



Tracking Sustainable Transport in Vietnam: Data and Policy Review for Energy Efficiency and Climate Change 2015



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The Project Context

The GIZ Programme on Cities, Environment and Transport (CET) in ASEAN seeks to reduce emissions from transport and industry by providing co-benefits for local and global environmental protection. The CET Project 'Energy Efficiency and Climate Change Mitigation in the Land Transport Sector in the ASEAN region' (Transport and Climate Change (TCC) www.TransportandClimateChange.org) aims in turn to develop strategies and action plans for more sustainable transport.

As presented to the ASEAN Land Transport Working group, TCC's regional activities are in the area of fuel efficiency, strategy development, green freight, and Nationally Appropriate Mitigation Actions in the transport sector. At the national level the project supports relevant transport and environment government bodies in the Philippines, Thailand, Vietnam, Malaysia and Indonesia, for the development of national action plans and improvement of policy monitoring systems. The project is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ).



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Abbreviations and Acronyms

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
ASIF	Activity-Structure-Intensity-Factor of Emissions
BAU	Business-as-usual
BMZ	German Federal Ministry for Economic Cooperation and Development
BRT	Bus rapid transit
CEMDC	Centre for Environmental Monitoring Motorcycle Driving Cycle
CNG	Compressed natural gas
CO	Carbon monoxide
CO ₂	Carbon dioxide
CTF	Clean Technology Fund
DRVN	Directorate for Roads of Vietnam
EIA	Energy Information Administration
EST	Environmentally sustainable transport
GDP	Gross domestic product
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German International Cooperation)
GSO	General Statistics Office
HAIDEP	Comprehensive Urban Development Programme for Hanoi
HC	Hydrocarbon
HCMC	Ho Chi Minh City
HMDC	Hanoi Motorcycle Driving Cycle
HDV	Heavy duty vehicle
HOUTRANS	The Study on Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area
IVE	International Vehicle Emission model
JICA	Japan International Cooperation Agency
km	Kilometre
KT	Kiloton
LDV	Light duty vehicle
LPG	Liquefied petroleum gas
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MOST	Ministry of Science and Technology
MOT	Ministry of Transport

MPI	Ministry of Planning and Investment
MtCO ₂ e	Million metric tonne of carbon dioxide equivalent
MRV	Measurement, reporting and verification
NAMA	Nationally appropriate mitigation action
NCCS	National Climate Change Strategy
NEDC	New European Driving Cycle
NGO	Non-governmental organisation
NO _x	Nitrogen oxide
NTP	National Target Program to Respond to Climate Change
NTSC	National Traffic Safety Committee
PKT	Passenger-kilometre travelled
PM	Particulate matter
PTD	Provincial Transport Department
SEACAP	South East Asia Community Access Programme
STAMEQ	Directorate for Standards, Metrology and Quality
SO ₂	Sulphur dioxide
SUV	Sports utility vehicle
tCO ₂ e	Ton of carbon dioxide equivalent
TDSI	Transport Development and Strategy Institute
TKT	Ton-kilometre travelled
TOE	Ton of oil equivalent
UMRT	Urban Mass Rapid Transit
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNCRD	United Nations Centre for Regional Development
UNFCCC	United Nations Framework Convention on Climate Change
USAID/RDMA	The United States Agency for International Development Regional Development Mission for Asia
VEA	Vietnam Environment Administration
VEMA	Vietnam Expressway Management Administration
VGG	Vietnam Green Growth Strategy
VITRANSS	Study on National Transport Development Strategy
VITRANSS 2	The Comprehensive Study on the Sustainable Development of Transport System in Vietnam
VKT	Vehicle-kilometre travelled
VNEEP	Vietnam National Energy Efficiency Program
VNR	Vietnam Railways
VOC	Volatile organic compound
VR	Vietnam Register

Executive Summary

A sustainable and efficient transportation system is important in ensuring sustained economic growth, social progress and environmental protection. This report reviews existing data, policies and international donor activity in the area of sustainable transport in Vietnam, in order to provide policy-makers, researchers, international organisations and other stakeholders a reference document for sustainable transport in the context of energy-efficiency and climate change.

Transport and Climate Data

Transport is the third largest greenhouse gas (GHG) emitter in the energy sector in Vietnam, accounting for 31.8 MtCO₂e or 23% of the energy sector emissions in 2010. Within the transport sector, road transport represents the largest share (68.5%), with passenger transport being responsible for 71% of the total road transport emissions, whilst freight transport accounts for 29%. Characteristic to Vietnam's transport system is the popularity of motorcycles, which comprises approximately 95% of passenger vehicles. Freight transport is dominated by trucks and is characterised by short-distance trips to and from Hanoi and Ho Chi Minh City, particularly under 200 km. Growth in transport demand has led Vietnam to become a net importer of oil in 2011.

Projections also indicate a significant rise in Vietnam's total GHG emissions, especially road transport emissions, which are estimated to increase at an average annual rate of 12.5%. While Vietnam's current transport emission per capita (0.4 tCO₂e/year) is lower than that of Indonesia (0.5 tCO₂e/year), Thailand (0.8 tCO₂e/year) and the world average (1.0 tCO₂e/year), several studies estimate that passenger and freight transport demand will soar 9-10 times by 2030 from 2005. In spite of the slowdown in motorcycle sales in recent years, this projection is attributed to a greater degree to substantial increase in car ownership, despite high taxes on cars and fuel prices. Road-based freight transport, in particular, is also projected to increase.

This report evaluates the existing transport-related data using the factors of the ASIF equation, namely, Activity-Structure-Intensity-Fuel (ASIF), in order to analyse the GHG emission profile of Vietnam's transport sector. This represents the total transport activity in passenger-kilometre travelled (PKT) and ton-kilometre travelled (TKT), the modal split, fuel intensity and emission factors. The quality and the availability of data remain a challenge as data collection is often fragmented and often conducted on an ad-hoc basis. Some transport-related data and statistics are relatively well-collected by the government, but they are not always readily available. Other relevant parameters, including vehicle speed and age, travel behaviour, in-use vehicles, modal split, fuel efficiency of the vehicle fleet, load factors and occupancy rates are not yet available.

Vietnam submitted its first Biennial Update Report in 2014, however there is considerable uncertainty in GHG emission projections towards 2020 and 2030. Information on mitigation potential and costs of transport options exists, however can be regarded as fragmented.

Policy Review

The Ministry of Transport is the central body for planning, managing and maintaining national transport infrastructure and developing policies, including energy and climate change related. For many 'improve' related policies, co-operation of several central government ministries like Ministry of Industry and Trade, Ministry of Nature Resources and Environment, Ministry of Science and Technology, Ministry of Finance is a prerequisite. The MOT's responsibility also extends to assisting local governments in project selection. The MOT prepares the long-term transport strategy, a five year Public Investment Program and receives the funds from the annual state budget. These are based upon strategic orientations and decisions from the National Assembly and the Prime Minister, some of which have a focus on sustainable development issues such as climate change and resource consumption, as well as other environmental protection laws.

The overall strategic sustainable transport policy framework centres on the Environmentally Sustainable Transport strategy, the Climate Change Action Plan and the Sustainable Development Plan of MOT, and the Transport Development Strategy. The National Climate Change Strategy, Green Growth Strategy and Energy Efficiency Programmes are drivers for these, and help in particular by including 'improve' measures in the transport strategies. These include objectives and specific targets related to public and multi-modal transport, energy and emission-savings, as well as the limitation of growth in private motorisation. They can be regarded as rather comprehensive, even if somewhat general in nature. Many actions are listed, and though budget estimates are included it is not always allocated for. Cooperation with the private sector is an important policy objective, but not yet well developed. Moreover, lack of implementation of policies is mentioned in different studies and plans. Balancing different interests related to environment, congestion, industry and finance also poses challenges. An improved prioritisation process for transport policies and investment, such as through the Climate Change Action Plan, may help overcome some of the difficulties. Climate change instruments such as nationally appropriate mitigation actions (NAMAs) can also help build a framework for sustainable transport measures, in addition to bringing in international technical and financial support.

This report reviews the transport policies and measures based on the Avoid-Shift-Improve approach. It appears that most of the key policies, particularly in the passenger transport sector, are being planned, piloted or implemented.

In relation to fuel economy policies for new vehicles, mandatory labelling for new passenger cars (up to 7 seats) and voluntary fuel economy standards (for passenger cars and motorcycles) are in place as of 2015. Together with the Euro 4 and Euro 3 emission standards for new cars and motorcycles in 2017, these provide a good basis for moving towards mandatory fuel economy standards. The government has also established an inspection and maintenance programme for cars, motorcycles and trucks since 2006, albeit lacking in effective implementation due to uncalibrated equipment and outdated test procedures as well as limited capacity of the inspectors. In the context of tyres, it appears that no policy discussions on energy-efficiency standards or labelling are taking place.

The emissions associated with poor enforcement of regulations in the road-based freight transport sector is also compounded by the fragmentation of the truck industry, with a large network of small-scale trucking companies that lack economies of scale to upgrade their vehicle fleets or optimise their supply chain.

Vietnam's Environmentally Sustainable Transport strategy, in line with the Transport Development Strategy, calls for "controlling the demand for private motorised travel through a combination of policies, such as regulatory measures (manage demand for road space), fiscal policies (such as parking fees, vehicle taxes, road or congestion charging, and fuel taxes, etc.), and infrastructure design measures". Such initiatives are only partially implemented at this stage.

Many cities in Vietnam have set targets for public transport to increase its modal share to 25-45% in 2020-2030, whereas currently few have higher than 10%, though increasing. Motorcycles appear to be more attractive to most people, while providing higher accessibility in many (sub) urban areas. It is not clear whether current policies and plans, including for BRT and MRT, are sufficient in achieving these targets. There is no comprehensive national urban transport policy in place or planned.

For 'Avoid' and 'Shift' in freight transport there appears to be less, though increasing, policy attention.

From an extensive inventory of financial and technical support programmes by international organisations for sustainable transport in Vietnam it appears that both passenger and freight sectors are well represented, even if there is not much activity on energy efficiency in freight.

Policy Recommendations

Improve

Improving the fuel efficiency of new vehicles (the short term option with the highest mitigation potential) requires thorough analysis of the vehicle market,¹ reliable test procedures and stakeholder dialogues to ensure the fuel economy standards are fair and will deliver real savings compared to business-as-usual. Given the preponderance of motorised two-wheelers, energy efficiency and electrification should be analysed and strongly considered as high-potential actions. As for fuel economy standards for heavy-duty vehicles, it is encouraging that Vietnam has started discussions as well.

Avoid and Shift

Effective policy options to alter the patterns of private vehicles ownership and its use and promote public and non-motorised transport include CO₂-based vehicle taxation, market-based mechanisms like auctioning titles, congestion charges and parking charges, and requiring road users to pay for infrastructure and services.

¹ See upcoming 2015 TCC report on fuel efficiency in Vietnam.

In addition, transit-oriented development and other integrated land-use planning concepts, which are not well developed yet in Vietnam, are needed to further reduce the need for motorised travel and make the alternatives attractive. This requires long-term planning and discussion among a range of public and private stakeholders. Achieving the public transport targets further requires substantially improving public transport, including implementing bus rapid transit and rail systems, as well as the quality of service.

Freight and Logistics

Useful interventions are in the area of enhancing logistics such as reducing empty backhauls, improving the routing of distribution system, clustering destinations together, setting up an online freight exchange (clearing house), and constructing logistics centres efficiently. Moreover, the private sector itself has a large role to play in improving freight and logistics, e.g. by providing technology such as radio frequency identification tags, global positioning system and vehicle routing software which are necessary to optimise street networks. Introduction of green freight labelling schemes and other information and communication instruments can also be considered.

Data, Indicators and Monitoring

Progress on sustainable transport often starts with data, which creates awareness and corresponding action. Local air pollution is example of a key issue that can expedite transport policies, as this is visible directly to citizens. Even though energy efficiency and climate change are less ‘visible’ problems, they can be mainstreamed into transport policy by monitoring appropriate indicators. Currently policy monitoring takes place based on policy-specific transport indicators but is not necessarily made public. A communication strategy beyond climate change related issues may be helpful to inform the public about the progress towards sustainability.

In order to move towards a more comprehensive monitoring system, increased collaboration between different public and private organisations that are already collecting data is required, as well as a central management system with consistent data formats, and incentives to make reporting on indicators an integral part of policymaking and an overall sustainable transport strategy.

Final considerations

Climate change instruments such as nationally appropriate mitigation actions (NAMAs), which Vietnam is currently developing for urban transport, fuel efficiency and green freight, can also help build a framework for sustainable transport measures, in addition to bringing in international technical and financial support.

1 Introduction

The member countries of the Association of Southeast Asian Nations (ASEAN) are experiencing robust economic growth in the recent years. This growth has resulted in a rapid increase in the demand for motorized transportation. With the 2nd largest vehicle fleet in Asia just after China, the ASEAN region already faces serious problems including congestion, poor energy efficiency, high oil imports, air pollution and road safety. However vehicle registrations are still increasing by over 10% annually in many countries, while shares of sustainable modes such as public transport and rail/water freight transport are often decreasing. With transport consuming approximately 25% of final energy and over 50% of oil consumption (OECD/IEA, 2013) it is also a significant and growing emitter of CO₂ and black carbon. Vietnam and other ASEAN countries are now facing significant challenges in providing sustainable, adequate and timely transport solutions that can keep up with the demand while minimizing the impacts.

These challenges are recognised at the regional level in the ASEAN Strategic Transport Action Plan (ASEAN, 2010) which calls for establishing ‘a sustainable, energy efficient and environmentally-friendly transport system’ and in the Vietnam in national strategies, as can be seen in the current report. Even though energy-efficiency measures in transport often benefit the economy, consumers and the environment, realising sustainable, low-carbon transport system is a daunting task and requires strong policy action as well as shifts in vehicle production patterns and consumer preferences.

The ‘Energy Efficiency and Climate Change Mitigation in the Land Transport Sector in the ASEAN Region’ project² (in short ‘Transport and Climate Change’) aims to contribute to the development, implementation and monitoring of strategies and action plans towards the improvement of energy efficiency and the reduction of greenhouse gas (GHG) emissions. At the regional level this includes development of an ASEAN policy or strategy as well as guidelines and templates for national policies and action plans for Member States. At the national level it aims at development of action plans and measures in five countries, and implementation of these according to national plans in at least three ASEAN Member States, as well as improvement of the measurement, reporting and verification (MRV) system in five countries: Indonesia, Malaysia, the Philippines, Thailand and Vietnam.

This report aims to provide an up to date picture of the transport sector and transport-related greenhouse gas emissions and mitigation policies in Vietnam for the project team, policymakers, and international organisations, as well as identify gaps, needs and potential areas for assistance and policy recommendations. It covers the full land transport sector, including passenger and freight, and discusses existing data based on the Activity-Structure-Intensity-Fuel (ASIF) approach (Chapter 2), policies and monitoring for sustainable transport and climate (Chapter 3), barriers towards low-carbon transport (Chapter 4), international donors (Chapter 5), and finally recommendations for further action on policy development and capacity-building. The report is based on existing literature and policy documents and interviews with policymakers and experts.

² www.TransportAndClimateChange.org

2 Transport and Climate Data

This chapter gives an overview of key trends of transportation and its environmental-related issues in Vietnam, such as vehicle sales and stock, transport demand, emissions, modal split in passenger and freight, average vehicle-kilometre travelled (VKT) by vehicle and fuel type, vehicle population by vehicle and fuel type, average speed, emission factors, fuel characteristics, gross domestic product (GDP), total population, average occupancy and average load factors, among others. Relevant data and emission indicators of transport sector are crucially needed for policy and decision makers to track the progress of policies that aim to increase energy efficiency and to reduce GHG emissions. The need for better governmental data is expected to increase considerably as climate negotiations and communications for an MRV mechanism would be used to assess emissions pledges and/or obligations.

2.1 General Information

Vietnam has seen an average of about 7% annual GDP growth rate over the past 10 years and this has enabled the country to accelerate infrastructure development. Its political centre is Hanoi with about 6.5 million people, while its largest city, Ho Chi Minh City (HCMC), has about 9 million. The port cities of Hai Phong and Da Nang have seen increased urbanisation in recent years and have become important areas for trade and commercial activities.

■ Geography

Vietnam is located in South East Asia. It is bound by the South China Sea to the east, Laos and Cambodia to the west and China to the north. The country can be divided into three regions, North Vietnam, Central Vietnam and South Vietnam. Vietnam is a strip of land shaped like the letter “S”. The S-shaped country has a north-to-south distance of 1,650 kilometres and is about 50 kilometres wide at the narrowest point. Vietnam’s territorial waters equal about 1,000,000 km², with an over 3,000 km long coastline.



Figure 1: Map of Vietnam

■ Demographics

Vietnam is home to 54 ethnic groups; among them, the Kinh is the largest group which accounts for 86.2% of the country's population. As of mid-2015, the population of Vietnam is about 94 million and it is growing by approximately 1.0 % every year³.

■ Urbanisation

Vietnam has seen its urban areas developing since 1990, with an urbanization rate of 17-18%. The number of urban areas rose from 500 in 1990 to 649 in 2000 and 656 in 2003. Now, the nation has 772 urban areas: following the classification by the Vietnamese government, this includes two special areas in Hanoi and HCMC, and 15 first-grade, 14 second-grade, 47 third-grade, 64 fourth-grade and

³ <https://www.cia.gov/library/publications/the-world-factbook/geos/vm.html>

630 fifth-grade cities. As of 2014, 30.5 million people live in urban area (33% of the population)⁴ and as of January 2015, the urbanization rate is 34.5%.

2.2 GHG Emissions from the Transport Sector

As the second country in the ASEAN after Singapore, Vietnam submitted its Biennial Update Report in December 2014 (MONRE, 2014). Its GHG inventory shows the energy sector emitted a total of 141 MtCO₂-eq (fuel combustion + fuel production). Out of this, 31.8 MtCO₂-eq or 23% was from the transport sector. In 2011, it was about 33 million tCO₂ (World Bank) or 0.37 tonnes per capita.

Within the transport sector, road transport accounts for the largest share of emissions (68.5% in 2010), followed by maritime transport (18.9% in 2010) (Table 1). In terms of emissions by fuel type, diesel oil is the dominant source of emissions in the transport sector, at 42.7% in 2010, closely followed by gasoline (see Figure 5 (World Bank, 2009)). Figure 2 illustrates CO₂ emissions from road transport in Vietnam from 2000 to 2010 as estimated by Clean Air Asia (2012). During this period, the road transport CO₂ emission in the country is estimated to have increased at an annual average rate of 12.5%. In particular, emissions from two-wheelers/motorcycles constitute the largest share of road transport CO₂ emissions (Figure 3).

Table 1: *Estimated GHG emissions by transport mode, 2005 and 2010*

Mode of transport	2005		2010	
	tCO ₂ e	%	tCO ₂ e	%
Roads	15,635,187	67.4	24,560,559	68.5
Inland waterways	475,734	2.0	759,976	2.1
Railways	838,907	3.6	1,340,138	3.7
Aviation	1,565,649	6.8	2,410,315	6.8
Maritime	4,694,743	20.2	6,761,252	18.9
Total	23,210,220	100.0	35 832 240	100.0

Source: World Bank, 2009

⁴ <http://www.worldometers.info/world-population/vietnam-population/>

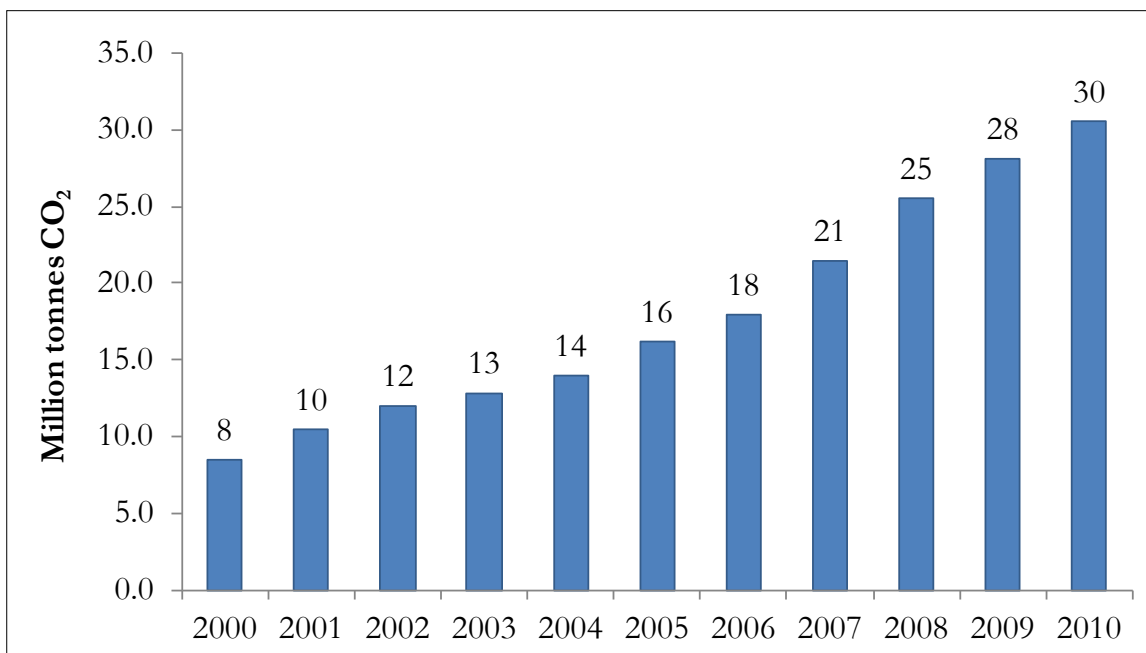


Figure 2: *Estimated CO₂ emissions from road transport, 2000-2010*

Source: Clean Air Asia, 2012. *Assessing Asia: Air Pollution and Greenhouse Gas Emissions from Road Transport and Electricity*

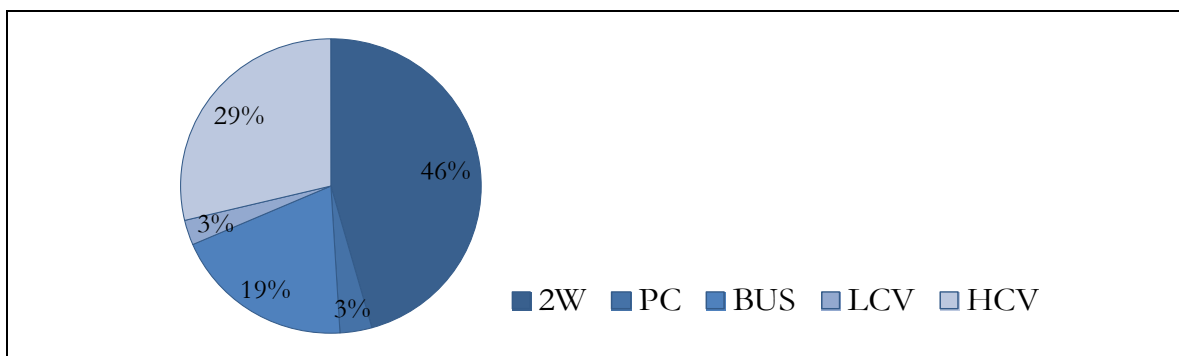


Figure 3: *Road transport CO₂ emissions by vehicle type, 2010*

Source: Clean Air Asia, 2012. *Assessing Asia: Air Pollution and Greenhouse Gas Emissions from Road Transport and Electricity*

In 2010, the transport sector ranks third after the industry and residential sectors in terms of share of total energy consumption, constituting of 22% of the overall energy consumption (Figure 4). The share of transport sector in the total energy consumption has increased from 14.7% in 2000 to 22% in 2010. Figure 5 illustrates the trend in gasoline and diesel fuel consumption in the road transport sector from 1980 to 2010, and shows that the road transport sector consumed slightly higher diesel fuel compared to gasoline fuel in the past two decades. In a business-as-usual scenario, the proportion of diesel consumption is projected to rise from 48% in 2010 to 71% in 2040 (World Bank, 2013).

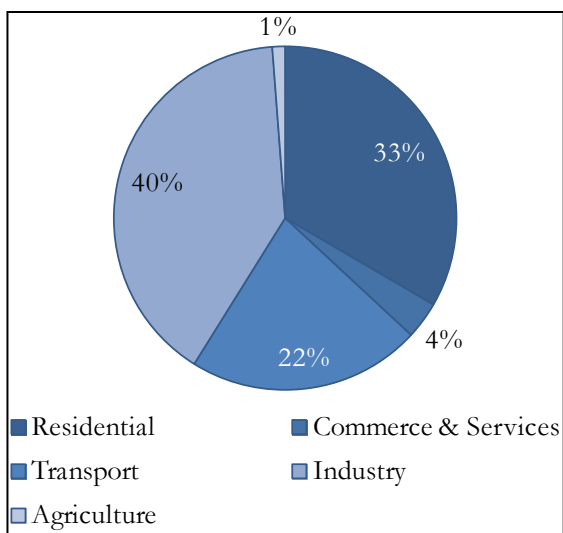


Figure 4: Share of final consumption by economic sector, 2010

Source: Toan, PK and Hung, TM, 2013

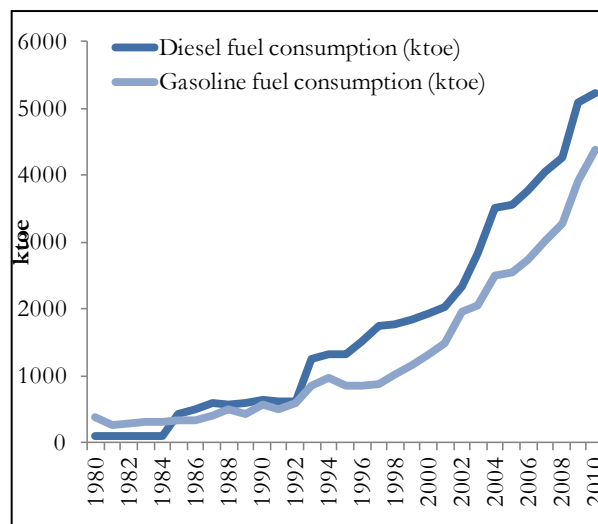


Figure 5: Road transport diesel and gasoline consumption

Source: World Bank Open Data, 2013

According to the World Bank report entitled *Vietnam: Expanding Opportunities in Energy Efficiency* (2010), Vietnam’s energy consumption has tripled during the period 1997-2007 and is likely to triple again over the next decade if mitigating measures are not taken. Meanwhile, a study released by the World Bank in 2013, *Low Carbon Development Assessment in Transport Sector*, projects that their energy consumption will increase eight-fold between 2005 and 2025 on the average. Energy demand for transport is projected to increase from 11 million tonnes of oil equivalent (TOE) in 2010 to 45-58 million TOE in 2030. Annex 2 provides the forecast of energy demand by sector with three plans (low, base and high) for the 2010-2030 period, with the low and high estimates being 45 and 58 MTOE respectively, illustrating uncertainty.

Based on estimates from the *Preliminary Study on Sustainable Low-Carbon Development Towards 2030 in Vietnam* (Nguyen, et al., 2010) passenger transport was estimated to account for 15 Mt (71%) of the total CO₂ transport emissions in 2005 while freight transport was responsible for 6 Mt or 29%. Both passenger and freight transport are projected to increase significantly in the next decade. According to the study, passenger transport is expected to soar 9 times to 519 billion passengers-km in 2030 from the 2005 figure of 57 billion passengers-km. Likewise, freight transport demand is expected to increase over 10 times to 1085 billion tonne-km in 2030 from the 2005 figure of 101 billion tonne-km. These trends result in 110 and 41 MtCO₂ respectively in 2030 in the BaU scenario.

The Biennial Update Report projects transport sector energy consumption to rise from 14.4 MTOE in 2015 to 19.5 and 31.8 MTOE in 2020 and 2030 respectively, implying a 5.4% average annual growth rate. This is based on a 7% GDP growth rate across the same period. GHG emissions in transport are projected to rise to 87.8 MtCO₂e in 2020, with the same figure being included for 2030.

2.3 Emission Reduction Potential from the Transport Sector

Nguyen et al. (2012) projects a 23 million tCO₂e and 29 million tCO₂e emission reduction in 2030 from passenger transport and freight transport, respectively, by adopting a selection of low carbon measures. Note that freight transport relies on roads, carrying 71% of total weight volume in 2005, while the rest are transported by maritime (27%) and rail (2%). Vietnam anticipates a growth in emission from freight transport due to rapid development in the industry sector; thus, the proposed countermeasures include modal shift from trucks to rail (increase to from 2% to 5%) and maritime transport (increase from 27% to 30%) which reflects a 4.0 MtCO₂e emission reduction, as well as improving the efficiency of vehicles being used and the switch to biofuel from oil, reflecting emission reductions of 23.9 MtCO₂e and 1.1 MtCO₂e, respectively.

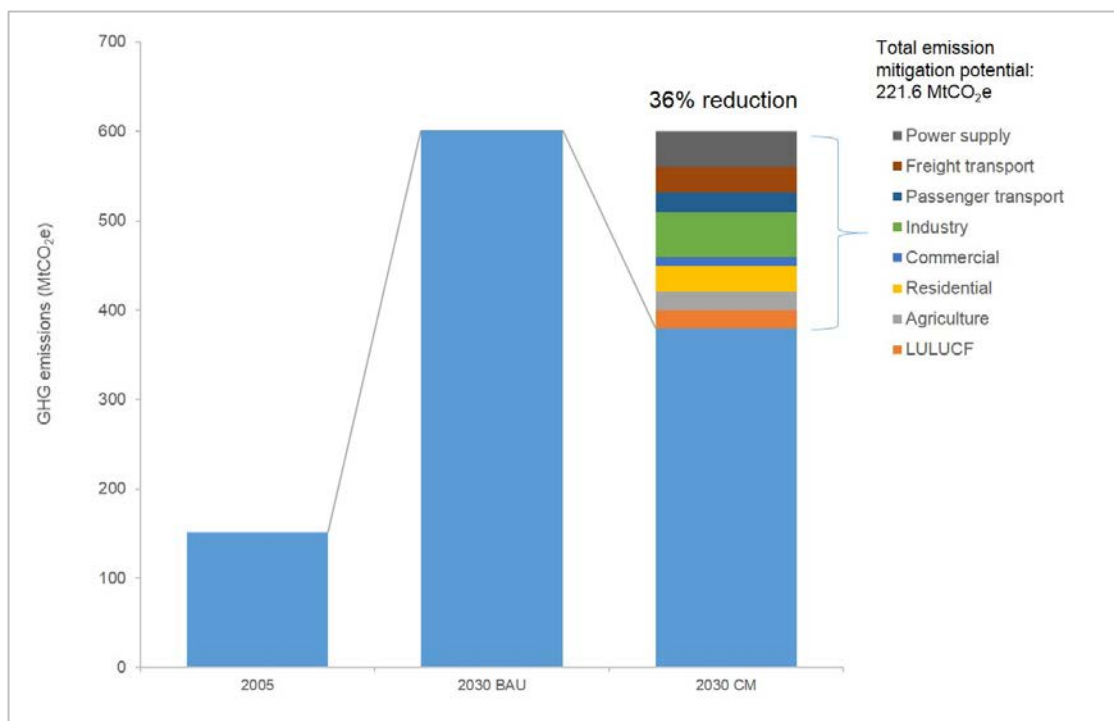


Figure 6: *GHG emissions and mitigation potential in Vietnam*

Source: Nguyen T. H., et al., 2012

The report's policy package for the transportation and their corresponding estimated emissions reduction potential include the following:

- Modal shift: Transform passenger transport from vehicle to walking, bicycle, train or bus and transform freight transport from large vehicle to train, ship, boat or ferry: 13.6 MtCO₂e.
- Eliminating and alternating old and unqualified vehicles, promoting high energy efficiency vehicles: 37.3 MtCO₂e.
- Encouraging environmental and economical fuel for vehicle such as biofuel: 1.4 MtCO₂e.

The Government of Vietnam, as part of the Clean Technology Fund grant proposal (Valkovic, n.d.), likewise summarises potential emission reduction interventions in the transport sector including potential savings and indicative costs in Table 2. The World Bank also carried out a specific study on the mitigation potential of the transport sector in Vietnam in 2009. Three strategies were deemed central to mitigation considering the change they could foster on the impact of this sector on GHG emissions: fuel switch, modal shift and efficiency improvement.

In another study in 2011, the World Bank outlines several mitigation opportunities in Vietnam and their theoretical emission reduction. According to the document, however, a true marginal curve that considers real costs and identifies which opportunity will be best for reducing GHG emissions and, at the same time, for generating financial benefits will require more research. Since motorcycles are responsible for a large fraction of vehicular emissions in Vietnam and passenger car ownership is projected to increase as income level increases, the improvement in fuel efficiency must remain a priority for Vietnam, including a modal shift from road freight to inland waterways, coastal shipping, and railways (World Bank, 2011). The study indicates that such mitigation opportunities in the transport sector can theoretically reduce 18.37 MtCO₂e annually, while its feasible medium-term (2015) goals could reduce 5.49 MtCO₂e annually. These mitigation opportunities, as well as the respective barriers to their implementation, are detailed in Annex 3.

Additionally, according to *Energy Outlook for Asia and the Pacific* (Asian Development Bank [ADB], 2013), shifting towards more efficient internal combustion engine and hybrid vehicles could result to an energy savings of 3.1 million TOE in 2035.

Table 2: *Potential GHG emissions reduction in the transport sector in Vietnam*

Sector/ Sub-sector	Activities planned or underway	Potential Emissions Reductions	Indicative Costs
Urban rail	Initial construction on 5 lines in Hanoi; initial design stage for 6 lines in HCMC	1.6 MtCO ₂ e/year in major cities (from rail lines plus connectivity investments)	USD 50-150 million/km
Bus rapid transit	n/a	0.33 MtCO ₂ e/year in Hanoi and HCMC	USD 2-10 million/km
Electric vehicles	n/a	4.2 MtCO ₂ e year by introduction of electric motorcycles replacing 50% of fleet	USD 750/motorcycle
Fuel switching (CNG, LPG, and biofuels)	Pilot testing of CNG in HCMC buses; initial biofuel production	E10 and B10 targeted by 2020; E20 potential is 1.6 MtCO ₂ e/year	Development funding needed for feasibility studies and front-end engineering design

Note: This was prepared for the application for Clean Technology Fund Project Preparation Grant.

Source: Valkovic, n.d. CTF Joint Mission notes; GHG reduction estimates from ADB (for urban rail) and World Bank Carbon Finance Assist, 2009 (for other interventions).

Scenario Development

The current and the future scenarios of transport emissions are being simulated in the Energy Forecasting Framework and Emissions Consensus Tool (EFFEKT) model of World Bank⁵ and in the Backcasting Tool of Institution for Transport Policy Studies (ITPS)⁶.

The table below (Table 3) summarises the assumptions and scenario results of these two studies. More detailed information of these studies will be provided in Annex 3.

Table 3: Overview of Backcasting Tool and Energy Forecasting Framework and Emissions Consensus Tool

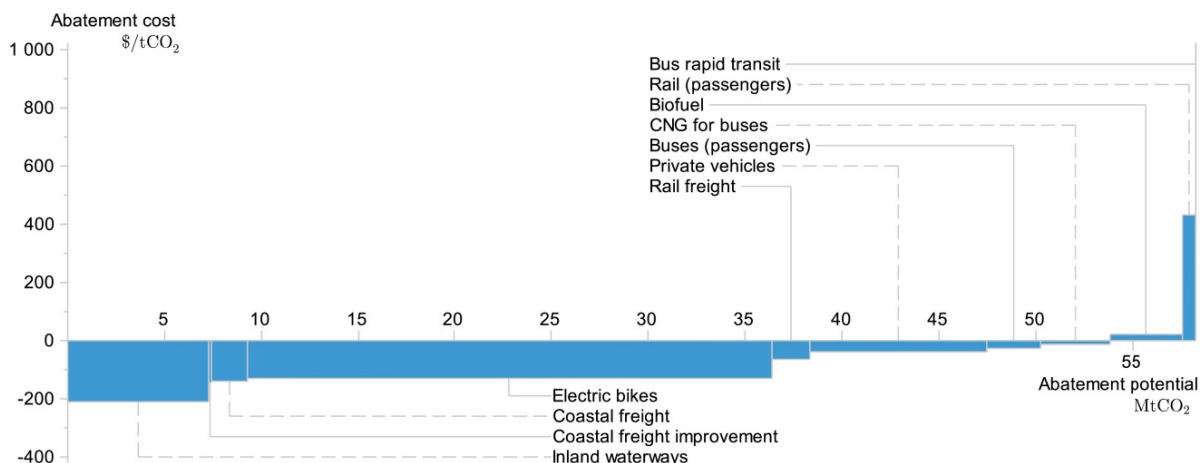
	Backcasting Tool	Energy Forecasting Framework and Emissions Consensus Tool (EFFEKT)
Period of study	2010 as the base year; 2005–2050	2010 as the base year; 2010–2040
Vehicle population	89 million vehicles by 2050, 57 million of which will be motorcycles	Increases 2.5 times from 26.1 million vehicles in the base year 2010 to 64.6 million vehicles by 2040
Modal share	Motorcycle: The share of the motorcycles in the total fleet in Vietnam will be 63%, much lower than its share in 2005 of 97%, mainly due to an increase in car population Car: Growth at annual average of 12% from 2005-2050.	Motorcycle: The annual growth rate of motorcycles, however, decreases over 10-year periods: 3.84% during 2010-2020, 2.61% during 2020-2030, and finally 1.65% during 2030-2040. Car: Passenger cars will have the highest growth rates (10.8% over the period 2010-2020, and 13.0% over the period 2020-2030); but will decrease to 8.6% during 2030-2040. They are expected to increase from about 0.5 million cars in 2010 to 10.2 million cars in 2040
BAU Scenario	Passenger, freight and emissions (2050): <ul style="list-style-type: none"> • Passenger travel = 2,235 billion passenger-km; vehicle population = 89 million vehicles, 57 million of which will be motorcycles. • Freight travel = 510 billion ton-km; freight mode share is expected to be dominated by road transport. Heavy commercial vehicles are expected to increase. Air freight activity is expected to grow at an average of 4% (million ton-km) • Transport CO₂emissions = 144.7 million tCO₂, 26% and 25% of which are from cars and motorcycles, respectively. Interregional transport will contribute 57% of the total transport emissions. 	Passenger, freight and emissions(2040): <ul style="list-style-type: none"> • Passenger travel = 740.96 billion passenger-km; vehicle population = 64.6 million vehicles. Motorcycles will dominate the road transport fleet. • Petrol consumption consumed for road transport vehicles is expected to increase twice in 2040 from its 2010 value. Biofuel consumption is also expected to increase most especially by the urban buses • Freight travel = 637.5 billion ton-km; heavy commercial vehicles is expected to increase but light commercial vehicles is expected to grow faster. Freight shift from road to rail is expected to increase. • TransportCO₂ emissions = 103 million tCO₂.The total of other emissions including CO, NOx, VOC, PM emissions (only calculated for on-road vehicles) is expected to reduce from nearly 2,500 Gg in 2010 (275,577 tons) to 600 Gg (661,386 tons).
Alternative Scenario	Passenger, freight and emissions (2050): <ul style="list-style-type: none"> • Passenger travel = 995.88 billion passenger-km; passenger mode share of cars will decrease to 6% and that of motorcycles will also decrease to 25%. Meanwhile, that of urban bus will increase to 59%. • Freight travel activity will be limited to 275.34 billion ton-km; freight mode share will be dominated by maritime (39%) and rail transport (37%). • Total transport CO₂emissions will be 51.2 million tCO₂by 2050. 	[The simulation results for the alternative scenarios are being developed.]

