

FS Title: “Feasibility Study on NAMA in the Transport Sector of Lao PDR”

Main Implementing Entity: Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.

1. Description of Project/Activity:

(1) Project/Activity:

Economic growth of Lao People’s Democratic Republic (Lao PDR or Laos) in recent years accompanied by rapid increase of traffic volume in the capital city of Vientiane has led to concerns over traffic congestion, increase in traffic accidents and air pollution. To address various issues arising from foreseen traffic congestion, the Lao government has developed EST (Environmentally Sustainable Transport) Strategy as well as Master Plan on Comprehensive Urban Transport of Vientiane (The Master Plan) to support bringing EST into reality. The Master Plan entails three basic plans consisting of 1) road network development plan, 2) public transport development plan and 3) transport management plan. Targeting the Master Plan as a case study, the Feasibility Study (The Study) discusses the feasibility of the case study as an activity within NAMA through investigating GHG emissions reduction effect and MRV feasibility among other aspects.

Target area

The target area of the Master Plan and its evaluation is central part of Vientiane where population and traffic are concentrated. Therefore, the Study also targets the same central Vientiane area which includes parts of Chanthabouly, Sisathanak, Sikhottabong, Xaysettha, Hatxayfong and Xaythny Districts. The total area of the target area is 38,190ha which occupies 9.7 % of Vientiane in area (392,000ha). The population of the target area is 422,426 persons in 2005, which is 61% of the total population of Vientiane (691,721 persons).

Project proponent

As the Project is a public project, the key role in implementing it will be played by Ministry of Public Works and Transport (MPWT) of Laos. MPWT will collaborate with other concerned government departments, local authorities, bus operators and para-transit unions to implement the Project.

Project implementation period

Projects in road network development, public transport development and transport management sectors are planned to be implemented in the following 3 stages. A part of road surfacing, widening, maintenance and bus procurement are expected to start by the end of 2011.

- i) Short term: 2008~2013
- ii) Mid-term: 2014~2018
- iii) Long-term: 2019~2025

Targeting the Urban Transport Master Plan of Laos as a case study is also crucial in furthering the understanding of the following two issues and studying the expected potential of NAMA in addressing these issues.

1. Mitigation actions in the transport sector

According to reports by IEA, 23% of global CO₂ emission is attributable to transport sector and such emissions are rapidly increasing particularly in developing countries. As such, mitigation actions in the transport sector of developing countries are important and require urgent attention. On the other hand, data collection, monitoring and quantification of GHG emission in the transport sector are difficult. At the same time, due to reasons including relatively high initial investment costs considering the amount of emissions reduction that can be expected, transport sector has not benefited from climate change related funding mechanisms including CDM. As such, the expectation held for NAMA is high and it is hoped that barriers in CDM for the transport sector are clarified and a new framework is built on the lessons learnt from such issues.

2. Mitigation actions in LDC

In reality, an LDC like Laos has a very low CO₂ emission level and emphasis placed on mitigation actions, as opposed to adaptation actions, are also small. In fact, urban transport condition of Laos fares well compared to neighboring countries in Asia. Nevertheless, it is clear that traffic volume will increase in the future due to rapid economic growth in recent years, population growth as well as increase in incoming traffic from Mekong region via East-West and North-South Economic Corridors taking advantage of the location of Laos bordering China, Thailand and Vietnam. There is an emphasis on the leapfrog development shifting towards low-carbon society without repeating the mistakes of industrialized countries and emerging countries of Asia. When considering mitigation actions in the transport sector, it is not only important to introduce technology improvement to reduce emissions that have already increased, but it is also important to develop strategies and plans to prevent future traffic volume increase. Thus, it is crucial to establish preventive measures for future traffic volume increase in a country like Laos where CO₂ emissions are yet to escalate. To this end, there is a great expectation for the role the Master Plan and EST Action Plan could play. At the same time, significance of the case study is worth recognizing in terms of contribution NAMA can make to the leapfrog towards low carbon society.

(2) Activity/ GHG Emissions Reduction by the Project:

Various GHG emissions reduction measures are available in the transport sector given the difference in the amount of GHG emissions reduction and whether the effect is direct or indirect. Some of the measures include improvement of fuel, fuel switching, modal shift by increasing supply of public transport and traffic reduction by transport demand management. On the other hand, due to difficulty in quantification of GHG emissions reduction, data collection and monitoring of transport projects and relatively small amount of emissions reduction compared to the high initial investment cost, CDM has not greatly contributed to the promotion of such mitigation measures.

At the same time, transport projects are expected to propel their full effect when multiple measures both hard and soft affect one another instead of a single project implemented independently. Therefore, the Study covers all activities with impacts on GHG emissions reduction and studies their overall effect in order to grasp comprehensive effect of the Master Plan. GHG emissions reduction of the comprehensive project is evaluated in terms of traffic volume (distance traveled by vehicles) in the target area, travel environment (travel speed) and emissions factor of vehicles.

