating the impact of TDM measures against those from other policy interventions

From this analysis, it is generally thought that in the short term (including the current moment), TDM would be most appropriate as a supported NAMA, whereby support could be provided particularly around MRV (data collection and the development of methodologies).

<sup>29</sup> It should be noted that in certain instances these would also apply to MRV for a supported NAMA.

This would allow TDM to move increasingly towards;

- A unilateral NAMA, whereby TDM becomes financially self-servicing, and “graduates” from international support, or
- A tradable NAMA, whereby the MRV is robust enough for TDM to generate credits for the local government as a component of a city-level crediting mechanism.

This does not imply that elements of international support (particularly around knowledge and technology transfer) would need to be fully retracted in the future. Such types of support are thought to be beneficial also in future years.

**Table 9: Applicability of TDM to the three types of NAMAs**

	Unilateral	Supported	Tradable
Short term	★ ★ ☆ ☆ ☆	★ ★ ★ ★ ★	★ ☆ ☆ ☆ ☆
Long term	★ ★ ★ ★ ★	★ ★ ★ ☆ ☆	★ ★ ★ ☆ ☆

## 7.2 A Roadmap for the TDM NAMA

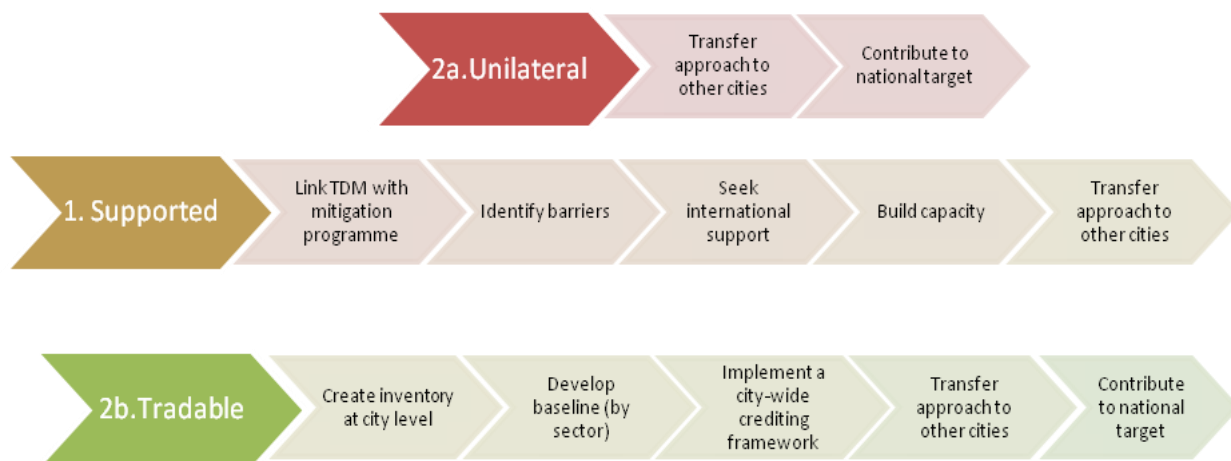
Based on these premises, the following are suggested as the key next steps which are required to ensure the successful implementation of the TDM NAMA, and ultimately for it to fully contribute to the mitigation of transport emissions in Jakarta and more widely in Indonesia as a whole.

### In the short term (next 2 years) - mainly as a supported NAMA:

- At the local level, TDM is to be explicitly acknowledged as a key element of a city-wide mitigation action programme to contribute to the local mitigation target. At the national level, TDM and its key elements could be included within the mid-term planning document (RPJM) as well as other strategic documents such as the Sectoral Roadmap on transport mitigation actions led by BAPPENAS, which already includes elements of TDM such as BRT.
- The main barriers to the full implementation of TDM as a MRV NAMA could then be mapped out. Aspects which can be addressed using international support (e.g. capacity building for MRV, transfer of crucial technology, and technical assistance on TDM measures), could be contrasted with other aspects that can be addressed domestically (e.g. legislative changes)
- International support could be actively sought based on the above assessment. In the absence of the timely operationalisation of a UNFCCC financial mechanism, funding from alternative existing sources such as the Climate Investment Fund or bilateral assistance could be sought.
- Multilateral and bilateral development agencies including the Asian Development Bank (e.g. its Sustainable Transport Initiative), could contribute in the areas of data collection, further pilot projects and capacity building prior to the NAMA framework being fully in place, and would serve an important, transitional role to enable transport NAMAs.
- Utilising the international support, technical capacity and the institutional framework to support MRV must be built. Here, the close institutional coordination horizontally (between regional agencies including DISHUB and BPLHD) as well as vertically (between regional and national agencies such as

between BPLHD and MoE, DISHUB and DEPHUB) would become vital to ensure the most robust and harmonised formulation of MRV methodologies.