⁵ The EFFEKT model can be accessed at <http://www.esmap.org/EFFEKT>

⁶ The Backcasting Tool is one of the components of the Study for Long-Term Transport Action Plan for ASEAN (LPA Project) which was led by the Institution for Transport Policy Studies (ITPS), supported by the Nippon Foundation, and implemented in cooperation with Clean Air Asia, the Indonesia Transport Society, the National Center for Transportation Studies of the University of the Philippines, and the Mizuho Information and Research Institute (MHIR). It builds upon the previous collaborative work that have been done by ITPS, Clean Air Asia, the Transport Research Laboratory (TRL), and the selected experts on the development of Visioning and Backcasting Tools and data collection initiatives developing long-term plans of actions for low emission transport in Southeast Asia. More information is available at <http://cleanairasia.org/portal/LPA>

Marginal Abatement Cost Curve for Vietnam

A study by the World Bank (2014) suggests that a large fraction of the mitigation potential in the transport sector has negative abatement costs. The EFFECT model is used, based on assumptions for low-carbon scenarios from expert judgement. Figure 7 presents the MAC curve, showing costs and potentials cumulative over the 2010-2030 period; the impacts start mainly after 2018. The WB analysis suggests that there is a high mitigation potential in e.g. improving inland waterways, energy efficiency of private vehicles (including moving to Euro IV), increasing the use of electric bikes and modal shift to buses at a negative cost to society.



Note: Mitigation potential is the cumulative reduction over the 2010–2030 period, with the main impacts after 2020.

Figure 7: Marginal abatement cost curve for the transport sector

Source: World Bank, 2014

2.4 Bottom-up data review

The relevant data and emissions in transport sector will be reviewed according to a framework of emissions from transport named Activity-Structure-Intensity-Fuel (ASIF) approach (Schipper & Marie-Lilliu, 1999). In this approach, transport emissions are dependent on the level of transport activity (A), the transport mode structure (S), the fuel intensity (I), and the carbon content of the fuel or emission factor (F). By using the ASIF approach, there are a lot of data related to each ASIF factor depending on dimensions and levels of estimation details which can be achieved using either a top-down (based on fuel consumption) or a bottom-up approach (based on travel activity). The ASIF framework, further elaborated in Annex 1, provides a diagramme for understanding the transport system, its energy use and emissions.

2.4.1 Transport Activity

Transport activity (A) is a primary cause of fuel consumption and GHG emissions. Movement of people and goods depends on many factors including: demographics, income, economy and its composition, and urban form (Zegras, 2007). Generally, the unit of transport activity (A) is passenger-kilometre travelled (PKT) for passenger transport, and ton-kilometre travelled (TKT) for

freight transport. While these transport activity units are not recorded or surveyed regularly in Vietnam, annual estimates are provided by the General Statistics Office of Vietnam (GSO). GSO releases the statistics based on surveys they conduct and on the reporting system of the MOT. Their data show passenger demand (in p-km travelled) has been rising 8-10% per year in the period 2010-2013, while freight demand does not show an increasing trend since 2010⁷.

Forecasts predict a surge in demand of all modes of passenger and goods transport by 2020 and 2030. In 2007, as part of the *Transport Development Strategy of Vietnam up to 2020*, MOT projected an average growth rate of goods transport and passenger transport demand of about 7.3% and 12% per year between 1990 and 2030, respectively (Figure 8). A significant growth in demand is projected by *The Comprehensive Study on the Sustainable Development of Transport System in Vietnam (VITRANSS 2)*⁸, as illustrated in Figure 9.

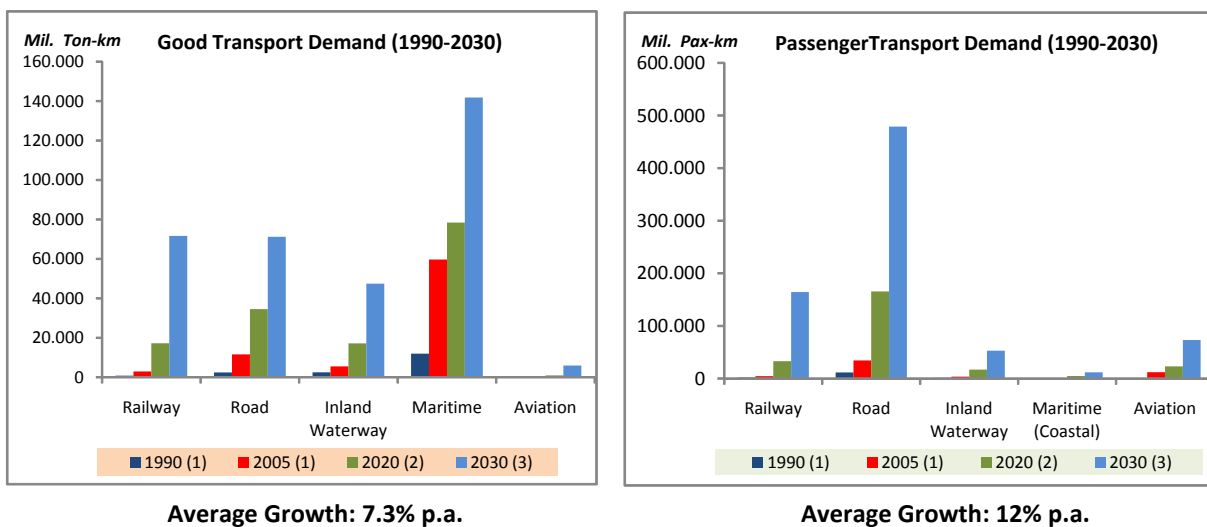


Figure 8: Goods transport (left) and passenger transport (right) demand growth in Vietnam

Source: Ministry of Transport, 2007

⁷ http://www.gso.gov.vn/default_en.aspx?tabid=781 (accessed 3 July 2015)

⁸ Some of the important sources of data include the comprehensive national traffic surveys conducted in 1999, 2005, 2008 as part of the project VITRANSS (2000), which was a *Study on National Transport Development Strategy*. The type of information gathered in three surveys covers traffic volume, origin-destination patterns, loading characteristics and vehicle characteristics. The study team deemed it necessary to conduct another traffic survey in 2008 due to the “fast growth of traffic and the impact of motorisation.” Moreover, the traffic surveys conducted prior to 2008 excluded motorcycles and other smaller vehicles, and the traffic stations where the surveys were conducted (39 stations in 1999, 64 in 2005) were spread all over the country. In contrast, the 2008 traffic survey included motorcycles and focused on 55 selected stations along key cordons and the north-south axis of the country. VITRANSS 2 (2010) was on *The Comprehensive Study on the Sustainable Development of Transport System in Vietnam*.

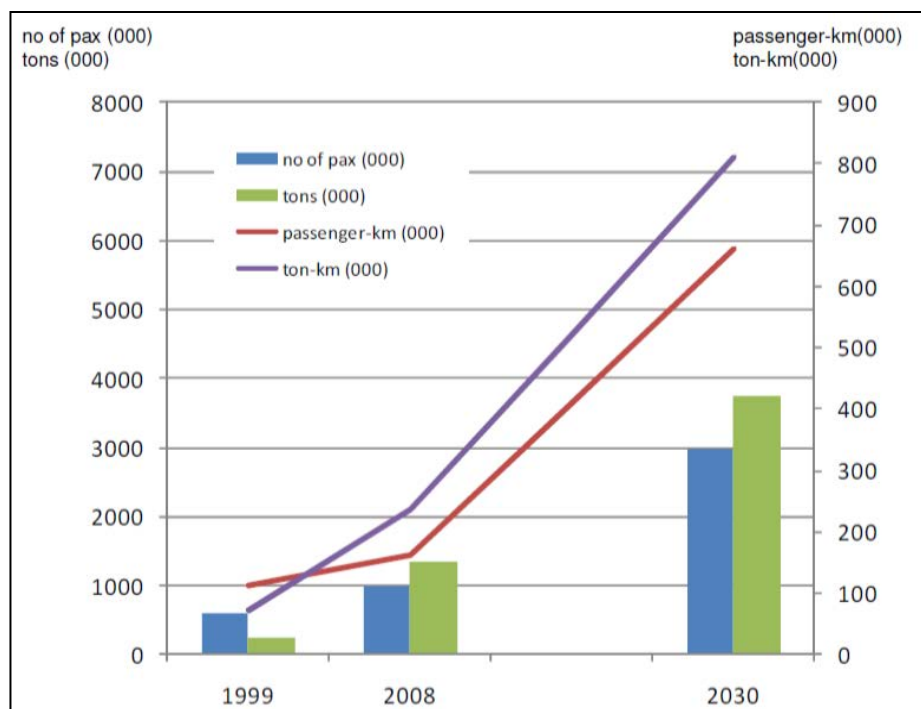


Figure 9: Goods and passenger transport demand growth in Vietnam

Source: VITRANSS 2, 2010

■ Passenger travel activity

The road traffic survey of VITRANSS 2, where 20,895 vehicles were surveyed⁹, shows that a considerable number of motorcycles and bicycles run on national roads. While vehicle composition varies, trucks comprise more than 50% of the total number of four-wheeled vehicles while passenger cars and buses comprise approximately 20% and 30%, respectively. A summary of the road traffic count is provided in Annex 6.

Figure 10 illustrates the national PKT trend from 1995 to 2011, using data from GSO. A Study of Long-Term Transport Action Plan for ASEAN" by ITPS and Clean Air Asia shows the vehicle fleet has grown at an average of 16% per annum from 2000-2012, and a high correlation between PKT and vehicle population was observed. The total PKT in Vietnam is anticipated to reach 741 billion in 2040 from 217 billion in 2010, according to the BAU scenario estimated by a report undertaken by the World Bank (2013), see also Table 3. While road transport is expected to account for the largest proportion of PKT in 2040, passengers are expected to shift from road transport to rail transport. The trend of vehicle growth and its composition will be discussed further in Section 2.4.2.

⁹ The survey covered 2,134 cars, 4,523 buses, 9,554 trucks, and 4,684 motorcycles. The overall sampling rate was 3.6%, excluding motorcycles and bicycles.

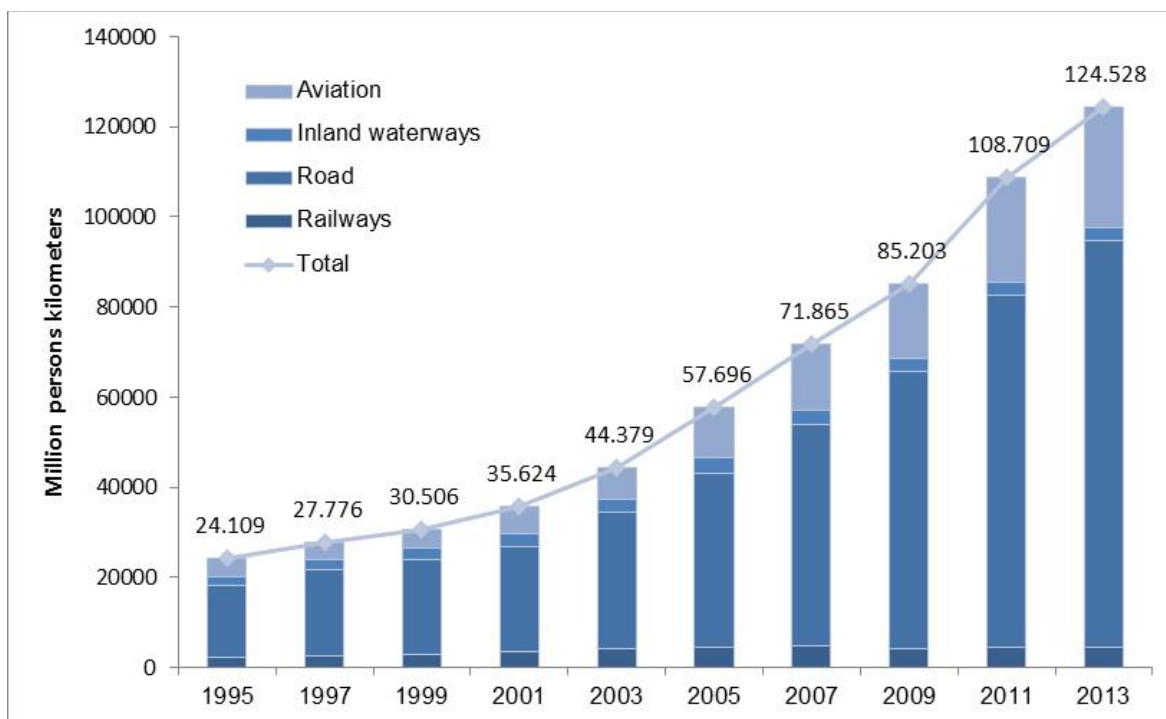


Figure 10: *Volume of passenger traffic by type of transport*

Source: Statistical Yearbook 2014 (GSO)

Overview of transport activity in Hanoi

The travel demand in Hanoi excluding walking in 1995 was estimated at 3.1 million trips/day. In 2005, it grew to 6.5 million trips/day or 1.74 trips/person/day. Annex 7 presents a summary of travel characteristics from a 2003 household interview survey conducted by the Transport Development and Strategy Institute (TDSI) covering 10,000 questionnaires in inner-city districts and suburbs districts in Hanoi (Schipper et al., 2008). During the period 1995-2005, there was an increase in the number of trips by private motorcycles and cars by 545% and 2443%, respectively, but a decrease in the share of bicycle trips by 29% (Table 4).

Table 4: *Travel demand by mode in Hanoi city and adjoining districts*

Travel Mode		No. of Trips (000/day)					Share of Total Vehicle Trips (excludes walking) (%)			
		1995	2005			Percent increase in Hanoi City: 1995-2005**	1995	2005		
		Hanoi City	Hanoi City	Adjoining districts	Total		Hanoi City	Hanoi City	Adjoining districts	Total
Private	Bicycle	2,257	1,598	486	2,084	-29%	73	24	52	28
	M/C*(drive r)	632	3,619	331	3,950	545%	21	55	36	53
	M/C (passenger)		459	41	500			7	4	7
	Car	7	178	6	184	2443%	0	3	1	2
	Truck	21	57	9	66	171%	1	1	1	1
	Subtotal	2,917	5,911	873	6,784	103%	95	90	94	91

Travel Mode		No. of Trips (000/day)				Share of Total Vehicle Trips (excludes walking) (%)				
		1995	2005			Percent increase in Hanoi City: 1995-2005**	1995	2005		
		Hanoi City	Hanoi City	Adjoining districts	Total		Hanoi City	Hanoi City	Adjoining districts	Total
Semi-public	Taxi	-	57	2	59	-	-	1	0	1
	Bicycle rickshaw	-	3	1	4	-	-	0	0	0
	Moped taxi (Xeom)	-	74	6	80	-	-	1	1	1
	Private bus	-	95	4	99	-	-	1	0	1
	Subtotal	-	229	13	242	-	-	3	1	3
Public	Bus	165	382	32	414	132%	5	6	3	6
	Rail	-	0	0	0	-	-	0	0	0
	Subtotal	165	382	32	414	132%	5	6	3	7
Others***		-	23	8	31	-	5	0	1	0
Total (excl. walking)		3,082	6,545	926	7,471	112%	100	100	100	100
Walking trips		3,141	2,176	688	2,864	-31%	50	25	43	28
Total (incl. walking)		6,223	8,721	1,614	10,335	40%				

Note: Due to all values being rounded to the nearest integer, some nonzero percentages may appear as 0%.

* M/C designates motorcycle.

** The 1995–2005 percentage increase was calculated using only Hanoi City data from 1995 and 2005, because data from adjoining districts were not available for 1995.

% increase = [(Hanoi City 2005 – Hanoi City 1995) / Hanoi City 1995] * 100.

*** Other forms of transport—boats, etc.

Sources: Vietnam Urban Transport Assistance Project (VUTAP), 1995; ALMEC, 2007. Obtained from Schipper et al. (2008).

Overview of transport activity in Ho Chi Minh City

In 1996, Department for International Development (DFID) conducted a survey covering 10,000 households. The study estimated a gross travel demand in the city as 8.2 million trips/day. A 2003 survey conducted by JICA interviewing 20.8 thousand households as part of HOUTRANS found that the gross travel demand has increased to 13.9 million trips/day (Mai, Ba, & Chinh, 2013) or 2.57 trips/person/day.

Overview of rural areas

A rural household survey called Time and Distance Study was conducted by TDSI in 2006 and funded by DFID for MOT as part of the South East Asia Community Access Programme (SEACAP). The survey included two communes of Son La province as representative of the mountainous terrain (204 households), 2 communes of Thanh Hoa province as representative of the plains terrain (202 households), and 2 communes of An Giang province as representative of the delta terrain (203 households).

Based on survey results, travels in Thanh Hoa and Son La provinces (representing the flat and mountainous regions) were mainly made by walking and cycling, accounting for 80% of the total journeys. In An Giang province, the trips made by foot and by bicycles accounted for only 60% because they also travelled by boats. The trips made by motorcycles accounted for 8% to 24% while those by passenger cars were not as significant (1.4% to 4.2%). (However, the survey highlights that

the local people in poor households in some mountainous locations usually have a “vague perception on time and distance” and have “poor estimating skills” for such indicators, recommending further that future surveys utilise familiar measurement units such as sun positions.)

■ Freight travel activity

Figure 11 presents the freight transportation volume (ton/day) by trip distance in 2008 according to the transportation and logistics survey completed in 2009 for VITRANSS 2, which has five components: logistics survey, trucking company survey, bus company survey, inland waterway transport operator survey, and shipping company survey. It is observed that road freight transport is mostly via short-distance trips (i.e. less than 100km), comprising 73% of the total road freight movement. An important observation is that about 87% of the total freight movements are characterised by short-distance trips (i.e. less than 200km). According to the World Bank (2011), “The highly skewed distribution is driven by the two dominant internal trade patterns centred on Hanoi and HCMC.” A spatially referenced route-specific trucking survey was commissioned by the World Bank in 2010, which further confirmed the concentration of freight movements in Hanoi and HCMC (World Bank, 2011). Moreover, the carrying capacity of an average cargo vessel fleet in Vietnam is approximately 100 deadweight tons; that of Western Europe is approximately 2,500 deadweight tons (Blancas & El-Hifnawi, 2013).

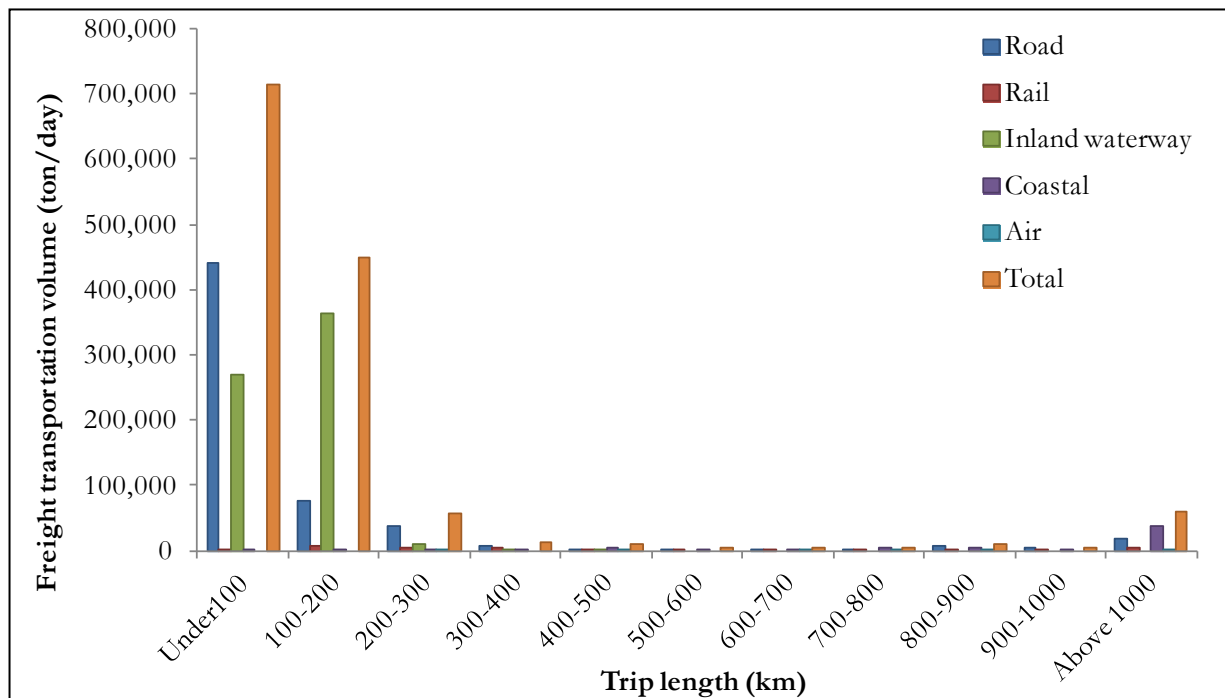


Figure 11: Freight transportation volume (ton/day) by trip distance, 2008

Source: VITRANSS 2, 2010

Figure 12 illustrates the national TKT trend from 1995 to 2011. According to the BAU scenario estimated by a report undertaken by the World Bank (2013), TKT in Vietnam is anticipated to reach 637.5 billion in 2040, seven times higher than the 2010 figure of 91.4 billion TKT.

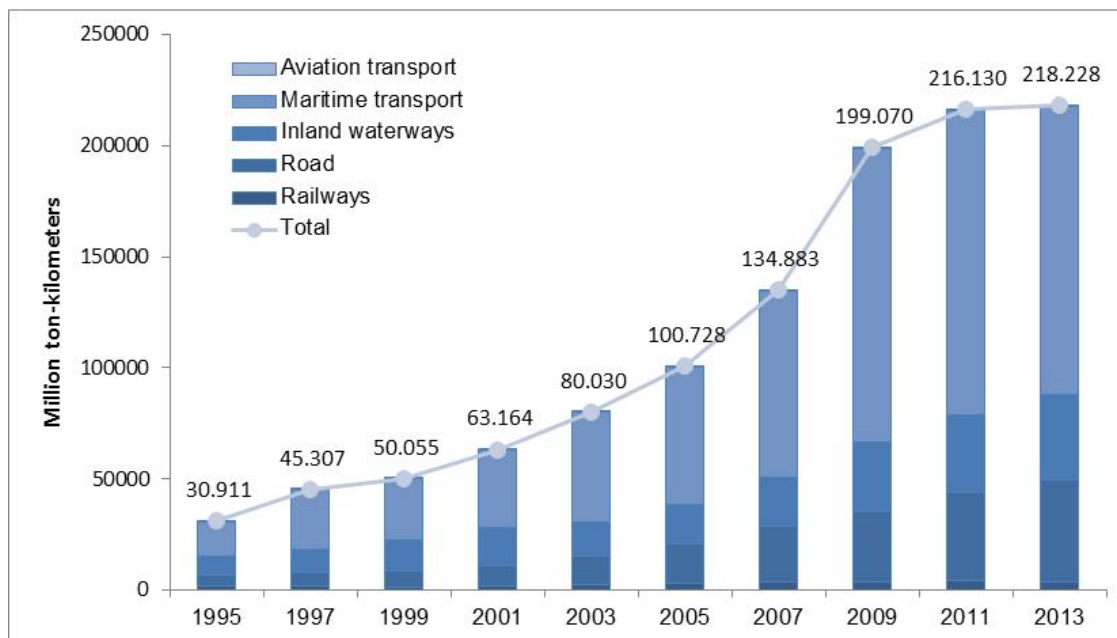


Figure 12: Volume of freight traffic by type of transport

Source: Statistical Yearbook 2014 (GSO)

2.4.2 Modal Share

Modal share (S) influences transportation energy use and GHG emissions because different travel modes have different emission rates. For example, human-powered transportation produces no direct emissions. There are also multiple factors which play important roles in modal share. For example, income influences people’s value of time and demand for speed, comfort, and privacy. This results in vehicle ownership, determined by the availability of and infrastructure for different modes. Moreover, availability and reliability of public transit systems can affect modal attractiveness (Zegras, 2007). Therefore, structural changes of transportation infrastructure will impact energy consumption and GHG emissions of country significantly.

■ Number of vehicles

The data on the total number of car and motorcycles registered is from the Road-Rail Traffic Police of the Ministry of Public Security. There is no data on in-use number of motorcycles. Further, because motorcycles are only required to register once, it is difficult to account for number of retired motorcycles. For cars, buses and trucks, data is from Vietnam Register (through their Monthly Magazine “Total Vehicle Population in the Country”).

In 2010, the total number of vehicles in the country reached 31.3 million vehicles and then continuously increased to 38.6 million vehicles in 2012 (Vietnam Register). Between 2000 and 2010, the total number of vehicles in Vietnam increased at an average rate of 17.7% per year (Clean Air Asia, 2012) while the average rate for 2010-2012 is 11.1% per year (Vietnam Register, 2013). The trend of vehicle growth for about two decades is illustrated in Annex 8 and 9, showing the vehicle fleet is dominated by motorcycles (95%).

The growth in the number of motorcycles in Hanoi and HCMC is provided in Figure 13. The figure shows the gap between Hanoi and HCMC in terms of motorcycle population has been decreasing since 2008, suggesting that Hanoi experienced a sharper increase in growth rate of this mode of transport.

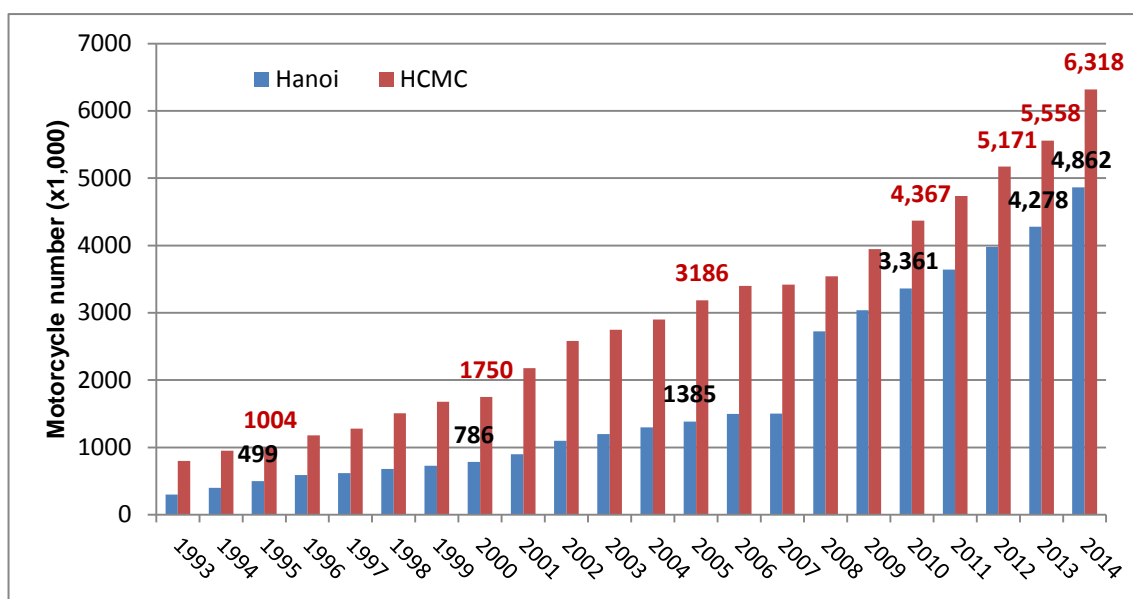


Figure 13: Number of in-use motorcycles in Hanoi and Ho Chi Minh City

Source: Vietnam Register, 2015

The World Bank report Winds of Change (2010) projects that passenger cars will grow more rapidly than 2 wheelers, if nothing is done to reverse the motorisation process and to implement mass transportation programs (Wang, Berrah, Mathur, & Vinuya, 2010). While Vietnam’s motorcycle market is among the largest globally, the market for two-wheeled motorcycles has reportedly saturated in recent years as supply exceeds demand. According to Vietnam Register, the number of registered motorcycles dropped to 2.92 million units last year compared to 3.27 million units in 2013, 3.28 million units in 2012 and 3.67 million units in 2011¹⁰. Sales continue to slow down despite the drop in prices. Nevertheless, businesses are determined to continue production and use Vietnam as an export base, and are expected to “turn Vietnam into a motorbike manufacturing centre in Asia” (Thanh Nien News, 2014).

¹⁰ <http://www.vietnambreakingnews.com/2015/02/number-of-registered-bikes-exceeds-2020-vision/>

■ Modal share of passengers

Modal share can be regarded as indicator helping to assess sustainability of the transport system. For sustainable transport and climate change mitigation, it is preferred to have a high share of public transport modes as well as non-motorised transport rather than private vehicles. At the national level, the modal share of vehicles has been reported by Vietnam Register however there is no official data on the modal share of passengers. These are only studied and reported by international organizations in some big cities in certain years as this is a costly process (Typically these data are reported through travel surveys which are conducted for long-term strategic planning purpose) and there is lack of recognition of the importance of this data.

The mode share (excluding walking) in Hanoi based on the 2003 household interview survey introduced earlier in Section 2.5 is illustrated in Figure 14. Bicycles and motorcycles comprise a significant share of the mode split with an average of 90% for inner-city, suburb, and entire city. Public passenger transport including buses and taxis comprise a minimal share in the mode split (less than 10%).

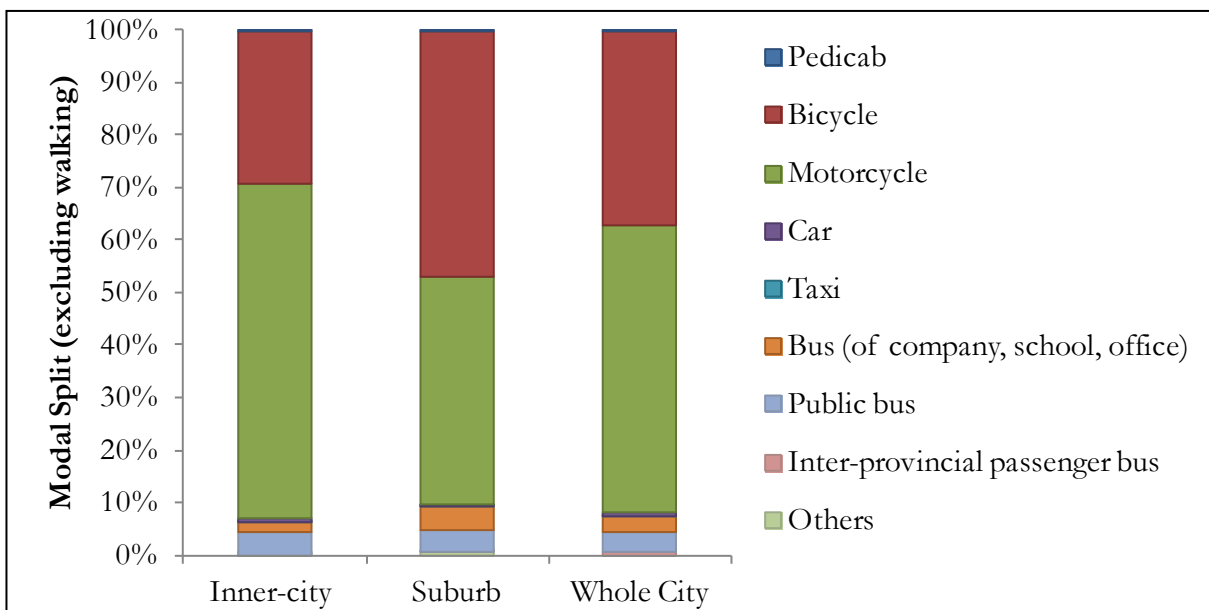


Figure 14: Mode share in Hanoi, 2003

Source: Transport Development and Strategy Institute, 2003

The same is observed in Ho Chi Minh City where motorcycles remain as the primary mean of mobility (Figure 15). About 90% of the trips are via motorcycle or bicycle for all trip purpose (e.g. school, home) except for business.

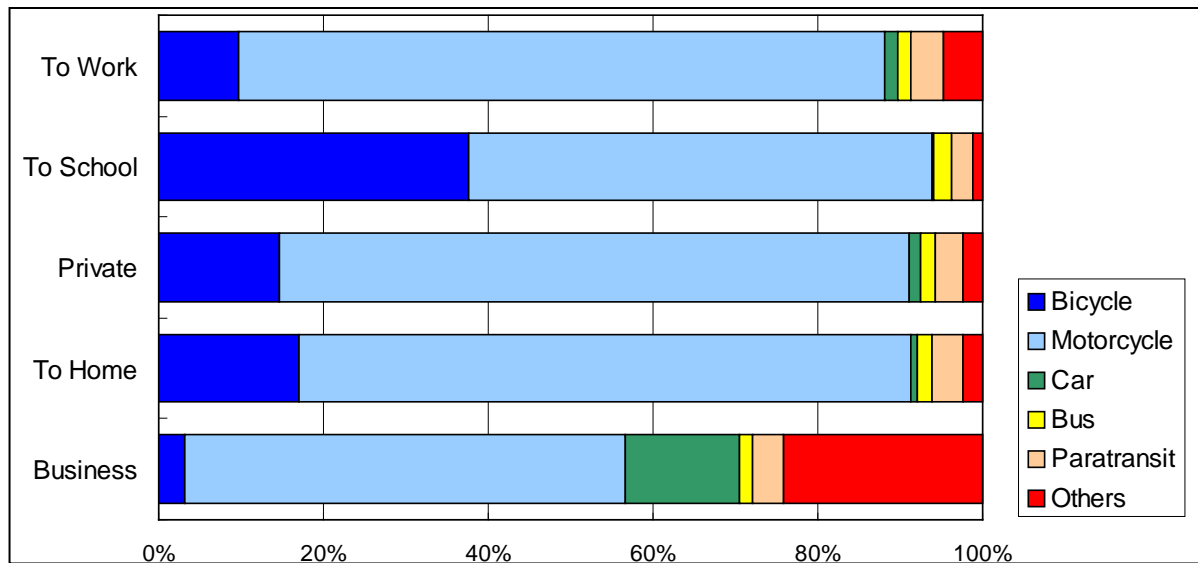


Figure 15: Mode share by trip purpose in Ho Chi Minh City, 2004

Source: JICA, HOUTRANS, 2004

During the period 1995-2005, both cities of Hanoi and Ho Chi Minh saw a shift from walking and bicycles to motorcycles, and a shift from motorcycles to cars. Additionally, the results from *The Study on Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area (HOUTRANS)* and the *Hanoi Integrated Development and Environment Programme (HAIDEP)* completed in 2004 and 2007, respectively, show a further decline in the shares of bicycles in both cities, as well as of motorcycles, and a growth in the shares of cars and taxis.

As the data from these studies is out of date and modal split might be changing quickly, especially the non-motorised share and also the improvement of the public transport infrastructure like MRT, BRT¹¹; the applicability of the above data for the present time should be considered.

Additionally, Hanoi has set a target of increasing the ridership of public transport to over 40% of demand as presented in Hanoi Urban Transport Master Plan (2013). Recent estimates also show that about 10% of the trips are made by public transport (TDSI, 2015); in 2005, its share was about 6%, representing a slight increase from its share of 3% in 1995 (The Motorbike JWG, 2007). In a detailed modelling study covering Hanoi and its satellite towns, Nguyen, N.Q. et al. (2013) show that motorcycles provide far better accessibility to jobs compared to public transport.

At the national level, there is no comprehensive study on modal split for passenger transport. Normally, these data are surveyed and presented in the cities and province’s transport master plan and are not reported annually.

¹¹ Tuan & Mateo-Babiano (2013) carried out a survey among 400 HCMC inhabitants in 2012, in which the share of bus transport was 12% and bicycle 8%, with the remainder predominantly by motorcycle. They find that motorcycle taxis provide a flexible alternative transport mode for the urban poor and could contribute to low-carbon transport as a convenient access mode to public transport in the future.

■ Modal share of freight

The VITRANSS 2 provides insight in the modal share of freight transportation. As illustrated in Table 5, freight movement is predominantly through roads and inland waterways. Together, roads and inland waterways comprise 94% of the total freight movement. Table 5 presents the mode shares of interprovincial freight transport in 2008 based on VITRANSS 2 survey results. It is observed that a significant share of the manufactured goods (88%) is transported by roads, while the most of heavy raw materials, such as construction materials (73%) and coal (79%), are transported via inland waterways (World Bank, 2011). Rail has a fairly limited role in freight movement in the country.

For long distance trips, the World Bank report released in 2014, *Efficient Logistics: A Key to Vietnam's Competitiveness*, likewise observes that Vietnam relies heavily on trucking and less on less expensive rail and inland waterway transport despite its geography, with goods moving from Ho Chi Minh City or Mekong Delta to distribution facilities in central and northern regions.

Table 5: Modal shares by commodity (ton/day), 2008

Commodity	Road	Rail	Inland waterway	Coastal waterway	Air	Total
1. Rice	78,969	204	36,109	4,261	0	119,543
2. Sugarcane/Sugar	3,682	0	4,847	88	0	8,617
3. Wood	11,499	523	11,683	914	0	24,619
4. Steel	41,965	2,156	1,015	764	0	45,900
5. Construction Materials	129,219	8,213	370,787	1,914	0	510,133
6. Cement	38,965	3,810	64,387	13,021	0	120,183
7. Fertiliser	8,813	2,939	28,678	1,168	0	41,598
8. Coal	12,106	2,377	92,549	10,092	0	117,124
9. Petroleum	33,374	404	5,018	8,234	0	47,030
10. Industrial Crops	5,628	0	2,415	0	0	8,043
11. Manufactured Goods	171,895	4,895	3,916	13,524	251	194,481
12. Fishery Products	7,186	0	12,203	0	0	19,389
13. Animal Meat & Others	61,578	0	9,373	4,118	0	75,069
Total Tonnage Transported (ton/day)	604,879	25,521	642,980	58,098	251	1,331,729
Modal Share (%ton)	45.4	1.9	48.3	4.4	0	100
Average Trip Length(km)	143	400	112	1,161	1,404	178
Modal Share (% ton-km)	36.6	4.3	30.5	28.5	0.1	100.0

Source: World Bank, 2011

As discussed in World Bank (2011), domestic freight transportation demand up to 2030 was projected by the VITRANSS 2 study based on various assumptions and model estimations¹². Table 6 summarises the information in Table 5 and provides the projection of modal shares of freight transportation in 2030. The results indicate that, in 2030, road and inland waterways will still comprise a large proportion of the freight movement. The modal share of inland waterways is projected to decrease from 48.3% in 2008 to 35.3% in 2030. In contrast, the modal shares of both rail and road are projected to increase in the same period. In terms of tonnage share, freight by inland waterway accounted for the largest total tonnage share among all modes in 2008 (48%), but will decline in 2030 (35%) and will be surpassed by the road sector (57%).