(3) Situation in Host Country:

Laos as an LDC is currently involved in the development and implementation of National Adaptation Programme of Activities (NAPA) with funding from Least Developed Countries Fund (LDCF) established under the United Nations Framework Convention on Climate Change. Therefore, Laos has not submitted its NAMA. Nevertheless, Strategy on Climate Change of the Lao PDR developed in 2010 indicates not only adaptation measures but also mitigation measures in seven areas. Even though it is the intention of the Lao government to prioritize NAPA, National Steering Committee on Climate Change (NSCCC) is in the position to study the potential of NAMA and carry out mitigation actions.

In the transport sector, efforts are underway for low carbon growth and mitigation measures as seen in the actions for EST to tackle issues arising from future traffic congestion and the development of the Master Plan to support the implementation of EST Strategy.

The Study has found through the dialogue between the Climate Change Office (CCO) of Lao Water Resources and Environment Administration (WREA) and the Japanese Ministry of Environment which has been held to seek possibility of setting a working group for future discussions that the Lao government has positive views towards taking part in NAMA and other new mechanisms.

(4) Activity/Dissemination of the Project:

It is generally perceived that the CDM has not been able to contribute to facilitation of project development in the transport sector for difficulties in basic data collection, quantification of GHG emissions and monitoring. On the other hand, as 23% of global CO₂ emissions is said to come from the transport sector,

mitigation measures in this sector are extremely important. In fact, out of 43 countries that have submitted NAMAs, 18 countries have stated intentions to engage in actions in the transport sector signifying the high level of interest in GHG emission mitigation in this sector.

If the framework design for NAMA in the transport sector that supports transport policy and the implementation of the Master Plan, estimation method of GHG emission reduction and feasibility of MRV can be demonstrated through the case study, similar actions in other cities of Laos, such as Luang Phabang and Savannakhet where traffic volume increase is feared in the future as in Vientiane. Also, wider dissemination can be expected to many countries that are proposing transport sector actions in their NAMAs in addition to neighboring Asian cities facing various transport and environmental issues due to high motorization rate caused by rapid economic growth and urbanization, such as Bangkok, Jakarta, Ho Chi Minh City and Hanoi.

2. Study Method:

(1) Study Implementation Framework:

Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. has conducted the Study in consultation with host country committee which comprises officials from Department of Transport (DOT) of Ministry of Public Works and Transport (MPWT) and Department of Environment (DOE) of Water Resources and Environment Administration (WREA) of Laos. Collections of basic data and local survey have been carried out with collaboration with the local consulting firm, Sukkaseum Road and Bridge Architect Survey Design Co., Ltd. MUMSS also received inputs from experts of the Task Force Team that was established in Japan for the Study.

(2) Study Issues:

Issues that need to be clarified by the Study are as follows.

1) Determination of the reference scenario

A scenario with the highest potential as a reference scenario is selected taking into account the current situations of the transport sector in Laos, National Strategy on EST and the Master Plan. Justification of reference scenario determination for each option is discussed in consultation with the counterparts in Laos.

2) Setting the project boundary

Clarification of the concept for the activity's boundary is studied.

3) Monitoring method and plan

Monitoring methods and monitoring plan required for measuring GHG emissions reduced by the implementation of the Activity are studied. Practical monitoring items and monitoring frequency that can continuously be implemented in Laos are considered and a monitoring plan is proposed.

4) Estimation of GHG emissions reduction

Calculation methods for emissions of the reference scenario determined in Section 1) are studied. At the same time, measured data during fieldwork, default values as well as performance values that are either available in Laos or internationally recognized are used to quantify GHG emissions for cases with and without the Activity and estimate GHG emissions reduction.

5) Measuring, Reporting and Verifying (MRV) method

MRV methods with high credibility are studied for GHG emissions reduction effect due to the implementation of the Activity. Such methods shall consider both an international MRV guideline that may be adopted in the future as well as applicable and reasonable method for Laos.

6) Measures to secure environmental integrity

Environmental impacts brought by the Activity as well as its further dissemination are studied and considered in the Study.

7) Financial plan and financial feasibility

Costs and income needed for the implementation of the Activity are estimated in a financial plan proposal. At the same time, financial feasibility of the Activity is evaluated while the significance of utilization of private investment is studied. Also, while evaluating scheme design options for generating carbon credits from NAMA from the viewpoint of potential for business activities by private investment, an approach method for parts that require public assistance and cooperation is studied.

8) Co-benefits

In addition to the GHG emissions reduction, the implementation of the Activity is expected to bring co-benefits, such as emissions reduction of air pollutants including NO_x. Methods of quantitatively evaluating such co-benefit in a way they are applicable to wide-ranging activities are studied based on “Co-benefit Quantification Manual”.