- Furthermore, the development of a city-wide approach towards mitigation could be considered, including the creation of a coordination office under the Governor, formulation of a city-wide programme of mitigation actions (directly linked to the -30% mitigation target of Jakarta), the development of a local GHG inventory, and the generation of standardized methodologies to MRV the impacts of TDM.



**Figure 25: Roadmap for the future**

#### **In the long term (2+ years) - mainly as a unilateral or tradable NAMA:**

- Depending on the developments during the first two years, both domestically and internationally (particularly surrounding the financial framework for NAMAs<sup>30</sup>) the relative advantages and disadvantages of pursuing a unilateral vs. tradable NAMA approach could be reassessed.
- If a unilateral NAMA approach is judged appropriate, duplication in other cities across Indonesia could be sought, whereby those cities with less capacity/ financial resources for implementation may be supported by domestic (national level) financial assistance e.g. through the future development of the ICCTF as a mechanism inclusive of mitigation actions at local level, and in every sector.
- If a tradable NAMA approach is shown to be workable, duplication of the approach in other cities across Indonesia may become feasible, facilitated for example by the sharing of methodology by the MoE/MoT. Setting up a city based carbon market could also be considered, whereby cities within Indonesia can trade credits with those in developed countries.

### **7.3 Recommendations for key stakeholders**

In light of the anticipated road ahead, the following recommendations are made for stakeholders at local, national and international level.

<sup>30</sup> The nature, scale and governance surrounding the Post-2012 financing framework (NAMA funding) remains unclear. If the new framework is inclusive of city-level crediting, the tradable NAMA approach should be pursued. Absent such developments, a unilateral NAMA could still be pursued.

### **7.3.1 Recommendations for local stakeholders**

- Revise existing legislation and practice which hamper the wider implementation of TDM measures, for example on ERP.
- Ensure strong and continuous political drive towards meeting the local mitigation target, and translate these into implementable tasks through e.g. a city-wide mitigation programme/roadmap.
- Consider the creation of a coordination office in charge of the above city-wide mitigation programme/roadmap, directly under the stewardship of the Governor, and supported by the Regional Environment Agency.
- Involve the civil society in the decision making process, and fully utilise their knowledge and skills on TDM.
- Communicate the social, environmental and economic co-benefits of TDM to help secure political commitment and the buy in of local residents.

### **7.3.2 Recommendations for national stakeholders**

- Revise national legislation (e.g. surrounding traffic management) which conflicts with local priorities and wishes to implement effective TDM strategies.
- Actively support local-level action by providing guidance on e.g. MRV methodologies, led for example by the MoE.
- Ensure harmonisation across Indonesian cities in their MRV methodologies, to ensure comparability of efforts and aggregation of figures at the national level, so that local actions can count effectively and accurately toward national mitigation targets.

### **7.3.3 Recommendations for international stakeholders (including climate negotiators)**

- Ensure that the future NAMA framework can accommodate actions taken at the local level, e.g. in the format of the NAMA registry, the allowance for a city-wide programme for mitigation etc.
- Proactively increase and coordinate international (donor) support efforts in Jakarta and more widely in Indonesia, to ensure effective and harmonised support for MRV methodology, and TDM strategies.
- In particular, support the development of a city-level GHG inventory which could pave the way towards a city-wide approach to carbon mitigation, potentially linked with existing efforts such as those by EPA on air pollution monitoring.
- Develop south-south transfer mechanisms through which good practice in one city (e.g. Jakarta) could be transferred and upscaled in other developing cities, thus catalysing further mitigation
- With regards to multilateral/bilateral development agencies, fully consider how their portfolio of support in transport can contribute to the enactment of transport NAMAs in the future, e.g. through support for data collection, further pilot projects, capacity building etc.

## **7.4 Outlook for the future**

These recommendations, as well as the roadmap presented earlier, would need to be revised in light of the anticipated developments of the future, including;

### **At the local level;**

- The way in which the local mitigation target will be translated into actions.

**At the national level;**

- The manner in which national level institutions will be given responsibility on key issues such as MRV and the formulation of NAMAs.
- The way in which the ICCTF would evolve, and the degree to which it would support local-level actions in the transport sector.

**At the international level;**

- The way in which the international negotiations will proceed in 2010, with new expectations that a legally binding agreement would only be possible in 2011, at the COP17 in Johannesburg.
- Developments in non-UNFCCC climate financing instruments, including the Clean Investment Fund administered by the World Bank, the kick-start finance pledged in the Copenhagen Accord, and other multilateral/bilateral initiatives.
- The programmes and actions of multilateral and bilateral development agencies including the Asian Development Bank (including its Sustainable Transport Initiative), who could contribute in the areas of data collection, further pilot projects and capacity building prior to the NAMA framework being fully in place, and would serve an important, transitional role to enable transport NAMAs.