In 2008, while freight demand by inland waterways is larger than by road, the distance made by inland waterway transport is shorter (112 km) than by road (143 km). Short-distance freight movement via inland waterways can also be attributed to topographical constraints. World Bank (2011) observes that the connected waterways have limited vertical navigational clearance under the bridges, and have sharp curves. Moreover, Blancas & El-Hifnawi (2013) observes that the waterway network “offers limited and largely east-west geographical coverage,” thereby limiting the trip length of this freight mode. Additionally, as presented earlier in Section 2.5, Table 6 shows that freight demand by inland waterway will continue to grow, but not as much as railway and road.

Nevertheless, recognising the potential of freight via maritime transport, Blancas & El-Hifnawi (2013) recommends that multi-modal linkages between rivers, ports and highways be improved, and that cargo-carrying capacity of the highest-priority inland waterway transport corridor be expanded.

Table 6: *Projection of modal shares of freight transportation, 2008 and 2030*

		Road	Rail	Inland waterway	Coastal waterway	Air	Total
Volume transported (“000 ton/day)	2008	604.9	25.5	643.0	58.1	0.3	1351.8
	2030	2132.7	155.1	1317.0	125.8	1.0	3731.6
Modal share (% , ton)	2008	45.4	1.9	48.3	4.4	0.0	100
	2030	57.2	4.2	35.3	3.4	0.0	100
Modal share (% , ton-km)	2008	36.6	4.3	30.5	28.5	0.1	100
	2030	53.0	9.7	19.9	17.2	0.2	100

Source: VITRANSS 2, 2010¹³

¹² “Projecting freight transportation demand starts with estimating production and consumption by province and by commodity group. The provincial-level surplus or deficit is then used as a source of freight traffic. Socioeconomic growth trends and planned projects are also taken into account. After forecasting future origin-destination distribution using the Fratar method, the modal split of freight traffic demand was estimated using differences in generalized cost of each transport mode.” Source: VITRANSS2 cited in World Bank, 2011.

¹³ http://www.citiesalliance.org/sites/citiesalliance.org/files/CAFiles/Projects/Final_669160ESW0P1130Review000Full0report.pdf

2.4.3 Energy Intensity

Energy or fuel intensity (I) is the consumption of fuel per amount of work done, i.e. passengers or goods moved. It is affected by e.g. vehicle technology, age, engine type, and driving cycles and driving conditions (Schipper, 2007).

■ Fuel economy of vehicles

Fuel economy is measured in terms of average vehicle-distance travelled per unit of fuel used (e.g. km/litre), or of the volume of fuel used per vehicle-distance travelled (e.g. litre/km). In developed countries such as U.S., Japan and Korea and other European countries, fuel economy data of new vehicles can be obtained from fuel economy or emission standard program where all new models of vehicles are tested with appropriate standard driving cycles to pass a minimum standard prior to obtaining certification for selling in the market. In Vietnam, type approval procedures require new vehicle to meet certain emission standards. All manufacturers and importers of new vehicles need to provide the necessary documents with pollutant emissions (included CO₂) and fuel consumption of the vehicle type to Vietnam Register before type approval certificate is issued. To examine the real fuel consumption, a study was conducted in Hanoi to collect some data through an on-road vehicle testing, fuel consumption of several types of motorcycles and LDVs was provided in Table 12 and Table 13.

As of 2015, Vietnam has a Euro 2 and sulphur levels regulation of 500 ppm in both gasoline and diesel under Tieu chuan Vietnam specification fuel (TCVN 5689:2005 for diesel and TCVN 6776:2005 for gasoline). No mandatory fuel economy standards have been implemented yet (see section 3.2).

■ Vehicle speed

Fuel intensity likewise depends on speed, driving behaviour, and vehicle age. The 2003 TDSI study in Hanoi, estimating journey speed from travel time and trip distance, shows that buses, motorcycles and bicycles run no faster than 20 km/hr in Hanoi (Table 7). In another review years later (World Bank, 2013) the average driving speed in an urban driving conditions in Vietnam remains no more 20 km/hr. for cars, trucks, buses, and motorcycles (Table 8). The average trip speed of trucks (trip distance divided by trip time) is 30-35 km/hr. (World Bank, 2011).

Table 7: *Average journey speed by mode in Hanoi, 2003*

Vehicle type	Average journey speed (km/h)
Bus	11.4
Motorcycle	17.8
Bicycle	11.6

Source: Transport Development and Strategy Institute, 2003

Table 8: *On-road vehicles' average speed, 2010*

Vehicle type	Average journey speed (km/h)		
	Urban	Rural	Highway
Car, SUV, MPV	20	60	75
LDV	20	60	65
HDV – Truck	18	40	45
HDV – Urban bus	14	37	37
HDV – Coach	18	50	65
Motorcycle	20	35	-

Source: World Bank, 2013

■ Vehicle age

Vietnam Register reports that automobiles over 15 years of age accounted for a little more than 13%, while 69.6% are less than 10 years old (Table 9) (Duc, 2009). Trucks, on average, are 16.6 years of age (World Bank, 2011). About a decade ago, about 80% of the public buses in Hanoi were over 10 years old, and only about 20% were under 5 years; similarly, most of the buses in Ho Chi Minh City were 25 years old on average (Vietnam Register, 2002).¹⁴ Subsequently, the Centre for Environmental Monitoring (CEM) of the Vietnam Environment Administration (VEA) gives an overview of motorcycle and LDV distribution by age in Hanoi (Figure 16) when it launched a two-year emission-monitoring program which developed the first emission factors and emission inventories for motorcycles and LDVs considering the local driving characteristics in Hanoi (Tung, Tong, Hung, & Anh, 2011; Tong, Tung, Hung, & Nguyen, 2011). The survey shows that LDVs are generally 3-7 years of age and only 6% are greater than 10 years, while 65% of motorcycles in Hanoi are 3 years of age and less, and only 10% are more than 10 years old. Annex 13 summarises the driving cycle for motorcycle and LDV in Hanoi. Motorcycles generally have shorter use time than automobiles (Manh, Thuy, & Duy, 2011). Ho Chi Minh City has relatively similar values: majority of its motorcycles are less than 3 years old (Figure 17).

Table 9: *Estimated age of motor vehicles in circulation, 2009*

Classification	Quantity	Percentage (%)
Total of automobiles in circulation	1,092,614	100
Age of automobiles less than 10 years	760,703	69.6
Age of automobiles from 10 to 15 years	141,674	12.97
Age of automobiles from 15 to 20 years	143,478	13.13
Age of automobiles more than 20 years	46,759	0.43

Note: excludes motorcycles

Source: Vietnam Register

¹⁴ This is from the Regional Technical Assistance project (RETA 5937) initiated by Asian Development Bank to support some countries to develop action plans to reduce vehicle emissions. The output, "Integrated Action Plan to Reduce Vehicle Emissions in Viet Nam," was formulated by Multi-sectoral Action Plan Group organised by Vietnam Register with representatives from relevant ministries

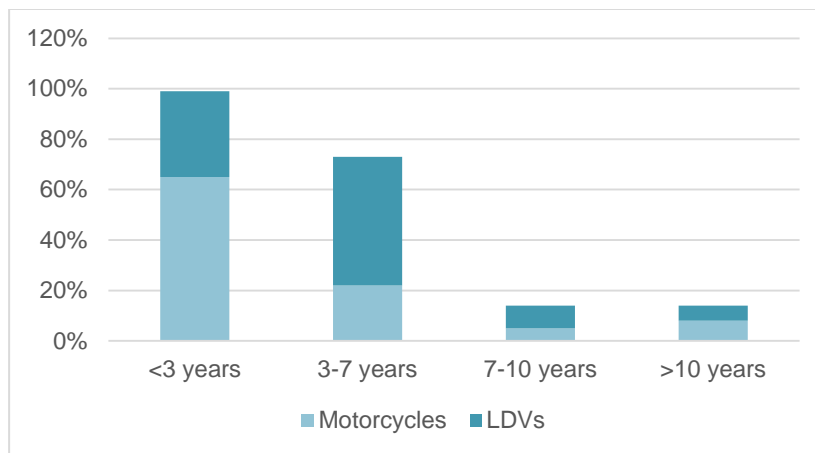


Figure 16: *Distribution by age of motorcycle and LDV in Hanoi*

Source: Tong, Tung, Hung, & Anh, 2011

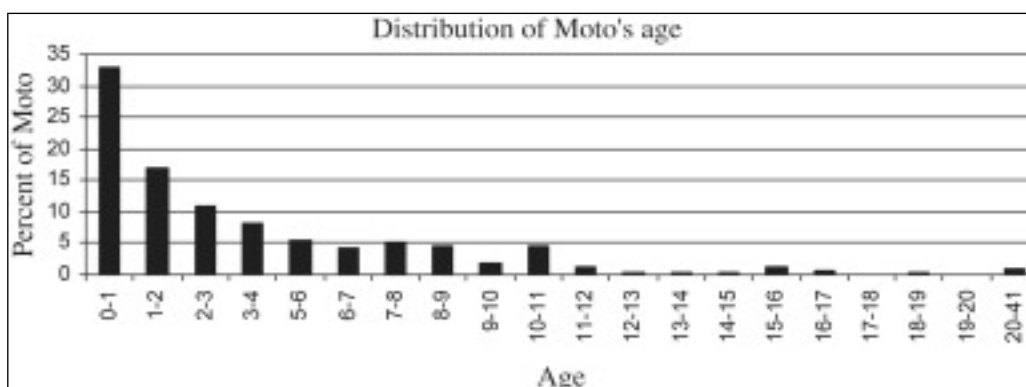


Figure 17: *Motorcycle distribution by age in Ho Chi Minh City*

Source: Dzung & Thang, 2011

According to Vietnam Register, of the 1.09 million vehicles (excluding motorcycles) in Vietnam in 2009, 69.6% are less than 10 years old, 12.97% are between 10 to 15 years old, 13.13% are from 15 to 20 years old, and 0.43% are over 20 years old. On the other hand, 26.16% of the motorcycles in circulation are 10 years old and above (Figure 18). This is based on the Motorcycle Emission Control in Major Cities Program (2007).

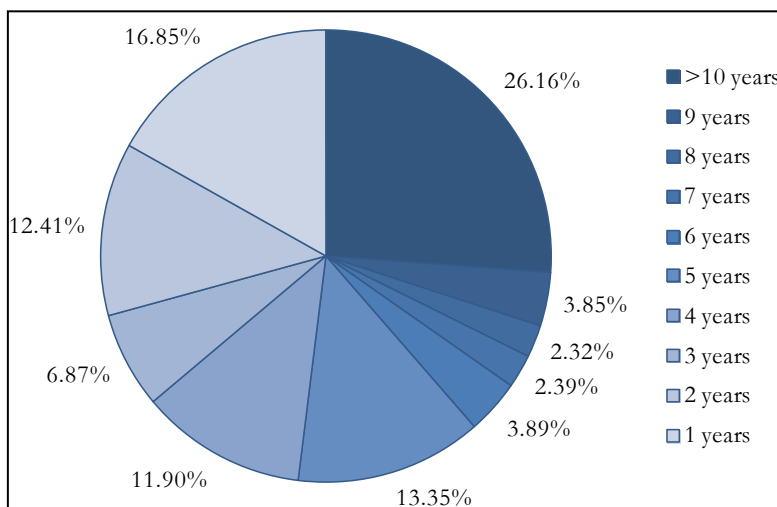


Figure 18: *Distribution of age of motorcycles*

Source: Motorcycle Emission Control in Major Cities Program. Hanoi, Vietnam. 6 March 2007

■ Vehicle and fuel technology

There is limited information on the fuel split of vehicles in the country, but there is information for Hanoi and HCMC. An estimate on gasoline and diesel fuel split by mode in Hanoi in 2005 is provided in Table 10. It indicates that passenger cars mostly rely on gasoline fuel while trucks rely more on diesel (Schipper et al., 2008). Annex 12 presents the fuel split for motorcycles and LDVs in Hanoi, and their classification according to engine capacity, and indicates that most motorcycles and LDVs rely on gasoline.

Table 10: *Estimated gasoline/ diesel fuel split by mode in Hanoi, 2005*

Fuel type	Passenger Cars	Bus	Truck
Gasoline	92%	50%	32%
Diesel	8%	50%	68%

Source: Estimated by Tuan Le Anh. 2008. Cited in Schipper et al., 2008.

In HCMC, similar studies on emissions estimation have been developed which also included survey to characterise the vehicle fleet characteristics in the city (Ho & Clappier, 2011). Results also show that primary fuel used by motorcycles is gasoline. In addition, their survey results found that, while most of the motorcycles in the city are not very old, their pollution share is significant. Ho & Clappier (2011) explain that this is because the motorcycles are manufactured by low standard technology (Euro 1 or pre-Euro) to keep the price low.

■ Fuel pricing and infrastructure

Fuel pricing holds a key role in climate change and energy efficiency strategies, mainly for two reasons: firstly, fuel subsidies or taxation can be either a financial burden or a source of revenues for national governments, which in the latter case can notably be used to finance costly urban transport projects and policies, and; secondly, taxation and subsidies can either encourage or discourage

certain transport practices of the people and businesses. High fuel prices can indeed avoid or delay a shift to private vehicle users from non-motorised transport modes or mass transportation systems.

Vietnam is one of the most important oil producers in Southeast Asia. It ranks third, following China and India, in terms of natural oil reserves for the Asia-Pacific region. It is also a significant consumer as a consequence of its economic development (with an overall yearly GDP of 7.2% between 2002 and 2012). The U.S. Energy Information Administration (EIA) (2012) likewise reports: “Vietnam held 4.4 billion barrels of proven oil reserves as of January 2012, compared to 0.6 billion barrels of oil in 2011. This increase is in part a result of Vietnam's efforts to intensify exploration and development of its offshore fields. Ongoing exploration activities could increase this figure in the future, as Vietnam's waters remain relatively underexplored.” Nonetheless, oil consumption in this country surpassed production in 2011. The EIA report further explains:

“Vietnam's oil sector is dominated by the state-owned Vietnam Oil & Gas Corporation (PetroVietnam), essentially both the operator and regulator in the industry. PetroVietnam is under the authority of the Ministry of Industry and Trade (MOIT). All oil production in the country is carried out by PetroVietnam's upstream subsidiary, PetroVietnam Exploration and Production (PVEP), or through joint-ventures or production sharing contracts, in which the national oil company (NOC) has at least a 20% equity interest. PetroVietnam is also involved in Vietnam's downstream oil sector through various subsidiaries, such as Petechim and PetroVietnam Oil Processing and Distribution Company (PV Oil). Petrolimex is the primary company charged with importing and distributing petroleum products in Vietnam and accounts for about 60% of the country's total petroleum distribution market.”

Military Petroleum Corporation and Comeco Company are the two most important secondary distributors in the country. The report continues, “There are plans to sell equity stakes in Petrolimex and provide greater competition for the domestic market. So far, only 3% of the company's shares were sold off in a partial privatisation to Vietnamese buyers” (EIA, 2012).

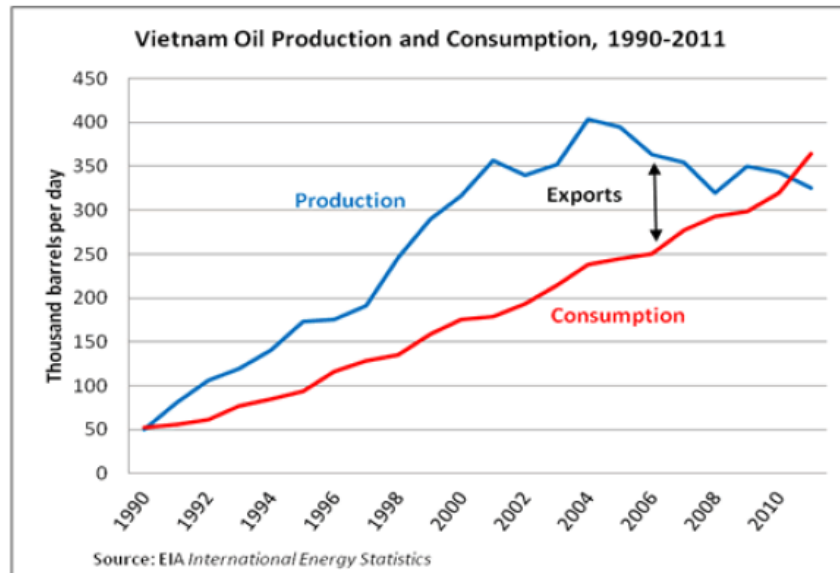


Figure 19: Vietnam oil production and consumption, 1990-2010

Source: Energy Information Administration, 2012. *Country Analysis Briefs: Vietnam*

Prices of ‘super gasoline’ and diesel in Vietnam have experienced an overall increase since 2005, as indicated in the graphs in Annex 11. This is notably due to the rise in global prices and the inflation in the country. The same report indicated that diesel fuel notably benefits from some government subsidies, contrary to gasoline which is taxed. As of December 2014, the gasoline was USD 1.03/litre while diesel was USD 0.92/litre.

The Government of Vietnam has adopted a model of active fuel price regulation following the example of the People’s Republic of China. The state systematically adjusts prices as explained by EIA (2012):

“Currently, Vietnam maintains wholesale and retail oil prices lower than international oil market prices to sustain a growing economy, keep inflation from rising, and protect consumers, resulting in revenue losses for oil distributors. Vietnam's Ministry of Finance attempts to manage these losses through tools such as import tax and tariff reductions and the Fuel Price Stabilization Fund, which allows distributors to withdraw cash. In times of high crude oil prices, though, the fund's resources tend to diminish. Vietnam intends to gradually roll back fuel subsidies in the oil and natural gas sector and use market-based pricing in order to alleviate state budget strains in times of high international oil prices. Limited reform under Decree 84 (2009) allows fuel retailers to increase oil prices by 7 % when international prices fluctuate by the same rate within a 30-day period, but the government typically tries to maintain lower prices for consumers and uses this measure as a last resort to reverse distributors' revenue losses. When crude oil prices escalated in 2010, Vietnam reduced oil product import tariffs several times until early 2012, when the government slashed duties on gasoline, jet fuel, and diesel to zero. Also, the government resorted to boosting retail oil product prices by a total of 34% in 2011, and by an additional 12% in March 2012.”

■ Logistics performance

The overall score of World Bank's Logistics Performance Index (LPI) reflects the perceptions of a country's logistics based on efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time. The index ranges from 1 to 5, with a higher score representing better performance. Based on the surveys conducted by the World Bank in partnership with academic and international institutions and private companies and individuals engaged in international logistics, Vietnam's LPI is 3.15 in 2014, and the country is among the over performing non-high-income economies (Table 11).

Table 11: *Logistics performance index for Vietnam*

	2007	2010	2012	2014
Logistics Performance Index	2.89	2.96	3.00	3.15

Source: World Bank, 2014. *Connecting to Compete: Trade Logistics in the Global Economy*

2.4.4 Fuel Emission Factors

Fuel choice (F) influences to GHG concentration in exhaust differ by fuel type. Natural gas has different GHG emissions than diesel, gasoline, and so on. In the case of electricity-powered transport electric vehicles, GHG emissions depend on the fuel sources, combustion technologies, and transmission and distribution losses.

■ Emission factors

Emission factors¹⁵ are important parameters in estimating emissions or the amount of CO₂ generated per unit activity. It can be expressed as gCO₂e/km. Emission factors vary between countries due to different vehicle technologies, fuel characteristics, driving characteristics, and so on. To have reasonable emission estimates, measurements need to be conducted for a sample size that is representative of the vehicle fleet following a typical local driving cycle which represents the traffic conditions a vehicle encounters (Schipper, et al., 2008)

¹⁵ An emissions factor is a measure of the rate that pollutants are emitted relative to units of activity and vary with vehicle technology, vehicle maintenance and tuning, driver behaviour, temperature, etc. This can be measured in multiple ways: in units of grams emitted per kilometre travelled by the vehicle (g/veh km), per passenger km (g/pass km), or per litre of fuel consumed (g/litre). Source: Schipper et al., 2008.

Schipper et al. (2008) assessed the emission reductions from two alternative transport policies. They used the European driving cycle proxies—ECE-R40 for motorcycles, New European Driving Cycle (NEDC) for cars, and test cycle ECE-R49 for trucks¹⁶—as well as a composite or an average emission factor to account for each kind of vehicle. However, a recent study which developed driving cycles for Hanoi (Tong et al., 2011) found that these exhibit different characteristics when compared with the European NEDC cycle, primarily because of the differences between a modal cycle (NEDC) and a transient cycle (CEMDC and CECDL).

As previously discussed in Section 2.4.3, the CEM of the emissions-monitoring program which developed the first emission factors and emission inventories for motorcycles and LDVs considers the local driving characteristics in Hanoi (Tung et al., 2011; Tong et al., 2011). Annex 15 lists the 12 representative test vehicles selected for emissions measurements with their specifications and VKT. These were selected because it was found that, firstly, most of the motorcycles are of three-engine capacity classes, 70–100 cc, 100–125 cc and over 125 cc, and aged mainly within 3 classes: 1–3 years, 3–7 years and over 7 years. Secondly, most of the LDVs are of four categories from 1300 cc to 2500 cc, and mostly aged smaller than 3 years or 3–7 years (Tung et al., 2011). Detailed description on the methodology applied is available in the document *Development of Emission Factors and Emission Inventories for Motorcycles and Light Duty Vehicles in the Urban Region in Vietnam* (Tung et al., 2011). Table 12 and Table 13 provide the emission factors and fuel consumption for motorcycles and LDVs in Hanoi. In Table 12, the older vehicles (3-7 years and >7 years) have lower emissions (e.g. CO₂ and FC) than the first class (1-3 years). The reason is these are manufactured by different brands of motorcycle and normally, the quality of the engines is different, for example, Dream II and Future is better than the rest.

Table 12: Fuel consumption and emission factors of motorcycles for Hanoi

Emission factors	70-100 cc		100-125 cc			125-150 cc		
	3-7 years (Wave RS)	>7 years (Dream II)	1-3 years (Jupiter)	3-7 years (Smash)	>7 years (Future)	1-3 years (Lead)	3-7 years (Skye)	>7 years (Future)
CO [g/km]	10.02	12.42	13.48	8.86	16.93	6.76	15.69	8.87
HC [g/km]	0.8	0.98	1.17	0.79	1.28	0.5	0.73	2.77
NOx [g/km]	0.2	0.05	0.09	0.13	0.06	0.11	0.11	0.05
CO ₂ [g/km]	29.24	22.95	31.73	26.01	22.1	50.26	51.03	26.51
FC [L/100 km]	2.07	1.99	2.47	1.85	2.3	2.72	3.4	2.15

Source: Tung, Tong, Hung, & Anh, 2011

¹⁶ The ECE (Economic Commission for Europe) test cycle is a European emissions test cycle performed on a chassis dynamometer for light-duty vehicles “devised to represent city driving conditions, e.g. in Paris or Rome. It is characterized by low vehicle speed, low engine load, and low exhaust gas temperature” (Diesel Net, 2004). ECER40 stands for ECE Regulation 40—Emission of gaseous pollutants of motorcycles. ECE49 is an older test standard for heavy-duty trucks that the European Commission adopted in 1988 under the Euro II standards. In October 2000 the Euro III standard was adopted, and the R49 cycle was replaced by the European Stationary Cycle schedule (Diesel Net, 2004). The NEDC (New European Driving Cycle) is a new test cycle adopted in 2000 that requires cold-start emissions testing. Emission measurements begin immediately after the engine is started (t=0s), as opposed to the ECE standard, which allows a 40s idling period before measurements begin (Diesel Net, 2004). This new test was adopted to better incorporate HC and CO emissions, most of which are generated during the warm-up idling period. Source: Schipper et al., 2008.

Table 13: *Fuel consumption and emission factors of LDVs for Hanoi*

Emission factors	1800 cc (Ford Laser)	2500 cc (Ford Ranger - Diesel)	2000 cc (Innova)	2500 cc (Prado)	Average
CO [g/km]	0.99	0.92	2.4	4.52	2.21
HC [g/km]	0.13	0.18	0.13	0.59	0.26
NOx [g/km]	0.25	1.84	0.13	1.97	1.05
CO ₂ [g/km]	234.07	283.88	216.88	293.92	257.19
PM [g/km]	–	0.3	–	–	0.3
FC [L/100 km]	10.2	12.36	9.55	13.09	11.3

Source: Tung, Tong, Hung, & Anh, 2011

In addition Tuan et al. (2012) developed the Hanoi Motorcycle Driving Cycle (HMDC) driving cycle for motorcycles to represent the actual driving conditions in Hanoi. Emission factors obtained from HMDC are comparable with those from ECE R40 in CO, CO₂, THC emissions which are quite similar. Detailed description on the methodology of HDMC Construction is available in the document *Measurements of emission factors and fuel consumption for motorcycles on a chassis dynamometer based on a localised driving cycle* (Tuan et al., 2012). Exhaust emission factors, fuel consumption for the test motorcycles obtained from HMDC and ECE-R40 driving cycles together with the combined average of the emission factors of the two driving cycles are shown in Table 14.

Table 14: *Averaged Emission Factors and Fuel Consumption Obtained from Motorcycles Tested on Chassis Dynamometer Using HMDC and ECE-R40 Driving Cycles*

Emission Factors	HMDC	ECE-R40	HMDC/ECE
THC (g/km)	1.017±0.300	1.186±0.225	0.858
NOx (g/km)	0.180±0.079	0.108±0.029	1.668
CO (g/km)	12.592±2.565	12.906±2.447	0.976
CO ₂ (g/km)	32.478±6.865	31.321±5.454	1.037
Fuel Consumption (l/100km)	2.360±0.277	2.345±0.178	1.006

Source: Tuan et al, 2012

2.5 Data Availability and Quality

Relevant transport-related data was reviewed using the ASIF framework in Section 2.4. This section summarises the key challenges in collating transport-related data for estimating emissions, particularly data availability, accessibility, and reliability, and identifies the institutions responsible for data collection.

In Vietnam, data and statistics of several sectors including the transport sector has been relatively well-collected. One statistical data source is the Statistical Yearbook, which is published yearly by the General Statistics Office and also accessible via its website¹⁷. GSO is a government body which generates and issues the official data at the national level regarding land use, population and labour,

¹⁷ <http://www.gso.gov.vn>

state budget, agriculture, industry, transport (PKT and TKT for road, rail, water and air transport), and others. It also provides data on provinces on the same topics. Provincial Statistic Offices (PSOs) issue data on local economic sectors by either statistical year books, and in some provinces/cities via websites.

The following list presents major data sources with regard to land transport (among many other information generated by each organisation):

- **Ministry of Transport (MOT):** status, strategies and policies on road/bridge network, vehicle fleet, roadmap for tightening emission standards. The Vietnam Inland Waterways Administration, the Vietnam Railways Authority (VNRA) and the Directorate for Roads of Vietnam (DRVN) are part of the organisations assisting the MOT in performing state management functions.
- **Vietnam Register (VR):** approved types of new vehicles imported to and manufactured in Vietnam, vehicle inspection network, inspected vehicle volume and failure rate, enforcement of emission standards.
- **National Traffic Safety Committee (NTSC):** Vehicle fleet, traffic accident and its fatalities/injuries
- **Ministry of Industry and Trade (MOIT):** automobiles and motorcycles industries, (technologies, production, sales and prices), energy industry and trading (fuel quality, refineries, import/export, sales and prices), biofuel development.
- **Traffic Police (national and provincial levels):** registered vehicle fleet
- **Ministry of Science and Technology (MOST):** development and issuance of fuel quality and vehicle emission standards
- **Ministry of Natural Resources and Environment (MONRE):** air quality monitoring, air pollution control, inspection and enforcement of air quality standards
- **Provincial Transport Department (PTD):** inspected vehicles and failure rate, vehicle fleet at local level

In general, various types of data can be retrieved from several organisations such as MOT, NTSC, Traffic Police and PTD. However, data can be relatively difficult to access, except for Statistical Yearbook, and there is no “consistent format for data” (Binh, 2008). Table 15 enumerates several challenges in data collection in Vietnam. Currently, the government is the main source of data. The private sector, NGOs and industry associations (e.g. Vietnam Automobile Manufacturers' Association) provide information on vehicle production and sales. International donors and research institutes likewise collect data and carry out surveys and studies for various projects. While many data are collected annually and/or monthly, the data needed for emissions estimation are generally very limited as most of them are only collected whenever a project is implemented. For the data that are available, their level of aggregation is too high which may not be useful for transport planning at

the sub-national level. These challenges in collecting transport-related data are present across Asia, as observed by Fabian and Patdu (2011) in Annex 16.

Table 15: *Challenges in availability, reliability, and quality of data that are relevant for emissions estimation in the Vietnam*

Activity	<ul style="list-style-type: none"> • Transport activity data (PKT and TKT) is annually monitored and reported by GSO through the Statistical Yearbook. The report is based on surveys conducted by GSO and the reporting system of MOT. The challenge is the consistency between the two type of monitoring systems, GSO and MOT while limited capacity and human resources for data collection are also noted... Some other activity data can be found in reports of technical assistance projects funded by development organisations, transportation planning studies, fleet records, and local studies. Most efforts in upgrading available data are ad hoc and project-dependent. Because data collection is dependent on projects, some activity data are only available for certain years and not in time-series. • Information on mobility is not included in regular national household surveys conducted by GSO.
Structure	<ul style="list-style-type: none"> • Data on the total number of cars and motorcycles registered is from the Road-Rail Traffic Police (C67) of the Ministry of Public Security. Vietnam Register under MOT likewise collects data on car and motorcycle ownership (Binh, 2008). Further, because motorcycles are only required to register once, it is difficult to account for number of retired motorcycles. For cars, buses and trucks, data is from Vietnam Register (through their Monthly Magazine “Total Vehicle Population in the Country”). • Comprehensive vehicle classifications by fuel type (especially for vehicles running on alternative fuels and on electricity) and by technology type (which is important for air pollutant emissions estimations) have limited availability. This is not provided in the monthly magazine published by Vietnam Register. This can be estimated using sales statistics from oil companies, market research data (e.g. Segment Y Ltd.) and local studies.
Intensity	<ul style="list-style-type: none"> • Information on average speed and fuel efficiency is limited. Some information is available in reports of technical assistance projects funded by development organisations, transportation planning studies, vehicle manufacturer’s statistics, transport company records, fleet operators’ surveys, and local studies.
Fuel	<ul style="list-style-type: none"> • Locally derived emission factors and driving cycles are outdated (T.A. Duong, personal communication, April, 30, 2014). There are some local studies to develop emission factors for two-wheelers, LDVs and HDVs for Hanoi and HCMC. Local driving cycle for Hanoi is also available.

The collection of transport-related data is also fragmented. Several government agencies collect data only according to their needs. While this in itself is not problematic, the lack of integration among agencies has resulted into datasets with different terminologies, classification, and reporting. The private sector also collects transport related data. While private companies have traditionally held on data they have collected or generated, they are presently becoming more receptive to sharing information especially for collaborative work.

In summary, the table below shows the data availability and the possibility of collecting these data parameters in Vietnam.

Table 16: *Available emissions-relevant data in Vietnam*

Parameter/ Indicator	Unit	Availability	Main source	Quality	Remarks
Activity					
Passenger transport trip	Number of passenger by railway, road, waterway and aviation transport	Annual data (million passenger) from 1995 onwards	General Statistics Office Of Vietnam (GSO)	Good	
Freight transport trips	Number of cargo by railway, road, inland waterway, maritime and aviation transport	Annual data (thousand ton) from 1995 onwards	GSO	Good	
PKT	Passenger kilometre travelled by railway, road, waterway and aviation transport	Annual data (million passenger kilometre) from 1995 onwards	GSO	Good	
TKT	Tonne kilometre travelled by railway, road, waterway and aviation transport	Annual data (million ton kilometre) from 1995 onwards	GSO		
Structure					
Modal share of vehicles (VKM)	Number of vehicles (car, truck, special and other cars, motorcycle)	Annual data	GSO	Good	

Parameter/ Indicator	Unit	Availability	Main source	Quality	Remarks
Modal share of passenger (PKM)	Percentage of passenger journeys or trips by the main mode of transport	Not frequently, only in some certain years	International organisation studies	Good	Local government
Intensity					
In-use vehicle	Detailed vehicle registration data per vehicle-fuel type	Annual data	Vietnam Register (VR)	Good	Vietnam Register also has disaggregation to different categories of engine sizes, for cars and 2 wheelers
Energy efficiency (vehicle)	Fuel consumption (l/100 km) non-mandatory standards for passenger cars, motorcycles and mopeds.		Ministry of Transport, Ministry of Science and Technology		TVCN 9854:2013 and TCVN 7356:2014
Energy efficiency (pkm or tkm)					
Emission factor					
CO ₂	g/km (emission factor for Hanoi)		Studies (Centre for Environmental Monitoring (CEM) of the Vietnam Environment Administration)		Some types of motorcycles and LDVs

Parameter/ Indicator	Unit	Availability	Main source	Quality	Remarks
Other emissions	g/km (emission factor for Hanoi)		Studies (CEM)		Some types of motorcycles and LDVs

3 Policies and Institutions

Over the last decade, the Government of Vietnam has acknowledged that their country is one of the most vulnerable to the impacts of climate change. Concerns about food security, public health, and environmental sustainability are becoming more and more mainstream for Vietnam's development agenda in the recent years. Increasing awareness cultivated by international partnerships and organisations has spurred action for the Vietnam government to take part in the global effort for climate change impact mitigation.

3.1 Institutional Structure and Stakeholders

The Ministry of Transport (MOT) has a sole responsibility to develop transport policy, although the implementation can be done at inter-ministerial levels. The process of developing transport policies follows the process of policy and plan making. The policy can be drawn from policy-makers, as well as comprehensive consideration and policy recommendation through studies and reports.

Vietnam's administrative structure is divided into four levels of government: (1) national level, (2) province and city, (3) rural district, urban district and town, and (4) ward/precinct, town districts, communes, as well as village and hamlet in rural areas.

The national level includes the National Assembly, the President, the Government, the People's Supreme Court and the Supreme People's Procuracy. Each level of state administration at the local government level (i.e., province, district and commune) has a corresponding People's Council and People's Committee, with the People's Council being the administrative agency of the state in the locality and the People's Committee being its executive agency.

MOT has the responsibility for planning, managing and maintaining national transport infrastructure. For the transport-related issues, the cooperation of other central government ministries like Ministry of Industry and Trade, Ministry of Nature Resources and Environment, Ministry of Science and Technology, Ministry of Finance is a prerequisite. The MOT's responsibility also extends to assisting local governments in project selection. The MOT prepares long-term transport strategies and the five-year Public Investment Program, and receives the funds from the annual state budget. Annex 17 illustrates the general institutional structure of the government of Vietnam.

The Provincial Transport Department under the People's Committees of Provinces and Cities has responsibility for transport issues in the Province and in the Municipality, in particular the development and management of the provincial and district roads.

According to Decree No. 107/2012/ND-CP by the Prime Minister defining the regulatory functions, duties, powers and organisational structure of MOT, the responsibilities of MOT with respect to environmental management in transport sector are enumerated as follows:

- a) Organise review council for Strategic Environment Assessment and Environmental Impact Assessment reports of projects that are subject to the approval within the competence of MOT.

- b) Provide certification standard for environmental facilities of road, railway transport, inland waterway, maritime and aviation; including leadership in supervising, certifying environmental standards for cars and other motor vehicles;
- c) Coordinate with the MONRE, other ministries, ministerial-level agencies and government agencies concerned and the relevant provincial People's Committees to direct, guide and supervise the implementation of legislation on environmental protection and other provisions of law relating to the construction of transport sector infrastructure and transport operations; monitor and supervise the implementation of the provisions of the Law on Environmental Protection (LEP) in the field under the jurisdiction of the MOT.

In this respect, the Department for Environment under the MOT (existing since 2008) is the focal agency responsible for the implementation of environmental measures in transportation sector, Vietnam Register is a body responsible for type approval, vehicle inspection and emission standards enforcement, while TDSI is one of the most well-known organisations in studying and developing strategies and policies in transport sector in Vietnam.

The two other key ministries that have primary responsibility for policy making related to sustainable transport and its energy use are the Ministry of Industry and Trade and the Ministry of Finance, predominantly relevant for 'improve' policies (though pricing instrument will have an impact on 'shift' and 'avoid' as well), as shown in Figure 20. The development and implementation of these policies involves coordination with other ministries such as MONRE, Ministry of Planning and Investment, Ministry of Science and Technology and Ministry of Public Security. Annex 18 provides a list of government agencies under these ministries that are responsible for land transport, energy, and climate change.

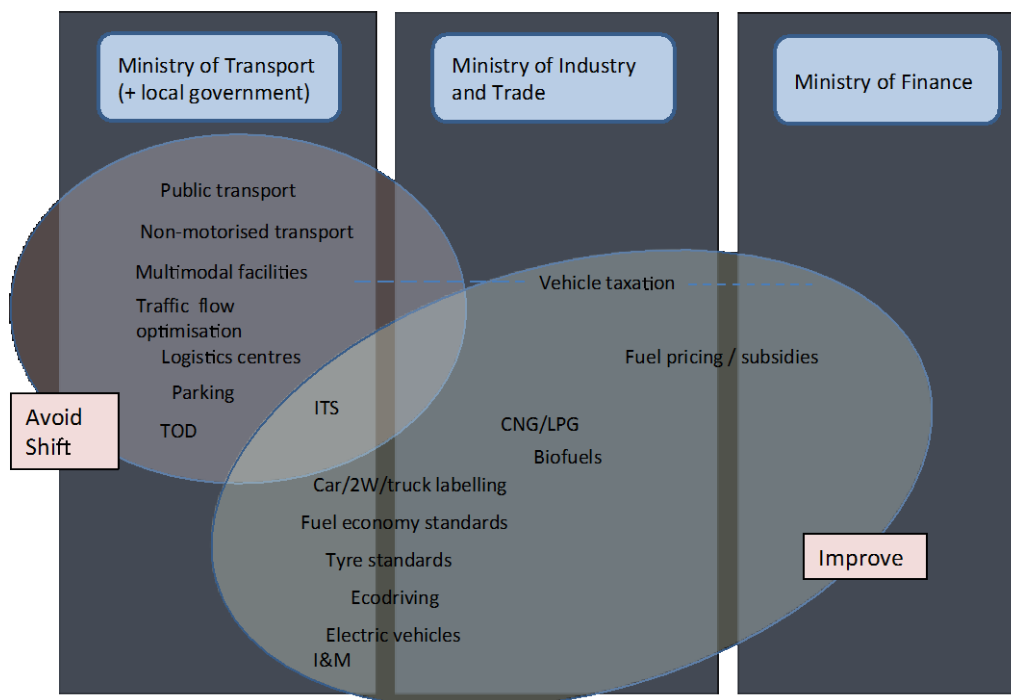


Figure 20: *Overview of primary responsibilities for transport policymaking*

Note: several other ministries (MOST, MONRE, MPI) also have a role in development and implementation of these policies.