9) Other indirect impacts

Indirect impacts on social, economic and cultural aspects brought by the implementation of the Activity as well as its further dissemination are studied taking into account the characteristics of each project.

3. Outcome of the Feasibility Study

(1) Determination of Reference Scenario:

At the AWG-LCA of COP16, it was agreed that “developing country Parties will take nationally appropriate mitigation actions in the context of sustainable development, supported and enabled by technology, financing and capacity-building, aimed at achieving a deviation in emissions relative to ‘business as usual’ emissions in 2020 “.

As such, the reference scenario of NAMA is determined as the level of BAU. In other words, GHG emissions that would occur in the absence of the projects planned under the Master Plan are deemed to form the reference level.

Even though the traffic condition in Vientiane currently fares well compared to other capital cities of Asia, the number of motor vehicles and traffic volume are rapidly escalating due to the recent population and economic growth. The real GDP growth rate of Laos between 1999 and 2009 is 7.8% which is the second highest in ASEAN after Cambodia (9.2%). At the same time, as the 7th National Socio-Economic Development Plan, 2011-2015 indicates, the Government places average GDP growth target between 2010 and 2015 at 8.0%.

As GDP and car ownership have positive correlation, it is expected that car ownership rate will rise in Laos with increase of household income aided by GDP growth. Difficulty in setting the reference scenario is what kind of measures will be implemented at the BAU level given the growing car and motorcycle ownership brought by population and economic growth.

One method to address the issue is reflecting historical changes of transport activities within the Target area. However, due to the lack of data on historical traffic volume or traffic condition in Laos, it is not possible to analyze historical trend. For the case study, the result of origin-destination (OD) survey of the target area as well as traffic survey which were conducted in 2007 was used; therefore, by conducting the same surveys again before starting the NAMA period, historical changes of transport activities can be clarified. Such historical changes should reflect impacts of road network development and other transport related projects within the target area. BAU should be changes in GHG emission levels based on traffic demand estimation that reflects historical trend.

The Study refers to future traffic demand estimated based on the OD survey and traffic volume survey conducted in 2007 as BAU. As these surveys require cost and know-how, funding and technical assistance from developed countries would be important.

(2) Determination of the boundary:

No rules have yet to be placed on the boundary of NAMA. NAMAs submitted by 43 countries show diverse patterns where some classify activities into sectors and some list specific projects. The boundary will differ according to whether NAMA constitutes one activity, combination of activities or comprehensive plan like a master plan.

In the case study, several activities planned under the Master Plan constitute mitigation measures in the transport sector NAMA. Therefore, the boundary is the same as the Master Plan, which is the central part of Vientiane.

In general, transport projects are more effective when synergy of several projects can be generated as opposed to implementing a single project. For example, BRT project would be more effective if implemented together with priority lane development, improvement of transfer convenience and competitive pricing system with cars and motorcycles. Feeder route development and park & ride facilities may also be needed for making BRT effective. As the examples indicate, it is important to implement BRT project within the package of a comprehensive transport project. Combination of hard and soft measures and complementarity of long term and short term plans are needed for planning a transport project.

The Study has looked into the GHG emission reduction potential of all activities planned under the Master Plan. If MRV of the comprehensive effect can be implemented, synergy of planned activities can be grasped. By regularly verifying such comprehensive effect, it is expected to check any discrepancy between what is planned and what is actually happening and adjust the plan so the long-term objective can be achieved. By targeting comprehensive activities within the boundary, it is possible to facilitate comprehensive and efficient plans and to incorporate GHG emissions and their environmental impact from the planning stage. Thus, studies were carried out on GHG emission reduction and monitoring among other aspects for the target area of the Master Plan.

(3) Estimation of GHG emissions reduction:

i) Method of GHG emission reduction estimation:

There are two main methods for estimating GHG emissions in the transport sector; “top-down” method based on fuel consumption and “bottom-up” method based on traffic volume. The “top-down” approach is the one adopted in National GHG inventories. It is relatively simple as only fuel consumption data are needed. It is suitable for measures on alternative fuel or vehicles themselves, but is not capable of properly assessing the impact of changes in transport activities. On the other hand, the “bottom-up” approach requires many data as it utilizes traffic volume, road network and emissions factor of vehicles, however, it is able to incorporate changes in transport activities. The “bottom-up” approach is therefore deemed appropriate to evaluate the Master Plan that accompanies measures on traffic volume and traffic flow.