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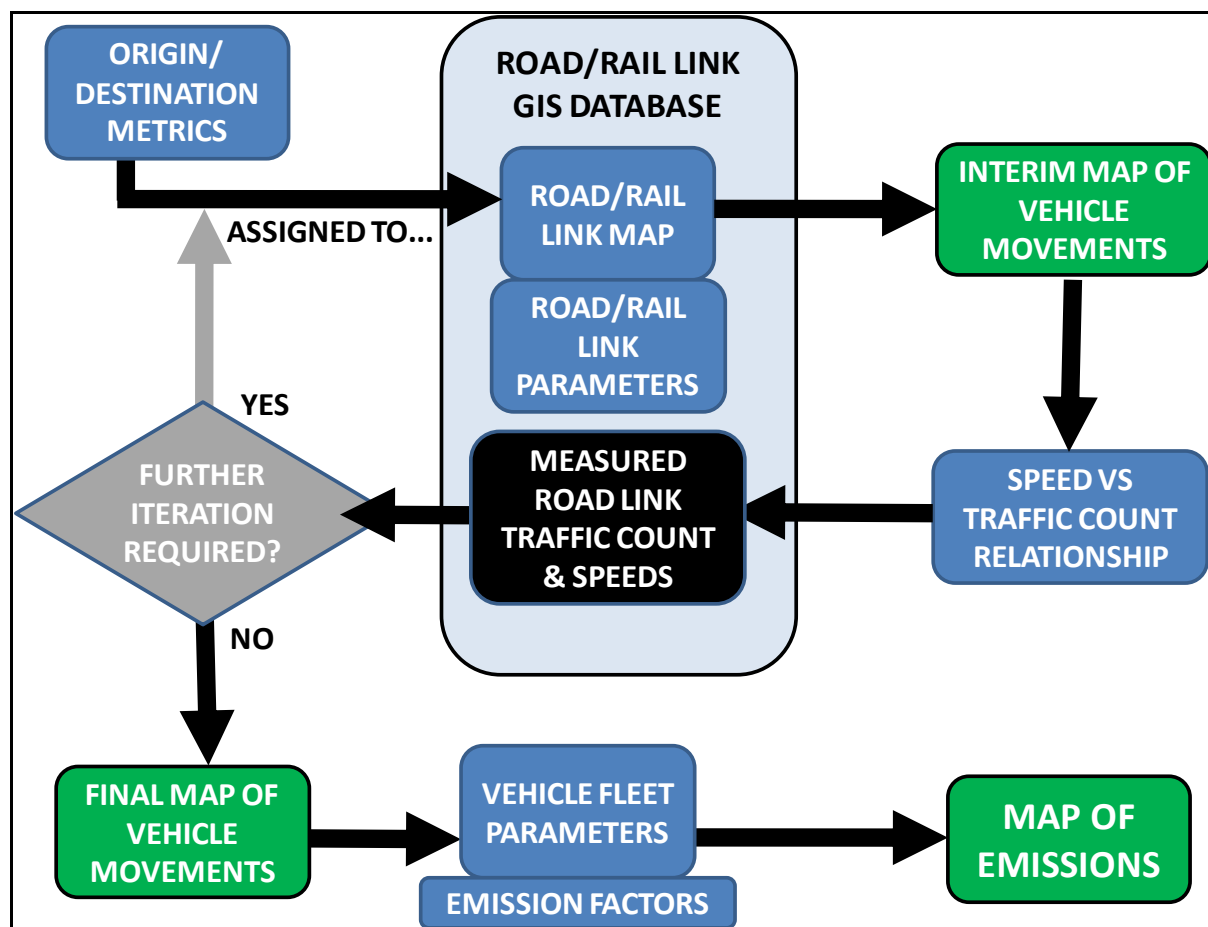
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## Appendix A: Details of the Model

### A.1 Introduction

The model used by the University of Bandung is based on the EMIT3 modelling software, and is an equilibrium flow model. A road and rail network is constructed, origin and destination metrics are determined, and traffic flows are then assigned to the different road links by using an iterative process. In this way, the model “solves” the spatial pattern of transport demand across the available network by balancing the “pressures” across the different parts of the network.



**Figure 26: A schematic diagram of the Jakarta Transport Model**

The equilibrium flow approach assigns travel to the different modes of transport as required to equalise the pressures across the different sections of the network. However, it is not currently clear to what extent the parameters affecting modal choice are accounted for as standard in the model (e.g. behavioural change factors such as discounting the price of public transport).

The model operates with passenger kms (and tonne kms), rather than vehicle kms. So parameters such as occupancy levels, or vehicle fleet parameters (which determine fuel consumption, and therefore carbon emissions) are extremely important in subsequently calculating accurate emissions to air. For example, occupancy levels in private cars will have a direct relationship with the carbon emissions. Also, vehicle speeds become very important, because at the very low speeds typically observed in Jakarta, fuel economy

becomes significantly worse. These are areas of high uncertainty, and are considered in more detail in the sections below.