Source: Authors

Key Organisations

There are many organisations currently involving with the plans and projects in the area of land transport in Vietnam. Types of organisations vary from governmental-, public-, academic-organisations to private sector and international support. This section categorizes them and details their roles in sustainable land transport area. Table 17 outlines these organisations.

- **Governmental organisations:** Necessary policies/plans for sustainable transport in the national level need to be enforced by the governmental side.
- **Public organisations or civil society:** Transport and climate change related public organisations in Vietnam are mostly autonomous non-governmental organisations. They play key roles in supporting and implementing those plans/policies into the practical level.
- **Academe and research institutions:** Research and development is another crucial factor for the development of sustainable transport policies and plans. Studies in the transport sector have been carried out with the financial support from grant institutions during recent years for researchers in Vietnam. The key funding organisations for the transport researches are shown below.

- **Private sector:** In the practical level, private sector is the successful key to adopt the policies/plans into practice.

- **International donors / international development agencies:**

International support/cooperation is vital to the development of sustainable transport. Various donors offer financial and technical support to Vietnam to tackle with the crucial problems in transport sector and are implementing sustainable transport projects/programmes (see Chapter 5 for a detailed overview).

Table 17: *Organisations related to land transport in Vietnam*

Type	Name		Role
Government	Vietnam Register	Ministry of Transport	See previous section for details
	International Cooperation Department		
	Environmental Department		
	Road Transport Administration		
	Vietnam Railway Authority (VNRA)		
	Transport Development and Strategy Institute (TDSI)		
	Provincial Departments of Transport		
	Ministry of Industry and Trade (MOIT)		
	Ministry of Finance		
	Vietnam Environment Administration (VEA)	Ministry of Natural Resources and Environment	Providing framework, guidelines, assisting and reviewing
	Pollution Control Department (PCD/VEA)		
	Institute of Strategy and Policies for Natural Resources and Environment (ISPONRE)		
	Institute of Hydro-meteorology and Climate Change (IMHEN)		
	Department of Hydro-meteorology and Climate Change		
Vietnam Standards and Quality Institute	Ministry of Science and Technology		
Directorate for Standards, Metrology and Quality (STAMEQ)			
International donors/ development agencies/ international development banks	Japan International Cooperation Agency	See next section for details	
	Agence française de Développement (Afd)		
	Canadian International Development Agency		
	AusAID (Australia)		
	World Bank		
	Asian Development Bank		
	United Nations Centre for Regional		

Type	Name	Role
	Development (UNCRD)	
	GIZ	
	Danish International Development Agency	
	German Bank KfW	
	Finnish partners: Ministry of Foreign Affairs, GTK, SYKE	
NGOs/Associations	Vietnam Clean Air Partnership (VCAP)	Stakeholders networking
	Vietnamese Non-governmental organisations and Climate Change (VNGO&CC)	A network of NGOs which is an open forum for its members in exchanging information, cooperation, and helping each other to connect to the National Assembly, governmental organisations and other social organisations and donor agencies http://www.vngo-cc.vn
	VUFO-NGO Resource Centre Vietnam	Facilitate work between international non-governmental organisations in Vietnam http://www.ngocentre.org.vn
	Vietnam Automobiles Manufacturing Association (VAMA)	Main activities: support for auto policy making, science and technology application, environment protection activities/regulations, international relations. They also have statistics on monthly sales http://www.vama.org.vn/
	Vietnam Auto Motorcycle Bicycle Association (VAMOBA)	No website
Academia	Universities of Technology (Hanoi, Da Nang, HCMC)	Collaboration on local transport plans (e.g. lifespan of motorcycles)
	Universities of Transport (Hanoi, HCMC)	Collaboration on local transport plans (e.g. transport master plans)
	National Institute for Education Management (NIEM)	Plans to raise awareness on climate change disaster risk reduction through training of 35,000 education leaders (cf. "Areas for Support")

3.2 Regulatory Framework and Initiatives for Sustainable Transport

Vietnam ratified several international conventions, notably the United Nations Framework Convention on Climate Change (UNFCCC) on 16 November 1994 and the Kyoto Protocol on 25 September 2002. Since February 1995, Vietnam is officially a Non-Annex I Party of the Convention. The government has assigned MONRE to be the national focal agency in implementing the UNFCCC and the Kyoto Protocol in Vietnam.

According to Vietnam's Second National Communication to the UNFCCC (MONRE, 2010), the National Assembly of Vietnam has issued a number of environmental protection laws and regulations (Annex 19) in order to reach the objective of UNFCCC on the "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." In addition, some key laws related to climate change are listed in Annex 19 (Tuan L. N., 2012). These laws provide a legal framework for the development and implementation of various policies and programs. Section 3.2.1 further discusses four frameworks for climate change.

Meanwhile, in the land transport sector of Vietnam, efforts are being carried out to reduce emissions from the vehicles through capacity-building, tightening of standards, technology enhancement and infrastructure investments that focus on sustainability. The development of the Environmentally Sustainable Transport (EST) strategy shows the level of commitment Vietnam gives to ensuring sustainable future. The EST strategy now serves as the primary framework for green development in the transport sector. Section 3.2.2 discusses the Vietnam EST Strategy as well as other key legal framework for greening the land transport sector.

Vietnam has also been active in promoting energy efficiency and conservation. Section 3.2.3 discusses Vietnam's energy efficiency policies and legal framework. There are three highlights in this area: Decree No. 102/2003/ND-CP on Energy Conservation and Energy Efficiency which sets the initial foundations for energy efficiency policies; the Vietnam National Energy Efficiency Program that is the current framework of the MOIT for energy efficient investments, and; the Law on Energy Efficiency and Conservation.

Decision No. 317/QD-BGTVT dated May 2013 emphasizes on completing the tasks planned for energy efficiency, the National Target Program, and Action Plan during period 2013–2015, specifically, the scheme on control of environmental pollution in transport activities (Decision No. 855/QD-TTg on 6 June 2011), the National Target Program on Energy Efficiency and Conservation period 2012–2015 (Decision No. 1427/QD-TTg on 2 October 2012), the National Target Program to Respond to Climate Change period 2012–2015 (Decision No. 1183/QD-Ttg on 30 August 2012), and Action Plan to Respond to Climate Change period 2011–2015 by the MOT (Decision No. 199/QD-BGTVT on 26 January 2011). Figure 21 gives an overview of how the different strategies are related.

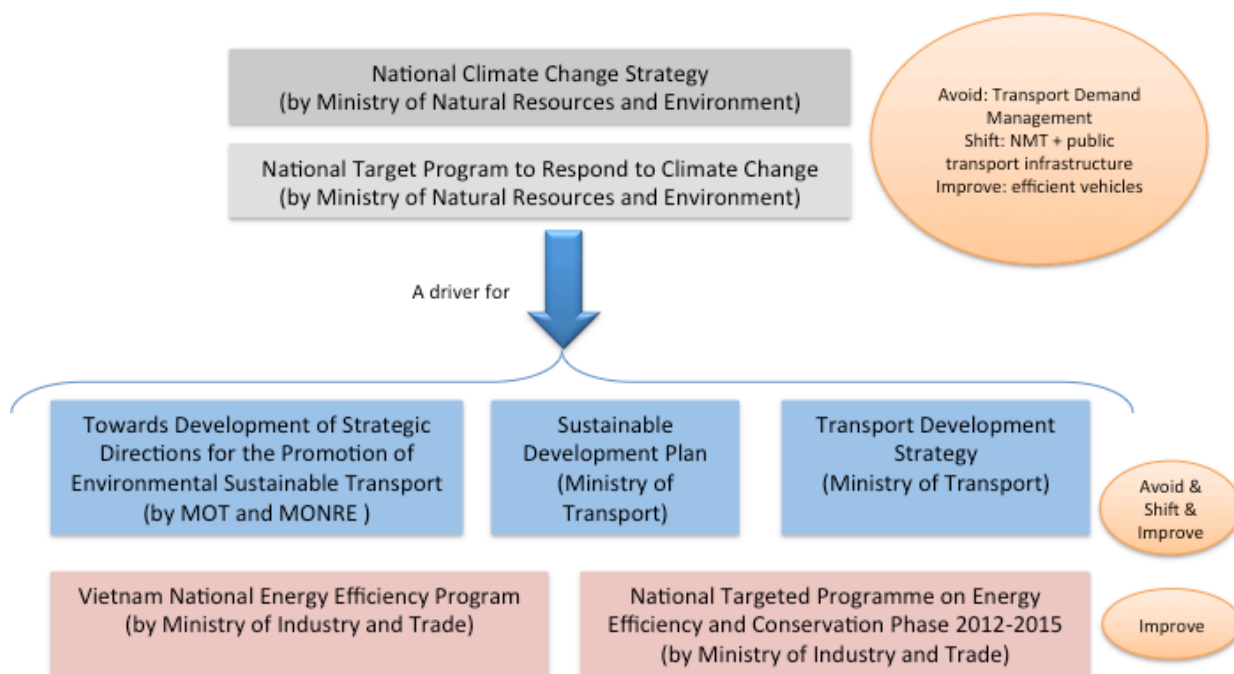


Figure 21: Sustainable transport and climate change strategies in Vietnam: climate change strategies are a driver for transport strategies and energy programmes with transport components.

Source: Authors

Moreover, the Prime Minister’s Decision approves the need to perform the necessary steps to control emissions of motorcycles and mopeds in Hanoi and Ho Chi Minh City, as well as the need to complete the legal basis for applying the emission standards of Euro 3 and Euro 4 on cars, motorised two-wheeled production, assembly and imports.

3.2.1 Vietnam’s Response to Climate Change Mitigation and Adaptation

Climate change is a major issue in Vietnam, but the policies are only recently catching up, with adaptation being emphasised more than mitigation. Most of the policies that govern climate change mitigation and adaptation focus on emission reduction, capacity-building, infrastructure development, and law enforcement. Four major strategic frameworks and action plans on climate change have been formulated in the recent years: the National Target Program to Respond to Climate Change, the National Climate Change Strategy, the National Green Growth Strategy, and the National Action Plan to Respond to Climate Change from 2012-2020 (DMHCC and MONRE, 2012).

National Target Program to Respond to Climate Change

The National Target Program to Respond to Climate Change (NTP) is an extensive programme proposed by MONRE through Resolution No. 60/2007/NQ-CP, and approved by Decision No. 158/2008/QD-TTg and Decision No. 1183/2012/QD-TTg covering the period of 2012-2015 which also specifies the tasks of MOT. NTP is a cross-cutting document of various policies that cover impact assessment, measurement identification, technological development, capacity-building, public awareness, international cooperation, planning and mainstreaming, and action plan development and implementation. The programme is essentially a policy and action framework for each government agency to set climate change impact mitigation in motion.

National Climate Change Strategy

As opposed to the NTP which vaguely stipulates programs and actions, the National Climate Change Strategy (NCCS) proposes more specific targets at a longer term and time frame (Prime Minister Nguyen Tan Dung, 2011) and expands the NTP to a timeframe of 2016-2025. The NCCS is the most updated framework for climate change impact mitigation for the sustainable development of Vietnam, remaining to be the prime strategic framework for climate change impact mitigation in Vietnam. The specific targets for transport are as follows:

- To design and implement policies which support and encourage the effective use of energies in economic fields, especially in transportation, urban development, industry, and agriculture; to check and reject ineffective technologies which largely consume energies and create greenhouse gases. Up to 2015, the plan on rejecting ineffective technologies must be finalised and issued.
- To research, develop and apply technologies, equipment and consumer goods which use energies effectively, consume non-fossil energies and create low emission, especially in transportation, urban development, industry and agriculture.
- To plan the system of transportation and improve its quality to international standards; to develop means of public transport in urban areas while controlling the growth of individual means of transport. By 2020, the system of public transport must in the main satisfy the society's demand for transportation. The modernisation of a nationwide transport network and externally-orientated transport corridor must be completed by 2050.
- To introduce fuels of low greenhouse gas emission to means of transport; to encourage buses and taxis' consumption of compressed natural gas and liquefied gas, so that 20% of these vehicles will use such energies by 2020 and 80% by 2050.
- To set up and apply mechanisms and policies encouraging the use of energy-saving vehicles while getting rid of energy-intensive ones.

National Action Plan to Respond to Climate Change in 2012-2020

This action plan reinforces and updates the objectives stated in the National Climate Change Strategy. It contains 65 programs, projects and tasks for 2012-2020 with 10 priorities in 2012-2015 (DMHCC and MONRE, 2012). The action plan was approved on 5 October 2012 and the implementation of programs and projects is still ongoing.

National Green Growth Strategy and National Green Growth Action Plan

The National Green Growth Strategy for the Period 2011-2020 with a vision to 2050 (or simply National Green Growth Strategy) as a climate change strategic framework focuses on sustainable economic development. Though it contains policies that relate to transport, the Green Growth Strategy is first and foremost an economic restructuring strategy for sustainable development. The strategy's objectives cover restructuring the economy to a "green economy", new technologies for natural resource management, and promotion of environmentally friendly lifestyle to the people (Ministry of Planning and Investment, 2012).

The strategy has three primary tasks for green growth: (1) reducing GHG with promotion of clean and renewable energy, (2) greening production, and (3) greening lifestyle and promoting sustainable consumption. These tasks entail corresponding targets that extend up to the year 2050. For GHG reduction, the targets are stated in Table 18.

Table 18: *Targets for the GHG Reduction Task of the Green Growth Strategy*

Period	Targets
2011-2020	<ul style="list-style-type: none"> • Reduce the intensity of GHG emissions by 8 - 10% compared to 2010 level • Reduce energy consumption per unit of GDP by 1 – 1.5% per year • Reduce GHG from energy activities by 10% - 20% when compared to BAU scenario • Voluntary reduction of approx. 10% and an additional 10% from international support
2030	<ul style="list-style-type: none"> • Reduce annual GHG emissions by at least 1.5 - 2% • Reduce GHG emissions from energy activities by 20 – 30% compared to BAU scenario • Voluntary reduction of approx. 20% and an additional 10% from international support
2050	<ul style="list-style-type: none"> • Reduce GHG emissions by 1.5 – 2% annually

Meanwhile, the task of "greening lifestyle" mentions a target of a 25-30% mode share for public transport by 2020 pursuant to Decision No. 355/QĐ-TTg dated 25 February 2013, which would require various investments on awareness programs and improvement of customer service. In line with the targets, the National Green Growth Strategy states 17 specific action plans, a good number of which are explicitly for improving transport systems and technology:

- Improving effectiveness and efficiency of energy use, reduce energy consumption in production activities, transportation and trade;

- Changing the fuel structure in industry and transportation;
- Development of key sustainable infrastructure including: transportation, energy, irrigation and urban works;
- Focus investment in research, development and application of green technologies, including: green energy technologies, the use of green materials and green construction, green transportation technology, green technologies for agriculture, forestry, biology, chemistry and waste management;
- Work for sustainable urbanisation, including urban transportation particularly:
 - Invest in renovation and development of technical infrastructure systems for urban transportation to achieve at least the average level of development in comparison with advanced countries in the region.
 - Prioritize the development of public transportation in urban areas with involvement from all economic sectors both in terms of investment in fuel efficient vehicles and exploitation of public transportation.
 - Use economic instruments and technical standards to control the quantity development of individual motorized vehicles in large and medium cities, allocating special routes for non-motorized vehicles.

The National Green Growth Action Plan for the period 2014-2020 concretises the National Green Growth Strategy and composes of 4 main themes, 12 groups of activities. Regarding the transport sector, some specific activities were proposed as follows:

- Establish and implement investment and tax policies as well as economic instruments for developing diversified transportation network that meets the transportation demand, saving energy and reducing environmental pollution. Optimize transportation networks and vehicles to improve energy efficiency, reducing traffic jams. Implement approved projects on environment pollution control in transportation, emission from cars, motorbikes
- Enhance the application of new technology, usage of renewable energy and less GHG emitted fuels in transportation. Implement a set of management in fuel, emission standards and vehicles maintenance.
- Invest to develop types of public transportation saving energy, using clean energy with low emission. Encourage all economic sectors to invest to develop high-quality public transportation services.
- Review the development in the period of 2000-2013 of the transportation sector under the light of sustainable development

3.2.2 Vietnam's Strategies for Sustainable Transport

Action Plan of the Ministry of Transport to Respond to Climate Change in the Period 2011-2015

In 2010, the Ministry of Transport developed the Action Plan to Respond to Climate Change in the Period 2011-2015 (Decision No. 199/QĐ-BGTVT dated 26 January 2011) for three important objectives: to assess impact level of climate change to the road, railways, inland waterways, maritime, aviation sectors and transportation activities, to identify suitable adaptation measures for transport construction works to minimise damage and ensure smooth and safe traffic, and to mobilise international resources to support the application the solutions to adapt to climate change, to mitigate GHG emissions and to raise awareness, expertise, management operations. The programme also provides solutions to establishing mechanisms for policy implementation, organisation and international cooperation, some financial and technical solutions. In 2015, a new transport sector Climate Change Action Plan for the period 2016-2020 is being developed.

Towards Development of Strategic Directions for the Promotion of EST in Vietnam

In 2005, an international policy framework for sustainable transport was established: the Asian Regional EST Forum, initiated by UNCRD and the Ministry of Environment of Japan (MOEJ). Strategies for various EST measures have since been adopted in various Asian countries. In Vietnam, MONRE, MOT, UNCRD and MOEJ (2012)¹⁸ produced the report *Towards Development of Strategic Directions for the Promotion of EST in Vietnam*, which identifies challenges and proposals for strategic orientations for the development of an EST in Vietnam in the future to meet the sustainable transport goals of Bangkok Declaration 2020 listed in terms of the Avoid-Shift-Improve framework¹⁹. The report proposes responsibilities for the implementation of measures and lists 10 proposed targets:

1. Development of public mass rapid transit systems in Hanoi and HCMC, reaching a market share of 35-45%;
2. Rational development of urban transport infrastructure and public transport system, ensuring 16-26% of land reserved for urban transport;
3. Restraint of the growth of private motorized vehicles, ensuring that by 2020 there are no more than 4 million automobiles and 40 million motorcycles in the whole country.
4. Reduction of TSP generated in Class I cities and above, ensuring national environmental technical specifications and standards as well as standards stipulated by WHO; reduction of SO₂, NO_x and VOC in Hanoi and HCMC from the 2005 figures;
5. Euro 3-equivalent emission standards to be applied to motorised two-wheelers and Euro 4 to new produced, assembled and new imported automobiles from 2017;

¹⁸ MONRE and MOT (2012) "Towards Development of Strategic Directions for the Promotion of EST in Vietnam by 2020" at http://www.uncrd.or.jp/content/documents/Viet-Nam_NESTS.pdf

¹⁹ More information on Avoid-Shift-Improve is available from the GIZ Sourcebook "Transport and Climate Change: Sourcebook Module 5e" at <http://www.slocat.net/sites/default/files/5e-tcc-en.pdf>

6. Emission check on motorcycles in use in major cities and provinces pursuant to the Prime Minister's Decision 909/QD-TTg;
7. Clean and alternative fuels to be used accounting for 10% of the total fuel consumption, with quality equivalent to Euro 4. Intensify the conversion of buses and taxis, such that those using CNG and LPG reach 20% of the fleets in major cities;
8. Implementation of measures to improve fuel efficiency in transport;
9. Substantial reduction of traffic accidents both in numbers of accidents and in numbers of fatalities and injuries, with an annual reduction of 5-10% of traffic accident-related deaths;
10. Development and improvement of air environmental quality monitoring networks, particularly in major cities.

Transport development strategy

In February 2013, the government issued "Decision No. 355/QD-TTg approving the adjusting strategy of Transport development in Vietnam up to 2020, with a vision to 2030" Among its goals is to form a rational transport system between various means of transport, which should be a step toward the modernisation of Vietnam and toward becoming an industrialised country by 2020. Other strategies mentioned are in regard to integration and international competition, such as connectivity with ASEAN road system, expansion of Mekong Sub-region and trans-ASEAN railways.

Several Decisions of the Prime Minister led to the development of Vietnam's transport development strategy. For instance, Decision No. 206/2004/QD-TTg was approved in December 10, 2004 approving the Strategy on Development of Vietnam's Communication and Transport till 2020. Among its strategies is "to give priority to the development of mass transit, especially large-quantity public passenger transport modes, ensuring the mass transit ratios of 25-30% by 2010 and 50-60% by 2020 in big cities, and to limit the motorbike number, and at the same time adopt rational solutions to development of private cars, especially in two big cities of Hanoi and Ho Chi Minh city." It also aims to utilize technologies to manage urban traffic such as traffic signals, control posts and camera systems. Moreover, it aims to develop maritime transport to increase the percentage of shipped export and import cargo volumes.

This framework eventually influenced the adoption of succeeding measures such as the piloting of intelligent transport systems and the infrastructure development of public transport systems to improve the transport sector in Vietnam as briefly presented in Section 3.3. In 2009, Decision 35/2009/QD-TTg dated 3/3/2009 on Transport Development Strategy up to 2020 and orientation to 2030 was eventually issued in recognition also that transportation should be developed toward a modern and high-quality system with reasonable cost, safety, reducing environmental pollution and energy saving by application of advanced transport technology, especially multi-modal transportation and logistics.

Sustainable Development Action Plan of MOT

Adopted in 2013, the Sustainable Development Action Plan of the Ministry of Transport for the period 2013 – 2020 (4088/QĐ-BGTVT) gives general actions and guidance to transport plans and policies:

- Improve institutional and strengthen management capacity
- Integrate the principles of sustainable development in the plans/strategies.
- Mobilise all resources to effectively implement the transportation plans/strategies
- Approach to the development of green freight
- Enhance the quality and safety of the transportation system
- Strengthen the pollution control in transport operations
- Encourage efficient natural resource use
- Promote the application and transfer of the technologies associated with sustainable development
- Promote international cooperation in the implementation of the action plan
- Training and awareness raising in the field of sustainable transport development.

Vehicle exhaust emission standards for in-use and new vehicles

The Prime Minister's Decision 249/2005/QĐ-TTg dated 10 October 2005 specifies the permitted maximum emission limit of locally manufactured and assembled, imported new motor vehicles as well as in-use motor vehicles. For manufactured, assembled and imported new cars and motorbikes, an updated regulation has been approved and will be mentioned below. For second-hand motor vehicles imported into Vietnam, the Decision sets a permitted maximum emission limits to 3 types of vehicles according to the regulations in Table 19 effective 1 July 2006: mopeds and motorcycles with spark-ignition engines shall follow Limit 2; automobiles with spark-ignition engines shall follow Limit 3, while vehicles fitted with compression-ignition (diesel) engines shall follow Limit 3.

The document likewise outlines emission standard limits for in-use diesel and gasoline vehicles having number plates of the cities of Hanoi, Ho Chi Minh, Hai Phong, Da Nang and Can Tho, to follow Limit 1 beginning 1 July 2006, and of the remaining provinces and cities to follow Limit 1 beginning 1 July 2008.

Table 19: *Decision No. 249/2005/QĐ-TTg emission limits of road motor vehicles¹*

Pollutants in exhaust gas	Vehicles fitted with spark-ignition (gasoline) engines					Vehicles fitted with compression ignition (diesel) engines		
	Automobiles			Mopeds, motorcycles		Limit 1	Limit 2	Limit 3
	Limit 1	Limit 2	Limit 3	Limit 1	Limit 2			
CO (% volume)	4.5	3.5	3.0	4.5	-	-	-	-
HCC (ppm volume)								
- Four - stroke engines	1,200	800	600	1,500	1,200	-	-	-
- Two - stroke engines	7,800	7,800	7,800	10,000	7,800	-	-	-
- Special engines ²	3,00	3,00	3,00			-	-	-
Smoke opacity (% HSU ³)	-	-	-	-	-	72	60	50

Notes:

¹ Issued together with the Prime Minister's Decision No. 249/2005/QĐ-TTg of October 10, 2005² Special engines include Wankel engines and a number of other engines with special structures different from those of piston engines which are widely used.³ HSU = Hartridge Smoke Unit

MOT has tightened the emission standards for in-use diesel vehicles, both light- and heavy-duty (Clean Air Asia, 2014). To suit the vehicle fleet in 2005 when the regulation was passed, the new standards require all such vehicles to achieve a smoke opacity test result of 72 Hartridge Smoke Units (HSU)²⁰ or less. Meanwhile, Decision No. 49/2011/QĐ-TTg dated 1 September 2011 provides the roadmap for application of exhaust emission standards to manufactured, assembled and imported brand-new cars and motorbikes, requiring manufactured, assembled and imported brand-new cars to comply with Euro 4 exhaust emission standard from 1 January 2017 and Euro 5 exhaust emission standard from 1 January 2022. It likewise requires manufactured, assembled and imported brand-new motorbikes to comply with Euro 3 exhaust emission standard from 1 January 2017. Table 20 summarises the roadmap of vehicle emission application in Vietnam.

Table 20: *Vietnam roadmap for Euro 3, 4, 5 emission standards**

	Automobiles**	Motorcycles	Fuel quality
Euro 3	N/A***	1 January 2017	
Euro 4	1 January 2017	N/A	1 January 2016
Euro 5	1 January 2022	N/A	1 January 2021

* Enacted through Decision No. 49/2011/QĐ-TTg on 1 September 2011

** Includes light duty vehicles and heavy duty vehicles.

*** The government enacted Decision NO. 249

Development of fuel economy standards and energy consumption labelling

While as of June 2015 Vietnam has yet to establish mandatory fuel economy standards for the transport sector, certain elements of its development are being prepared such as fuel quality, fuel consumption and vehicle exhaust emissions. MOT is developing the fuel economy standards for

²⁰ A smoke test is a component of vehicle emission inspection. Hartridge Smoke Unit (HSU) measures smoke density of vehicle exhaust emissions. The higher the scale of percentage opacity, defined in terms of HSU, the denser the smoke.

motorcycles and light duty vehicles and currently there are two non-mandatory standards on limit of fuel consumption for passenger cars and two-wheeled motorcycles and mopeds.

In April 2014, VAMA proposed to the government that the internationally recognized fuel consumption test results be used once passenger vehicles (up to seven seats) are required to have an fuel consumption label starting 1 January 1 2015 in accordance with a Circular released by MOT²¹. Fuel labelling for passenger cars, which will include the fuel consumption in urban and rural cycle, test method, and energy savings, has become mandatory in 2015²². Domestically manufactured or assembled cars already certified to meet technical safety and environment requirements by 2015 are likewise required to display the label effective 2016 (Tuoitre Online, 2014; Chi, 2014).

As mentioned in Section 2.4.3, the (non-mandatory) national standards TVCN 9854:2013 on fuel consumption limits for passenger cars and method for determination has been established through Decision No. 2586/QD-BKHHCN dated 22 August 2013, while national standards TVCN 7356:2014 on fuel consumption limits for two-wheeled motorcycles and mopeds has been established through Decision No. 1201/QD-BKHHCN dated 23 May 2014.

3.2.3 Vietnam's Response to Energy Efficiency and Conservation

As the energy consumption of Vietnam is projected to increase significantly within the next decade (as discussed in Section 2.2), measures are being taken to provide a sound legal framework for energy efficiency.

Decree No. 102/2003/ND-CP on Energy Conservation and Energy Efficiency

In 2003, the Prime Minister of Vietnam approved Decree No. 102/2003/ND-CP on Energy Conservation and Energy Efficiency or "EE&C." The decree specifies roles and responsibilities for the various government agencies regarding energy efficiency. It focuses on mitigating energy use by production establishments, buildings, and equipment through technological modifications and choice of investment, energy-efficient design, and operations management. The decree also aims to promote thrifty energy consumption of citizens' lifestyles.

Vietnam National Energy Efficiency Program

In line with EE&C decree, the Ministry developed specific strategies to promote energy efficiency. MOIT currently leads the activities and projects provided by the Vietnam National Energy Efficiency Program, whose objective is to map activities between 2006 and 2015 to reach certain targets on energy saving, investment reduction for energy supply system, and social economic benefit. Regarding transport sector, the sixth component requires making optimal use of transportation facilities, equipment and minimize amount of fuel consumed.

²¹ A joint Circular between Ministry of Transport and Ministry of Industry and Trade (No. 43/2014/TILT-BGTVT-BCT) has been issued on the energy labels for passenger car up to 7 seats. This regulation stipulates that from January 1, 2015, brand-new domestically assembled and imported cars must be labelled with energy labels before selling to consumers. The fuel consumption values before public shall be verified by a competent test centre. The tested value shall not exceed the declared value of manufacturer or importer more than 4%. On the other hand, the current regulation only requires enterprises to make public information about fuel consumption, while it does not set the maximum possible consumption level.

²² <http://www.fiafoundation.org/our-work/global-fuel-economy-initiative/in-country-work> (accessed 23 July 2015)

National Targeted Programme on Energy Efficiency and Conservation Phase 2012-2015

In 2012, National Targeted Programme on Energy Efficiency and Conservation (EE&C) Phase 2012-2015 was approved pursuant to Decision No. 1427/2012/QĐ-TTg dated 2 October 2012. Among the six objectives stated in the document, the programme sets one target focusing primarily on transportation:

Development of transportation system to meet the transport demand with increasingly high quality, save fuel and reduce environmental pollution. Reinforce the application of new technologies, renewable energy to replace traditional fuels in transportation. Strive to have public transport in 2015 meeting the 10 - 15% of travel demand in large urban areas.

Minister Vu Huy Hoang of MOIT states that for a successful EE&C program, a saving rate of 5-8% of Vietnam's total energy consumption must be reached in the period 2011-2015. Annex 19 lists the key documents on Vietnam's energy efficiency strategies.

The Law on Energy Efficiency and Conservation

This Decision is pursuant to the Law on Energy Efficiency and Conservation which was passed by the 12th National Assembly on 18 June 2010 and emphasises the road map of energy labelling. It highlights energy labelling as an effective method to increase the use of vehicles and appliances with high efficiency, gradually removing the use of vehicles and appliances with outdated technology, reducing energy consumption in production. The law likewise encourages organisations and individuals “to provide consultancy on and design and invest in the development of mass transit networks, manufacture and use energy-saving vehicles, exploit and expand the application of liquefied gas, natural gas, electricity, mixed fuels and biofuels in replacement of petrol and oil,” as well as inspection and maintenance of vehicles to reduce fuel consumption, and mandates the MOT to “direct and guide the elimination of expired vehicles or those failing to reach the minimum energy yield,” and to “plan the investment in and exploitation of mass transit systems, increasingly use railway and waterway networks in combination with multimodal transport” (Ministry of Justice, 2010).

Some interesting highlights of the policies is the establishment of a labelling scheme for EE&C through Circular No. 08/2006/TT-BCN, which is in line with the National Target Energy Efficiency Programme. This would include new and in-use vehicles to ensure that future programs and policies will align with the defined fuel economy/energy efficiency. Part of the proposed labelling scheme of the Law is the grouping of vehicles, including cars. Annex 19 lists other key documents on Vietnam's Energy Efficiency.

3.3 Existing policies

While there are policies on transport and energy efficiency being implemented in Vietnam that do not list climate change as their primary rationale, these have co-benefits that support the efforts to tackle climate change such as reduction of emissions and of vehicular congestion. Additionally, a good number of transport policies are intended for other social and economic purposes such as improved logistics.

Table 21 and Table 22 provide a summary overview of the key policies and measures in passenger and freight transport, respectively, and their status as of the end of 2014 in Vietnam, while Annex 20 particularises the measures and policies and also includes the information sources. Status is assessed according to these categories:

- *Implemented*: the policy is implemented and enforced, or the transport plan (e.g. metro) is completed and functioning. However, it does not imply there can be no further implementation, e.g. if a certain fuel economy standard is implemented, a future, more stringent, standard can still be developed, or new standards be developed for other types of vehicles
- *Partially implemented*: some parts of the policy or transport plan are (being) implemented
- *Implementation ongoing*: implementation has started but not yet completed
- *Pilot*: may refer to a policy that is being implemented, but not (yet) at a large scale
- *Planned*: clear policy signals, particularly published official documents, that a policy will start implementation in a certain year in the future
- *Intended*: evidence of policy discussions have been found (public information or personal communication)
- *Not in discussion*: no information on policy discussion has been found

The policies have been categorised according to Avoid, Shift, Improve or General policies: “Avoid” policies refer to those that reduce the need to travel or the length of travel; “Shift” policies refer to those that encourage a shift to more efficient modes of transport or those that promote a high share of such modes, and; “Improve” policies refer to those that increase energy and carbon efficiency of vehicles, their operation and fuels used in the different modes.

Table 21: Passenger transport policies and measures: current status (end 2014)

	Existing policies /measures	Implementation Status	Remarks
Avoid	Road pricing	Partially implemented	Toll roads are applied for roads under PPP and BOT schemes.
	TOD / land-use planning	Intended	There is a specified distance between mass transit routes in urban centre to the public transport infrastructure.
Shift – incentives / regulation/ information	Bus management reform	Partially implemented	Hanoi has a centralised bus operator management and contracting system, smaller cities have not
	Parking policies	Implementation ongoing	Many larger cities have paid parking, but no comprehensive parking management plan; pilot cases for park and ride facilities have been developed by organisations such as ADB and local People's Committee.
	Low prices for some public transport options	Partially implemented	Some public bus services are subsidised by local government in order to keep low prices.
	Integrated ticketing for PT	Intended	Some bus lines have integrated tickets, for rail and bus integration discussions are at early stage
Shift – infrastructure	High-speed rail infrastructure	Planned	The express railway linking HCMC and Hanoi is being studied, and investments have been proposed.
	Improvement of inter-urban rail	Planned	National railway transport master plan intends to connect Hanoi and HCMC.
	Urban rail	Planned / pilot	Six metro lines are planned and two are being constructed for HCMC while in Hanoi, eight metro lines are planned and two are being constructed.
	BRT and other bus prioritisation	Implementation ongoing	The pilot BRT system in Hanoi is being constructed. It is started in mid-2013 and planned to operate by mid-2015. The total length of the route is approximately 14.7 km with 23 stops included 2 stations. Danang is planning 1 line.
	Sidewalks	Implementation ongoing	A minimum width of pedestrian pavements along each side of the road is required. Initial plans to pedestrianise certain roads drew mixed reactions.
	Cycling lanes and bike sharing	Pilot	Vietnam will launch pilot public bike rental services in 5 cities in 2015. And in the master plan, bicycle route has been defined in some areas to attract the people. Regional or higher grade roads are required to have bike lanes.
Improve – efficiency	CO ₂ or energy based vehicle tax	Partially implemented	There is import duty reduction for certain energy efficient vehicles
	Car / motorcycle labelling	Implementation ongoing	Producers and importers are required to affix equipment and vehicles with energy labels. Fuel consumption labelling for passenger cars of 7 seats and less since on 1 January 2015.
	Fuel efficiency standards	Partially implemented	A study on fuel consumption standards for LDVs and motorbikes was completed in 2013. The non-mandatory standard on limit of fuel consumption for passenger cars and two-wheeled motorcycles and mopeds has been issued.
Improve – operation	Speed limits	Implemented	Speed limits are in place for motor vehicles. Its main purpose is to ensure traffic safety.
	Ecodriving	Not in discussion	
	Real-time public transport information (ITS)	Pilot	The city of Danang has an agreement with IBM technology to establish a real-time information on Danang's city buses such as driving speed, location, and predicted journey times.
	Traffic flow improvement (ITS)	Pilot	Pilot for a traffic control centre in Danang City. Hanoi has a Traffic Signal Control Centre but it appears that only a small fraction of the cameras installed are functioning and the software is outdated.
	Inspection and maintenance	Implementation ongoing	This had been applied for motor vehicles from 2006 under Decision 249/2005/QĐ-TTg.
Improve – fuel	Incentives for low-carbon fuels	Implementation ongoing	Vehicles running on LPG, natural gas, electricity, mixed fuel or biofuel which are domestically unavailable are entitled to import duty exemption and reduction under the tax law. E5 is less expensive than gasoline.
	Standards for biofuels	Implementation ongoing	By 1 December 2014, petrol with 5% bioethanol content, or E5 petrol, will be sold in 7 cities and provinces, and vehicles in these areas will be required to use biofuel by 2015
	CNG/LPG for taxis and buses	Implementation ongoing	CNG/LPG taxis are operated in Hanoi and HCMC. Law No.50/2010/QH12 states the exemption/reduction under the tax law for the natural gas, electricity and mixed fuels and biofuels which are domestically unavailable. There are programmes to replace diesel bus by CNG bus implemented in several cities in South of Vietnam, including HCMC.
	Electric vehicle incentives (2W/car)	Intended	Electric 2-wheelers are increasing without policy interventions, for cars discussions are taking place
General	Fuel price reform	Intended	Being considered to revise regulations on the pricing of fuel products to bring them in line with market trends

Table 22: Freight transport policies and measures: current status (end 2014)

	Existing policies/measures		Implementation Status	Remarks
Avoid	Pipelines		Implementation ongoing	Trans-ASEAN Gas Pipeline (TAGP) designed to interconnect gas pipeline infrastructure of ASEAN member-states. International consortium and construction have been founded and have begun. Oil pipeline network exists.
	Improve logistics centres and their location		Implementation ongoing	Logistics centres are further being built near key cities and ports. Vietnam recognizes the importance of ensuring “interconnectivity between seaports and national transport networks and core logistics centres in the region” as cited in their master plan on development of Vietnam’s seaport system through 2020, with orientation toward 2030.
Shift	Lorry restrictions		Partially implemented	In 2011, HCMC people’s committee regulated the restricted schedule for lorries to be run in the urban area.
	Master planning for rail and water		Planned	The national railway transport master plan focuses on developing the external railway network linked with seaports and border countries. There are plans to upgrade the current railway connecting HCMC and Hanoi.
	Multimodal facilities/dry ports		Intended	In November 2013, Vietnam, along with 13 other countries, signed an inter-governmental agreement on dry ports, pledging to create an integrated and sustainable inter-modal transport and logistics system.
Improve – efficiency	Import restriction for inefficient vehicles		Implementation ongoing	Second-hand vehicles that are to be imported must not be over five years of age from the date of manufacture to the date of import but no tax incentive to efficient vehicles.
	Fuel economy/ emission standard		Intended	
Improve – operation	Vehicle scrapping/fleet replacement		Not in discussion	While vehicle-scrapping programs are not at the national policy level, Vietnam limits the age of motor vehicles. Decree No.95/2009/ND-CP regulates that passenger automobiles of over 20 years, cargo automobiles of over 25 years, will be suspended from circulation
	Empty hauling reduction		Pilot / planned	DRVN is planning a ‘stock exchange’ and a freight database or clearing house. ADB-GMS Green Freight pilot project is also working on this.
	Inspection and maintenance		Implementation ongoing	Law on Environmental Protection requires motor vehicles to satisfy gas emission and noise standards. Circular No.21/2010/further regulates the life time of freight truck, freight car, and passenger cars. I/M had been applied for motor vehicles from 2006 under Decision 249/2005/QĐ-TTg
	Speed limits/management		Implemented	Speed limits are regulated in expressway, national and province roads. Inter-city bus and freight vehicles plying any 500-km-plus routes are required to install a black box, a device that would record speed and driving time.
	Eco-driving		Intended	While there seems to be no decrees promoting eco-driving, the private sector collaborates with the government to raise awareness on fuel-efficient driving methods.
	Tyre standards / labelling		Not in discussion	
	Aerodynamic standards		Not in discussion	-
Improve – fuel	Low carbon fuel (1 st /2 nd gen Biofuel, CNG, LPG) incentives		Implementation ongoing	Vehicles running on LPG, natural gas, electricity, mixed fuel or biofuel which are domestically unavailable are entitled to import duty exemption and reduction under the tax law.E5 is less expensive than gasoline.
General	Fuel price reform		Intended	Being considered to revise regulations on the pricing of fuel products to bring them in line with market trends

It appears that most of the key policies, particularly in the passenger transport sector, are being planned, piloted or implemented. In relation to fuel economy policies for new vehicles, mandatory labelling for new passenger cars (up to 7 seats) and voluntary fuel economy standards (for passenger cars and motorcycles) are in place, while fuel economy standards are also intended for trucks. An inspection and maintenance programme has been in place for cars, motorcycles and trucks since 2006, with 114 testing centres in 63 provinces as of 2014, albeit lacking in effective implementation due to uncalibrated equipment and outdated test procedures as well as limited capacity of the inspectors. However there are concerns as to the effective implementation, due lack of capacity of the inspectors, uncalibrated equipment and outdated test procedures. In the context of tyres, it appears no policy discussions on energy-efficiency standards or labelling is in place. The same can be said of CO₂-based vehicle taxation, although incentives for energy-efficient vehicles exist.