ASIF (The activity-structure-intensity-fuel) is generally used as a method of carrying out the “bottom-up” approach. GHG emissions in the transport sector (G) can be derived from transport activity (A), modal share (S), fuel intensity of each mode (I) and emission factor (F) as described in the following equation.

$$G = A * S_i * I_i * F_{i,j} \quad (1)$$

Where,

G : CO₂Emissions from transport (ton CO₂)

A : Transport activity (person-km traveled, vehicle-km traveled, ton-km transported for freight)

S : Modal share

I : Fuel intensity (liter/person-km traveled)

F : Carbon content of fuel or emission factor (ton C or ton CO₂ per liter)

i : Transport mode

j : Fuel type

The Studied utilized a method of estimating CO₂ emissions reflecting traffic volume by vehicle type, travel speed and emission factor by speed for each segment derived from traffic volume forecast based on ASIF approach.

ii) Traffic volume forecast

Total traffic volume expressed as vehicle-km traveled is calculated using 4-step estimation method and then used in GHG emissions estimate for reference and ex-ante project scenario. The 4-step method is the most recognized method for transport demand forecasting which is crucial in planning and proposing investment strategies in the transport sector. Transport demand forecasting is conducted by simulating transport system supply and using socio-economic data.

In the case study, future transport demand is forecasted in accordance with the 4-sptep method based on the OD chart obtained from the person trip survey of 2007 and road network and socioeconomic data. Table 1 demonstrates transport demand of 2025 forecasted for BAU, the scenario with road network development under the Master Plan and the scenario with road network development and bus development.

Table 1: Transport demand forecast by scenario in 2025

Scenario	Motorcycle	Passenger car	Tuk-tuk	Bus	Truck
BAU*	8,901,243	3,331,593	43,452	148,244	466,455
Road network development	8,570,579	3,192,499	41,073	139,685	428,601
Bus development	3,427,334	2,422,417	67,480	203,327	413,425

*Do-nothing scenario Unit: vehicle-km traveled/day
 Source: JICA, The Study of Master Plan on Comprehensive Urban Transport in Vientiane in Lao PDR 2008

iii) Vehicle emission factor

It is suitable to use traffic volume by segment and emission factor by vehicle type and average speed as road congestion levels change according to policy implementation and traffic volume. As the vehicle emission factor is dependent on vehicle type, engine type and driving patters, it is necessary to use country-specific emission factor in order to accurately calculate emission of that country. However, in developing countries, availability of emission factor data is very limited due to the requirement for vehicle exhaust gas testing facilities and various know-hows for the development of vehicle emission factors.

As Laos has not developed vehicle emission factors to date, vehicle emissions factors mainly measured in Bangkok, Thailand were utilized in the Study.

iv) GHG emissions reduction:

As only preliminary calculation is conducted in the Study, emissions levels for each scenario in 2025 have been forecasted using only vehicle-km traveled by vehicle type and vehicle emission factor for average sped.

Table 2: CO₂ emissions for each scenario in 2025

Scenario	Motorcycle	Passenger car	Tuk-tuk	Bus	Truck	Total	Emissions reduction
BAU*	177,068	202,104	4,758	60,873	171,959	616,762	0
Road network development	170,490	193,667	4,497	57,358	158,004	584,016	32,746
Bus development	68,178	146,951	7,389	83,491	152,409	458,419	158,343

*Do-nothing scenario

Unit: ton CO₂/year

Figure 1 shows the calculation result of CO₂ emissions for each scenario. Approximately 370,000 tons of CO₂ will be reduced between 2013 and 2020 from BAU level due to the implementation of road network development and bus development.

