7. CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

1) EV Diffusion in the World

7.1 Both developed and developing countries have become more active in EV introduction and diffusion. In developed countries, the government has led the promotion of next-generation environment-friendly vehicles. In the industrial world, not only conventional auto manufacturers but also large and small enterprises have joined the EV business as new business opportunities. In accordance with the implementation of many pilot projects and EV related events, public expectation on EVs is high. However, there is no clear indication for full-fledged diffusion. This is because of high prices of EVs, limited models, lack of charging infrastructure, and lack of trust in the market in terms of life span of EVs and safety. On the other hand, big auto manufacturers have become bolder in EV development, which is seen to address the above-mentioned problems and accelerate EV diffusion.

2) Significance of EVs in Lao PDR

7.2 Lao PDR can gain significant benefits from EV diffusion. One of the biggest benefits is energy saving. If all motorcycles and mini buses and 50% of other types of vehicles are replaced with EVs by 2030, Lao PDR will save USD938 million from the reduction of fossil fuel import by 2030. Moreover, the saving from fossil fuel will be USD6,456 million in the period of 2015 - 2030. On the other hand, the electric consumption of EVs by 2030 is only USD183 million, and the additional electric demand due to EV introduction is less than 7% of electric generation, i.e. the additional investment on power plant is unnecessary for EV diffusion. The environmental benefit is clear. The emission of PM, NOx, CO and THC will be zero. Regarding the CO2 which causes climate change, the energy sources of Lao PDR is mainly hydropower plant, so that the grid emission is zero. Thus, EVs in Lao PDR also does not emit CO2. This is very little case in the world. The zero emission transport system will bring the positive impact on the society. The traffic pollution such as air pollution and noise will be disappeared. The attractiveness of cities in Lao PDR (tranquil and compact urban area which surrounded by historical heritage and nature) will be increased. The image of Lao PDR will be improved. The tourism sector which is one of the main industry of Lao PDR will be further developed. In addition, EV can change the value chain of vehicles which create new business opportunities.

3) Establish a System for Accepting EVs

7.3 It is not necessary for Lao PDR to participate to the production and sales of EVs, but Lao PDR needs to prepare to introduce various EVs and related infrastructures appropriately which appear in the global market one after another. EVs have been already introduced by the private sector without related regulations. However, it is important to establish a basic system to avoid the inappropriate operation of those EVs and to promote appropriate information of EVs to the society.

7.4 Development situation of EVs are varied by the types of EVs. While small types of EVs (motorcycle and mini bus) already have an economical advantage against ICE vehicle through tis lifecycle, larger types of EVs (larger than sedan type) still cannot compare with ICE vehicles in terms of vehicle operating cost due to high battery price of EVs. Therefore, the government in developed countries generally subsidize EVs. In developing countries, imported vehicles are imposed high tax rates. So the reduction of tax rates on EVs has the

same effect as subsidy. Regarding large buses which play important role for public transport system, there are many trials, but it cannot be feasible without huge subsidy. Thus, it is important to consider the different development direction for different types of EVs.

7.2 Recommendations

- (1) Reflect EV development policy to national policy and prepare roadmap: In order to produce a notable effect by EV development actions, it is necessary to introduce as many EVs as possible. For this, medium- and long-term policies on EVs should be carried in the coordination among the related agencies and organizations. Besides the central government, there are many other stakeholders whose opinion must be sought, including those groups which may be affected negatively by the introduction of EVs. Therefore, EV development should be included in the national policy to effectively promote the implementation of related projects and actions. Furthermore, showing concrete EV policy in the short, medium, and long term can help clarify the direction of relevant agencies, and facilitate the sharing of the progress of the policy among these agencies.
- (2) Establish implementation system: There is no foundation to introduce and promote EVs in Lao PDR. Because the full-fledged development of EV technology in developed countries is expected to start from around 2015, the period between 2012 and 2015 is a good opportunity to establish an implementation system in Lao PDR. It is advisable to conduct the following as preparatory steps:
 - (i) Establishment of EV preparatory committee: The committee will be the core body which will conduct preparatory tasks to promote EVs. The MPWT will be the lead agency in coordination with relevant agencies.
 - (ii) Prepare EV master plan: This study will propose the basic directions for EV development. However, it is also necessary to further study by region and by issue, after which, the EV master plan will be formulated.
 - (iii) Build the basic regulations related to EVs: It is necessary to develop regulations on import, registration, as well as operation and management of EVs because private enterprises have already introduced EVs. Meanwhile, the minimum required regulations will be prepared to respond to market needs.
 - (iv) Develop human resources: The mechanism to develop human resources will be developed in both public and private sector.
- (3) Conduct model project: The implementation of the model project is very effective to evaluate the feasibility and the impact of EV introduction and to conduct capacity building which mentioned in the above (2). The model project can enable to collect the necessary information for full-fledged EV development and to strengthen the implementation capacity of relevant agencies. It is advisable to utilize the support from the developed countries to implement the model project.