Policies related to limiting the growth in private vehicle transport demand, such as parking management, vehicle and fuel taxation, road pricing are in the pipeline or are being implemented. Efforts to increase the mode share of public transport, especially for BRT and MRT, are mostly focused on larger cities like Hanoi and Ho Chi Minh City. For optimizing bus systems, reforming their management systems and increasing their attractiveness, Hanoi and HCMC have made progress, however for other cities policy are not developed. Also, policies such as low-emission zones, pedestrianisation of roads and provision of walking and cycling infrastructure, application of transit-oriented development, together with information instruments such as campaigns, are not yet fully in place.

In the freight transport sector, ‘Avoid’ and ‘Shift’ measures appear to be less in policy focus, although the government has been exploring plans to enhance maritime and rail freight transport, and to improve logistics activities.

3.4 Finance

The Ministry of Finance (MOF) is the primary agency that manages Vietnam’s national revenues and expenses. The Ministry of Planning and Investment (MPI) governs mobilisation of funds as decreed by the Ministry of Finance. As a middle-income economy, Vietnam has yet to have the capacity to fund all its large-scale programs and projects for climate change mitigation, energy efficiency and transport; as such, Vietnam heavily utilises the provisions of international partners and organisations.

Vietnam coordinates with the Asian Development Bank and the World Bank to tap USD 250 million from the Clean Technology Fund (CTF) for targeted low-carbon investments in the power, transport, and industrial sectors.²³ The CTF Investment Plan of Vietnam proposes financing for meeting mid-term goals of reducing energy consumption by 5-8% by 2015 as cited in National Targeted Programme on Energy Efficiency and Conservation Phase 2012-2015 in Section 3.2.3

²³ For more information on the investment plan for Vietnam, visit Climate Investment Funds at <https://www.climateinvestmentfunds.org/cifnet/country/vietnam>

In the transport sector, CTF funding amounting to USD 48.95 million has been approved in September 2013 for the project “Sustainable Urban Transport for Ho Chi Minh City Mass Rapid Transit Line 2 Project in Vietnam” submitted by the Government of Vietnam and ADB. In September 2011, CTF funding of about USD 1 million has been granted to for the project preparation grant “Vietnam: Strengthening Sustainable Urban Transport for Hanoi Metro Line 3 Project,” submitted also by ADB. CTF financing will support enhancements in the urban transport systems, particularly in expanding the rail and bus systems Hanoi and Ho Chi Minh City, to help Vietnam reach its goals of increasing total PKT on public transport from 10-15% to 50% by 2020 (Climate Investment Funds, 2012).

Another foreign assistance fund is the Official Development Assistance (ODA) fund. It is currently the largest source of funding for development projects in Vietnam. Management of this fund is governed by Decree No. 131/2006/ND-CP dated November 09, 2006 for Promulgating the Regulation and Use of Official Development Assistance. According to MPI, Vietnam will have received about USD 80 billion in ODA by the end of 2013 (StoxPlus, 2013).

The National Target Program to Respond to Climate Change

The National Target Program to Respond to Climate Change (NTP) specified that from 2009–2015, the budget of implementing activities from the program is VND 1,965 billion (about USD 92.36 million in mid-2014) allocated as follows:

- 50% Foreign capital (ODA, CTF)
- 50% Domestic capital
 - 30% central budget
 - 10% local budget
 - 10% private sector contributions.

Specifically, for tasks regarding the program, estimated budget is presented in Table 23.

Table 23: *Estimated budget of the tasks and projects for the implementation of the National Target Program*

Category, task, project	Tentative Budget (in VND Billion)
Assess climate change intensity and develop climate change and sea level rise scenarios	38
Develop and implement science and technology programs on climate change	350
Building capacity of organisation, institution, policy on climate change	104
Awareness enhancement and human resources training	292
Enhance international cooperation	50
Develop a standard framework for mainstreaming climate change issue into development	60
Develop and implement action plans to respond to climate change	921

Source: The REDD Desk, 2008

The Support Programme to Respond to Climate Change in Vietnam (SP-RCC)

AFD together with JICA were the pioneer donors in the Support Programme to Response to Climate Change of Vietnam which coordinates support from multiple international donors in Vietnam by means of a ‘policy matrix’ since 2009. The World Bank and Australia, Canada, Korean government also participate in this programme. So far, main climate funding has been distributed via the Support Program to Respond to Climate Change (SP-RCC). USD 240 million has been pledged by international and bilateral donor agencies towards the SP-RCC.

Private sector participation

According to the report “Status of Climate Finance in Vietnam” funded by the GIZ and the Climate and Development Knowledge Network (CDKN)²⁴, private sector’s readiness to engage in climate change activity is still limited in Vietnam and further investigation into this area is highly recommended. An analysis of public-private partnerships (PPP) by the ADB (2012) suggested that the finance sector in Vietnam is underdeveloped and cannot yet sufficiently meet the need for long-term capital.

The Government of Vietnam can support the engagement of the private sector by developing innovative policies, including tax incentives, low-cost debt financing, equity investments, and sharing of research and development costs. However, the factors that can contribute to a more favourable investment environment in Vietnam still need to be analysed in detail to explore further potential for climate financing. A systematic reflection of the climate finance relevance of private sector activities is also needed.

3.5 Monitoring

In the main report of VITRANSS, the lack of modern management system and database is highlighted as one of the major concerns in Vietnam. “New management systems, information systems (including comprehensive inventories of infrastructure and work planning/management tools), new guidance documents to define procedures (both to allow decentralisation and devolution of responsibilities within the sector and to coordinate activities between agencies in transport and agencies outside, especially the police)” are cited as among the priority areas for institutional strengthening. The availability of data is also observed to be limited to each administrator’s personal interests rather than shared more widely, with the lack of a central database resulting to managers having various sources of data that are usually in “conflict with each other”. The lack of reliable monitoring information could hinder the monitoring of policy implementation conducted by MOT as well as the effective planning for future initiatives resulting from the poor statistics.

The government through the GSO provides most of the data required as well as TDSI, particularly through the Statistical Yearbook. Other sources of data are the research and development agencies

²⁴ <http://www.climatefinanceoptions.org/cfo/node/3526>

and donors which conduct studies prior to and during project implementation, such as the World Bank, Asian Development Bank, French Development Agency (AFD), JICA, and National Institute for Environmental Studies. The table below summarises the status of monitoring system in Vietnam.

In Vietnam, the ministries are responsible for reviewing, developing and promulgating the policies in accordance with their fields of responsibilities. As assigned by Minister, some state organizations under the Ministry will conduct the studies and these studies' findings will provide the implications for the improvement of transport policies in Vietnam. In these studies, some data are surveyed and sometime are collected from many sources as mentioned in Section 2.5 (International donors, research institutes and private sector). And when the desirable data is not available, it is simply difficult for policy makers to evaluate and develop a good policy. Table 24 shows the current status of monitoring system for each group of policy in transport sector in Vietnam and from this we could see data availability is the key challenge in proposing the policies for some policy groups.

Table 24: *Current status of monitoring system for each group of policy in Vietnam*

Policy group	Current approach	Data availability
Energy efficiency (passenger)	Driving cycles specified in terms of speed and times, are conducted by TDSI infrequently. ^a MOT provides the roadmap for tightening emission standards, the enforcement of such is covered by Vietnam Register.	Some data such as vehicle type, fuel type, engine size and fuel consumption can be obtained from VR as these data are included in the type approval process, in registration files and/or I&M program.
Energy efficiency (freight)	MOT provides the roadmap for tightening emission standards. As freight sector is gaining attention, development agencies, research bodies and the private sector have been providing estimates for their technical reports.	TDSI surveys fuel use by vehicle type and fuel type, though infrequently. ^a Load factors of trucks and logistics-related database are either not available or not widely circulated and discussed.
Urban transport including public transport, NMT, land use policies, etc.	Indicators for transport activity such as PKT are from GSO which releases statistics based on surveys they conducted and on the reporting system of MOT. The transport activity units, including trips and distance per day by mode, are surveyed, though infrequently. Information on average growth of transport demand is kept by MOT. Data on vehicle numbers and characteristics and ownership can be obtained from Vietnam Register. Master plans drafted by private research agencies often contain relevant data.	There is no comprehensive information or assessments on transport activity for all modes including walking and rickshaws, as well as km/year/vehicle. Transport and Urban Public Works Service annually updates passenger capacity per hour of the bus network, though infrequently, and updates that of the rail system. It is also a possible source for interchanges within rail and bus transit systems. ^a
Modal shift in non-urban transport	MOT studies average growth of transport demand. Provincial Transport Departments surveys the vehicle fleet at the local level. Police Department also provides information on motorcycle registration. Vietnam Register has registration details on cars, buses and trucks.	Data can be obtained from Statistical Yearbook every year and Census every ten years.
Modal shift in freight	MOT studies average growth of transport demand. Vietnam Register has registration details on cars, buses and trucks. Vietnamese Inland Waterways Authority (VIWA) also conducts interviews. ^b	Data can be obtained from Statistical Yearbook every year and Census every ten years. May not be complete.

Source: ^aClean Air Asia. (2005, December); ^bGille, Dusseldorp, Veldman. (n.d.)

Regarding current practical policy monitoring, there is still weakness in the monitoring system, for example the vehicle labelling policy effective from 1 January 2015 however there is no assessment on the impacts at this time, another example is the recent crackdown on overloading of trucks, with truck weighing stations are only located on some national highways and there is lack of both equipment and manpower. The capacity to monitor and evaluate programs and projects is strengthened, for example, with support from AusAID through learning-by-doing (Cuong & Fargher, 2007). OECD suggests that the goal of capacity development is “to inform policy making and increase accountability in-country, in support of shared development goals.”

Institutionalisation of data collection remains a top priority. Evaluation of policies and projects can be greatly enhanced with knowledge-sharing between research agencies conducting the modelling and the government bodies. Evaluation of progress of the entire transport sector towards policy goals such as energy efficiency, climate change or air quality could be done, through sector-wide indicator such as MJ/p-km, MJ/t-km or modal split, which are currently not monitored and reported.

4 Barriers to sustainable, energy-efficient transport

Given the scenarios in the future of the transport sector in Vietnam as presented in Section 2.3, there is a necessity to evaluate the fundamental barriers to implementing sustainable transport in Vietnam. The review on current transport policies addressing sustainable transport and climate change reveals several points of considerations, while Annex 3 lists some regulatory and technical barriers of specific measures that have mitigation potential.

Political

- According to the document *Viet Nam Socialist Republic: Transport Sector Assessment, Strategy, and Road Map* published by ADB (2012), there has been an emphasis to separate policy, regulatory, and operator roles, citing the recent reorganisation of the roads and expressways subsector at MOT with the creation of the Directorate for Roads of Vietnam (DRVN) and the planned creation of an exclusive expressway administration agency, tentatively called the Vietnam Expressway Management Administration (VEMA), which were meant to improve institutional efficiency. However, the study observes that “a multi-modal orientation is still lacking, resulting in imbalances and integration problems between subsectors, and coordination with investments and programs in other sectors remains poor.”

At the local level, there is a lack of integration of the different transport institutions under the city People’s Committee. Indeed, separate agencies exist for bus management, bus operations, new agencies for MRT systems, and departments for road investment and traffic management. A case study of Hanoi also highlights that there are state-owned enterprises in the city responsible for supply of bus services and development of rail system which report directly to the People’s Committee (Phin & Dotson, 2013). Hanoi and HCMC however propose to establish urban transport authorities to undertake management, planning and regulations to ensure good coordination between the transport agencies (ADB, 2012).

Institutional

- Institutional arrangements for railway projects are not flexible, as the capacity of private sector to join in development programs is not facilitated. ADB (2012) observes that, while the Railway Law of 1995 encourages private sector participation, private companies can only participate through a joint venture with the Vietnam Railways Corporation (VNR), which operates and maintains the existing railway network (while the Vietnam Railways Administration is in charge of planning and development).
- According to World Bank (2011), introducing bus rapid transit systems in Vietnam are hindered by institutional and financing concerns, mainly that there is fragmented planning process and that financing for urban transport infrastructure is below targets.
- Infrastructure projects in Vietnam generally lack multi-modal corridor strategy due to poorly integrated planning between the different modes. As well, facilitation payments or bribes were necessary to accelerate supply chains. In Vietnam, corruption has been cited as a major challenge for trucking firms; these “facilitation payments” account for about 8% of the total trucking cost while fuel costs account for roughly 65% (Vietnam News, 2014). Supply chain

management does not only concern logistics, but also the mechanisms and linkages that coordinate stakeholders in terms of information sharing, production processes, among others (Rich & Narrod, 2010).

- The World Bank report cites that “logistics operations in Vietnam are costly relative to key regional peers like China, Malaysia, and Thailand, primarily because of the prevalence of unpredictability in supply chains” which “increases logistics costs by making it necessary for businesses to carry more inventory than they would otherwise need to manage their everyday operations” (Blancas, et al., 2014). It further elaborates the key root causes of supply chain unpredictability:
 - Cumbersome and inconsistently-applied government regulations;
 - Lack of automation in key trade-related processes such as trade clearance;
 - Fragmented modal planning in transportation;
 - A belief among shippers and logistics service providers that facilitation payments are necessary to avoid delays in supply chains;
 - Low barriers to entry in trucking; and
 - Major supply-demand imbalances in infrastructure provision.
- Fragmented road freight sector can hinder the government from effectively implementing sustainable transport initiatives, such as eco-driving, truck improvements or logistics optimisation. In Vietnam, each of the road freight companies, usually of small or medium size, owns about 50 vehicles. Furthermore, the sector consists of “tens of thousands of individual household businesses exist that operate informally” (Business Monitor International, 2011). This fragmentation of relatively small trucking companies can result to difficulty in monitoring, as well as to a lack of efficiency in terms of economies of scale when truck companies will be necessitated to improve their fleet (e.g. retrofitting trucks with low rolling resistance tires, aerodynamic technologies such as roof fairings).

Financial

- Financial cost is one of the most typical obstacles to the success of policies that require investments. In addition to administration and allocation of budget, funding sources can be hard to identify, especially regarding urban infrastructures which require massive investments and which may discourage the private sector to participate in the financing of the project. For instance, there are about 1,000 logistics firms in operation in Vietnam but foreign ones dominate the market (Vietnam News, 2014) while the local ones have limited financial capacity to compete. Shifting from road to maritime freight is also hindered by underinvestment (World Bank, 2011). Bus operators in Hanoi and HCMC are subsidized in recent years and were able to increase their service and ridership. In other cities however there are hardly any subsidies, save for a few routes, and the operators are struggling to survive and have a lack of capital to invest in new and efficient vehicles.

- The World Bank report *Winds of Change* (Wang, Berrah, Mathur, & Vinuya, 2010), citing Taylor et al. (2008), defines three main financing mechanisms developed for energy-efficiency projects: (1) loans and partial loan guarantee schemes operating within commercial banks or as specialised agencies or revolving funds; (2) energy-efficiency and demand-management funds, financed by a surcharge on electricity consumption (system benefit charge) or a government budget, and managed by utilities or dedicated agencies; and (3) third-party financing through Energy Service Companies (ESCOs). It observes that, for the second mechanism, a number of East Asian countries including Vietnam set up energy efficiency and demand-side management funds. These countries usually face three key issues: (1) where to obtain the funding, (2) who should administer the funds and implement the energy efficiency/demand-side management programs, and (3) how to ensure effective use of the funds and verify results.
- According to ADB (2012), MOT identified the insufficient state budget and other financial sources as among the causes of environmental and social degradation in its Five-Year Plan in October 2009 for inclusion in Vietnam's 2011-2015 Socioeconomic Development Plan (SEDP). In a developing country such as Vietnam, the priorities of the national and local governments are usually split between ensuring socioeconomic development or poverty alleviation and ensuring road or public transport infrastructure development. For example, planning for biofuel in developing countries must ensure that its energy production will not threaten the country's food security or agricultural outputs.
- In a report on private finance for transport in Vietnam, Darko et al. (2015) conclude that, 'as Viet Nam's economy has grown, the level of international assistance (in the form of ODA) has declined in absolute terms and relative to GDP, leaving a financing gap for infrastructure projects (including for transport). The government is seeking to fill this, in part through private investment', and therefore 'investments in transport are part of specific legislation on the manner in which private actors and investors can engage in different sectors in Viet Nam through Build-Operate-Transfer (BOT), Build-Transfer- Operate (BTO) or Build-Transfer (BT) contracts (Decree 108/2009/ND-CP). Under this legislation, roads, road tunnels, ferry landings, railways, railway tunnels and bridges, airports, seaports and river ports are highlighted as areas for private sector participation. Under these types of contracts, the participation of government is limited to 49% of the total investment capital of the project. Under this legislation, the central government issues investment licences for private actors to enter into BOT, BTO and BT contracts. Domestic investors do not need to acquire investment licenses for projects of less than VND 15 billion (approximately \$714,000).' 'The investment law reform included the process of 'equitisation' (or partial privatisation) of State Owned Enterprises by selling part of the assets or liabilities to the private sector, transforming the SOE into a JSC.' However, 'in spite of stated objectives to develop PPPs in the sector, there is currently limited government capacity to implement these – in terms of both civil servant experience in PPP structuring and mismatched expectations from the public and private sectors around investment in PPPs. As a result, the only PPPs that have thus far been developed in Viet Nam have been in the area of road construction.'

Capacity

- Addressing climate change through energy efficiency and sustainable transport is a long-term process and achieving ambitious goals necessarily take years. Renewing urban infrastructures often represents massive and exhaustive challenges, and time to implement projects must be taken into account. Thus, because of the intrinsic nature of transport infrastructures, the capacity of Vietnam and cities to reverse the GHG emissions process is limited in the short term.
- While many initiatives do not directly require a relatively significant financial investment to commence, the financing of its operation and maintenance and hence the sustainability of the initiative may be a concern, especially when the capacity to enforce standards and regulations is inadequate. In terms of parking management, this can include the need for personnel tasked for eliminating or ticketing illegal on-site parking.
- Vehicular inspection and maintenance programs needs capacity for the operation of various technical tools such as on-board diagnostics (OBD) and remote sensing²⁵ which can aid in the implementation of such programs. The policy table in Annex 20 presents some information on the current status of inspection and maintenance. The inspectors and mechanics must also know how to properly calibrate the equipment and maximise the available infrastructure. The lack of capacity of personnel to enforce the standards may lead to the evasion of compliance and tampering with the vehicle components to “pass” the test. One of the most primary concerns in vehicle inspection and maintenance is fraud and corruption (Kolke, 2005) as drivers may cheat on tests and/or bribe to pass inspection, and inspectors and mechanics may pocket the bribes (Hausker, 2004).

Social awareness and education

- The failure of implementation associated with the regulation of old trucks and buses is a good example of the need to raise awareness on existing laws but also on the necessity to engage individuals in climate change mitigation. Technological advances for the freight sector such as tire standards, aerodynamic technologies, and logistics brokerage platforms to maximize haulage efficiency have not yet fully penetrated the freight sector of Vietnam for emission reduction purposes. For instance, the installation of global positioning systems (GPS) or black boxes in automobiles currently do not include any specific inclusion of fuel consumption parameters.
- Many Vietnamese citizens are switching from two-wheelers to passenger cars. For the promotion of biking as an alternative mode of transport, not only would it be necessary to provide bike lanes but it would also be necessary to educate the motorists and vendors not to encroach on such lanes.

²⁵ OBD systems are micro-computers commonly installed in the new vehicles which monitor the performance of the major components of a vehicle such as the chassis and the body, in addition to complete emission controls. This tool provides vehicle owners an early sign of vehicular malfunction. Remote sensing, on the other hand, uses a beam of radiation projected across a parcel of air on the road to investigate emissions from vehicles, allowing for the identification of gross polluters.

Implementation and enforcement

- Regulation of old trucks and buses is another good example of implementation obstacles. According to the Vietnam Register, about 70,000 automobiles had passed their expiry date since the beginning of 2011 and were no longer considered road worthy—but the majority were still in use. Furthermore, 40,000 trucks and nearly 30,000 buses were considered no longer roadworthy but only 10,400 had been impounded. Reasons for implementation failure are twofold: vehicle owners are ignorant of the law and punishments were not strict enough to deter potential law breakers. As such, fake documents are often used by vehicle owners to bypass the law in the country (Vietnam News, 2011).
- Implementation of vehicle emission targets has been reported inefficient by Vietnam Register. The existing and future Euro regulations are and will be applied to all vehicles of the business manufactured in one year, which implies that businesses have to adjust engineering, technology but also production and importing plans to comply to the new standards. However, lack of financial measures to incite businesses to make the necessary changes have jeopardised the implementation of the policy. Vietnam Register has in this perspective proposed three complementary solutions: allow compensation between years in the stage, allow compensation among businesses and withdraw quality certificate or stop granting Stamps or Certificates to finished vehicles (Vietnam Register, 2013).

5 Activities by international organisations

International support is provided for Vietnam in the form of funds and technical cooperation. As Darko et al. (2015) notes, ‘ODA funding for the transport sector increased significantly in between 2009 and 2014, with ODA mirroring government investment and focusing on road transportation. Japan, Korea, France, ADB and the World Bank are the primary providers of ODA in the sector’. Figure 22 shows that transport finance in Vietnam comes mainly from national budget, but international sources such as ODA, fast-start climate finance and others important too, mostly for rail and water transport.

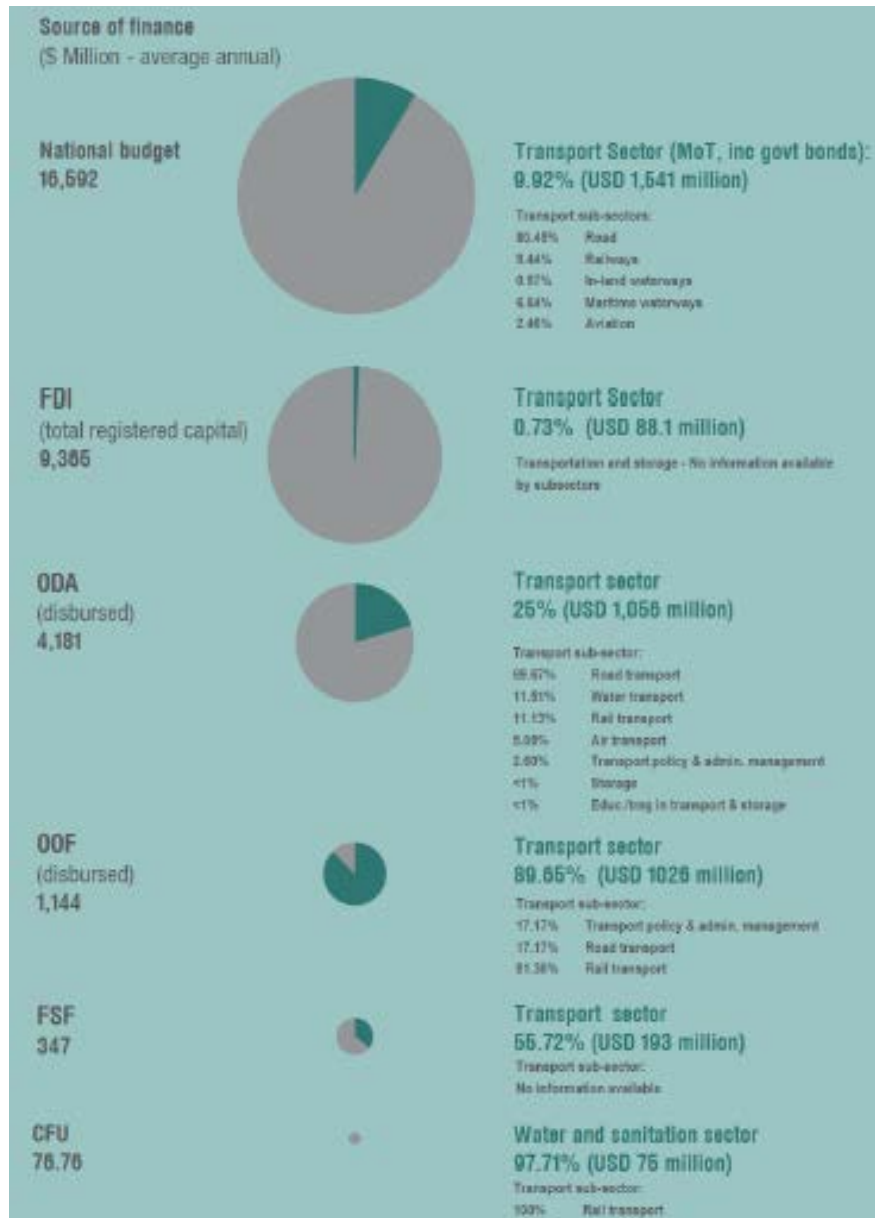


Figure 22: International support for transport in Vietnam

Source: Darko et al. (2015)

Most of the key international organisations also assist Vietnam with the development of the sustainable transport policies/plans/projects. Today, a variety of projects on transport infrastructure development are under preparation, focusing on road and bridge building, especially urban trams, BRT and subways for big cities like Hanoi, Danang and HCMC. Without claiming comprehensiveness, major projects in Vietnam are enumerated in Table 25.

Table 25: Donor activity on monitoring of policies

	Passenger	Freight
Transport Demand Management (TDM)	<p>ADB</p> <ul style="list-style-type: none"> - Tolloed expressway to reduce travel and to ease congestion on roads connecting to the port area: In 2008, ADB has approved a USD 410-million loan for the construction of a 51-km tolled expressway linking HCMC and Dong Nai Province to ease the congestion within HCMC and those roads connecting the centre of HCMC and the port area. ²⁶ <p>JICA</p> <ul style="list-style-type: none"> - Loans have been made for projects on Hanoi city urban railway construction, and aids have been granted for the development of traffic control system for expressway in Hanoi. ²⁷ <p>SMBC, Citibank Japan</p> <ul style="list-style-type: none"> - In early 2012, Vietnam Development Bank signed an agreement with Sumitomo Mitsui Banking (SMBC) and Citibank Japan to secure a USD 270-million loan for the 6-lane Hanoi-Haiphong Expressway project features an intelligent traffic control system. ²⁸ <p>REMON - Real Time Monitoring of Urban Transport</p> <ul style="list-style-type: none"> - Solutions for Traffic Management and Urban Development in Hanoi, http://www.remon-hanoi.net/en 	<p>ADB</p> <ul style="list-style-type: none"> - Tolloed expressway to reduce travel and to ease congestion on roads connecting to the port area. - Roads, ports, railways to enable unrestricted passenger and freight transport. ²⁹ <p>JICA</p> <ul style="list-style-type: none"> - JICA signed the Japanese ODA Loan agreements in December 2013 which includes the Hanoi City Ring Road No. 3 Construction Project to facilitate the logistics with the neighbouring industrial complexes and areas such as Hai Phong City. ³⁰ <p>World Bank</p> <ul style="list-style-type: none"> - The Haiphong Urban Transport Project aims to improve urban roads to alleviate port and inter-city traffic movements. The Bac Son–Nam Hai East–West Link is expected to relieve residents along the existing section of the corridor of heavy freight traffic. ³¹
Modal shift	<p>JICA</p> <ul style="list-style-type: none"> - Strengthening of public transportation: Public transportation in the capital is being improved through the Project for Improving Public Transportation in Hanoi³², a Technical Assistance Project related to ODA loan. Other projects include the study of the implementation of integrated UMRT and urban development for Hanoi³³, strengthening of the capacity of regulator and the establishment of operation and maintenance company of metropolitan railway lines in Hanoi. ³⁴ Loans have also been made for HCMC urban railway construction, particularly Line 1: Ben Thanh-SuoiTien.³⁵ <p>ADB, KfW, EIB</p> <ul style="list-style-type: none"> - Railway projects: ADB provided Technical Assistance to HCMC to advise their People's Committee on the integrated development of their 	<p>ADB</p> <ul style="list-style-type: none"> - Railways developed: Railways are developed to ease transport of goods. Its goals include the completion of the infrastructure improvements enabling unrestricted passenger and freight transport⁴⁵. <p>Norway (NORAD)</p> <ul style="list-style-type: none"> - Technical and management training for development of shipbuilding industry: Norwegian Agency for Development Cooperation (NORAD) co-funded Vietnam Shipbuilding Training Project, as executed by state-owned Vietnam Shipbuilding Industry Group, known as VINASHIN, from 2008-2013 to contribute to the development of the shipbuilding industry in Vietnam to

	Passenger	Freight
	<p>first 2 MRT lines. The development of urban rail MRT, specifically the MRT Line 2, facilitates public transport access and connectivity in six central districts of HCMC, promotes a modal shift from private to public transport, reduces vehicle trips and the need to expand road network, and reduces greenhouse gas emissions. The fund will be provided by ADB, German Development Bank (KfW) and European Investment Bank (EIB)³⁶. The three organisations will also help finance Line 5³⁷.</p> <p>AFD, ADB</p> <ul style="list-style-type: none"> - A loan is provided for a national railroad rehabilitation project between Yen Vien in the outskirts of Hanoi and Lao Cai. ³⁸ <p>AFD, General Directorate of French Treasury, FFEM, EIB, ADB</p> <ul style="list-style-type: none"> - These organisations are funding Line 3: Nhon-Ha Noi Station, covering 12.5 km between the Nhon terminal to the west and the Hanoi central train³⁹. - ADB provided Technical Assistance to develop an integrated public transport system in 5 districts of Hanoi that will support effective utilisation of Hanoi Metro Line 3. The project will provide infrastructure for improving accessibility to Metro Line 3 stations, implement feeder bus links, a public transport management system, integrated multi-modal stations with "park and ride" facilities, as well as a comprehensive parking plan for the city⁴⁰. <p>World Bank</p> <ul style="list-style-type: none"> - Hanoi Urban Transport Development Project includes a Bus Rapid Transit (BRT) component which will support the development of segregated bus lanes and bus priority⁴¹. <p>Additionally, one of the components of the Haiphong Urban Transport Projects aims to improve public transportation services along the Tam Bac-Kien an urban corridor, including measures to strengthen institutional development for public transport management, piloting of transformative approaches to fleet management, acquisition of new buses, and upgrading of infrastructure and facilities⁴²</p> <p>Da Nang Sustainable City Development project⁴³ consists of 4 components, including a bus rapid transit development, urban strategic roads. In 2012, the central city of Da Nang has approved a project to open three more BRT lines in the 2012-15 period with an investment of around USD 37 million sourced from ODA funding⁴⁴.</p>	<p>ensure its products satisfy the requirements of international rules and standards⁴⁶.</p> <p>Administered by the World Bank, the global, multi-donor technical assistance trust fund Energy Sector Management Assistance Program (ESMAP) funded a study to analyse the nature of the main freight movements by land and by coastal shipping, among others, with the ultimate objective of shifting some of the main north-south freight movements from trucks to coastal vessels⁴⁷</p>

	Passenger	Freight
Energy efficiency	<p>GIZ:</p> <ul style="list-style-type: none"> - Assist in developing a national action plan on energy efficiency and climate change in the transport sector, and develop a NAMA proposal for fuel efficiency policies - KfW is supporting Da Nang in providing environmentally friendly buses for its citizens. A fleet of 75 buses that meet international environmental standards have been developed, including exhaust fumes that come up to the Euro 4 standard. They were put in services in 2011. The project was also coupled with the BRT program for which KfW also brought support. <p>World Bank</p> <ul style="list-style-type: none"> - Through ESMAP, a bus energy efficiency study was conducted which included the assessment on the energy efficiency status of the current bus services (including bus routes planning and bus operations), identification critical areas for improvement and identification of cost-effective options for improving energy efficiency of the bus services⁴⁸. <p>Clean Production and Energy Efficiency Project: The third component of the project is capacity-building for program management, and monitoring and evaluation. This component will support capacity-building of MOIT's Energy Efficiency and Conservation Office (EE&CO) through provision of expert assistance and training activities in implementation, and monitoring and evaluation (M&E) of various energy efficiency projects, programs, and policies⁴⁹.</p>	<p>ADB-GMS⁵⁰:</p> <ul style="list-style-type: none"> - MRV for the NAMAs in freight sector - Eco-driving, financial channel assessment, truck retrofitting and monitoring of energy efficiency measures in trucks
General	<p>JICA, AFD</p> <ul style="list-style-type: none"> - Support for GHG inventories and programs: JICA signed an agreement with MONRE for "Capacity-building for National Greenhouse Gas Inventory in Vietnam" project to enhance the capacity of Vietnam in periodically and systematically collecting and compiling necessary data for national GHG inventories, and managing quality assurance/quality control of GHG inventories for key sectors⁵¹. - JICA has also committed the Support Program to Respond to Climate Change (SP-RCC) to support the implementation of the National Target Program to Respond to Climate Change (NTP-RCC). JICA likewise supports the law on energy efficiency and conservation which promotes the introduction of the energy conservation labelling system. AFD provided co-financing⁵². <p>AFD</p> <ul style="list-style-type: none"> - AFD assists in implementing mitigation measures, particularly in reducing GHG emissions, as well as climate change adaptation strategies, and understanding the emissions generated and reduced of projects through the use of a carbon footprint methodology designed by AFD. In the period of 2006-2012, for instance, 12 projects on mitigation and adaptation amounting to over USD 470 million were committed to Vietnam, enough to mitigate 1.18 MtCO₂ emissions/year⁵³. <p>JICA</p> <ul style="list-style-type: none"> - Development of master plan studies and capacity-building: JICA supported Da Nang City 	

	Passenger	Freight
	<p>Development Master Plan Study which includes the city's development through 2025, an urban traffic program and an overall environmental sustainability program. An urban database will be maintained and training be provided for relevant agency personnel to improve their administrative capabilities⁵⁴.</p> <ul style="list-style-type: none"> - Among other technical cooperation projects are capacity-building for national GHG inventory, for road maintenance, and for planning nationally appropriate mitigation actions (NAMAs) in Vietnam for UNFCCC registry and carbon offset mechanism⁵⁵. <p>Australia, ADB</p> <ul style="list-style-type: none"> - Improvement of Mekong trade and transport facilitation: Australia has committed to assisting Vietnam develop infrastructure, and will advocate more for greater private sector involvement in delivering infrastructure. The Australia–Vietnam Joint Aid Program Strategy 2010–2015 aims to increase economic activity in targeted regions (including cross-border). Together with ADB, Australia will continue to improve Mekong trade and transport facilitation through activities such as capacity-building for border officials and relevant line agencies, building on their support to the Cross Border Transport Agreement, designed to free the legal movement of goods across borders in the sub region by streamlining licensing, customs, among others⁵⁶. <p>GIZ</p> <ul style="list-style-type: none"> - The GIZ project 'Creation of an overarching framework for nationally appropriate mitigation actions' was set up to support Viet Nam in four main areas: Establishing the NAMAs National Coordination Unit within MONRE, to coordinate and advise on the development and implementation of NAMAs; Identifying and developing two bankable NAMAs, as well as guidelines for NAMA development and implementation; Developing a national system for measuring, reporting and verifying GHG emissions data, including an integrated MRV system for sectoral NAMAs; Strengthening the negotiating capacities of Vietnamese delegations at international climate change negotiations⁵⁷ <p>EIB</p> <ul style="list-style-type: none"> - European Investment Bank (EIB) granted €150 million loan to the Government of Vietnam to finance projects that will contribute to the mitigation of climate change⁵⁸ <p>World Bank</p> <ul style="list-style-type: none"> - World Bank supports the government in implementing Green Growth Strategy, using the EFFECT model provided by ADB in 2012 to assess various low-carbon development options in the transport sector. This is aimed to help the government in identifying priority interventions in the short- to medium-term that supports their long-term strategy up to 2040⁵⁹. <p>EU:</p> <ul style="list-style-type: none"> - Focusing on establishing of MRV system for climate change action. 	

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²⁷ <http://vietnamnews.vn/print/221210/japan-loans-us270m-for-ha-noi--hai-phong-expressway-project.htm>

²⁸ <http://vietnamnews.vn/print/221210/japan-loans-us270m-for-ha-noi--hai-phong-expressway-project.htm>

²⁹ <http://www.vietnambreakingnews.com/2008/10/adb-agrees-410-million-for-southern-expressway/>

³⁰ http://www.jica.go.jp/english/news/press/2013/2013/20131224_01.html

³¹ <http://www.worldbank.org/projects/P111548/vietnam-haiphong-urban-transport-project?lang=en>

³² <http://www.almec.org/projects/d01.html>

³³ <http://www.jica.go.jp/vietnam/english/office/topics/pdf/press0807.pdf>

³⁴ http://www.jica.go.jp/vietnam/ku57pq00000468pr-att/A3_English.pdf

³⁵ http://www.jica.go.jp/vietnam/english/office/topics/c8h0vm000001sp52-att/press120828_en.pdf

³⁶ http://adb.org/projects/details?page=details&proj_id=39500-012, <http://www.adb.org/sites/default/files/linked-documents/39500-02-vic-ffa.pdf>

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- ⁴⁰ <http://www.adb.org/news/adb-loan-boost-connectivity-services-ha-noi-s-metro-line-3>
- ⁴¹ <http://www.worldbank.org/projects/P083581/hanoi-urban-transport-development-project?lang=en>
- ⁴² <http://www.talkvietnam.com/2012/12/start-building-resettlement-housing-areas-under-haiphong-urban-transport-development-project/>
- ⁴³ <http://www.worldbank.org/projects/P123384/danang-sustainable-city-development-project-scdp?lang=en>
- ⁴⁴ <http://en.baomoi.com/Info/Da-Nang-to-open-more-bus-lines/3/311524.epl>
- ⁴⁵ <http://www.vietnambreakingnews.com/2008/10/adb-agrees-410-million-for-southern-expressway/>
- ⁴⁶ http://www.dnv.com/news_events/news/2006/vietnamlookingtothetop.asp?Edit=1
- ⁴⁷ <https://esmap.org/sites/esmap.org/files/activities/P119287.pdf>
- ⁴⁸ <https://www.esmap.org/taxonomy/term/250?page=2>
- ⁴⁹ <http://documents.worldbank.org/curated/en/2011/06/14415985/vietnam-clean-production-energy-efficiency-project>
- ⁵⁰ <http://www.gms-eoc.org/resources/gms-green-freight>
- ⁵¹ http://www.jica.go.jp/vietnam/office/information/press/pdf/press2010/201007_03e.pdf
- ⁵² http://www.jica.go.jp/vietnam/office/information/press/pdf/press2010/201007_03e.pdf
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- ⁵⁶ <http://dfat.gov.au/about-us/publications/Documents/vietnam-strategy-2010-15.pdf>
- ⁵⁷ <https://www.giz.de/en/worldwide/26246.html>
- ⁵⁸ <http://www.eib.org/infocentre/press/releases/all/2012/2012-150-vietnam-eur-150-million-loan-for-climate-change-mitigation.htm>
- ⁵⁹ <https://www.esmap.org/node/2023>

6 Policy recommendations

Improve

Currently consumers do not value fuel economy highly when purchasing vehicles, with two standards on limit of fuel consumption for passenger cars and two-wheeled motorcycles and mopeds are voluntary. Improving the fuel efficiency of new vehicles (the short term option with the highest mitigation potential) requires thorough analysis of the vehicle market, reliable test procedures and discussions among stakeholders in order to ensure the fuel economy standards are fair and deliver real savings compared to business-as-usual. These standards should be proposed and regularly strengthened in order to promote manufacturer innovation and the creation of new efficiency solutions. It also helps to enhance the competitiveness between the manufactures in the market.