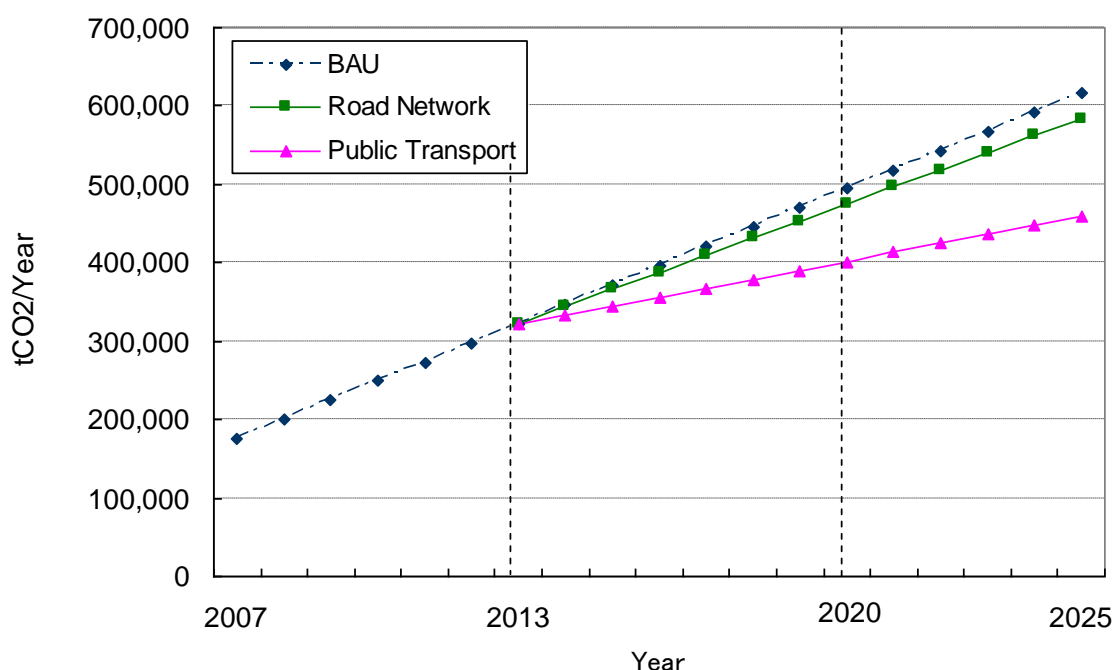


Figure 1: Trend in CO₂ emissions by scenario

(4) Monitoring Method and Monitoring Plan:

GHG emission estimation using the bottom up approach has various merits as previously described; however, it also requires collection of extensive transported related data which is not normally tallied in many developing countries. Many of these data require costs, manpower and technical assistance from industrialized countries. In fact, the lack of available data is one of the factors that hindered transport project development in CDM. The level of rigor in evaluating GHG emission reduction may differ according to whether NAMA is unilateral, supported or credit-generating. Items to be monitored, monitoring frequency and scope need also be considered taking into account the level of assistance from industrialized countries.

The Study has looked into the monitoring items listed in Table 3. Monitoring is divided into monitoring of reference scenario and monitoring of project emissions. Reference emissions will be estimated using transport demand forecast, however, adjustments will be made between forecasted data and measured data. Socioeconomic data as well as cross-section traffic volume and travel speed at major road segments will be monitored for adjustment.

Collecting these data are crucial in developing low carbon growth and urban planning strategies and

evaluating such strategies in developing countries. Therefore, it is important to conduct surveys, provide funding for data collection, technical assistance and capacity building as part of NAMA. It is also worth considering the frequency and scope of survey required or the utilization of default values depending on the level of assistance from industrialized countries.

Table 3: Monitoring items

Monitoring Parameter	Potential Sources
Monitoring Reference Scenario	
Population	Census
Individual Attribution	Census
Number of Vehicles	Registered number of vehicles
GRP	National Statistics
Traffic Volume	Screen line survey
Velocity of Vehicles	Traffic Survey
Monitoring Project Scenario	
Progress of Activities	-Progress of planned activities, Any new project, Timeline
Population	Census
Individual Attribution	Census
Number of Vehicles	Registered number of vehicles
GRP	National Statistics
Road Network	Road Network at the monitoring
Distance Traveled (Vehicle-km)	O-D Survey
Type of Vehicles	O-D Survey
Velocity of Vehicles	Traffic Survey
Number of Passengers on Buses	Record of bus company
Emission Factors (tonCO ₂ /km)	Measured (Ideally)

At the same time, it is important to develop a robust organizational structure for monitoring implementation to carrying monitoring in a continuous and proper manner. Capacity building is expected to be provided with industrialized countries' assistance to develop the following functional framework.

- Developing a manual indicating method of carrying out OD and traffic volume surveys and their frequency.
- Developing a database to properly record and manage data.
- Developing a structured monitoring organization that clarifies responsible departments and personnel for monitoring, data recording and management.
- Determination of personnel in charge of QA/QC within the above organization for managing the quality of monitoring method and collected data.
- Developing a manual for data recording, management and QA/QC.

(5) Monitoring, Reporting and Verification (MRV) method:

Although MRV has become a hot issue as it concerns ways in which transparency is secured for mitigation actions of developing countries, details are not yet clear. Nevertheless, some specifics have become clear in the COP 16 agreement where development of a guideline was decided.

In order for transport sector NAMA to be effective in mitigation overcome barriers faced in CDM, it is important that MRV for NAMA is developed into a reasonable framework that is feasible in developing countries and the balance of rigor and cost is maintained. Factors of MRV are summarized below.

1) Measurement (M)

In the case study, GHG emission in reference scenario and project scenario are quantified based on transport activities and emission factor using ASIF approach. Assumed uncertainty factors and how they can be addressed have been studied as follows.

i) Ex-ante determination of the reference scenario

Issue: Reference scenario is determined as BAU which is the scenario reflecting traffic volume trend between 2007 and project start. The scenario is pre-determined based on transport demand forecast surveys conducted prior to the project implementation. After the project implementation, the reference scenario cannot be actually monitored as road network and urban structure change.