Appendix

Appendix 1.1 Meeting and Interview Lists

APPENDIX1.1: MEETING AND INTERVIEW LISTS

Meeting/ Interview	Date	Main Purpose
Vientiane Capital State Bus Enterprise	24 th January, 2012	Operation condition of electric minibus
Dept. of Tourism, Luang Prabang Province	27 th January, 2012	Current condition of tourism sector in Luang Prabang
Dept. of World Heritage, Luang Prabang Province	27 th January, 2012	Concerns on EV introduction
DPWT, Luang Prabang Province	27 th January, 2012	Current condition of traffic management in Luang Prabang
Inception Meeting	31 th January, 2012	Introduction of the Study to relevant agencies
Engineering Faculty of NOUL	6th February, 2012	Introduction of the Study
		Transport MP, EST strategies, parking issues, regulation on
Div. of Land Transport, DOT of MPWT	7th February, 2012	paratransit
Div. of Industry Promotion and Management, and Handicraft, Dept. of Industry of Min. of Industry and Commerce	7 th February, 2012	Situation and development orientation of vehicle related industries
JICA expert at Dept. of Energy of Min. of Energy and Mines	8th February, 2012	Current condition of energy supply and development orientation
Dept. of Energy of Min. of Energy and Mines	8th February, 2012	Current condition of energy supply, electric tariff, development situation of mining
Dept. of Planning of MPI	9th February, 2012	Investment condition in general and in vehicle industry
Dept. of Pollution Control of MONRE	9th February, 2012	Environmental legislation, air pollution, natural disasters
Div. of Infrastructure and Transport, DOT of MPWT	10th February, 2012	Current situation of urban planning
Dept. of Tourism of Min. of Culture, Sports and Tourism	10 th February, 2012	Current condition and development orientation of tourism sector
Div. of Traffic Management, DOT of MPWT	13th February, 2012	Traffic management, inspection system, vehicle registration
Association of Tuktuk and Taxi	14th February, 2012	Operation condition of paratransit
GIZ Project Office of Clean Air Plan	15th February, 2012	The situation of the project, air pollution of Vientiane Capital
ADB	16th February, 2012	ADB new project on Sustainable Urban Transport in Vientiane Capital
Toyota Lao Thani	20th February, 2012	Sales situation of TOYOTA in Laos, situation of vehicle industry
Isuzu	20th February, 2012	Sales situation of ISUZU in Laos, situation of vehicle industry
Dept. of State Assets Management of MOF	20th February, 2012	Situation of government official vehicles
Dept. of Tax and Dept. of Central Budget of MOF	28th February, 2012	Budget and expenditure situation of the country and the local government, vehicle related tax
Dept. of Transport, Vientiane Capital	20th March, 2012	Issues in Vientiane Capital, the opportunities and constraints to introduce EV/PHEV to Vientiane Capital
Vientiane Capital State Bus Enterprise	20 th March, 2012	Issues in Vientiane Capital, the opportunities and constraints to introduce EV/PHEV to Vientiane Capital
Dong Palan Temple	20th March, 2012	Issues in Vientiane Capital, the opportunities and constraints to introduce EV/PHEV to Vientiane Capital
DOT of MPWT	21th March, 2012	Issues in Vientiane Capital, the opportunities and constraints to introduce EV/PHEV to Vientiane Capital
Prime Minister's Office for NCSEZ	20 th March, 2012	Issues in Vientiane Capital, the opportunities and constraints to introduce EV/PHEV to Vientiane Capital
DPWT, Savannakhet	2 nd April, 2012	Current condition of transport in Kayson Phomvihane
DPWT, Champasack	2 nd April, 2012	Current condition of transport in Pakse
DEM, Savannakhet	2 nd April, 2012	Current condition of energy supply in Kayson Phomvihane
DEM, Champasack	2 nd April, 2012	Current condition of energy supply in Pakse
DICT, Savannakhet	2 nd April, 2012	Current condition of tourism in Kayson Phomvihane
DICT, Champasack	2 nd April, 2012	Current condition of tourism in Pakse
DPI, Savannakhet	3 rd April, 2012	Current condition of investment in Kayson Phomvihane
DPI, Champasack	3 rd April, 2012	Current condition of investment in Pakse
DOE, Savannakhet	4 th April, 2012	Current condition of environment in Kayson Phomvihane
DOE, Champasack	4 th April, 2012	Current condition of environment in Pakse
Chamber of Industry and Commerce, Savannakhet	4 th April, 2012	Current condition of private sector activities in Kayson Phomvihane
Chamber of Industry and Commerce, Champasck	4 th April, 2012	Current condition of private sector activities in Pakse
JICA expert at Dept. of Energy of Min. of Energy and Mines	10 th May, 2012	Prediction of EVs propagation, balance of electric supply and demand
Electricite du Laos (EDL)	14 th May, 2012	Current condition of electric generation
Renewable Energy Promotion Institute of MEM	14 th May, 2012	Condition of promotion on renewable energy
DOT of DPWT, Champasack	14 th May, 2012	Transport condition of Pakse