The model incorporates the road transport network (with a mode resolution of cars, motorbikes, buses, and lorries). Inclusion of trams or monorail types systems are considered under the different scenarios, but may be achieved by simply adding links to the network with the appropriate properties (such as flows across the relevant network links).

Scenarios are modelled by either making changes to the origin/destination metrics, the road/rail network, or the vehicle fleet parameters.

Changes to the origin/destination metrics are associated with scenarios which affect the demand for travel (either in a spatial sense, or absolute levels).

Changes to the road/rail network may be small, or very large. At the smaller scale, it would be possible to e.g. change a two-way road link to a one-way link, to investigate the changes to the traffic flows. At the larger scale, it is possible to investigate the impacts of introducing an entire network of BRT.

Changes to the vehicle fleet parameters are typically made to investigate scenarios such as discounting the price of newer vehicles to promote fleet turnover.

It is clear that the model is very flexible, allowing it to reflect the details associated with the introduction of a wide range of very different measures.

## A.2 Input datasets

The following sections consider the input data that is used for the model. Each section considers the data quality/extent, whether there is any additional data which could be incorporated, and whether the dataset is a priority for improvement.

As a general observation, the model methodology is reasonably well developed, but there is a severe shortcoming in the quality<sup>31</sup> and extent of the available input data. This will need to be addressed if the model is to be developed to a level which is of sufficient quality to meet even relatively modest levels of MRV requirement.

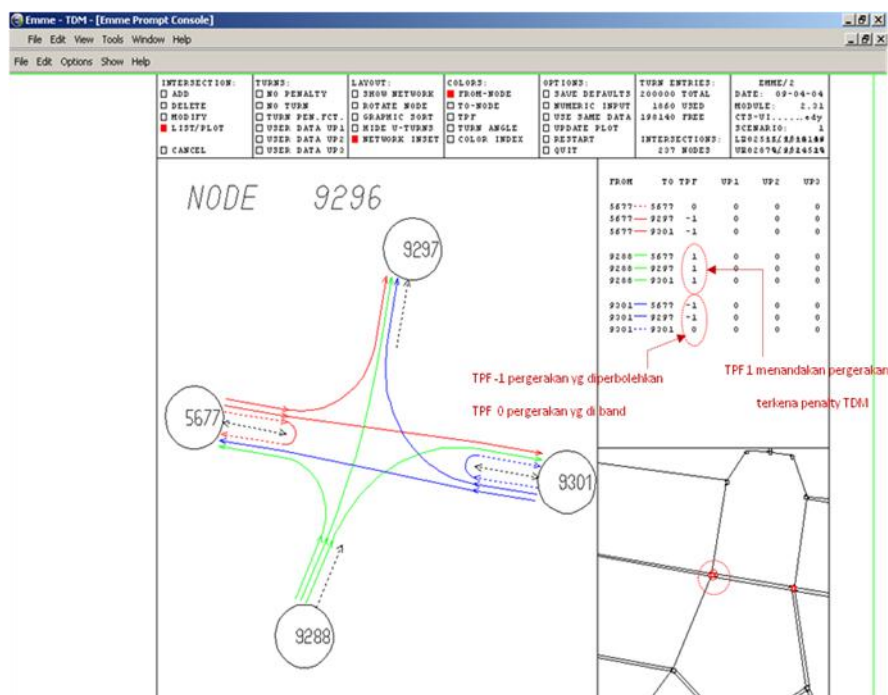
### Road Link Dataset

Current data quality/extent	★★★★☆
Current availability of additional data	☆☆☆☆☆
Priority for improvement	☆☆☆☆☆

The road link dataset not only includes the location of each of the road links, but also a number of parameters for each link, e.g. number of lanes, direction of traffic flow and capacity. As a result, this dataset is considered to be of a high standard.

An example of the road link information that is available, and the user- interface, is shown in the following figure.

<sup>31</sup> Throughout this report, the term “quality” is taken to include transparency, accuracy, completeness, consistency, comparability, and up to date.



**Figure 27: Example of road link data parameters**

Parameters such as road link speed and vehicle count are included in the same database (see Figure 3.2), but considered separately, in more detail, below.

#### Origin/Destination Metrics

Current data quality/extent	★★★★☆
Current availability of additional data	★☆☆☆☆
Priority for improvement	★★★★☆

The origin/destination dataset is compiled to indicate the spatial “demand” for transport across the road network. The data are collected by ad hoc surveys, which target people on the road and those who call at petrol stations. It was only possible to gather a little information on the extent of the surveys during the in-country visit. So the assessment of these data must be considered provisional. However, it is understood that the dataset is several years old, and would therefore benefit from being updated. It is also thought that the sample size would need to be significantly increased to improve coverage.