Response: The input data, such as population, socioeconomic data and transport demand forecast that can be monitored will be updated and used for re-forecasting. Also, cross-section traffic volume and travel speed at major road segments will be monitored and their comparison with forecasted data will be used to adjust the reference emissions. These actions will decrease the level of uncertainty.

ii) Uncertainty due to the utilization of transport demand forecasting model

Issue: Transport demand forecasting modeling is used for estimation of traffic volume under the reference and project scenarios. As far as the utilization of a modeling is concerned, there are concerns over uncertainty as what happens within the model becomes unclear and much control is in the hands of the operator of the model.

Response: The following 4 measures can be implemented to address the issue of uncertainty in utilizing transport modeling.

1) Application of a robust model

JICA-STRADA¹ was used for the Master Plan of Vientiane in Laos and therefore continues to be used for the Study. JICA-STRADA has been used in many cases of JICA's technology assistance projects in transport planning sector of developing countries.

2) Verification of the model

Comparison analysis of estimated data and measured data has been conducted when establishing a model. It is important that such analysis results are reported and verified by a third party to secure transparency of measurement methods in modeling.

3) Comparison analysis of measured data

Using measured data for the project scenario enables collection of more accurate data on transport activities. Uncertainty can also be adjusted for the reference scenario by comparing estimates with measured data and by regular adjustment and verification.

4) Sensitivity analysis

When high uncertainty is expected for data, such as population forecast that underlies the transport demand forecast, sensitivity analysis should be conducted. Conservativeness can be maintained by adopting the least emissions when applied to the reference scenario and the highest emissions when applied to the project scenario.

iii) Accuracy of GHG emission factor

Vehicle emission factors have not been developed in many developing countries as they require various know-hows. Nevertheless, in order to raise the accuracy level of emissions calculation and to properly evaluate impact of mitigation measures, it is important to support the development of vehicle emission factors by vehicle type and speed in Laos.

2) Reporting (R)

It is deemed appropriate that pre-project reporting is conducted in a form of document, such as CDM-PDD while post-project reporting is conducted by submitting a monitoring report containing monitoring outcome. Implementation framework of monitoring requires further discussion.

3) Verification (V)

¹ System for Traffic Demand Analysis, a packaged system for transport demand forecasting

Verification contains factors of both validation and verification. It is desirable to follow the CDM process where validation confirming the project validity is implemented at the time of pre-project reporting and verification is implemented at the time of post-project monitoring. However, standards of validation and verification are not decided and are subject to further discussion. At the same time, the suitable types of organizations to conduct verification calls for careful consideration.

(6) Credit Generating Potential of Emissions Reduction:

Some argue that credit generating NAMA applies to emissions reduction achieved beyond the target established under Supported NAMA. Other argue that credit generating NAMA is subject to tougher MRV compared to Supported NAMA and is not so different from CDM. Therefore, credit generating potential of NAMA is dependent on the required level of rigor. Particularly for the transport sector, areas where strict MRV and direct impact measurement can be applied are limited. Therefore, depending on the required level of rigor, there is a possibility that type of activities that can generate credits will be limited. In the case study, credit generating potential is classified into the following two scenarios depending on whether the utilization of transport demand forecast modeling will be recognized.

1) MRV including the utilization of transport demand forecast modeling is NOT recognized
Forecasting based on simulation modeling has a tendency of not being recognized in CDM. If rigor at the level of CDM is required, it is highly likely that evaluation of comprehensive outcome of multiple activities using demand forecast modeling is not recognized. In such cases, projects with credit-generation potential would be limited to BRT and other bus development projects where impacts can directly be measured. Implementation will be limited to project-base approach and impacts of other projects and urban structure change will not be reflected.

2) When MRV including the utilization of transport demand forecast modeling IS recognized
Emissions reduction achieved beyond the target set by the Lao government in advance may be able to generate credits.

In Case 1), problems faced in CDM will not be resolved. Therefore, Case 2) which utilizes demand forecasting model with an emphasis on the comprehensive impact of the Master Plan is desirable. Transport demand forecasting model is widely used in transport planning and is practical. Adjustment of the reference emissions by adjustment and robust monitoring of project emission as previously described would be able to increase the accuracy level. If Case 2) can be applied, the Lao government can set the target scenario which should be a reasonable one taking additionality into account.

(7) Securing Environmental Integrity:

Initial Environmental Examination (IEE) has been carried out for the Master Plan. It has been indicated in the IEE that environmental impact assessment (EIA) and mitigation measures of impacts are being discussed. As far as road widening and new road building are concerned, site acquisition and removal of residents that lead to impacts on nature and social environment are foreseen. EIA is planned for such projects.

At the same time, it is expected that the Master Plan implementation will not only reduce vehicle traffic and GHG emission reduction, but also reduce the emissions of air pollutants in exhaust gas, such as NOx.

(8) Other Impacts and Countermeasures:

By developing transport infrastructures, economy will be energized through active movement of people, goods and services. Economic growth is expected to contribute to improvement of income as well as quality of life. In Laos, traffic accidents are on rise accompanying growth in traffic volume. Provision of safe public transport and prevention of traffic accidents by development of transport infrastructure are also desired.