Table 1.1 Meetings and Interviews Conducted in Laos

Meeting/ Interview	Date	Main Purpose
DHUP of DPWT, Champasack	14 th May, 2012	Urban development condition of Pakse
Div. of Transport Techniques and Environment, DOT of MPWT	15 th May, 2012	Situation of environmental condition in transport sector
Div. of Environment, DONRE, Champasack	15 th May, 2012	Environmental condition of Pakse
Div. of Skilled Development & Employment, DLSW, Champasack	15 th May, 2012	Vocational school and labors condition of Pakse
Dept. of Climate Change, MONRE	16 th May, 2012	Organization structure, situation and action on climate change
Dept. of Intellectual Property, MST	16 th May, 2012	Standards on fuel and vehicles, process on making new standards
Dept. of Pollution Control, MONRE	16 th May, 2012	Law and regulation on environment, countermeasures to environment pollution
Sunlabob	16 th May, 2012	Development of E-tuktuk
Div. of Energy, DEM, Champasack	16 th May, 2012	Energy supply condition of Pakse
DOT of DPWT, Savannakhet	17 th May, 2012	Transport condition of Savannakhet
DHUP of DPWT, Savannakhet	17 th May, 2012	Urban development condition of Savannakhet
Div. of Environment, DONRE, Savannakhet	18 th May, 2012	Environmental condition of Savannakhet
Div. of Energy, DEM, Savannakhet	18 th May, 2012	Energy supply condition of Savannakhet
Div. of Skilled Development & Employment, DLSW, Savannakhet	18 th May, 2012	Vocational school and labors condition of Savannakhet
DOT of DPWT, Luang Prabang	21 st May, 2012	Transport condition of Luang Prabang
DHUP of DPWT, Luang Prabang	21 st May, 2012	Urban development condition of Luang Prabang
Div. of Vehicle and Machinery, DOT of MPWT	22 nd May, 2012	Statistical data of vehicles
Div. of Environment, DONRE, Luang Prabang	22 nd May, 2012	Environmental condition of Luang Prabang
Div. of Energy, DEM, Luang Prabang	22 nd May, 2012	Energy supply condition of Luang Prabang
Div. of Skilled Development & Employment, DLSW, Luang Prabang	22 nd May, 2012	Vocational school and labors condition of Luang Prabang
Dept. of Technical Vocational Education, MES	23 rd May, 2012	Current condition of vocational school, process on making new curricula
Dept. of Tax, MOF	24 th May, 2012	Preferential tax system on low-emission vehicles
Dept. of Environment and Social Impact Assessment, MONRE	25 th May, 2012	EIA
Lao State Fuel Company	26th July, 2012	Standard on fuels, import condition of fuels
Sunlao Electric Car Company	24th August, 2012	Company activities, import of EVs in Laos
Paratransit Association	4th September, 2012	Willingness to use EVs, opportunities to convert to EVs
Source: JICA Study Team	1	1