It has been suggested that there may be a limited amount of data collected which corresponds to more recent years than that currently incorporated into the model (although this would need clarification/confirmation). As this dataset provides the spatial demand for travel to the model, it is a very important input dataset to the modelling. A high priority has therefore been assigned to developing this dataset further.

#### Road Link Traffic Count

Current data quality/extent	★★★★☆
Current availability of additional data	☆☆☆☆☆
Priority for improvement	★★★★☆

There is a network of traffic count points in Jakarta. These provide levels of traffic flow and speed on specific road links. This information is then used in the equilibrium flow calculations to ensure that the calculated vehicle kilometres are scaled to the measured traffic flow data.

However, in Jakarta there are a number of difficulties associated with obtaining good quality traffic flow data. The majority of data collection is by using induction loops. These are often located at sites which have several lanes, and are subject to heavy congestion. When traffic speeds are near standstill at carriageways of several lanes, it is difficult to get reliable count data from induction loops. In addition, motorbikes are used extensively in Jakarta. During congestion, these weave between stationary cars, again causing difficulties in interpreting the count data.

Some traffic flow data are obtained by manual traffic counts. However, there are anecdotal comments which suggest that these data are not particularly reliable, and are perhaps scaled up from a relatively small period of time when counts are actually made.

General improvements to the dataset could be achieved by including a larger number of measurement sites across the network, and compiling a more comprehensive set of high quality data. One way of improving data capture is to site two or more induction loops at the same measurement point, but across different lanes of the carriageway. By sampling lanes individually, it should be possible to considerably improve the data quality. However, it is recognised that this would require a significant investment in measurement equipment.

#### Road Link Flow/Speeds

Current data quality/extent	★★★★☆
Current availability of additional data	☆☆☆☆☆
Priority for improvement	★★☆☆☆

A relationship between hourly traffic count and vehicle speed is included in the model for each road link. This is done by selecting the traffic count data which gives the highest count for a one hour period i.e. "free flowing" traffic, and obtaining the corresponding average vehicle speed (at each measurement point). An empirical relationship is then used to determine how the speed decreases with higher vehicle counts at each measurement point. These are then applied to road links across the network, to give vehicle count and speed on an hourly resolution for the road network.

However, it should be noted that the speed information is not used in determining the average emission factors for each of the vehicle classes.

As mentioned above, it would be useful to extend the measurement dataset which is available. It would also be advisable to consider how more real data could be used, rather than empirical relationships. However it is likely that scope for improvement here is limited without additional measurement.

Congestion is a major problem in Jakarta, and many road links have very low speeds at peak times. Assessing these low speeds is important, as the fuel efficiency of the vehicles is very sensitive to speed at lower speeds (as well as being higher in uncertainty).

#### Vehicle Occupancy

Current data quality/extent	★★☆☆☆
Current availability of additional data	☆☆☆☆☆
Priority for improvement	★★★★☆

The general approach of the model is to characterise vehicle flows of people across the network. Whilst this is of great value to planners, it provides limited information on carbon emissions, unless the movement of people can be accurately converted into vehicle movements, which in turn are converted into emission estimates (see also Vehicle Fleet Data below). One significant drawback of the current model is that the relationship between vehicle movements and emissions to air is rather simple.

It is important to characterise the occupancy levels of all modes of transport, as it not only allows the relationship between people movements and vehicle movements to be determined, but also the unused capacity of each of the modes.

Current occupancy levels have been determined from traffic surveys. The extent of these surveys is not clear, but it has been suggested that the data would benefit from both an update and the undertaking of a more comprehensive survey.

There are similar surveys for freight movements, to determine the average tonne kms.

#### Vehicle Fleet Data

Current data quality/extent	★☆☆☆☆
Current availability of additional data	★★★☆☆
Priority for improvement	★★★★★

The only fleet specific information used in the calculation of emissions is the split of movement data into different vehicle types- cars, motorbikes and buses. The movement data (by vehicle type) from the road network is combined with average emission factors to calculate the emission.

To improve the reliability of the emissions calculation, a number of fleet specific parameters should be used. In Indonesia, vehicle registration plates include a "regional" code. So if information on the national vehicle fleet was made available, selecting the Jakarta subset from the national registration dataset should be relatively straightforward. This would allow the following parameters to be included in the emissions calculation:

- Vehicle age (and therefore improved estimates of fuel efficiency)
- Engine size
- Fuel type (petrol/diesel/other)
- Engine technology or standard (catalyst and/or "Euro" emission standard etc. Linked to vehicle age)
- Degradation rates (gradual decrease of fuel efficiency or catalyst performance with age).