Vietnam has started discussions on standards for heavy-duty vehicles, but policy discussions on energy-efficiency standards, labelling or information for tyres, which could save up to 3% of energy, could be initiated. For inspection and maintenance, more stringent enforcement of polluters, updating test procedures and making use of the on-board diagnostics would help making the programme more effective.

Avoid and Shift

Effective policy options include CO₂-based vehicle taxation (also for ‘improve’), market-based mechanisms like auctioning titles, congestion charges and parking charges, and requiring road users to pay for infrastructure and services.

In addition, transit-oriented development and other integrated land-use planning concepts are needed to further reduce the need for motorised travel and make the alternatives attractive. This requires long-term planning and discussion among a range of public and private stakeholders.

Achieving the public transport targets further requires substantially improving mass public transport infrastructure, particularly bus rapid transit and rail systems. At least equally important is a focus on quality of public transport: bus frequency, service, reliability, attractiveness and interconnectivity between modes. Such multi-modal planning may require increased cooperation between national and international organisations, and an urban transport authority for management, planning and coordination could be considered.

Current policies, governance structures and funding may need improvement and strengthening to achieve the said targets. This includes a national public transport policy which gives financial and technical assistance to cities and provinces. At the local level, bus reform (such as done in Hanoi), bus route optimisation, BRT, and performance-based operational subsidies to operators may be needed. As part of a comprehensive ‘push and pull’ strategy, the pricing strategies mentioned above, together with measures and infrastructure for walking and cycling, and connectivity between different public transport modes are key in increasing ridership. This could include low-emissions zones, pedestrianisation of inner city roads and dedicated bicycle lanes in urban areas; this could help reverse the declining trend in modal shares of walking and cycling.

Freight and Logistics

Useful interventions are in the area of enhancing logistics such as reducing empty backhauls, improving the routing of distribution system, clustering destinations together, setting up an online freight exchange (clearing house), and constructing logistics centres efficiently. Moreover, the private sector itself has a large role to play in improving freight and logistics, e.g. by providing technology such as radio frequency identification tags, global positioning system and vehicle routing software which are necessary to optimise street networks (Punte et al., 2010). Introduction of green freight labelling schemes and other information and communication instruments can also be considered.

Data, Indicators and Monitoring

Progress on sustainable transport often starts with data, which creates awareness and corresponding action. Local air pollution is example of a key issue that can expedite transport policies, as this is visible directly to citizens. Even though energy efficiency and climate change are less 'visible' problems, they can be mainstreamed into transport policy by monitoring appropriate indicators. These indicators can include macro-level energy or environmental performance indicators related to transport (e.g. MJ/vkm, kgCO₂/capita, gCO₂/p-km or t-km, total tons CO₂ for the transport sector), infrastructure or services indicators (km bike lines, #buses/capita), as well as project-specific or activity-specific indicators. Such a set of indicators help to get a more complete picture of the climate change impacts of transport. It thereby supports, the development of baseline emission projections (which exhibit large uncertainty), future BURs, mitigation potential of transport options (e.g. in the context of the INDC) as well as MRV of NAMAs. Currently policy monitoring takes place based on policy-specific transport indicators but is not necessarily made public. A communication strategy beyond climate change related issues may be helpful to inform the public about the progress towards sustainability.

Improvement of data quality and availability for annual vkm and fuel efficiency by vehicle and fuel type, modal split (including NMT), vehicle fleet composition, average speed and occupancy rates/load factor are needed for monitoring energy and CO₂ of the transport sector; and can be used for assessing progress towards other transport policy objectives such as modal shift, motorisation, air quality, logistics optimisation and fuel diversification. Comprehensive travel surveys at the national level, which can be collected and reported by GSO in the statistical yearbook, and fuel efficiency information in the vehicle type approval process, can be considered, as well as including transport questions in annual GSO surveys.

In order to move towards a more comprehensive monitoring system, increased collaboration between different public and private organisations that are already collecting data is required, as well as a central management system with consistent data formats, and incentives to make reporting on indicators an integral part of policymaking and an overall sustainable transport strategy.

ASEAN

The suggestions and recommendations in this report can also be seen in the ASEAN regional context, in particular given that the successor of the ASEAN Strategy Transport Plan 2011-2015 will have a significant focus on sustainable transport policies, capacity building and data systems. We observe a momentum within many of the ASEAN Member States as well, e.g. for fuel economy standards and incentives, green freight, and public and non-motorised transport. Exchange of experience and success stories between different countries is essential in faster developing and implementing more effective policies.

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Annexes

Annex 1: Emissions inventory for motorcycles and light duty vehicles

Motorcycles are the main source of emissions in Hanoi and HCMC especially for CO, HC, and NO_x. In the capital city of Hanoi, for instance, Kim Oanh, Phuong & Permadi (2012) estimated that the motorcycle fleet in Hanoi emitted 158.2 kt of CO, 51.5 kt of VOC, 9.5 kt of NO_x, 2.4 kt of PM₁₀, 964.3 kt of CO₂ and 0.17 kt of SO₂ in 2008. Although the majority of the motorcycles are relatively new (3.6 years) and had four-stroke engines, the study found that “only 6% was equipped with catalyst exhaust control devices” and “about 35% of the fleet did not comply with any Euro standards”²⁶. In another emission study for in-use motorcycles in 2006-2007, it was found that 59% of the 1,675 surveyed motorcycles in Hanoi and 52% of the 1,627 surveyed in HCMC exceeded the emission limit of 4.5% CO and 1,200 ppm HC (Do, 2011)

Another study by Tung et al (2011) developed emissions inventory for motorcycles and LDVs in Hanoi from 2007 to 2009. The emissions were derived by combining vehicle population data, developed vehicle specific emission factors and VKT information from the traffic surveys. Their results show that contribution of motorcycles to CO, HC and NO_x emissions were much higher compared with the LDVs. The study notes that the difference in the results with Kim Oanh, Phuong, and Permadi (2012) is because the base emission factors and speed adjustment factors used in the IVE model by the latter were based on the LA4 driving cycle while their study developed and used local emission factors.

Emission inventory for motorcycles and LDVs in Hanoi, 2005 to 2009

	Pollutants	2005	2006	2007	2008	2009
Motorcycles	CO (ton)	104,355	114,677	126,144	-	150,729
	CO ₂ (ton)	277,362	304,795	335,275	-	400,617
	HC (ton)	8,656	9,512	10,464	-	12,503
	NO _x (ton)	1,389	1,526	1,678	-	2,005
	FC (m ³)	204,336	224,547	247,001	-	295,140
LDVs	CO (ton)	-	-	2,320	3037	3,862
	CO ₂ (ton)	-	-	435,078	554,695	706,477
	HC (ton)	-	-	250	319	406
	NO _x (ton)	-	-	476	631	790
	PM (ton)	-	-	9	17	19
	FC (m ³)	-	-	189,941	242,214	308,487

Source: Tung, Tong, Hung, & Anh, 2011. *Development of emission factors and emission inventories for motorcycles and light duty vehicles in the urban region in Vietnam*

²⁶ The study estimated the total emissions (running, start and evaporative) for the active motorcycle population in 2008 using the International Vehicle Emission (IVE) Model with 1,000 survey questionnaires, GPS monitoring for driving patterns as well as traffic videos. The data collection covered three typical road types, namely highways, arterials and residential streets, in three zones of the city. It assumes a total annual VKT of 15.8 x 10⁹km and a total number of starts of 3.8 x 10⁹. More information is available from the published paper: Kim Oanh, N.T., Phuong, M.T.T., and Permadi, D.A., (2012). *Analysis of motorcycle fleet in Hanoi for estimation of air pollution emission and climate mitigation co-benefit of technology implementation*, Atmospheric Environment, 59, Pages 438-448.

Annex 2: Forecast of energy demand in Vietnam by sector, 2000-2025 (in kTOE)

Sectors	2010	2015			2020			2025			2030		
		Low	Base case	High	Low	Base case	High	Low	Base case	High	Low	Base case	High
Industry	17497	24895	25419	26440	33647	35407	37680	43771	46790	52162	55301	59881	70127
Agriculture	612	762	769	780	855	870	882	919	946	967	951	986	1007
Transportation	11139	15961	16322	16651	23460	25142	26241	32581	36136	39036	45139	51488	57721
Commercial and Service	1754	4588	4609	5209	9314	9492	10852	15589	16090	19073	23645	24661	30457
Household	16893	18783	18805	19069	20511	20641	21016	22496	22868	23477	25704	26524	27575
Non-commercial	1209	1240	1240	1240	1271	1271	1271	1303	1303	1303	1336	1336	1336
TOTAL	49104	66229	67164	69389	89058	92823	97942	116659	124133	136018	152076	164876	188223

Note: This table provides the projections that reflect GDP growth rate and population growth rate.

Source: Vietnam Institute of Energy, Power Development Plan VII, 2010

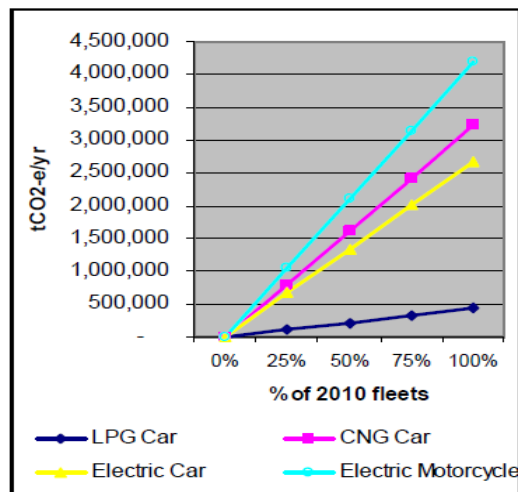
Annex 3: Three groups of potential climate change mitigation opportunities in the transport sector: Fuel switch, modal shift, and efficiency improvement

A background paper on *Potential Climate Change Mitigation Opportunities in the Transport Sector in Vietnam* prepared by the World Bank in 2009 discusses the GHG emission reduction potential from fuel switch, modal shift, and efficiency improvement. The study notes that these estimates “were based on the sector structure over the time span of 2010 and 2015 and used CDM and IPCC methodologies where available and local emission factors where available.” The results of different studies vary based on the methodologies, assumptions, forecasts, emission factor of Vietnam’s power grid, and baseline used, among others.²⁷

Fuel switch policies notably include introduction of low-emissions vehicles (LPG, CNG, electric and hybrid technologies) into commercial vehicle fleets, and use of biofuels in the transport sector. If LPG, CNG and electric vehicles have already been introduced (to some extent) in Vietnam, hybrid vehicles are currently not available in this country. The World Bank study in 2009 illustrates the GHG emission reduction potential from the introduction of low-emission vehicles into the car and motorcycle fleets. It shows that, when 100% of the car fleet in 2010 would switch to LPG, emission reduction could reach 434,162 tCO₂e/year.

²⁷ For further information on the methodologies used: World Bank. (2009, May). *Potential climate change mitigation opportunities in the transport sector in Vietnam: Background paper*. Retrieved November 3, 2013, from Washington, DC: World Bank: <http://documents.worldbank.org/curated/en/2009/05/13160223/potential-climate-change-mitigation-opportunities-transport-sector-vietnam-background-paper>

% of 2010 fleets	LPG car	CNG car	Electric car	Electric motorcycle
5%	21,708	161,712	133,739	209,818
10%	43,416	323,423	267,478	419,636
15%	65,124	485,135	401,217	629,454
20%	86,832	646,846	534,956	839,272
25%	108,541	808,558	668,695	1,049,090
30%	130,249	970,269	802,433	1,258,908
35%	151,957	1,131,981	936,172	1,468,725
40%	173,665	1,293,692	1,069,911	1,678,543
45%	195,373	1,455,404	1,203,650	1,888,361
50%	217,081	1,617,116	1,337,389	2,098,179
55%	238,789	1,778,827	1,471,128	2,307,997
60%	260,497	1,940,539	1,604,867	2,517,815
65%	282,205	2,102,250	1,738,606	2,727,633
70%	303,914	2,263,962	1,872,345	2,937,451
75%	325,622	2,425,673	2,006,084	3,147,269
80%	347,330	2,587,385	2,139,823	3,357,087
85%	369,038	2,749,097	2,273,562	3,566,905
90%	390,746	2,910,808	2,407,300	3,776,723
95%	412,454	3,072,520	2,541,039	3,986,541
100%	434,162	3,234,231	2,674,778	4,196,358

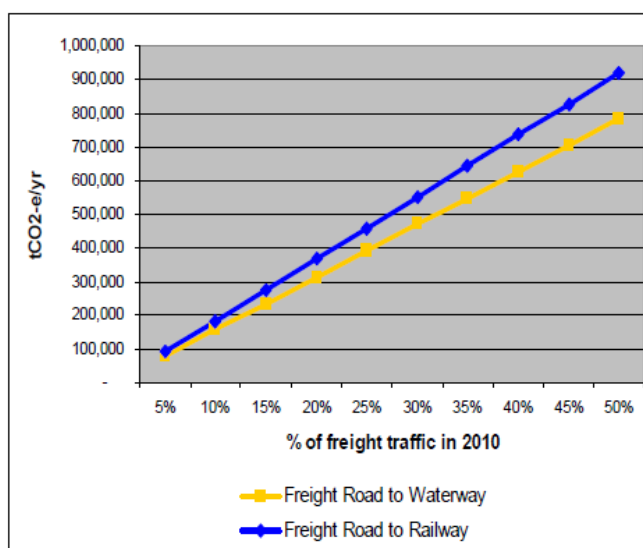


Estimated GHG emissions reductions from use of low emission vehicles in Vietnam (tCO2eq/yr)

Source: World Bank, 2009

Modal shift refers to the progressive replacement of road use by lower GHG emitting modes such as railways and inland waterways, as well as the increased use of public transportation in cities. The impact on GHG emissions would be less significant than fuel switch but remains nonetheless central given the figures:

% of road freight traffic	Modal shift from road freight to waterways	Modal shift from road freight to railways
5%	78,400	92,000
10%	156,800	184,000
15%	235,200	276,000
20%	313,600	368,000
25%	392,000	460,000
30%	470,400	552,000
35%	548,800	644,000
40%	627,200	736,000
45%	705,600	828,000
50%	784,000	920,000



Estimated GHG emissions reductions from modal shift (tCO2eq/yr)

Note: The assumptions made for the calculations include the following emission factors: 104 g/ton-km for diesel-powered freight transport (trucks); 42 g/ton-km for inland waterway transport; 25 g/ton-km for diesel-powered train. Emission reductions assumed include the following: 98 g/ton-km from the shift from diesel-powered truck to waterway transport; 115 g/ton-km from the shift from diesel-powered truck to diesel-powered train; 16.0 billion ton-km in road freight traffic.

Source: World Bank, 2009

Efficiency improvement refers to the improvement of traffic management and developing infrastructures. Overall, if these three main strategies are combined, emissions could be reduced by millions of tons of CO₂ per year, depending on scenarios. The table below illustrates some examples.

Selected mitigation opportunities in Vietnam

Intervention and Theoretical Emission Reduction	Feasible Medium-Term (2015) Reduction Potential	Major Barriers	WB Studies/Projects
Introduction of electric motorcycles (5.9 MtCO _{2e} /yr)	100% introduction of electric motorcycles in five major cities (HCMC, Hanoi, HaiPhong, Danang and Can Tho) (2.3 MtCO _{2e} /yr)	<i>Regulatory:</i> Both standard for electric motor cycles and regulatory control on the use of motorcycles are key driving factors. <i>Market:</i> A large enough demand is necessary to increase demand	
Biofuel E20 (20% ethanol gasoline) in vehicles (2.6 MtCO _{2e} /yr)	Introduction of E20 to substitute for gasoline used nationally using the planned production capacity for bioethanol (equivalent of 1% of gasoline supply) (0.1 MtCO _{2e} /yr)	<i>Regulatory:</i> Program normally necessitates mandatory blends or other government fuel price control <i>Technology:</i> Introduction of technology and increase in processing capacity is needed	
Modal shift from road to inland waterway freight (2.2 tCO _{2e} /yr)	Shift of 10% of road freight traffic to inland waterways through improved waterways, infrastructure, and other incentives (0.22 tCO _{2e} /yr)	<i>Technical:</i> Lack of infrastructure including logistics and intermodal linkages. <i>Financial:</i> Underinvestment in waterways as a mode of transport	Bank supports a number of projects that finance inland waterways, such as Inland Waterways and Port Rehabilitation Project (P004843)
Modal shift from road to rail freight (2.6 tCO _{2e} /yr)	Shift of 10% of road freight traffic to railways through improved infrastructure (0.26 tCO _{2e} /yr)	<i>Technical:</i> Lack of infrastructure including logistics and intermodal linkages. <i>Financial:</i> Requires large infrastructure investments	
Modal shift from road to coastal freight (0.8 MtCO _{2e} /yr)	Shift of 10% road freight traffic to coastal shipping using larger capacity vessels and improved infrastructure (0.08 tCO _{2e} /yr)	<i>Technical:</i> Lack of infrastructure including logistics and intermodal linkages. <i>Financial:</i> Underinvestment in coastal shipping as a mode of transport	Bank supports a number of projects that finance inland waterways, such as Mekong Delta Transport Infrastructure Development Project (P083588)
Bus Rapid Transit in five major cities (0.57 tCO _{2e} /yr)	City program for construction of BRT system for Hanoi and Ho Chi Minh to replace 30% of motorcycles and 30% cars in the city (0.53 tCO _{2e} /yr)	<i>Institutional:</i> Fragmented planning process. <i>Financial:</i> Financing for urban transport infrastructure is below targets	Hanoi Urban Transport Project (GEF) (P083593); possible support to BRT in Da Nang
Passenger vehicle fuel efficiency standards (3.7 MtCO _{2e} /yr)	EU standards (from five years ago) met in Ho Chi Minh and Hanoi (2.0 MtCO _{2e} /yr)	<i>Regulatory:</i> Fuel efficiency standards are not in place	
TOTAL: 18.37 MtCO_{2eq}/yr	TOTAL: 5.49 MtCO_{2eq}/yr		

Note: The document by The World Bank, “Climate-Resilient Development in Vietnam: Strategic Directions for the World Bank,” (<http://siteresources.worldbank.org/INTVIETNAM/Resources/CCStrategyVNFinal-Eng.pdf>) provides the methodological basis for the calculation of theoretical emission reduction.

Source: The World Bank, 2011

Annex 4: Scenario Development

The term “backcasting” means setting a goal first and then deriving necessary actions to reach there. The Backcasting Tool, which is used to formulate long-term national strategies, requires setting a specific target of CO₂ emission from the transport sector in a specific year, and evaluating policies to reach the goal. In this study, the target set is 0.33 tCO₂ per capita for the transport sector by the year 2050²⁸ (ITPS, 2014) while the current emission is 0.37 tCO₂ per capita (WBI, 2011 & IEA, 2011). Meanwhile, the EFFECT model forecasts GHG emissions from a range of policy options, and forecasts energy balances and amounts of energy generating or consuming assets in a country or sector.

The policy packages used in the Backcasting Tool, classified according to the Avoid-Shift-Improve framework, are translated to meet the data input requirements, such as in terms of mode shift rates and technology penetration rates. The Tool then assesses the impacts and the mitigation potential of these policy packages on transport CO₂ emissions. The Backcasting Tool recognises that the distance travelled per vehicle per year will differ in each region and averages the km/year for each mode throughout the study period of concern.

In contrast, the data requirement for the EFFECT model is much more comprehensive, involving statistics on vehicle mortality, vehicle usage and cost of ownership, average price of new vehicles (further split into emission standard, fuel type and system), average age of maritime freight fleet usage, specifications of freight vehicles, as well as the ratio of new vehicles in each on-road vehicle category, average age of vehicles on retirement, years of zero mortality for each vehicle type, railway annual scrap page rate, among others. The overview of the input data requirements, the simulation results for the business-as-usual scenario and for the alternative scenario is presented in the table below.

²⁸ Based on the calculations done using the 2050 projections. OECD/IEA (2009). *Transport, Energy and CO₂: Moving toward Sustainability*. OECD/IEA, 2009.

Overview of Backcasting Tool and Energy Forecasting Framework and Emissions Consensus Tool

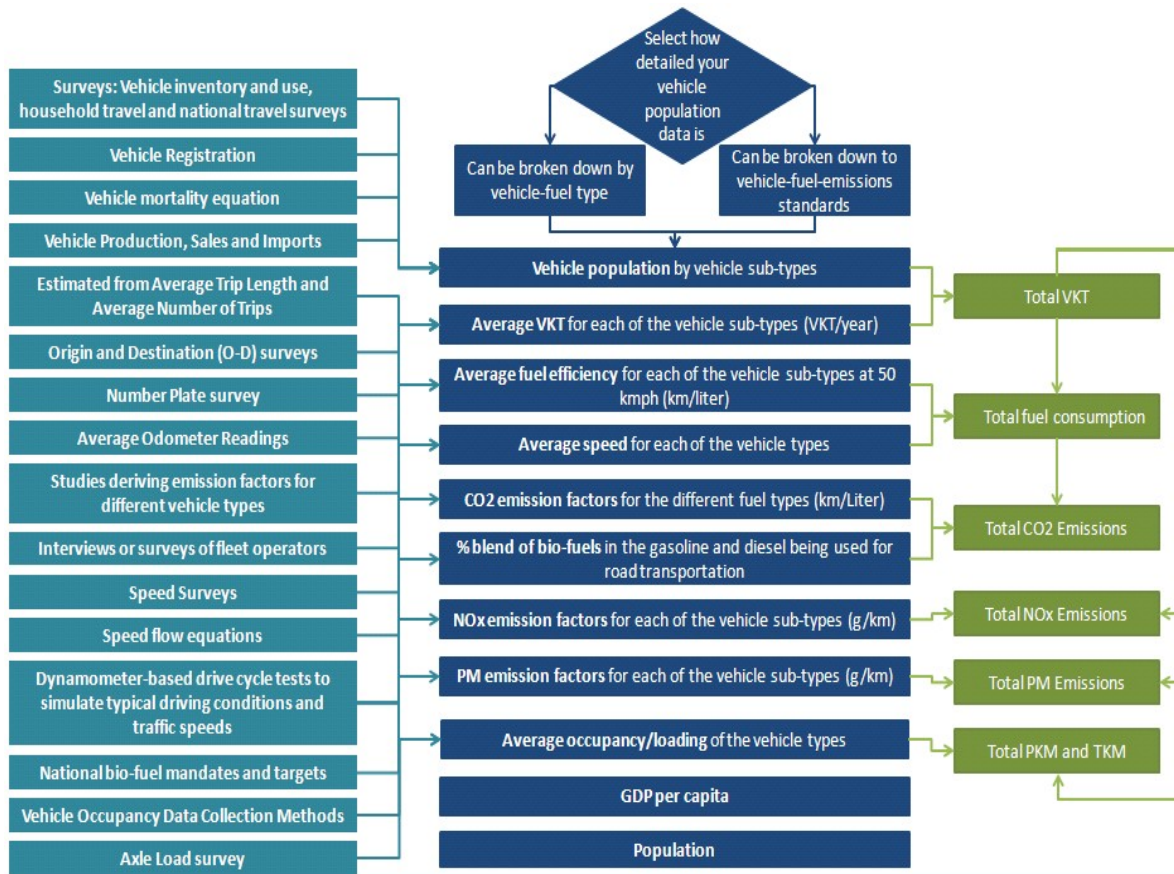
	Backcasting Tool	Energy Forecasting Framework and Emissions Consensus Tool (EFFECT)
Period of study	2010 as the base year; 2005–2050	2010 as the base year; 2010–2040
Input data	<p>Socio-economy: GDP per capita, sectoral contribution to GDP, population growth rates (by urban and rural, and by age group).</p> <p>Transport: Plans and policies, trip length, passenger- and ton-km travelled, mode shares. Travel characteristics in primary cities, urban cities, rural areas. Inter-regional and intra-regional transport.</p> <ul style="list-style-type: none"> • Road transport: vehicle population, distance travelled per vehicle, load factor, fuel efficiency, CO₂ emission coefficient • Rail transport: total volume of transport, fuel efficiency, CO₂ emission coefficient • Maritime transport: energy consumption (in litres), fuel efficiency, CO₂ emission coefficient • Air transport: total volume of transport, fuel efficiency, CO₂ emission coefficient 	<p>Socio-economy: GDP per capita, sectoral contribution to GDP, population growth rates (by urban and rural, and by age group).</p> <p>Transport: Plans and policies, trip length, passenger- and ton-km travelled, share of ethanol and biodiesel in gasoline and diesel consumption</p> <ul style="list-style-type: none"> • Road transport: private car ownership, vehicle sales and population (historic sale data, sales annual forecast by vehicle type, vehicle mortality), vehicle usage and cost of ownership (mix of private and business use, amount of goods carried), average speed, fuel consumption, vehicle technology, average price of new vehicles, among others. • Rail transport: average passengers, average annual mileage per passenger car, locomotives scrappage rate, propulsion and non-propulsion energy per passenger-km, among others; average revenue freight-tons per wagon, average annual mileage per wagon, propulsion energy per ton-km, scrappage rate of locomotives, switchers, among others • Maritime transport: coastal freight fleet usage and specification; inland freight and passenger fleet population and specification, operational speed, trip length; freight mix, vessel loading, annual operating time, cargo handling rate.
Low-carbon Options	<ul style="list-style-type: none"> • Avoid: Pricing regimes, ICT, improved travel awareness, freight transport subsidiarity, freight dematerialisation, urban and land-use planning • Shift: The infrastructure development for—and the promotion of the use of—buses and bus rapid transit systems, as well as of rail transit systems for both passenger transport and freight. • Improve: CNG vehicles mass supply and promotion (through economic measures such as incentives), and the development and promotion of biofuels. 	<ul style="list-style-type: none"> • National transport development planning: Integrated low carbon and transport planning, improved infrastructure system, proper modal split, promotion of multi-modal transport and logistics • Urban transport development: Public transport promotion, private vehicle control. • Use and promotion of cleaner fuel: Fuel quality improvement, use of cleaner fuel, diesel and biodiesel for electric generators, recycle energy at railway stations, policies on emission management, policies on replacement of old vehicles • Raise public awareness of low carbon in transport sector: This includes efficient driving training.

Annex 5: Factors under the ASIF component

Emissions	<u>A. Activities</u> (pkm=trips x km)	<u>S. Mode Share</u> (% pkm)	<u>I. Fuel Intensity</u> (quantity per pkm)	<u>F. Fuel Choice</u> (emission per quantity)
	=	<i>Determinants</i> <ul style="list-style-type: none"> Population Demographics Income Economy Urban form 	<i>Determinants</i> <ul style="list-style-type: none"> Income Motorisation rate Infrastructure Service provision Relative costs Urban form 	<i>Determinants</i> <ul style="list-style-type: none"> Engine type Vehicle load Vehicle age Congestion levels Capacity mix Urban form

Source: Clean Air Asia, 2012. *Assessing Asia: Air Pollution and Greenhouse Gas Emissions from Road Transport and Electricity*

Clean Air Asia (2012) published a set of guidelines to identify air pollution and GHG emissions indicators for road transport and electricity sectors. Based on the ASIF framework, data availability of input parameters for each country can be identified and then measurement method for each indicator can be suggested. The figure on the next page illustrates the calculation flowchart and related data used to estimate emissions using the ASIF approach.



Flowchart to estimate emission from road transport

Source: Clean Air Asia, 2012. *Assessing Asia: Air Pollution and Greenhouse Gas Emissions from Road Transport and Electricity*

Annex 6: Summary of road traffic count*

Province	Road	Car/ Van	Mini Bus	Large Bus	Pick-up & 4W truck	2-axle, 6Wtruck	3-axle truck	4-axle truck	Motorc ycle	Bicycle
Ha Tay-Phu Tho	NH32	816	130	137	62	707	126	103	2,463	815
VinhPhuc-Phu Tho	NH2	1,605	454	721	159	2,199	418	459	9,671	1,734
ThaiNguyen-Hanoi	NH3	1,687	424	494	122	1,955	286	254	4,877	778
Hanoi-B.Ninh	NH18	1,954	666	364	116	2,234	802	729	2,310	466
Hanoi-V.Phuc	NH2	3,283	801	875	1,190	2,672	1,104	775	9,834	933
Hanoi-B.Ninh	NH1(n)	1,920	177	478	1,192	2,263	669	419	14,810	2,780
Hanoi-B.Ninh	NH1(s)	5,893	1,498	972	254	4,032	552	605	10,780	187
Hanoi-Ha Tay	NH32	804	148	244	306	1,115	169	40	24,871	5,035
Hanoi-Ha Tay	H-HL	4,529	621	476	776	3,359	1,418	446	25,400	979
Hanoi-Ha Tay	NH6(e)	12,807	1,242	2,661	1,071	3,765	971	675	143,944	13,897
Hanoi-Ha Tay	NH6(w)	2,535	583	334	499	2,358	798	347	29,234	3,800
Hanoi-HungYen	NH5	8,952	1,946	2,269	1,937	7,608	2,317	2,461	29,114	1,633
Hanoi-Ha Tay	NH1	1,204	204	504	360	2,055	185	196	24,815	2,976
BacNinh-BacGiang	NH1	528	67	269	156	753	656	12,633	2,914	2,487
BacNinh-BacGiang	NH1	3,082	1,238	705	248	2,965	366	501	8,105	116
Ha Tay-Hoa Binh	NH6	1,737	657	228	207	1,650	397	298	7,145	1,069
HaiDuong-BacGiang	NH37	145	39	42	32	474	52	48	2,418	548
HaiDuong-QuangNinh	NH18	2,082	625	935	72	1,860	210	448	5,369	1,441
HaiPhong-QuangNinh	NH10 (n)	1,629	356	747	124	2,025	329	686	5,388	394
H. Duong-H.Phong	NH5	4,102	780	766	834	3,184	700	3,224	10,212	1,280
H.Phong-T.Binh	NH10	1,091	356	545	237	1,557	243	583	3,486	1,381
Ha Tay-Ha Nam	NH1	5,977	1,707	2,619	952	4,729	1,459	959	8,941	1,079
Ha Tay-Ha Nam	NH21b	169	71	38	25	1,096	164	121	1,564	1,177
Ha Nam-Hoa Binh	NH21	91	23	13	5	314	29	63	1,449	342
H.Yen-T.Binh	NH39	285	110	204	26	613	17	5	2,784	1,480
NinhBinh-ThanhHoa	NH1	2,212	699	1,366	54	3,686	913	785	5,631	1,452
NinhBinh-ThanhHoa	NH10	46	20	18	5	484	1	-	3,137	1,463
T.Hoa-NgheAn	NH1	1,321	635	914	988	1,378	1,239	1,061	2,406	1,003
NgheAn-Ha Tinh	NH1	1,761	316	1,123	28	1,794	353	502	8,892	1,516
Ha Tinh-Q.Binh	NH1	421	119	706	1	1,105	371	459	906	210
Q.Binh-Q.Tri	NH1	500	375	858	12	1,092	394	466	1,404	424
Q.Tri-T.T.Hue	NH1	820	633	964	29	1,262	478	503	4,701	1,209
T.T.Hue-Danang	NH1	851	561	872	46	1,090	466	589	3,469	654
Danang-Q.Nam	NH1	1,657	838	1,062	238	2,400	663	587	26,395	2,223
Danang-Q.Nam	NH14b	436	212	235	267	632	387	200	2,441	275
Q.Nam-Q.Ngai	NH1	818	507	681	70	1,347	474	536	3,428	537
Q.Ngai-B.Dinh	NH1	390	363	825	14	1,062	353	487	2,419	205
B.Dinh-PhuYen	NH1	397	315	667	30	1,083	436	562	2,609	189
PhuYen-K.Hoa	NH1	436	457	997	43	1,377	550	596	2,166	247
KhanhHoa-NinhThuan	NH1	658	580	1,074	72	1,919	594	675	3,055	960
N.Thuan-B.Thuan	NH1	588	487	991	107	1,548	605	660	1,794	44
B.Thuan-D.Nai	NH1	1,193	1,105	1,194	93	2,711	779	768	4,611	265
B.Thuan-BR-VT	NH55	107	58	76	36	307	43	5	2,355	158
TayNinh-HCMC	NH22	3,004	1,078	513	148	2,984	532	328	19,053	2,324
D.Nai-HCMC	NH1	13,021	4,945	5,595	2,859	16,550	8,387	7,543	20,550	326
B.Duong-HCMC	NH13	6,146	2,247	523	593	4,003	767	342	38,618	1,038
HCMC-LongAn	NH1	5,516	3,286	1,427	1,608	7,085	1,156	703	26,748	348
HCMC-LongAn	NH50	510	119	376	91	418	6	2	18,354	232
D.Nai-BR-VT	NH56	192	147	101	108	338	76	15	3,891	749
D.Nai-BR-VT	NH51	4,512	1,497	1,242	1,623	2,468	1,987	1,347	22,780	460
LongAn-T.Giang	NH1	5,120	5,179	1,396	999	9,384	1,428	667	27,538	861
CanTho-H.Giang	NH1	1,765	1,884	642	233	2,777	262	89	34,003	255
V.Long-CanTho	NH1	1,992	2,278	491	77	3,269	303	114	31,570	5,918
AnGiang-CanTho	NH91	1,096	902	377	181	2,581	172	49	34,100	3,410
K.Giang-CanTho	NH80	440	542	306	41	1,209	78	4	8,203	3,593

* 2-way, 24-hour traffic, adjusted.

Source: VITRANSS 2 Road Traffic Survey, 2010

Annex 7: Transport Activity in Hanoi

Based on the survey results (TDSI, 2003), the inner-city results of Hanoi indicate that:

- The average number of trips per person in 7 inner-city districts per day is 2.25 trips (average number of frequent trips is 1.92 trips/day and unexpected trips is 0.33 trips/day).
- Total trips in 7 inner-city districts/day are 2.8 million.
- The average length of one trip is around 4.34 km excluding walks (this length is relatively short and appropriate to the different modes of 2 wheel vehicles).
- Walking accounts for about 20% of total trips.

Based on the survey results (TDSI, 2003), the suburb results of Hanoi indicate that:

- The average number of trips of a person per day is 1.16.
- The number of trips on foot is around 25%.
- The share of trips by bicycles is around 35%.
- The number of trips by motorbikes account for 32.65%.