(9) Activity/Implementation Framework of the Project:

MPWT which is the government department responsible for the transport sector is going to play a central role in facilitating the Master Plan. Meanwhile, as all concerned organizations need to cooperate/coordinate with one another to resolve urban transport issues, establishment of a road and public transport coordination committee which may consist of the following members is recommended.

- Vice-Minister responsible for transport in MPWT (Chair)
- Director-General of Transport, MPWT
- Director-General of Roads, MPWT
- Vice-Mayor responsible for transport in the Special City of Vientiane
- A representative from Vientiane Urban Development Management Directorate
- A representative from transport police
- A representative from bus operators
- A representative from para-transit union
- Representatives from public transport and road users, universities, chamber of commerce, etc.

(10) Financial Plan:

Regarding the project cost required for the implementation of the Master Plan, foreign aid is planned to be used to fill in the gap between the required funding and Lao government's own available fund. As such, financial aid, such as ODA from Japan and other aids from international agencies and other countries continue to play a major role in implementing the Project. Nevertheless, implementation of the Master Plan as NAMA is desired contribute to fund procurement by attracting climate change funding as well as additional funding from industrialized countries. As for activities that can generate profit, such as bus operation, NAMA and other climate change related funding can be used as subsidy or they can act as an insurance to attract private investment and technology transfer.

(11) Outlook Towards Implementation:

Implementation of the Master Plan is under preparation with assistance from JICA and other international organizations. Nevertheless, whether it will be implemented according to the plan depends on further assistance from overseas. In order to maximize the effect of the measures under the Master Plan, it is necessary to verify the comprehensive effect. To this end, a great expectation is held for the role NAMA could play.

It is deemed that ODA is necessary for the implementation of the projects planned under the Master Plan. Moreover, in order to implement the projects as part of NAMA, various surveys and data collection as well as technical assistance are needed. It is important that such assistance is provided as part of supported NAMA. Together with developing the implementation plan with utilization of ODA, it is important to prepare fund required for implementing the projects as NAMA as well clarifying required technical assistance.

As transport projects can be last over several decades, it is important that long term urban and transport plans are developed beyond 2020. Studying the feasibility of the projects by separating them into mid-term and long-term plans and feasibility is important in maximizing the role of NAMA in the long-term development plan.

4. Proposing a New Market Mechanism Framework:

Regarding NAMA, which still have many ambiguities, discussions are ongoing for its framework design. A framework depicted in Figure 2 can be drawn from the case study. It is to be noted that the organizations and processes mentioned in the Figure are based on the results of the case study as well as current international discussion, not formally agreed or decided.

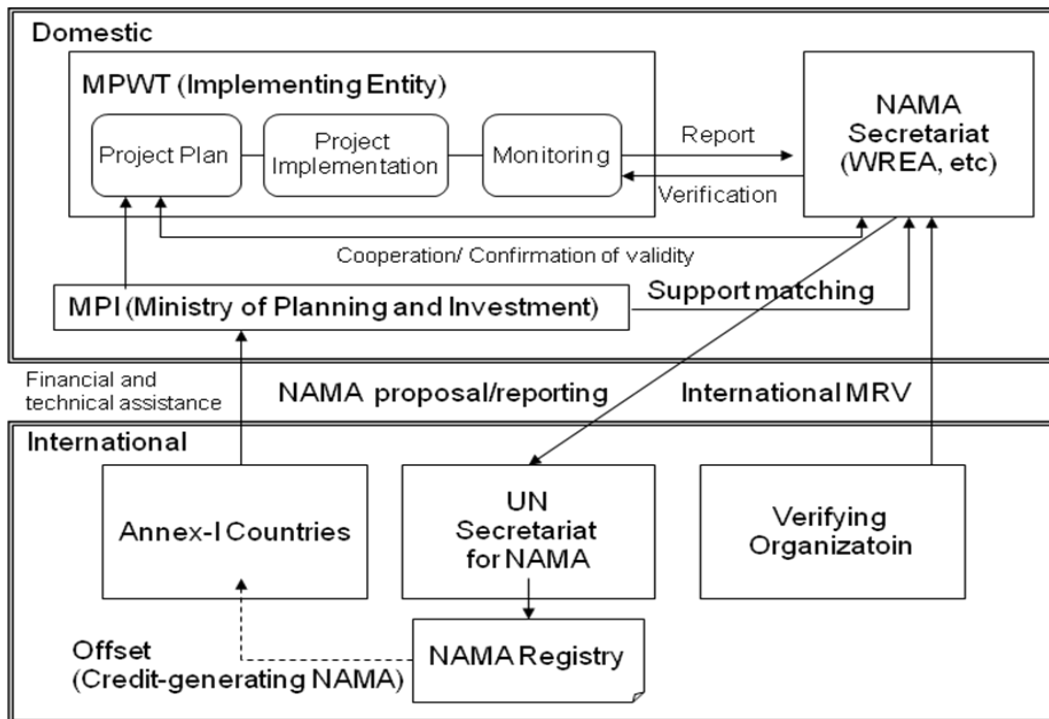


Figure 2: Idea for NAMA framework as the Transport NAMA of Laos as an example

Particularly for the following issues, further discussions are essential.