Currently it is assumed that all vehicles are either petrol or diesel engine, with no electric vehicles, hybrids, CNG or LPG vehicles. This is a reasonable assumption. Hybrids are considered in future scenarios (emissions are simply scaled down from the base case diesel/petrol emissions).

In Indonesia there is no price differential between DERV and "red" diesel. So the illegal use of off-road fuel by road vehicles is not considered to be an issue.

#### Emission Factors

Current data quality/extent	★★☆☆☆
Current availability of additional data	★★★☆☆
Priority for improvement	★★★★★

Improvements to the emission factors relate to the points made under Vehicle Fleet Data above.

The emission factors currently used in the model are not varied across the time series to represent increased vehicle efficiencies or changes in average engine size, petrol/diesel mix etc. However a scenario has been undertaken which does vary the EFs across the time series to account for improved efficiencies.

When improved vehicle fleet information becomes available, then it will be possible to include emission factors which vary with time in the base case projection.

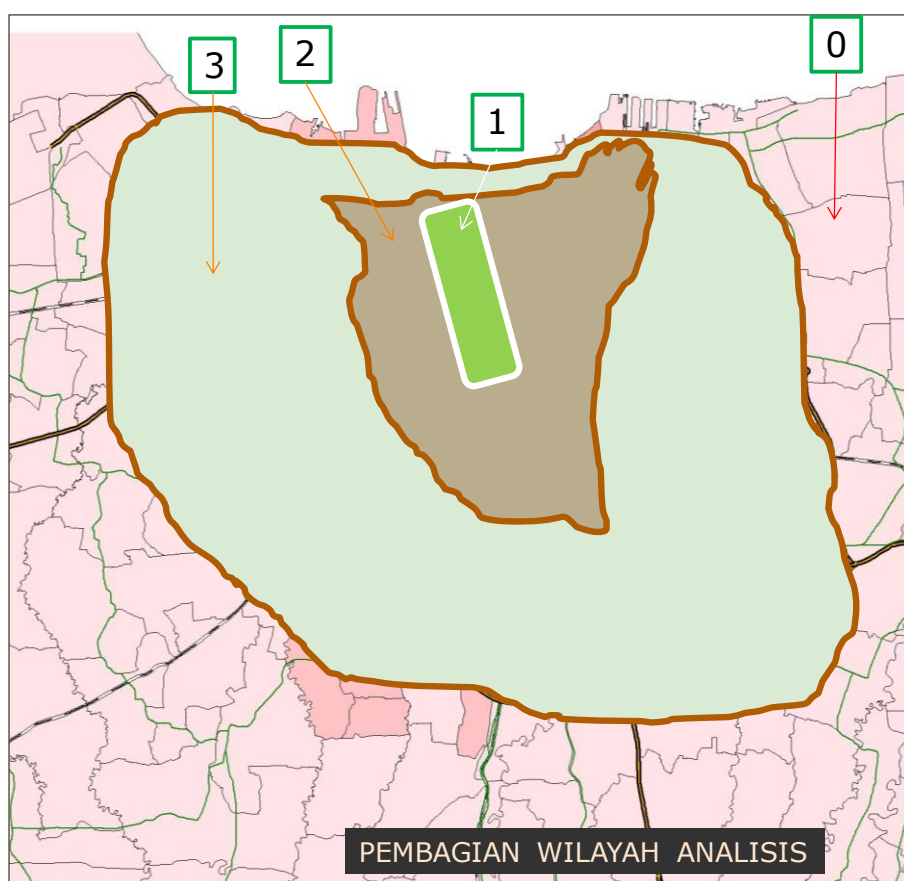
### A.3 Other model parameters

#### Spatial Resolution, Geographical Extent and Boundaries

Current data quality/extent	★★★★★
Current availability of additional data	★☆☆☆☆
Priority for improvement	★☆☆☆☆

The model is run at the resolution of individual road links, providing a high spatial resolution.

The geographical extent of the road network coverage encompasses all of Jakarta and is shown by the outer brown border in Figure 28 below:



**Figure 28: Geographical extent of the Jakarta modelling**



There is a substantial amount of traffic moving into and out of the model extent through the course of a day. The flows are estimated at key points at the perimeter of the model extent to account for the net influx/outflow of vehicles during any one hour.

The overall result is that these aspects of the model are considered to be at a high degree of precision.

#### **Taxis**

Current data quality/extent	☆☆☆☆☆
Current availability of additional data	★☆☆☆☆
Priority for improvement	★★☆☆☆

One mode of transport which is not included in the model is the use of taxis- which are extensively used in Jakarta. However, whilst their overall contribution to the vehicle movements is significant, it is not thought to be a particularly large fraction of the car movements (hence the relatively low priority for improvement).

There are a number of difficulties associated with identifying taxis as a specific mode, and gathering reliable data.