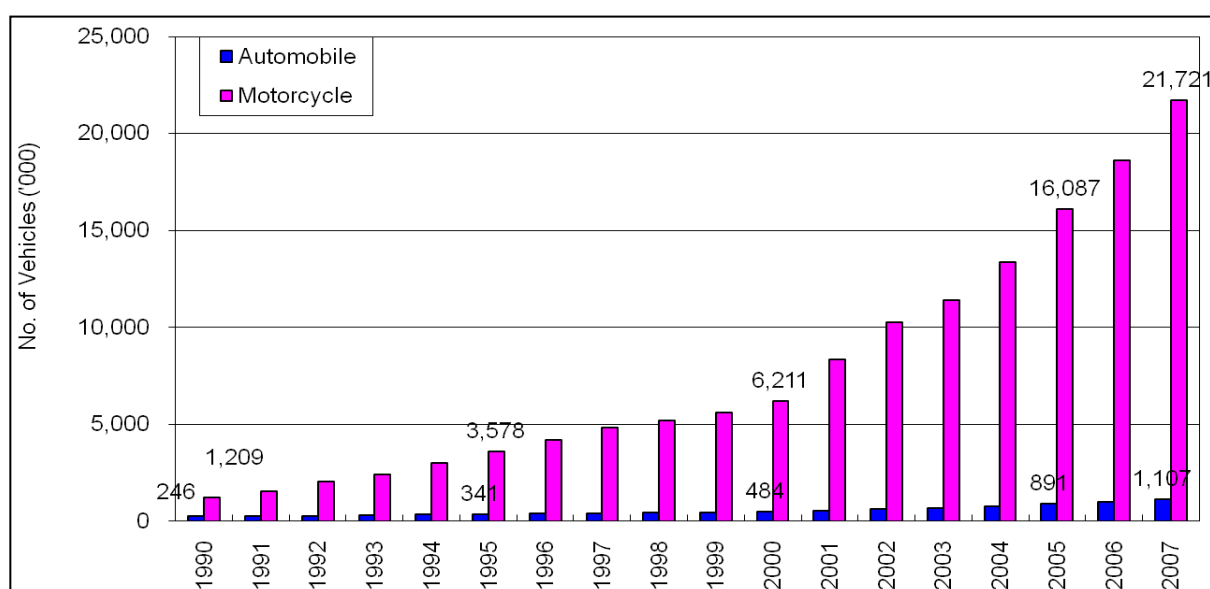
Travel Characteristics from Hanoi Household Interview Survey

Travel Characteristics		Unit	Inner City	Suburb	Whole city
Trip rates	Average number of frequent trips per person	Trips/day	1.92	0.9	1.44
	Average number of unexpected trips per person	Trips/day	0.33	0.26	0.3
	Total average number of trips per person per day	Trips/day	2.25	1.16	1.74
Purpose of trips	Go home	%	49.5	50.1	49.82
	Go to work	%	22	17.3	19.83
	Go to school	%	14.5	15.3	14.86
	Others	%	13.9	17.3	15.49
Average travel distance	Walk	Km	0.66	1.02	0.83
	Pedicab	Km	3.07	1.54	2.36
	Bicycle	Km	2.9	3.31	3.09
	Motorbike	Km	4.7	7.16	5.84
	Car	Km	6.38	12.69	9.32
	Taxi	Km	5.37	10	7.43
	Bus (of company, school, office, etc.)	Km	7.23	13.43	10.12
	Public bus	Km	7.15	13.64	10.17
Means of transport	Inter-provincial passenger bus	Km	4.03	4.03	4.03
	Walk	%	20.3	24.85	22.42
	Pedicab	%	0.05	0.22	0.13
	Bicycle	%	23.21	34.91	28.66
	Motorbike	%	50.79	32.65	42.34
	Car	%	0.54	0.38	0.46
	Taxi	%	0.05	0.02	0.03
	Bus (of company, school, office, etc.)	%	1.47	3.41	2.37
	Public bus	%	3.22	2.88	3.06
	Inter-provincial passenger bus	%	0.2	0.22	0.21
Average	Others	%	0.16	0.46	0.30
	Walk	Km	0.66	1.02	0.83
	Pedicab	Km	3.07	1.54	2.36

Travel Characteristics		Unit	Inner City	Suburb	Whole city
	Bicycle	Km	2.90	3.31	3.09
	Motorbike	Km	4.70	7.16	5.84
	Car	Km	6.38	12.69	9.32
	Taxi	Km	5.37	10.0	7.53
	Bus (of company, school, office, etc.)	Km	7.23	13.43	10.12
	Public bus	Km	7.15	13.64	10.17
	Inter-provincial passenger bus	Km	4.03	4.03	4.03

Source: Transport Development and Strategy Institute, 2003

Annex 8: Growth of automobile and motorcycle vehicles in Vietnam, 1990-2007



Note: Quoted by Dr-Ing.Khuat Viet Hung, “Vietnam Transport’s CO2: Existing Conditions and the Way to Planning Future”, presented in Manila for the 2nd Steering Committee meeting and ASEAN Experts Meeting, 2011

Source: Ministry of Transport, 2009

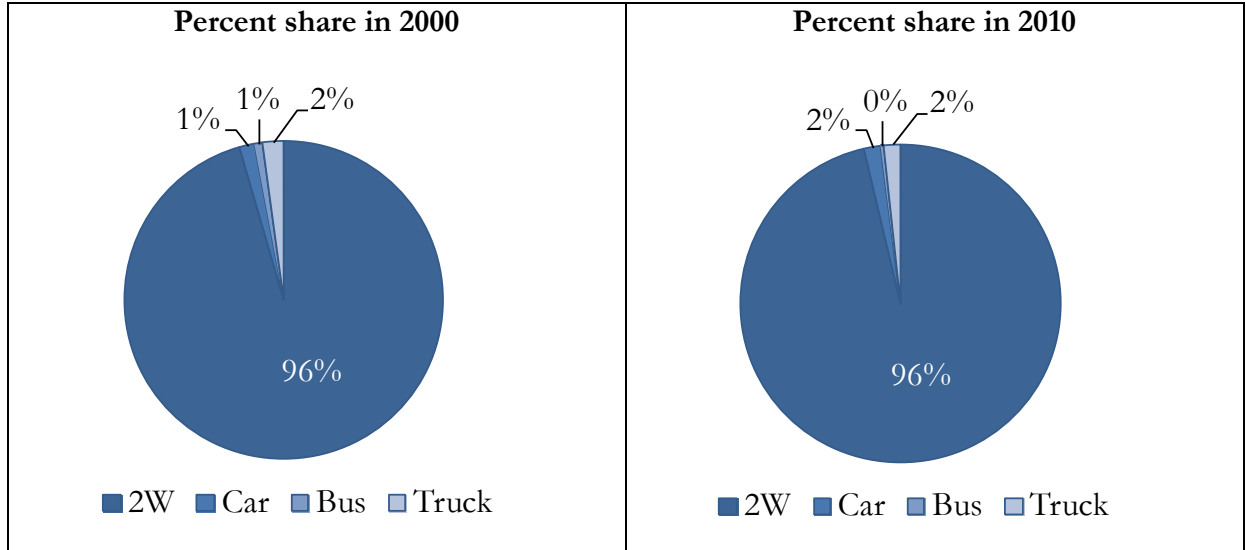
Annex 9: Share of vehicles by type, 2000 and 2010

A survey of 1,675 motorcycles in Hanoi and 1,627 motorcycles in Ho Chi Minh City (Vietnam Register, 2011) shows that:

- Most are not periodically maintained.
- About 59% of inspected motorcycles in Hanoi and 52% of inspected motorcycles in Ho Chi Minh City exceed the prescribed emission level (*i.e.*, 4.5% CO and 1,200 ppm HC).
- Most have small displacement: 70-150 cc.
- Most are 4 stroke engine motorcycles.

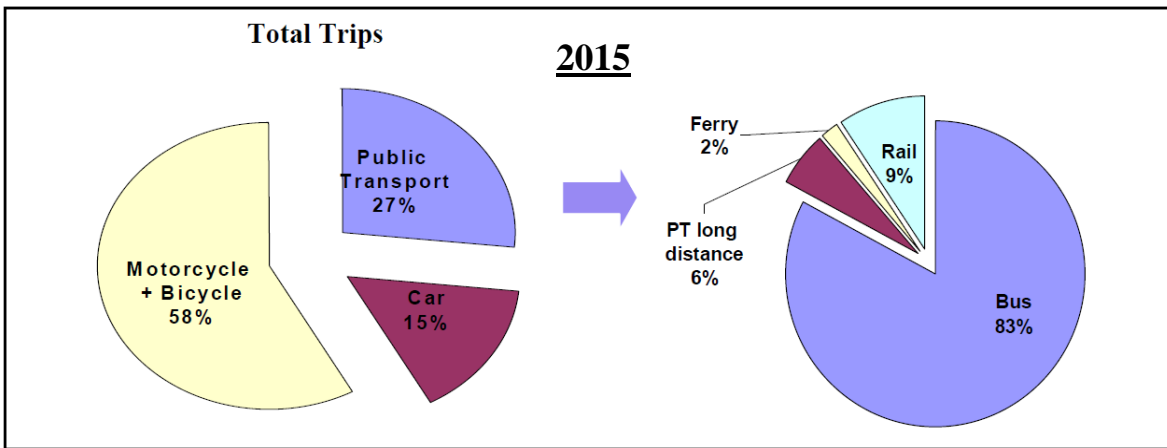
The master plan on the road transport development (Decision No 356/2013/QĐ-TTg) stipulates that by 2020, limiting the increasing number of motorcycle by administrative measures, economy and techniques for controlling the number of motorcycles, motorcycles would be used mostly in

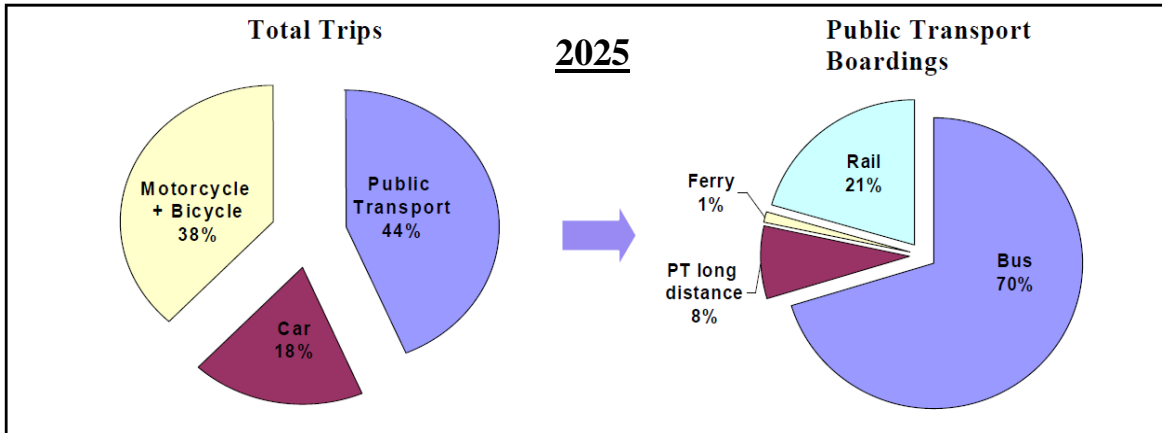
rural areas and the areas with no means of public transport. It is projected that, by 2020, there would be a total of 36 million motorcycles in the country. However, the Ministry of Transport reported that by end of July 2012, registered motor vehicles already reached 37.19 million, of which 35.24 million are motorcycles.



Source: Clean Air Asia, 2012

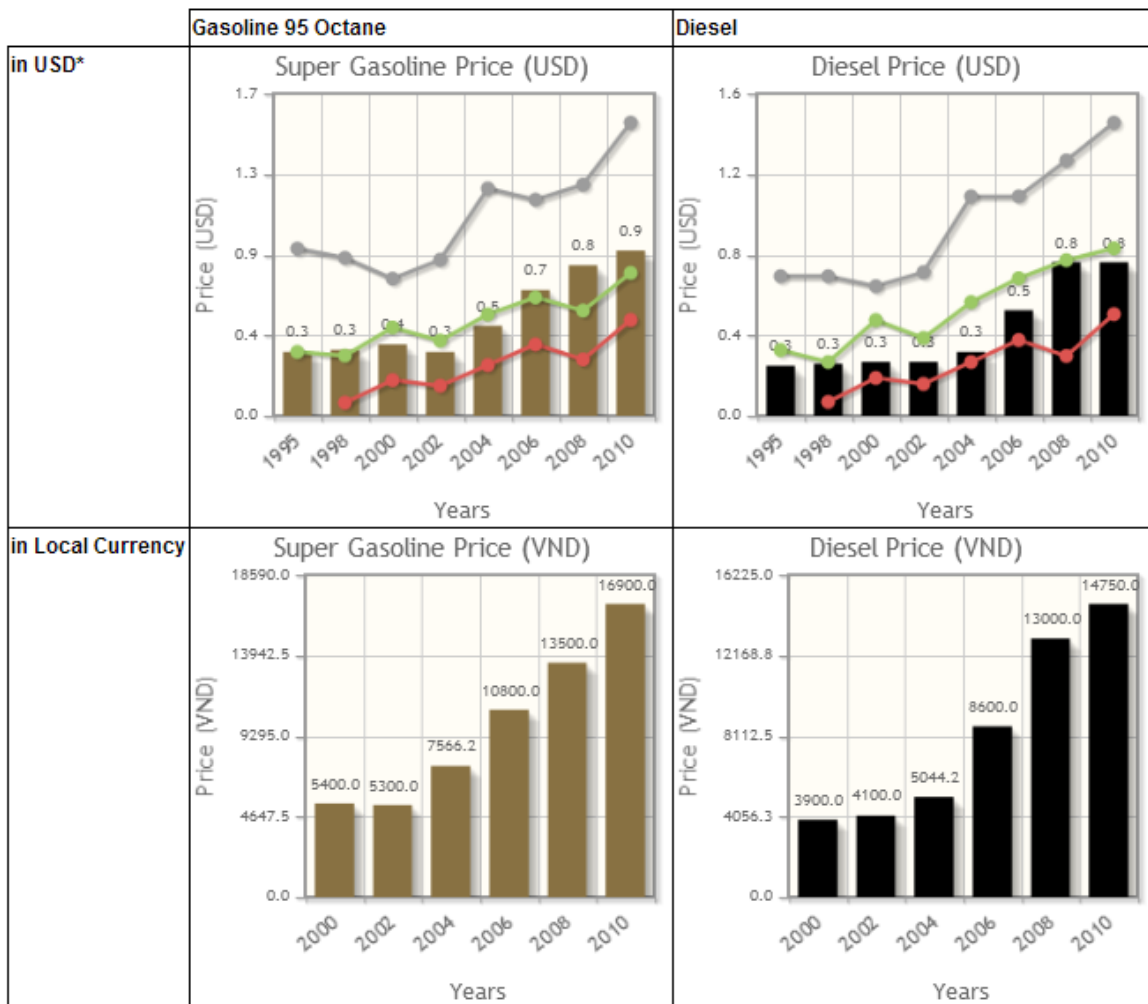
Annex 10: Projected modal share in Ho Chi Minh City, 2015 and 2025





Source: MVA Asia Limited, 2010. *Technical Assistance Consultant's Report: Preparing the Ho Chi Minh City Metro Rail System Project*

Annex 11: Fuel prices and trends in Vietnam, 1995-2010

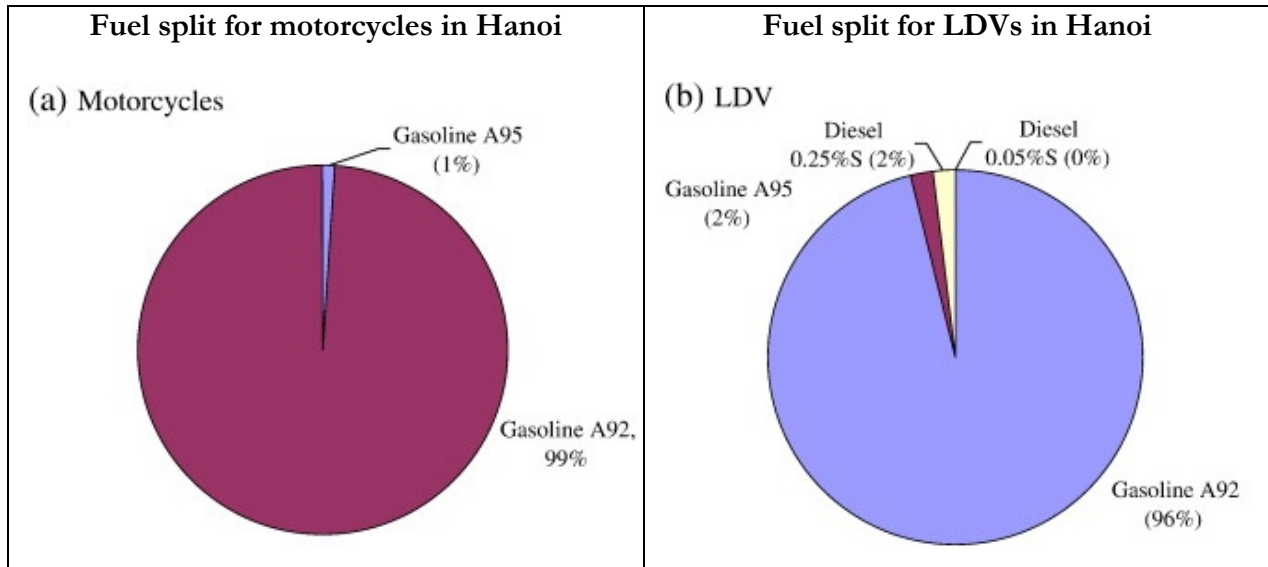


* benchmark lines: green=US price; grey=price in Spain; red=price of Crude Oil

Source: GIZ, International Fuel Price Database, <http://www.giz.de/fuelprices>

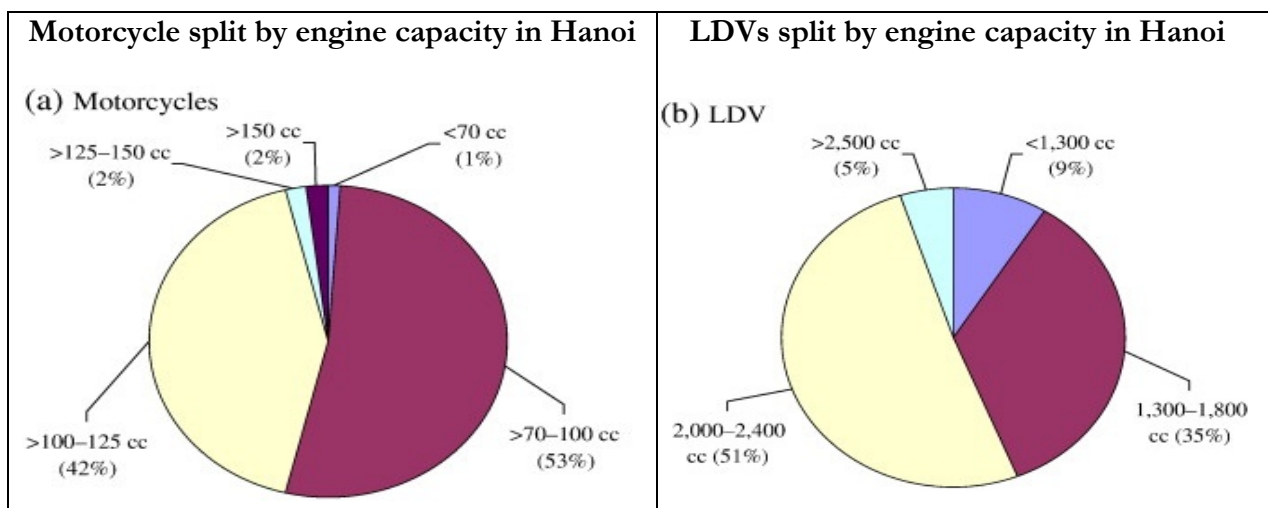
Annex 12: Vehicle split by fuel type and engine capacity in Hanoi

In a recent work by Tung et al. (2011), more detail on the characteristics of the vehicle fleet in Hanoi is provided, including the vehicle split by fuel type and engine capacity based on survey results involving 3,000 questionnaires. The figures below present the fuel split for motorcycles and LDVs in Hanoi. It is clear that gasoline-fuelled vehicles dominate the split.



Source: Tung, Tong, Hung, & Anh, 2011. *Development of emission factors and emission inventories for motorcycles and light duty vehicles in the urban region in Vietnam*

The figures below show the motorcycle and LDV split by engine capacity. It is observed that most of the motorcycles in Hanoi have an engine capacity of 70-100 cc (53%) or 100-125 cc (42%). On the other hand, most of the LDVs have an engine capacity of 2000-2400 cc (51%) or 1300 cc (35%). Tung et al. (2011) also noted that in Hanoi, most of the LDVs are Euro I and II (79%); about 11% are using Euro III and IV and the remaining 10% is not certain.

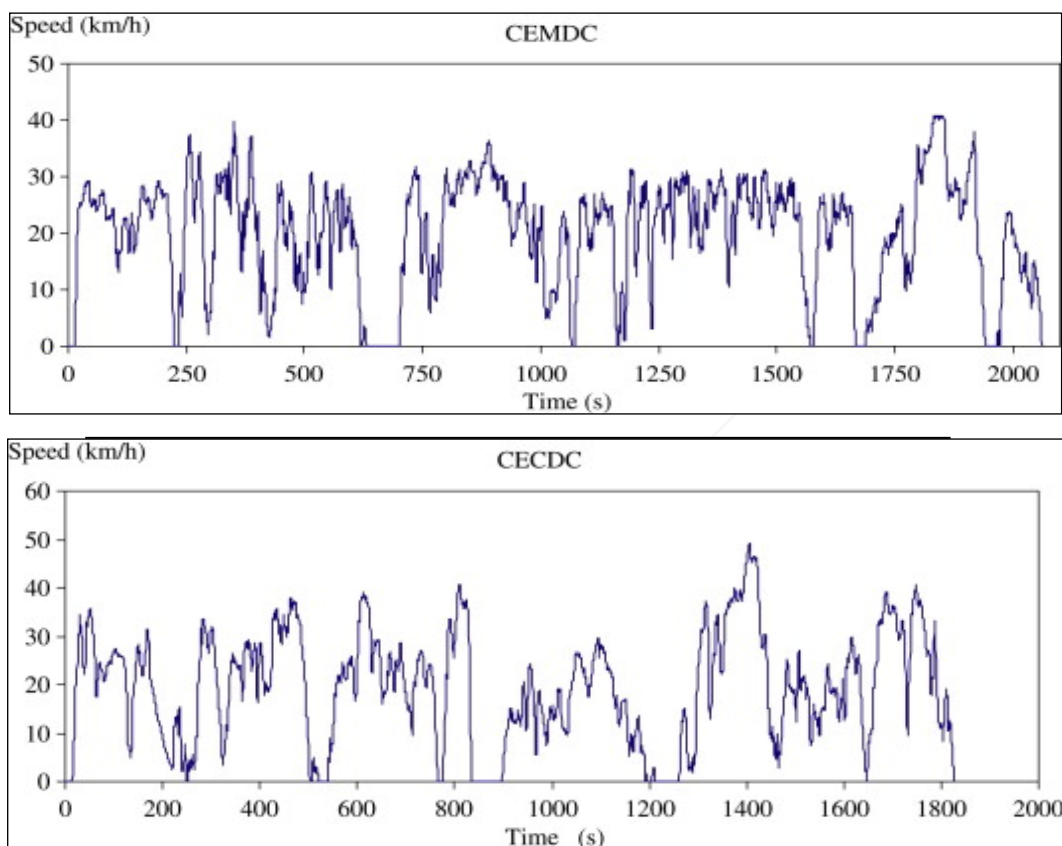


Source: Tung, Tong, Hung, & Anh, 2011. *Development of emission factors and emission inventories for motorcycles and light duty vehicles in the urban region in Vietnam*

Annex 13: Driving characteristics in Hanoi and Ho Chi Minh City

The work was completed through compilation of a database for motorcycles and LDVs, development of two typical driving cycles for motorcycles and LDVs in Hanoi, and then the selection of 12 representative test vehicles to determine vehicle specific fuel consumption and emission factors (CO, HC, NO_x, and CO₂).

Driving cycle for motorcycle (top) CEMDC and car (bottom) CECDC in Hanoi



Source: Tong, Tung, Hung, & Nguyen, 2011. *Development of driving cycles for motorcycles and light-duty vehicles in Vietnam.*

Annex 14: Fuel consumption limits of road motor vehicles

National Standards TCVN 9854:2013: Limit of Fuel Consumption and Fuel Efficiency for Passenger Cars (non-mandatory)

Kerb mass/Unladen mass (m _k) kg	Fuel Consumption Limit (FC) L/100km	Fuel Efficiency (FE) Km/L
550 < m _k ≤ 610	4.8	21.5
610 < m _k ≤ 750	5.6	17.8
750 < m _k ≤ 865	6.1	16.4
865 < m _k ≤ 980	6.24	15.6
980 < m _k ≤ 1090	6.57	14.9
1090 < m _k ≤ 1205	7.5	13.4
1250 < m _k ≤ 1320	7.9	12.7

Kerb mass/Unladen mass (m_k) kg	Fuel Consumption Limit (FC) L/100km	Fuel Efficiency (FE) Km/L
1320<m _k ≤1430	8.5	11.8
1430<m _k ≤1540	9.6	10.4
1540<m _k ≤1660	9.8	10.2
1660<m _k ≤1770	10.6	9.4
1770<m _k ≤1880	11.0	9.1
1880<m _k ≤2000	12.0	8.4
2000<m _k ≤2110	12.2	8.2
2110<m _k ≤2280	14.5	6.9
2280<m _k ≤2510	14.7	6.8
2510<m _k ≤3500	15.4	6.5

Source: Decision 2586/QD-BKHCH issued on 22 Aug. 2013 by Ministry of Science and Technology

National Standards TVCN 7356:2014: Limit of Fuel Consumption and Fuel Efficiency for Two-Wheeled Motorcycles and Mopeds (non-mandatory)

Capacity (cm³)	Fuel Consumption Limit (FC) L/100km	Fuel Efficiency (FE) Km/L
Up to 50	2.0	50.0
>50 to 100	2.3	43.5
>100 to 125	2.5	40.0
>125 to 150	2.5	40.0
>150 to 250	2.9	34.5
>250 to 400	3.4	29.4
>400 to 650	5.2	19.2
>650 to 1000	6.3	15.9
>1,000 to 1250	7.2	13.9
>1250	8.0	12.5

Source: Decision 1201/QD-BKHCH issued on 23 May 2014 by Ministry of Science and Technology

Annex 15: Types of motorcycles and LDVs selected for emissions-testing

	Model	Engine type	Capacity (cc)	Catalyst	Age (years)	Average VKT (km)
Motorcycle	Honda Wave RS	Gasoline, 4 stroke	100	No	3-7	19,632,000
	Honda Dream II	Gasoline, 4 stroke	100	No	> 7	41,745,000
	Yamaha Jupiter	Gasoline, 4 stroke	110	No	1-3	17,550,000
	Suzuki Smash	Gasoline, 4 stroke	110	No	3-7	32,054,000
	Honda Future	Gasoline, 4 stroke	110	No	> 7	54,645,000
	Honda Lead	PGM-FI, Gasoline, 4 stroke	125	No	1-3	4,931,000
	Honda Sky	Gasoline, 4 stroke	125	No	3-7	24,624,000
	Honda Future II	Gasoline, 4 stroke	125	No	> 7	23,478,000
LDVs	Ford (Laser)	1840 cm ³ , EFi	1300-1800	No	3-7	10,000,000
	Toyota (Innova)	1998 cm ³ , VVT-i, EFi	2000-2400	No	1-3	14,000,000
	Toyota (Prado)	2500 cm ³ , VVT-i, EFi	2300-2500	No	3-7	115,000,000
	Ford (Ranger)	2499 cm ³ , Turbo diesel 2.5 L TDCi	2300-2500	No	1-3	14,500,000

Source: Tung, Tong, Hung, & Anh, 2011. *Development of emission factors and emission inventories for motorcycles and light duty vehicles in the urban region in Vietnam*

Annex 16: Challenges in transport data in Asian countries

Fabian and Patdu (2011) identifies the common challenges of Asian countries in collecting transport-related data:

Availability of Basic Transport Data in Asia

- Data availability differs greatly across the data types

Transport Data Flow and its Impact on Quality and Availability

- Available and accessible data are usually presented at very high levels of aggregation

System of Transport Data Collection and Maintenance

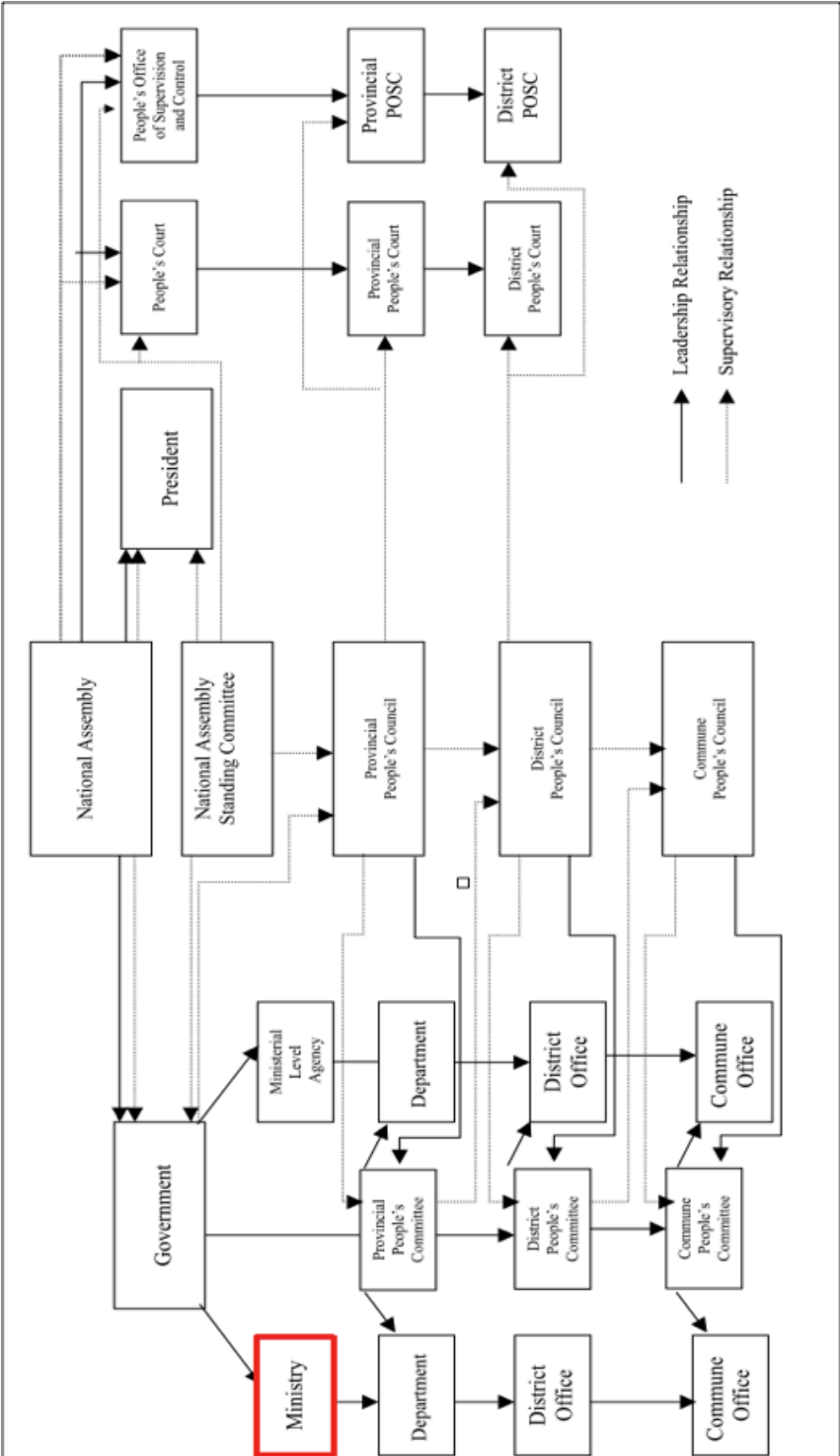
- Type of data collected/generated is influenced by its need (driver) with different, sometimes overlapping, data requirements
- Fragmented generation of transport data
- Fragmented responsibility for collection of different types of data and the absence of an organisation with a mandate and organisational capacity to integrate different data sets
- Private sector is a relevant player in transport data collection but their databases are typically not openly shared to public
- Information generated at the project/city/province level is usually stored at the local levels, unless required by the national government
- Limited budget allocation for transport data collection, processing and management

Comparability of Transport Data within and between Countries

- Lack of harmonized classification and methodologies

Source: Background Paper for the Sixth Regional EST Forum in Asia:
http://cleanairinitiative.org/portal/sites/default/files/Background_Paper_on_EST_Data_and_Indicators_FINAL.pdf

Annex 17: General institutional structure of the Government of Vietnam



Source: Adam Forde and Associates Pty Ltd., 2003.

Annex 18: Government agencies on land transport, energy, and climate change

Name of Organisation	Website
Ministry of Natural Resources and Environment (MONRE)	www.monre.gov.vn
Vietnam Environment Administration (VEA)	http://vea.gov.vn/en/Pages/trangchu.aspx
Pollution Control Department (PCD/VEA)	http://vea.gov.vn/en/aboutvea/UnitsunderVEA/Pages/DepartmentofPollutionControl.aspx
Institute of Strategy and Policies for Natural Resources and Environment (ISPONRE)	http://isponre.gov.vn/home/
Institute of Meteorology, Hydrology and Environment (IMHEN)	http://www.imh.ac.vn/
Department of Hydro-meteorology and Climate Change	www.monre.gov.vn
International Cooperation Department (focal point of AWGCC in Vietnam)	www.monre.gov.vn
Ministry of Transport (MOT)	www.mt.gov.vn
Vietnam Register	http://www.vr.org.vn/vre/HomeNE.aspx
International Cooperation Department	www.mt.gov.vn
Environmental Department	www.mt.gov.vn
Directorate for Road of Vietnam (DRVN)	www.dr.vn.gov.vn
Vietnam Railway Authority (VNRA)	www.mt.gov.vn
Transport Development and Strategy Institute (TDSI)	www.tdsi.gov.vn
Department of Transport	www.mt.gov.vn
Provincial Departments of Transport	
Cuu Long Corporation for Investment Development and Project Management of Infrastructure	http://cuulongcipm.com.vn/
Vietnam Railway Corporation	www.vr.com.vn
Ministry of Science and Technology (MOST)	
STAMEQ	www.tcvn.gov.vn
Vietnam Standards and Quality Institute	www.vsqi.gov.vn
Ministry of Industry and Trade (MOIT)	www.moit.gov.vn
General Department of Energy	www.moit.gov.vn
Department of Technical Safety and Industrial Environment	www.moit.gov.vn
Industrial Policies and Strategy Institute	http://www.ipsi.org.vn/
PetroVietnam	www.pvn.vn
Vietnam Petroleum Group (Petrolimex)	www.petrolimex.com.vn
Oil refinery companies	
Ministry of Planning and Investment (MPI)	www.mpi.gov.vn
General Statistics Office	www.gso.gov.vn
Provincial Statistics Offices	

Name of Organisation	Website
Ministry of Public Security (MPS)	www.mps.gov.vn/
Traffic Police Bureau	www.mps.gov.vn/
Local Traffic Police	
National Traffic Safety Committee	http://antoangiaothong.gov.vn
NGOs/Associations	
Vietnam Automobile Manufacturers Association (VAMA)	www.vama.org.vn/
Vietnam Association of Motorcycles Manufacturers (VAMM)	Not available
Vietnam Bicycles and Motorcycles Association	
Vietnam Automobile Transportation Association (VATA)	http://www.hiephoivantaioto.vn/

Annex 19: Overview of laws and decisions relevant for sustainable transport

Laws related to environmental protection according to Vietnam's Second National Communication to UNFCCC

- Law on Environmental Protection No. 52/2005/QH11 dated 29th November 2005 (replaces the 1993 Law on Environmental Protection)
- Water Resources Law No. 08/1998/QH10 dated 20th May 1998
- Petroleum Law (1993) No. 10/2008/QH12 dated 6th July 1993 (amended twice on 9th June 2000 and 3rd June 2008)
- Law on Minerals No. 2/1996/QH9 dated 1st September 1996 (amended on 27th June 2005).
- Law on Forest Protection and Development No. 29/2004/QH11 dated 3rd December 2004 (replaces the 1991 Law on Forest Protection and Development)
- Law of Electricity No. 28/2004/QH11 dated 3 December 2004
- Law on Energy Efficiency and Conservation No. 50/2010/QH12 dated 28th June 2010

Laws related to climate change according to “Vietnam Climate Change Policy Development” presented in 7th Regional Network Meeting of SEAN-CC in Manila, Philippines

- Land Law, 2003;
- Law on Environmental Protection, 2005;
- Law on Biodiversity, 2008;
- Law on Minerals, 2010;
- Law on Water Resources, 2012;
- Law on Natural Disaster Risk Prevention and Reduction (draft)

Decisions that led to the development of the Environmentally Sustainable Transport (EST) Strategy

- Decision 256/2003/QĐ-TTg on the approval of the National Environmental Protection Strategy until 2010 and Orientations towards 2020.
- Decision 153/2004/QĐ-TTg on the promulgation of orientations for sustainable development strategy in Viet Nam (Viet Nam Agenda 21).
- Decision 355/2013/QĐ-TTg on the modification of the Viet Nam Transport Development Strategy until 2020 and vision to 2030
- Decision 4088/QĐ-BGTVT on Sustainable Development Action Plan of MOT for the period 2013 – 2020.

Key documents on Vietnam's Energy Efficiency

- Decree No. 102/2003/NĐ-CP on Energy Efficiency and Conservation (EE&C)
- Circular No. 01/2004/TT/BCN on EE&C in establishments
- Decision No. 79/2006/QĐ-TTg on approval of the National Program on EE&C

- Decision No. 80/2006/QĐ-TTg on approval of the Electricity Saving Program for the period 2006-2010
- Decision No. 1855/QĐ-TTg on approval of the National Energy Development Strategy of Vietnam up to 2020 with vision to 2050
- Law on energy efficiency and conservation: No. 50/2010/QH12
- Decree No. 21/2011/NĐ-CP on detailed prescription and measures to execute the Law on EE&C
- Decision No. 1427/2012/QĐ-TTg dated 2 October 2012 on approval of National Targeted Programme on Energy Efficiency and Conservation Phase 2012–2015

Legal framework for establishing fuel economy standards

- Law on energy saving and efficiency
- Decree No. 21/2011/NĐ-CP dated 29/03/2011 of the Government "Detailed regulations and law enforcement measures to use energy-saving and efficiency";
- Decision No 51/2011/QĐ-TTg dated 12/09/2011 of the PM "Regulate the list of means and equipment to energy labelling, impose minimum energy efficiency and roadmap "
- Decision No 1427/QĐ-TTg dated 02.10.2012 of the PM on the "Approval to national target program on energy use and efficiency savings for the period 2012-2015"
- Circular No 64/2011/TT-BGTVT dated 26/12/2011 of the Ministry of Transport of the "Regulation on measures energy savings and efficiency in transportation operations"
- Decision No 3335/QĐ-BGTVT dated 12.24.2012 of the Ministry of Transport on "Project approval made on national target program on energy use and efficiency savings in 2013"
- Circular No 07/2012/TT-BCT 04 dated 04/01/2012 of the Ministry of Industry and Trade "energy labelling regulations for vehicles and equipment use energy"

Development of bus public transport for the period 2012-2020 (280/QĐ-TTg, dated 8/3/2012)

- In term of public transport services, bus will be the dominant vehicle in the period of 2012-2020
- Develop a comprehensive bus system that integrate smoothly with other public transport means (MRT, BRT...)
- Should be convenient and in accordance with travel needs (frequency, bus station, e-ticket) to encourage people shifting from private vehicle to buses.
- Good route planning and route optimization
- Improve the quality of bus services
- Encourage the environmentally friendly buses
- Application of new technologies in bus management and operation.

For implementing this a work plan following Decision by the Prime Minister assigns the following responsibilities:

Ministry of Transport: To supervise the implementation of the master plan for the development of the bus transport system. Submit the annual report which includes the results of the implementation to the Prime Minister

Ministry of Finance: Take the lead and coordinate with relevant ministries, agencies to propose the mechanism of the interest subsidy on the bank loans for bus investment. Develop mechanism and specific policies to promote environmentally friendly buses

MoNRE: To coordinate with the City and Provincial People's Committee in allocating land for the operation of bus service.

Ministry of Education and Training: To steer the schools to transport students by bus, encourage students to use bus.

Ministry of Information and Communications: To coordinate with the National Traffic Safety Committee to undertake awareness campaigns to promote the benefits of using bus services. To coordinate with MoT, MoF in the deployment of ticketing system by using internet, telephone...

Ministry of Planning and Investment: To coordinate with MoF to propose subsidies from state budgets for bus operation.

City and Provincial People's Committee: Develop the master plan for the development of the bus transport system. To implement the policies to subsidize the bus routes.