1) International MRV

As previously mentioned, because NAMA is a national activity, a careful discussion on the suitable institution to conduct MRV is necessary. Differentiation from ICA also warrants discussion.

2) Matching with support

Methods of matching activities with support, responsible organization, database development for record keeping all need to be discussed in conjunction with designing robust and transparent implementation framework.

3) NAMA registry

Discussions are underway for the target, content and management organization with regards to NAMA registry. It is necessary to further discuss double-counting issue with CDM and other schemes and supporting mitigation activities outside of the registry.

5. Co-benefits:

In accordance with “Co-benefit Quantification Manual”, quantitative analysis for NO_x has been conducted for air quality improvement co-benefit of vehicle emission reduction. Baseline and project scenarios are as follows.

Baseline scenario (reference scenario): NO_x emission from vehicles traveling in Vientiane in the absence of the Master Plan.

Project scenario: NO_x emission from vehicles traveling in Vientiane after the Master Plan is implemented.

Data required for quantitative analysis and data collection methods are listed in Table 4.

Table 4: Data required for quantitative analysis and data collection methods

Classification	Data	Data collection method
Data required for emissions calculation in baseline	Total distance traveled by target vehicles in the baseline scenario (vehicle-km)	Transport demand forecast based on OD survey and traffic volume survey conducted prior to the project implementation
	Traveling speed of target vehicles in the baseline scenario (km/hr)	Transport demand forecast based on OD survey and traffic volume survey conducted prior to the project implementation
	Emission factor (ton NO _x /km)	Survey on vehicle emission factor by vehicle type and speed
Data required for emissions calculation in project	Total distance traveled by target vehicles in the project scenario (vehicle-km)	OD survey and traffic volume survey to be implemented as well as Transport demand forecasting
	Traveling speed of target vehicles in the project scenario (km/hr)	Travelling speed survey
	Emission factor (ton NO _x /km)	Survey on vehicle emission factor by vehicle type and speed

Baseline emissions, project emissions and emissions reduction are calculated in accordance with equations (3)~(5). Based on the estimation, the emissions reduction amounts to 560 tons of NO_x as of 2025.

$$BE_{NOx,y} = \sum_{m=n}^{m=l} A_{m,BL} * EF_{NOx} \quad (3)$$

Where;

$BE_{NOx,y}$: NO_x emissions from transport (ton NO_x)

$A_{m,BL}$: Transport activity within the project boundary by transport mode m (vehicle-km)

EF_{NOx} : NO_x emissions factor by transport mode m (ton NO_x/km)

m : Transport mode

$$PE_{NOx,y} = \sum_{m=n}^{m=l} A_{m,PR} * EF_{NOx} \quad (4)$$

Where;

$PE_{NOx,y}$: NO_x emissions from transport (ton NO_x)

$A_{m,PR}$: Transport activity within the project boundary by transport mode m (vehicle-km)

EF_{NOx} : NO_x emissions factor by transport mode m (ton NO_x/km)

m : Transport mode

$$ER_{NOx} = BE_{NOx} - PE_{NOx} \quad (5)$$

Where;

$ER_{NOx,y}$: NO_x emissions reduction (ton NO_x)

6. Contribution to Sustainable Development

Promotion of activities involving people, goods and services, promotion of service activities and economic revitalization are picked up by co-benefits in “Co-benefit Quantification Manual”. Even though details of such co-benefits are still under consideration, it is believed that evaluation should be made by economic indices.

Particularly in the transport sector projects, it is often the case that benefits other than those related to climate change are far greater. Therefore, many argue that achievement of fundamental objectives of transport infrastructure and public transport system development, such as the impact of traffic congestion mitigation should also be subject to MRV and financial assistance as a co-benefit.

In Laos, traffic accident occurrence has become a serious issue. Illness due to traffic accidents poses serious impact on individual lives and assets. Costs associated with traffic accidents in Laos amounted to 2.7% of GDP in 2003 and are estimated to reach US\$ 1,689 million in 2013.

Therefore, it is important to consider socioeconomic impacts of the Master Plan when implementing it as NAMA. It is desired that benefits brought by transport projects, such as travel time and travel cost savings as well as reduction in traffic accidents are properly evaluated. It is also important that these benefits are evaluated as economic value in order to include them in the framework of NAMA.