Taxi movements cannot be distinguished from cars at automatic traffic count points, and there is little information on the typical annual kms driven. So obtaining accurate information on current usage is difficult. Data collection from the taxi operators themselves is difficult because there are numerous operators, typically each with only several cars. So the data is very decentralised.

Some consideration will have to be given to capturing data on taxis as they do make a contribution to meeting the demands of people's transport, and have different driving patterns to private cars.

## **A.4 Model output**

### **Carbon Emissions**

There are some aspects of the transport model which are well developed, and simply require improved input data, such as the vehicle count dataset. However some aspects of the model do require model development to allow the calculation of carbon emissions with a high degree of quality e.g. fuel consumption/efficiency of the fleet and the detail to which emission factors are applied.

So as a general observation, the model could be used to assess future carbon emissions following some model development, focused on improving the availability and quality of input datasets.

### **Uncertainties**

It is difficult to assess the levels of uncertainty associated with output from complex models such as this. However, it is important to be able to parameterise uncertainties, and it is recommended that a propagation of errors approach (e.g. Monte Carlo) is undertaken to provide a guide to the uncertainty levels.

It is recognised that this calculation will require a number of "best guesses" to be made regarding the uncertainty levels and distributions associated with the various input datasets/parameters. But, it should provide a good indication of the parts of the model calculation which are most uncertain, and therefore the areas which should be prioritised for improvement in the future.

### **Model Validation/Verification**

There are no known validation or verification studies of the model to date. It is suggested that some studies be conducted to provide some reassurance that the model is performing to a suitable standard. Some suggestions are included below:

#### **Comparison of modelled and measures traffic flows:**

It would be very simple to collect some traffic count data at new locations, and compare the results with those from the model. Although there are uncertainties associated with the automatic traffic count data, it would provide a valuable insight into the accuracy of the modelled traffic flows. There would be gains in understanding the general reliability of the model results, but importantly, it would also be possible to assess how well the model performs in different situations. For example, are the major or minor roads most accurately represented? Are there particular areas of Jakarta which are represented well, or poorly etc. These studies allow a much better understanding of the performance of the model in different situations.

#### **Comparison of modelled and measured fuel consumption:**

Emission estimates from the transport sector are typically compiled by assessing the fuel consumption, or the vehicle kms. The model uses vehicle km data, and it would be useful to compare this with fuel consumption data.

The difficulty in undertaking this study is collecting fuel sales which represented the vehicle movements in Jakarta. Evidently some drivers will fill up with petrol outside of the city and drive in, or visa-versa. Despite these "boundary" issues, it would be useful to collate fuel sales data from all outlet in Jakarta (if this is not too time consuming). It may be that these data can be corrected for the boundary issue, or that the correction required is not significant. Either way, it would allow the comparison of the calculated fuel consumed from the model, with real fuel sales data across a specified time scale (one year would be a sensible time frame). Again, this would provide a valuable insight into the model performance, and allow improvement work to be targeted to where it proves the best returns.

#### **Assessing an existing measure:**

Another standard method used for model validation is to compare the predicted model results from the implementation of a measure, with the actual outcome of the measure that was put in place. Ideally this would be conducted for different types of mitigation measure.

This type of study can only be undertaken if historic and current data are available (to allow the assessment of the mitigation measure before and after implementation). If this type of validation study could be conducted, then it becomes possible to assess the accuracy of the model output very quickly. However, it is likely that the limited input data available for Jakarta will restrict the options for doing this. But, with the introduction of mitigation measures in Jakarta planned for 2010, it should be possible to do this in the future. It is therefore very timely to consider what data is available now, so that current model predictions can be used at a later date for comparison with what the mitigation measures actually delivered.

## A.5 Model Scenarios

The transport model has been used to investigate the impact of a large number of measures, applied in different ways.

A long-list of measures is included below. These were considered in terms of potential benefits and costs. A short-list of measures (also below) was then determined. The main focus has been on modelling scenarios which are a combination/mix of the short-listed measures, implemented to differing levels or strengths.