Annex 20: Existing policies on transport (status: end of 2014)

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
I/G	P/F	E	CO ₂ based fuel pricing / taxation systems			While tax mechanism and incentives have been renewed to encourage the use of alternative fuels (e.g. Decision No. 177/2007/QD-TTG of November 20, 2007, approving the scheme on development of biofuel up to 2015, with a vision to 2025 ³⁵), taxation for passenger cars and trucks are not based on CO ₂ emissions.	-	Not in discussion	
G	P/F	E	Fuel subsidy reduction		National Assembly	No policy is in place to subsidise fossil fuels in accordance with their political commitment through international systems including G20, APEC, Rio+20 to rationalise/phase out fossil fuel subsidies in the medium-term, while providing essential energy services for vulnerable communities. ³⁶	-	Implementation ongoing	Law No. 50/2010/QH12 mandates providing financial support and energy price subsidy and other necessary incentives to promote economical and efficient use of energy. ³⁷
G	P/F	R	Integrated land-use planning				-		
G	F	I	Certification system for low-carbon companies				-		
G	P/F	I	GHG Emissions monitoring system				-		Top down approach used in GHG inventories and BURs
G	P/F	E	Road pricing	1 January 2013	MOT	Toll roads are applied for roads under the public-private partnership (PPP) or build-operate-transfer (BOT) system only. For roads constructed by government budget, the monthly road fee is applied for each vehicle and the annual road fee is applied for each motorbike. On 1 January 2013, revised road fees have been collected for motorcycles and automobile.	-	Implemented	In July 2013, authorities in many provinces and cities noted that fees have not yet been collected from motorbikes as they did not have sufficient time to prepare a detailed fee collection system and to submit it to the local's people council (the law-making body) as the fees

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
A	P/F	E/R	Parking pricing and management	2012 (Hanoi)	Hanoi People's Committee	<p>- motorbikes: VND50,000 per year fee for 100cc and VND100,000 for those with larger engines</p> <p>- Automobiles: VND1.56-12.48 million, depending on engine capacity.</p> <p>Toll fees also increased by 3.5 times starting November 2012, lasting until 2016.³⁸For cars and trucks, roadworthiness certificates are granted to pay the fee since 1 January 2013. Users can pay annually at local vehicle registries in charge of certifying roadworthiness, or when obtaining roadworthiness certificates at stipulated intervals of three to 30 months ³⁹</p> <p>On-street parking fee is imposed on cars and motorbikes but rates vary between cities and districts. In the central districts of Hanoi, parking fees for cars of less than 9 seats are charged up to VND 40,000, while cars with more than 10 seats are charged up to VND 50,000. Monthly parking fee is VND 2 million to VND 4.5. Million, while roofed lots charge higher.⁴⁰ Additionally, businesses running parking lots must pay 2% of their revenue to city authorities.⁴¹</p>	-	Implementation ongoing	were only approved in November 2012.
				2006, revised 1 August 2012	Ho Chi Minh City People's Committee	In Ho Chi Minh City, bicycles, motorbikes and electric bikes pay between VND500 and VND 4,000, depending on location groups. ⁴³		Implementation ongoing	<p>Overcharging parking fees are common. Parking lots are likewise illegally set up on special occasions (e.g. Lunar New Year).⁴²</p> <p>Three location groups for the parking rate fees of bikes, electric bikes, and motorbikes: Group 1 will cover schools and hospitals; Group 2 will cover markets, supermarkets, apartment blocks of Grade III and IV, shops and headquarters of organisations; Group 3 will include apartment blocks of Grade I and II, amusement and entertainment areas, hotels, restaurants, dance halls, theatres and commercial centres.</p> <p>The parking fee rates for automobiles will be divided into two areas. Area 1 will cover Districts 1, 3, and 5; Area 2 will cover the remaining Districts.</p>

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
A	P/F	I/Invt	ITS	2012-2030	MOT	MOT announced in late 2012 that there will soon be a set of regulation to implement ITS in Vietnam beginning 2013. It will be divided into phases: from 2012 to 2015, 3centres to co-operate and control traffic situation in regions of north, central and south will be built, while the periods 2015-2020 and 2020-2030 will be more focused in updating information-technology application and perfecting intelligent transport systems' services. ⁴⁴	-	Pilot	There were various other initiatives to develop an ITS. In 2010, there was news regarding a “15-year project to set up 115 booths and maps across the city to provide bus passengers plans for their routes, including estimated fees and stops, whenever they enter starting points and destination on touchable screens.” ⁴⁵ In October 2013, an ITS on the 50-km CauGie–NinhBinh highway in Ha Nam province began operation. ⁴⁶ The city of Da Nang has an agreement with IBM Technology to establish a real-time bus transit information such as driving speed, location, as well as a traffic control centre. Meanwhile, Hanoi has a traffic signal control centre but it appears that only a small fraction of the cameras installed are functioning and the software is outdated. Japanese firms Toshiba, Hitachi and ITOCHU have partnered to supply ITS package to Vietnam Expressway Corporation, which is to be deployed on the 55-km-long Ho Chi Minh and Dau Giay section of North-South expressway. The package consists of electronic toll collection, traffic control and equipment monitoring systems, and is meant to reduce traffic jams and to improve logistics. The project will begin commercial operations in the first half of 2017. ⁴⁷
A	P	R/E	TOD/compact development /mixed-use planning	3 April 2009	Ministry of Construction	A general urban construction planning is required to propose land-use planning solutions which optimize the possibility to use land for mixed purposes pursuant to the Vietnam Building Code on Regional and Urban Planning and Rural Residential Planning, issued as Decision No. 04/2008/QĐ-BXD of 3 April 2008. The Decision likewise specifies the distance between mass transit routes in urban	-	Intended	It has been observed that a “significant number of buildings, particularly those in suburban districts do not have construction permits, resulting in spontaneous urbanisation and occupation of agricultural land.” Moreover, large urban planning or infrastructure projects

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
						centres, the distance between residential/working places and public car parks, the distance between urban centres and bus stops, tramcar stations, railways, among others. ⁴⁸			in Ho Chi Minh City have been prepared and executed with large partners and by public-private partnerships, and “this has considerably contributed to the improvement of planning.” ⁴⁹
A	P	R	Telecommunication promotion				-	Not in discussion	
A	P	E	Public transport fare level/structures				-	Not in discussion	
S	P	E	Incentives for PT investments				-	Not in discussion	
S	P	R/In	Bike-sharing	2015	MOT	Vietnam will launch pilot public bike rental services in 5 cities in 2015, namely Hanoi, Ho Chi Minh City, HaiPhong, Danang, and Can Tho. ⁵⁰		Pilot	In March 2014, Hanoi city authority announced that the program to be launched in Hoan Kiem district in Hanoi will consist of 250 bikes which will be for rent for USD 0.19 per hour and will be paid for by electronic bikes. The long-term objective of the program as cited is to attract tourists. ⁵¹
S	P	R	Car-sharing				-	Not in discussion	
S	P	R	NMT-friendly building regulations	3 April 2008	Ministry of Construction	The Vietnam Building Code on Regional and Urban Planning and Rural Residential Planning, issued as Decision No. 04/2008/QĐ-BXD of 3 April 2008, specifies minimum width for pedestrian pavements along the roads,	-	Intended	Essential daily-life services (e.g. preschool education, lower secondary education, culture and information, marketplace, commercial services, sports and physical

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
						and a maximum allowable distance of 500 m. for pedestrians going from their residential or working places to public car parks. Additionally, it has provisions on the distance between tunnels and overpasses for pedestrians, width of a tunnel and overpass for pedestrians, and lighting of roads for cyclists and pedestrians.			training, spaces for strolls and leisure) are also required to be within a 500-m. radius or less to promote walking and the use of mass transit vehicles. The Decision also outlines minimum parking space requirements for cars, motorcycles, bicycles, buses and trucks in various types of buildings.
S	P	R	Three in one policy/high-occupancy vehicle lanes				-	Not in discussion	
S	P	R	Regulatory and physical restrictions on car use	Varies	MOT, People's Committees of communes, wards and townships will collect the fees	Road closures and pedestrianised streets in the form of a car-free day campaign were only run in the ancient city of Hoi An in Quang Nam province in Vietnam in 2012. ⁵² Although Hanoi authorities planned to pedestrianise six streets in the Old Quarter on weekends, this drew varied reaction from citizens. No discussions are available online. ⁵³	-	Varies between cities, but mostly either planned, implemented or partially implemented.	
S	P	I	Real-time public transport information		Danang's Department of Transport	Danang has an agreement with IBM technology to establish a traffic control centre to control the traffic signal system. Real-time information on Danang's city buses such as driving speed, location, and predicted journey times will likewise be provided, and changes to bus routes, time tables, and estimate arrival times will be available on the city's web portal. ^{54,55,56}	--	Pilot	Da Nang was chosen to receive a USD 400,000 grant from IBM for its smart city project. The two priority areas where technologies will be deployed are in water system and transport sector.
S	P	I	Campaigns			Many of the Decisions and Decrees include provisions on educating the public and raising awareness, but campaigns to shift to a more sustainable form of transport (e.g. bus	-	Intended	

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
S	P	R	Master planning for PT/NMT	2009	MOT	<p>system or NMT) are not done massively and consistently.</p> <p>Railways: National railway transport master plan has been approved.⁵⁷This promotes international integration and the development of urban railway network as the key public transport in big cities (Hanoi and Ho Chi Minh City). It covers freight as well. It also notes the completion of railway networks in Hanoi and Ho Chi Minh City, including the development of Highland railway network, the railway connecting coastal provinces in the northern delta and the railway to Mekong delta.⁵⁸ This updates the Decision of the Prime Minister in 2002 approving the master plan on the development of railway communications and transport sector until 2020.⁵⁹</p>	-	Planned	Railway transport is expected to account for at least 13% of passenger transport and 14% of commodities transport by 2020. Of the total, the urban passenger railway transport should make up at least 20% of the public passenger transport in Hanoi and Ho Chi Minh City. By 2030, the railway transport should reach 20% of total passenger transport and 25% of total public passenger transport in big urban areas. ⁶⁰
				2012	MOT, MOF, MONRE, MOET, MIC, MPI, PCs	<p>Bus system: The Decision 280/QD-TTg on program of development of public transport by bus from 2012 to 2020 was approved to develop the bus transit, and integrate it with other forms of transport in various provinces and cities, investment in infrastructure. ⁶¹</p>		Implementation ongoing	
				2010-2025		<p>Ho Chi Minh City development master plan towards 2025 will develop an elevated railway and metro lines and 19 bridges to relieve the city's current overloaded traffic system. A separate paper notes a revised master plan of Ho Chi Minh City approved by the People's Committee in March 2008.</p>		Implementation ongoing	Funding sources will come from current vehicle fleet and foreign loans from international development organisations. ⁶² Promoting PT/NMT is not clearly visible in the master plans. In fact, underground parking lots will be built in accordance with the Ho Chi Minh City development master plan ⁶³
				Up to 2030		<p>Hanoi master plan for 2030 and vision to 2050 ensures the preservation of tree-lined streets and the development of green corridors. ⁶⁴Hanoi will also have 8 urban railway routes covering 284 km. by 2030.⁶⁵ Authorities try to</p>		Planned	

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
						prevent illegal vending and encroachment on sidewalks by commercial establishments. ⁶⁶			
S	P	R	Low-emission zones				-	Not in discussion	
S	P	R	Bus route optimisation and prioritisation		Hanoi's People Committee	Bus transport makes up a small fraction of the daily commute. Developing agencies support the government in optimising bus systems. Reform of bus system management, with a single agency responsible for routing, contracting operators and a revenues collection system, is being implemented in Hanoi. Smaller cities don't have this.	BRT in 5 major cities 0.57 MtCO ₂ eq/a -Hanoi and HCMC 0.53 tCO ₂ eq/a 2015. ⁶⁷	Planned	The World Bank-funded Hanoi Urban Transport Development Project ⁶⁸ includes a bus rapid transit (BRT) component, segregating bus lanes and developing bus priority. BRT lines will also be built in Ho Chi Minh City by mid-2018 ^{69,70} and in Da Nang by 2016, ^{71,72} both funded by The World Bank.
S	P	R	Integrated ticketing			Metro lines are still being constructed ⁷³ and bus systems are being reformed and constructed. Some bus lines in Hanoi have ticket integration.	-	Intended	
S	P	Inv	Cycling infrastructure		Ministry of Construction	Pursuant to the Vietnam Building Code on Regional and Urban Planning and Rural Residential Planning, issued as Decision No. 04/2008/QD-BXD of April 3, 2008, under "Planning on communal central zones," markets and services shops must have a place for keeping bicycles and motorcycles. Moreover, along roads of regional or higher grade, separate road parts for bicycles must be arranged with median strips or lines against motorways. On roads of other kinds, bicycles and motor vehicles may use the same road parts. The minimum parking space in a parking lot for bikes is set at 0.9m ² while that for motorbikes is 3m ² .. ⁷⁴	-	Intended	Since 2009, the operation of cyclos, the three-wheeled bike taxis, has been regulated in Hanoi. In 2013, Hanoi government says that cyclos will gradually be banned. ⁷⁵

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
S	P	R	Park and ride			A case study on building the pilot park-and-ride facilities along bus route No. 6 in Hanoi, to be managed either by Hanoi city or local People's Committee, has been conducted. ⁷⁶ An ADB project in Hanoi will develop integrated multi-modal stations with park-and-ride facilities to support effective utilisation of Hanoi metro Line 3. ⁷⁷	-	Intended	
				March 2009	-	Park-and-ride facilities for motorcycles are provided in Long Bien bus interchange. This bus interchange was officially opened in March 2009. ⁷⁸		Pilot	
S	P	Inv	Walking infrastructure	3 April 2008	Ministry of Construction	The Vietnam Building Code on Regional and Urban Planning and Rural Residential Planning, issued as Decision No. 04/2008/QĐ-BXD of 3 April 2008 ⁷⁹ specifies a minimum width of the pavements for pedestrians along each side of the road. For urban roads and streets connecting to accesses to trade centres, markets or cultural centres, 6.0 m. For regional roads, 4.5 m. For sub-regional roads: 3.0 m.	-	Implementation ongoing	Ho Chi Minh City has a relatively good set of amenities such as shading for pedestrians but the walkability rating in the areas around public transport terminals in Ho Chi Minh City was found to be low. In Hanoi, several agencies likewise do not know who is primarily responsible for the walkways. ⁸⁰ Illegal parking is considered a problem.
S	P/F	Inv	Non-urban rail improvements	2009	Vietnam Railways	The national railway transport master plan until 2020 aims to develop the external railway network linked with seaports and border countries. Long-distance passenger transport will also be developed. By 2030, the country will build the Highland railway network, the railway connecting coastal provinces in the northern delta and the railway to Mekong delta. ⁸¹	-	Planned	
				2012-2015		Discussions regarding a proposal being drafted in 2013 to construct a high-speed train linking Ho Chi Minh City and Hanoi include talks on repairing dangerous sections of existing railways by 2020 before renovating locomotives and carriages. Barriers at crossroads will also be installed. ⁸² Railway line is going to be rehabilitated between Yen Vien (on the outskirts of Hanoi) and Lao Cai (Chinese border). ⁸³	40,000 tCO ₂ eq/a	Partially implemented	

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
S	P/F	Inv	High-speed rail infrastructure			An upgrade of the express railway linking Ho Chi Minh City and Hanoi is being discussed. The plan is to be proposed to the National Assembly (Vietnam's parliament). Of the four scenarios that JICA recently proposed, JICA advised that strengthening the capacity for the current single rail, with speed of 90 km an hour, travel time of 25 hours, and the capacity of 50 trains/days and an investment cost of USD 1.8 billion is the most feasible for Vietnam. ⁸⁴	-	Planned	A similar plan initially stirred controversy and was rejected by the National Assembly in 2010 due to the high cost (USD 56 billion). The bullet train would be travelling at 300 km an hour, and would have cut the travel time between Ho Chi Minh City and Hanoi from the current 29-33 hours to less than six hours. ^{85,86,87} However, a revised study was re-submitted in 2013.
S	P	Inv	Urban PT infrastructure	Approved in 2007 ⁸⁸	Ho Chi Minh City Management Authority for Urban Railways	<p>Six metro lines are planned for Ho Chi Minh City.⁸⁹ Construction of the USD 2.2-billion Metro Line 1, which is nearly 20-km long, began in 2012⁹⁰ and will be operational in 2017. It will pass through Ho Chi Minh City's districts 1, 2, 9, among others, and will have underground stations.⁹¹ Construction for Metro Line 2 will commence in 2014.⁹²</p> <p>In Hanoi, the implementation of public transport projects was delayed. It will have a large carrier such as Metropolitan Rapid Transit, Light Rapid Transit and Bus Rapid Transit. there is no urban railway going into operation up to 2015⁹⁴</p> <p>One of the pilot lines in the transport sector of the master plan for Hanoi, the 12.5-km Nhon-Hanoi metro station, co-financed by AFD, is scheduled to be commissioned in 2015. Another line is urban railway project Cat Linh - Ha Dong with the total investment of nearly 8770 billion, co-financed by China.</p>	-	<p>Implementation ongoing</p> <p>Implementation ongoing</p> <p>Implementation ongoing</p>	<p>There are inadequate facilities to encourage the use of public transport, and there is a strong sense of car culture. ⁹³</p>
I	P/F	E	Taxation measures stimulating energy-			Vehicle taxation does not directly have a relation with energy or CO ₂ (however there is an exemption for certain vehicle types, see below EV/LPG incentives). In Vietnam, car ownership is limited due to import tax,	20,000 tCO ₂ eq per year between 2010 and 2030	Not in discussion	Taxes account for more than 50% of the price of a car. The collected fees are said to be utilized for road maintenance, as the current capital of Vietnam yearly can

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
			efficient or lower-carbon vehicles			excise tax, value added tax (VAT), environment protection tax, enterprise income tax, application fee, registration fee, number plate application fee, civil liability insurance premium, tangible insurance premium, fuel fee, and road maintenance fee. These rates can be high. For instance, imported cars bear an import tax of 68-78% plus an excise tax (equalling 45-60% of the total value of import price and import tax) and a 10% VAT. ^{95/96/97} Motorcycles carry the same burden. They are charged with road maintenance fees as well. ^{98/99}			manage to maintain only a fraction of the roads. There is over 256,600 km of roads, of which more than 17,200 km of national roads, 23,530 km of provincial roads. ^{100/101} However, the targeted sum of fees to be collected is believed to meet only 20-30% of the requirement for fixing the country's bad roads. ¹⁰²
I	P/F	E/R	Import restriction for inefficient vehicles	1 May 2006	MOIT	Second-hand cars that are to be imported must not be over five years of age from the date of manufacture to the date of import. Importation of bicycles and two-wheeled and three-wheeled vehicles, including second-hand parts and transport facilities comprising frames, tyres and tubes, accessories and engines of all types of automobiles, among others, is prohibited by Decree No. 12/2006/ND-CP. ¹⁰³		Implementation ongoing	
				1 January 2001	MOT	Importation to Vietnam of vehicles that burn leaded gasoline was banned in 2001 pursuant to Directive No. 24/2000/CT-TTg of November 23, 2000. ^{104/105}		Implemented	
I	P/F	E/R	Vehicle scrapping/ fleet replacement			While vehicle-scrapping programs are not at the national policy level, Vietnam limits the age of motor vehicles. (See "Inspection and Maintenance")		Not in discussion	
I	P/F	I	Car labelling	From 2015	MOIT	Decree No. 21/2011/ND-CP of 29 March 2011 requires producers and importers to affix equipment and vehicles with energy labels pursuant to the Law on Energy Conservation, and discusses two types of labelling: the comparative label, which provides information on energy consumption, among others, to help consumers compare with products of the same type in the market, and the certification label, which certifies that the equipment or vehicle has the highest energy efficiency compared to those		Implemented / planned	Effective for cars, planned for motorcycles

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
I	P/F	R	Fuel economy standard		MOT	of the same type. ¹⁰⁶ (non-mandatory) national standards TVCN 9854:2013 on fuel consumption limits for passenger cars and method for determination has been established through Decision No. 2586/QD-BKHHCN dated 22 August 2013, while national standards TVCN 7356:2014 on fuel consumption limits for two-wheeled motorcycles and mopeds has been established through Decision No. 1201/QD-BKHHCN dated 23 May 2014.	FE standard: 3.7 MtCO _{2e} medium-term: 2.0 MtCO _{2e} /a ¹⁰⁷ ; 26% reduction for HDVs ¹⁰⁸	Implementation ongoing / planned	Mandatory standards are being discussed
		R	Emission standards	From 2017	MOT	Decision No. 49/2011/QD-TTg dated 1 September 2011 likewise provides the roadmap for application of exhaust emission standards to manufactured, assembled and imported brand-new cars and motorbikes, requiring manufactured, assembled and imported brand-new cars to comply with Euro 4 exhaust emission standard from 1 January 2017 and Euro 5 exhaust emission standard from 1 January 2022. It likewise requires manufactured, assembled and imported brand-new motorbikes to comply with Euro 3 exhaust emission standard from 1 January 2017. ¹⁰⁹		Implementation ongoing; more stringent standards planned	Current standards are being implemented; more stringent emission standards are planned for 2017
		R		From 2016	MOT	<u>Fuel quality</u> must comply with Euro 4 standards by 1 January 2016, and eventually with Euro 5 by 1 January 2021.		Planned	
		R		Since 2012	MOT	MOST has issued Circular20/2009/TT-BKHHCN dated 30 September 2009 on the promulgation and implementation of national technical regulations on gasoline, diesel fuel oils and biofuels. ¹¹⁰		Implementation ongoing	The Circular covers unleaded gasoline and gasoline E5, diesel fuel oils and diesel fuel B5, biodiesel fuel B100 used for mixing diesel fuel, and denatured fuel ethanol for mixing gasoline.
		R		2010 to 2015	MOT	For the period 2013 to 2015, the implementation the verification of emissions standards for 80% to 90% of motor vehicles in Hanoi and Ho Chi Minh City is sought pursuant to Decision No.909/2010/QD-TTg. The		Implementation ongoing	The Decision covers motorcycles and mopeds.

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
				since 2001	MOT	network of verification agencies is sought to be expanded to implement the verification of emission standards for 60% of motor vehicles, motorcycles in the cities. Directive No. 24/2000/CT-TTg of November 23, 2000 eliminates the use of leaded petrol beginning January 2001, and motorized vehicles of various types using leaded petrol and emitting black smoke that cause environmental pollution are banned from operation. ¹¹¹¹¹²		Implementation ongoing	
I	P/F	R	Inspection and maintenance	2017 onward	MOT	The Vietnam Law on Environmental Protection requires cars, motorbikes and other motor vehicles which are locally manufactured or assembled or imported to satisfy gas emission and noise standards. ¹¹³ In 2011, the Prime Minister announced that <u>motor vehicles</u> are to comply with Euro 4 standards by 1 January 2017, and eventually with Euro 5 by 1 January 2022, whereas motorcycles are to comply with Euro 3 standards by 1 January 2017. ¹¹⁴		Implementation ongoing; Planned	Current standards are being implemented; more stringent emission standards are planned for 2017
				2010 to 2015	MOT	From the period 2010 to 2013, Decision No.909/2010/QĐ-TTg aims to <u>achieve 20% of the people using automobiles in Hanoi and Ho Chi Minh City to comply with regulations</u> on verification, maintenance and repairing of motorcycles to meet emission standards, and to build a network of motor vehicle <u>emission-testing centres</u> (at least 100 in Hanoi and 150 in Ho Chi Minh City) and training for at least 500 managers, technicians, staff in Hanoi and Ho Chi Minh City. ¹¹⁵	Implementation ongoing	This Decision covers emission control from motorcycles. According to the news ¹¹⁶ , “105 auto registration stations across the country and centres for vehicle emissions testing have been built.”	
				Since 2006	MOT, MOIT, MOF, Ministry of Public Safety (MPS)	Used <u>motor cars of less than 16 seats</u> which are imported to Vietnam must be no more than 5 years old from the date of manufacturing to the date of arrival to Vietnam pursuant to Joint Circular No. 03/2006/TTLT-BTM-BGTVT-BTC-BCA dated March 31, 2006. ¹¹⁷ Circular No.19/2009/TT-BCT dated July 7, 2009 on the amendment of and supplement to Inter-Circular	Implementation ongoing		

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
I	P/F	R	Age	Since 2010	MOT, MOIT, MOF	No.03/2006/TTLT-BTM-BGTVT-BTC-BCA guides the <u>import of used, less than 16-seat passenger cars</u> in accordance with Decree No.12/2006/ND-CP dated January 23, 2006 ¹¹⁸ New passenger cars imported into Vietnam must be granted a certificate of conformity from inspection of quality, technical safety and environmental protection or a notice of exemption from inspection of quality, technical safety and environmental protection by Vietnam Register pursuant to Joint Circular No. 25/2010/TTLT-BCT-BGTVT-BTC dated 14 June 2010. ¹¹⁹		Implementation ongoing	This circular applies to the improvement of automobiles which have registered plates or are used cars and permitted for import. It does not cover motorcycle and mopeds.
				01 May 2013	Vietnam Register	For <u>imported motorbikes</u> , imported engines for motorbike manufacture and assembly, Circular No. 44/2012/TT-BGTVT dated 23 October 2012 stipulates the inspection of the technical quality, safety and environment protection, including the inspection method and certification of imports. ¹²⁰		Implementation ongoing	
				1 October 2012	Vietnam Register Department, Services of Transportation, motored vehicle inspection Units	<u>Circular No. 29/2012/TT-BGTVT dated July 31, 2012</u> regarding regulations on renovation of motorized means of road transportation prohibits the conversion of the function of motored vehicle that are over 15 years of age (starting from the production year to the time of renovation), the renovation of passenger cars into trucks (except the conversion of those of passenger cars with less than 16 seats into vans), the renovation and modification of the basic length of truck, even the renovation of a truck into a truck of different type and vice versa, the renovation to increase the length, width and height of truck cargo tank (except for special-use truck), among others. No renovation is permitted for imported automobiles within five years and for imported frozen trucks within 3 years from date of issuance of registered plate. ¹²¹		Implementation ongoing	
				Since 2009	MOT	Decree No.95/2009/ND-CP dated 30 October 2009		Implementation	While this Decree covers cargo

Category			Policy / measure	Implementation period	Main responsible organization (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
			limitation of vehicles			regulates that <u>passenger automobiles of over 20 years, cargo automobiles of over 25 years</u> , including passenger automobiles transformed from other vehicles before January 1, 2002 of over 17 years, will be suspended from circulation. ¹²² Circular No.21/2010/TT-BGTVT further regulates <u>passenger cars older than the stipulated use life</u> and is changed into freight cars must adopt the use life of a freight car, which is no more 25 years, while a passenger car over 10 seats (including the driver's seat) and specialized passenger cars converted into passenger cars must apply the use life of a passenger car, which is not more than 20 years. Freight trucks which are converted into specialized cars must apply the use life of a freight car which is not more than 25 years, while specialized cars and passenger cars up to 9 seats which are converted into freight cars must adopt the use life of a freight car which is not more than 25 years. Freight trucks which are converted into a passenger car before 1 January 2002 must adopt the use life of functionally converted a passenger car which is not more than 17 years.		ongoing	automobiles (, i.e. trucks), it does not cover special-use automobiles (with a structure and equipment designed for a special function or utility), trailers and semi-trailers. It also does not cover passenger automobiles of up to 9 seats.
I	P/F	R	Speed limits/management	1 July 2012	MOT	Operating a motor vehicle at a speed beyond the prescribed speed limit is prohibited pursuant to Law No. 23/2008/QH12 on road traffic. On expressways, the allowable speed is indicated on the road signs or painted road markings. ¹²³ Decree No. 91/2009/ND-CP dated October 21, 2009 of the Government on road transport business and business conditions ¹²⁴ requires passenger cars plying any 500-km-plus routes and freight vehicles to install a black box, a device that would record speed and driving time. Transport firms with 20% of their vehicles found speeding will be shut down. ¹²⁵ A digital map that would provide a vehicle's location and its road's speed limit via the black box is already being discussed. ¹²⁶		Implementation ongoing for black box	
				Since 2009	MOT, Ministry of Public	The speed limits are detailed in Circular No. 13/2009/TT-BGTVT dated 17 July 2009, ¹²⁷ ¹²⁸ the fines for violation of which is stipulated in Decree No. 71/2012/ND-CP. ¹²⁹		Implemented	Sanctions since 2012

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
					Safety				
I	P/F	R	Low-emission zones					Not in discussion	
I	P/F	I	Eco driving	-	National Transport Safety Committee, Ford Vietnam	While there seems to be no decrees promoting eco-driving, Ford Vietnam, in cooperation with Vietnam's National Transport Safety Committee, Asia Injury Prevention Foundation, and the VOV Traffic Channel launched a program to raise awareness on fuel-efficient driving methods. ¹³⁰ Ford's Driving Skills for Life (DSFL) programme ¹³¹ started in 2008 and has been training drivers globally.	0.2 MtCO2 potential in 2020	Intended	While the initiative is not at the national policy level, the Vietnamese government has an involvement in the project. The private sector typically administers such programs. Isuzu Eco Drive Seminar also holds seminars specifically aimed at truck drivers ¹³²
I	P/F	I	Traffic information			Hanoi has a Traffic Signal Control Centre (TSCC) but it appears that only a small fraction of the cameras installed are functioning and the software is outdated. Additionally, the control centre has two separate control systems which are not integrated. ¹³³		Not in discussion	
I	P/F	R	Traffic impact control/ traffic flow improvement			The city of Danang has an agreement with IBM technology to establish a traffic control centre to control the traffic signal system. ¹³⁴ ¹³⁵ ¹³⁶	-	Planned	
I	P/F	E	EV/hybrid/hydrogen tax incentive	15 May 2011	MOIT	Energy-efficient products, fuel-efficient vehicles and vehicles running on LPG, natural gas, electricity, mixed fuel or biofuel are which are domestically unavailable are entitled to import duty exemption and reduction under the tax law pursuant to Decree No. 21/2011/ND-CP of 29 March 2011. ¹³⁷	E2W: 5.9 MtCO2eq/a; medium-term: 2.3 MtCO2eq/a	Implemented	While the use of electric vehicles (bikes and motorbikes) increased in Vietnam due to increased gas prices, CNG vehicles and hybrid vehicles are not widely used as CNG is not commercially available. "The price of hybrid vehicles is still high compared with the price of other low-emission vehicles." ¹³⁸

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
I	P/F	E	Low carbon fuel (1st/2nd gen Biofuel, CNG, LPG) incentives	Since 2010		E5 biofuel was launched in Hanoi market with the price of VND 500/litre, lower than the RON92 petrol	-	Implemented	The sale of the biofuel was rather slow, and this was partially attributed to “consumers’ lack of information about the advantages of the biofuel.” ¹³⁹
				15 May 2011	MOIT	Energy-efficient products, fuel-efficient vehicles and vehicles running on LPG, natural gas, electricity, mixed fuel or biofuel are which are domestically unavailable are entitled to import duty exemption and reduction under the tax law pursuant to Decree No. 21/2011/ND-CP of 29 March 2011. ¹⁴⁰		Implemented	
				2007 – 2025	MOIT	The creation of open market favourable for biofuel development and the adoption of preferential policies on credit, tax and land use rights for enterprises which invest in the development of biofuel production is stipulated in Decision No. 177/2007/QĐ-TTg of November 20, 2007, which likewise makes mention of Decree No. 24/2007/ND-CP of February 14, 2007 entitling biofuel production enterprises to income tax exemption or reduction for biofuel products, and to the highest land rent and land use incentives for 20 years. Raw materials and equipment used for its research and development will be exempted from import tax, while those used for its production are entitled to the lowest import tax rate. ¹⁴¹		Implemented	
				Since 2011	National Assembly, MOIT	Law No.50/2010/QH12 also provides a list of measures to promote the economical and efficient use of energy, stipulating that fuel-saving vehicles and those using LPG. Natural gas, electricity and mixed fuels and biofuels which are domestically unavailable and on the list provided by the Government are entitled to import duty exemption or reduction under the tax law.		Implemented	While this law has taken effect, there remain no incentives as of 2010 to businesses to encourage the building of large LPG warehouses to help stabilise gas prices. ¹⁴²
				2013	Department of Domestic	In 2013, in order to push for the biofuel conversion plan, the Government assigned the Department of Domestic Market to amend Draft Decree 84 on oil and gas		Intended / Planning	Among the key challenges to the success to the biofuel conversion plan is the need for enterprises to have a large working

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
A	F	R	Logistic planning		c Market	<p>management and business in order to create favourable conditions for E5 biofuel business enterprises. It has also been suggested that E5 biofuel be exempted from environmental tax because it is an environmentally friendly product.¹⁴³</p> <p>While Vietnam has a wide range of logistics providers, many do not offer integrated logistics service.¹⁴⁶ Vietnam, however, is improving logistics zones and port facilities, as well as their locations, all of which are components of logistic planning.</p>	-	Intended	capital to purchase and invest in storages because cassava, a raw material for biofuel production, is seasonal. ¹⁴⁴¹⁴⁵
A	F	R/In	Pipelines			The ASEAN Plan of Action for Energy Cooperation 2010-2015 includes the implementation of the Trans-ASEAN Gas Pipeline (TAGP) designed to interconnect gas pipeline infrastructure of ASEAN member-states. International consortium and construction have been founded and have begun. ¹⁴⁷	-	Implementation ongoing	
A	F	R	Empty hauling reduction			Directorate for Roads of Vietnam (DRVN) is discussing with donors DRVN, together with freight companies in Vietnam, developed the “stock exchange” programme. For more comprehensive solution, DRVN is planning to develop the freight database by installing black boxes in trucks for tracking and collecting the travelling data in freight sector. ¹⁴⁸	-	Intended	
A	F	R	Improve logistics centres and their location			Decision No. 2190/QĐ-TTg of December 24, 2009 approving the master plan on development of Vietnam’s seaport system through 2020, with orientations toward 2030 ¹⁴⁹ outlines the functions and development scope of six groups of seaports in Northern, Central and Southern Vietnam and the group of Mekong River delta seaports (including also Phu Quoc and south western islands). The contents of the master plan covers national general ports (including an international transshipment port, international gateway ports, and key regional ports), local ports to operate mainly within localities (provinces, cities),	-	Implementation ongoing	One example of logistics zone being built is in Hai Phong City. It includes 640-hectare Hai Phong international gateway port (Lach Huyen port), 251-hectare Dinh Vu port, 144-hectare Nam Dinh Vu port, and 11-hectare Cat Hai port (fishing port). It is expected to be completed in 2015. ¹⁵⁰

Category			Policy / measure	Implementation period	Main responsible organization (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
						and specialized ports to directly serve certain particular commodities such as cement, crude oil, coal ore. Through the entire seaport system to be developed, the throughput of goods is projected to reach the following figures: between 500 and 600 million tons/year by 2015; between 900 and 1,100 million tons/year by 2020, and; between 1,600 and 2,100 million tons/year by 2030.			
S	F	E	Rail incentives				-	Not in discussion	
S	F	E	NMT freight incentives				-	Not in discussion	
S	F	R	Lorry restrictions	2010	Directorate for Roads of Vietnam	Circular No. 07/2010/TT-BGTVT dated 11 February 2010 ¹⁵¹ and Circular No. 03/2011/TT-BGTVT ¹⁵² stipulates the load and clearance limits applicable for roads; circulation of overloaded, oversized and caterpillar vehicles on roads; delivery of over length and overweight goods; and most importantly, loading limits on road traffic.	-	Implementation ongoing	MOT has set up 10 mobile weighing stations along national highways to inspect overloaded trucks. About 26,255 trucks were found to be overloaded from January to November 2013. This figure does not include trucks passing through other roads. ¹⁵³
				2012		Decision No.: 1502/QD-TTg dated 11 October 2012 approves the master plan of vehicle load checking station on the road till 2020, with a vision to the year 2030. ¹⁵⁴		Implementation ongoing	
S	F	I	“Branding” campaigns				-	Not in discussion	
S	F	R	Master planning for rail and water			The national railway transport master plan specifies that the key point of the plan is to focus on developing the external railway network linked with seaports and border countries. The goal of the plan is for railway transport to account for at least 13% of passenger transport and 14% of freight transport by 2020, and that the standard gauge of 1,435 mm be built across the network and the current diesel engines be transformed into electric engines. ¹⁵⁵ There have	road to rail freight: 2.6 MtCO ₂ eq/a ; medium-term: 0.26 tCO ₂ eq/a ¹⁵⁷	Planned	A similar plan initially stirred controversy and was rejected by the National Assembly in 2010 due to the high cost (USD56 billion). However, a revised study was re-submitted in 2013. ^{159,160,161}

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
					MOT	<p>been plans to upgrade the current railway connecting Ho Chi Minh City and Hanoi from single-track railway gauge to a double-track board gauge. They will mainly serve as cargo trains when the double-track railway is completed.¹⁵⁶</p> <p>The master plan was submitted to the Prime Minister in July 2009¹⁶² and was approved according to Decision No. 2190/QD-TTg of December 24, 2009 approving the master plan on development of Vietnam’s seaport system through 2020, with orientations toward 2030.¹⁶³</p>	<p>Road to waterway 2.2 MtCO₂eq/y r; medium-term 0.22 MtCO₂; Road to coastal 0.8 MtCO₂eq; medium-term: 0.08 MtCO₂eq per year.¹⁵⁸</p>	Partially implemented	This decision summarises the contents of the master plan, and major solutions and policies, which mentions the application of PPP to develop new large ports and wharf areas, integrating the master plan with the development of transport networks, and building goods distribution and logistics service centres in key regional ports and international gateway ports in order to increase the operational capacity.
S	F	Inv	Multimodal facilities/dry ports			The “transport development strategy up to 2020, with a vision toward 2030” was adjusted in Decision No. 35/2009/QD-TTg dated 3 March 2009 recognising in No. 4 of Development Viewpoints that transportation should be developed toward a modern and high-quality system with reasonable cost, safety, reducing environmental pollution and energy saving by application of advanced transport technology, especially multi-modal transportation and logistics. ¹⁶⁴ In November 2013, Vietnam, along with 13 other countries, signed an inter-governmental agreement on dry ports, pledging to create an integrated and sustainable inter-modal transport and logistics system. ¹⁶⁵	-	Planned	Apart from Vietnam, other signatories to the agreement are Cambodia, China, Indonesia, Iran, Laos, Mongolia, Myanmar, Nepal, the Republic of Korea, Russia, Tajikistan, Thailand, and the United States.
I	F	E	CO ₂ based vehicle taxation/registration fees			Taxation for trucks is not based on CO ₂ emissions.	-	Not in discussion	
I	F	R	Tyre standards			None for freight. Tyre standards for motorcycles are set out in TCVN 5721-1993, TCVN 6771-2001, TCVN 7057-	-	Not in discussion	

Category			Policy / measure	Implementation period	Main responsible organisation (s)	Description	Mitigation potential	Status ***	Assessment / remarks****
ASI (G)*	Passenger/ Freight	Policy instrument**							
						1-2002. ¹⁶⁶			
I	F	R	Aerodynamics standards				-	Not in discussion	
I	F	I	Information on efficiency to companies				-	Not in discussion	
I	F	I	Driving information				-	Not in discussion	

*ASI (G): Avoid, Shift, Improve, General

**Types of policy instruments: Economic (E), Regulatory and planning (R), Information & Communication (I), Investments in infrastructure (Inv)

***Status: not in discussion, intended, planned, partially implemented, implementation ongoing, implemented (see Section 3.3 for explanation)

****Assessment/Remarks are related to scope, impact, key successes, progress, etc.

Sources:

³⁵ Decision No. 177/2007/QĐ-TTg of November 20, 2007, approving the scheme on development of biofuel up to 2015, with a vision to 2025. Retrieved December 2013, from : <http://www.asiabiomass.jp/biofuelDB/vietnam/pdf/Decision%20No.%20177.pdf>

³⁶ Tung, T. (2013, December 10). *No fossil fuel subsidies*. Retrieved December 2013, from Vietnam Investment Review: <http://www.vir.com.vn/news/en/highlight/no-fossil-fuel-subsidies.html>

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