**Table 10: Long and short list of measures**

Long-List of Measures	
<ul style="list-style-type: none"> <li>Staggered Working Hours</li> <li>Flexible Hours</li> <li>Compressed Working Weeks</li> </ul>	<ul style="list-style-type: none"> <li>MRT (Subway)</li> <li>Monorail</li> <li>Busway</li> </ul>
<ul style="list-style-type: none"> <li>Truck Routes</li> <li>HCV Entry/Use Restrictions</li> </ul>	<ul style="list-style-type: none"> <li>Minimum Occupancy</li> </ul>
<ul style="list-style-type: none"> <li>Road Traveler Information</li> <li>PT User Real-Time Information</li> <li>Internet Transport Information</li> </ul>	<ul style="list-style-type: none"> <li>Tele-working</li> <li>Teleconferencing</li> <li>Teleshopping</li> </ul>
<ul style="list-style-type: none"> <li>Taxation Measures</li> <li>Congestion Pricing</li> <li>Cordon/Route Tolls</li> <li>Employer Public Transport Subsidy</li> <li>Parking Restraint</li> </ul>	<ul style="list-style-type: none"> <li>High Density Housing near PT Stops</li> <li>Higher Densities in New Growth Areas</li> <li>Local Growth Limits</li> <li>Mixed-Use Development</li> <li>Neo-Traditional Suburban Design</li> </ul>
<ul style="list-style-type: none"> <li>Ride Sharing Promotion: Carpools, Vanpools</li> <li>Guaranteed Ride Home Program</li> <li>Rideshare Matching</li> <li>Subscription Buses</li> <li>Shuttle Buses</li> </ul>	
Short-list of Measures	
<ul style="list-style-type: none"> <li><b>Short-list</b></li> <li>Road Pricing</li> <li>Public Transport Development</li> <li>Parking Restraint</li> </ul>	

It is worth noting that the equilibrium flow nature of the model does typically assess the multiple benefits arising from a single measure. For example the introduction of a monorail would provide modal shift (a benefit), as well as reduce congestion, resulting in improved traffic flows for the remaining vehicles (a second benefit)- and these are all captured by the model.

A general overview, rather than detailed information, has been obtained on how the model has been used to assess each of the scenarios.

## Assessing Behavioural Change

As with most model calculations, technological changes are relatively easy to represent, as this means simply revising the appropriate e.g. emission factors. The most difficult aspects to model are associated with behavioural change. For example, the introduction of a monorail system will result in modal shift from private cars and existing public transport. The different emission rates from these different modes can be estimated relatively easily. However, what is not easy to represent is the extent to which people will choose to take the new monorail system. This will depend on price differentials, convenience, availability of information etc.

In using an equilibrium flow approach, the model does try to account for these different “pressures”, but relies on a substantial amount of additional information- e.g. how sensitive is monorail occupancy to price etc. For this particular scenario, survey information was collected (as it was a particular measure which the Government are looking to implement). However, there are a wide number of similar aspects where a default relationship will need to be used in the model.

### **Leakage from Measures**

Another aspect of modelling is addressing “leakage”. This is where, for a variety of different reasons, the model does not accurately capture the impact of a measure. This is typically associated with behavioural change being less than originally anticipated. For example, the initial novelty of using a new and modern mode of public transport might result in a decline in usage with time.

There are currently more important aspects of the model to address. But ensuring that leakage in scenario evaluation is minimised will be an important consideration going forward. This will need additional data to allow behavioural change to be assessed in more detail.

### **Stronger and Weaker Aspects of Modelling Scenarios**

In assessing the scenario outputs, there are strong parallels with assessing the underlying methodology of the model itself:

- Spatial distributions are considered to be well represented in scenario outputs
- Absolute emission estimates could be improved in scenario outputs by improving the detail of emission factors
- Additional input data is needed (particularly associated with assessing behavioural change), to capture some of the more detailed aspects of the scenarios. This is particularly important to avoid leakage.

## Appendix B: List of interviewees

This appendix provides a list of institutions or individuals interviewed during the study team's second visit to Jakarta, to develop a thorough and up-to-date understanding of the institutional and financial structures currently in place in Jakarta/Indonesia, and to assess the implications for the TDM NAMA.

The author remains grateful for their kind inputs which have enriched this report.

(In alphabetical order of institutions, honourable titles abbreviated. Omission of names are not intentional)

- BAPPENAS – Mr. Edi Effendi
- BPLHD – Mr Rusman Sagala
- Deputy Governor of Jakarta – Mr. Sutanto Soehodho
- DISHUB – Mr M. Akbar
- DNPI – Mr Farhan Helmy
- EC – Mr Thibaut Portevin
- Gadjah Mada University – Mr. Danang Parikesit, Mr. Heru Sutomo
- GTZ –, Mr. Manfred Breithaupt, Mr. Dieter Brulez, Mr. Daniel Bongardt Mr. Heiner von Luepke
- ITDP Indonesia – Mr. Yoga Adiwinarto, Ms. Restiti Sekartini, Ms Ratna Yunita
- KPBB – Mr Ahmad Satrudin
- Ministry of Environment – Ms. Liana Bratasresida
- Ministry of Transportation – Mr. Wendy Aritenang
- PELANGI – Ms. Moekti Handajani Soejachmoen, Ms Indira Darmoyono, Mr. Bobby A. Tamaela Wattimena
- William J. Clinton Foundation – Ms. Amanda Ikert, Ms Anissa Febrina
- WWF-Indonesia - Mr. Muhamad Suhud, Mr. Ari Muhammad