Source: JICA Study Team

Table 1.2 Interviews Conducted in Japan

Meeting/Interview	Date	Main Purpose
Japan Automobile Research Institute (JARI)	8 th August, 2012	Profile of JARI, possibility to support EV project in Laos
Terra Motors	15 th August, 2012	Profile of company, possibility to prove E-MC to Laos
NISSAN	16 th August, 2012	Appropriate types of EVs to introduce in Laos, possible support from Nissan to EV project in Laos
Japan Automobile Manufacturers Association	17 th August, 2012	Profile of JAMA, possibility to support EV project in Laos
Toyota Tusho	3 rd October 2012	Business opportunities for Toyota Tusho in EV projects of Lao PDR
Mitsubishi Motors	4th October 2012	Possibility to participate in the EV Model Project of Lao PDR
Japan Automobile Research Institute (JARI)	4th October 2012	Opinions on Japanese EVs

Source: JICA Study Team

Meeting/Interview	Date	Main Purpose
Dalian University of Technology	8 th March, 2012	Implemented situation of Ten Cities Thousand Vehicles Program
New Energy Vehicle Center	8 th March, 2012	Implemented situation of Ten Cities Thousand Vehicles Program
School of Traffic and Transportation	8th March, 2012	Implemented situation of Ten Cities Thousand Vehicles Program
Beijing Transportation University	9 th March, 2012	Implemented situation of Ten Cities Thousand Vehicles Program
Beijing Municipal Transportation Development Research Center	13 th March, 2012	Implemented situation of Ten Cities Thousand Vehicles Program
Korea Research Institute for Human Settlements (KRIHS)	15 th March, 2012	EV development and introduction condition of Korea
Korea Transport Institute (KOTI)	15 th March, 2012	EV development and introduction condition of Korea
Korean Society of Transportation	16 th March, 2012	EV development and introduction condition of Korea
EV Car Rental Company in Taipei	16 th March, 2012	EV development and introduction condition of Taipei
Eastern Asia Society for Transportation Studies (EASTS)	19 th March, 2012	EV development and introduction condition of Taiwan
Industrial Development Bureau, Min. of Economic Affairs	20th March, 2012	EV development and introduction condition of Taiwan
National Chiao Tung University	20th March, 2012	EV development and introduction condition of Taiwan
Institute of Transportation, Min. of Transportation and Communication	20 th March, 2012	EV development and introduction condition of Taiwan

Table 1.3 Interviews Conducted in China, Korea and Taiwan

Source: JICA Study Team

Table 1.4 Meetings Conducted in Vietnam, Thailand and Indonesia

Date	Main Purpose
27th August, 2012	Project introduction, activities related to EVs
27 th August, 2012	Project introduction, activities related to EVs
27 th August, 2012	Project introduction, activities related to EVs
28 th August, 2012	Project introduction, activities related to EVs
28 th August, 2012	Project introduction, activities related to EVs
28 th August, 2012	Project introduction, activities related to EVs
29 th August, 2012	Project introduction, activities related to EVs
29th August, 2012	Project introduction, activities related to EVs
29 th August, 2012	Project introduction, activities related to EVs
29 th August, 2012	Project introduction, activities related to EVs
30 th August, 2012	Project introduction, activities related to EVs
30 th August, 2012	Project introduction, activities related to EVs
	27 th August, 2012 27 th August, 2012 27 th August, 2012 28 th August, 2012 28 th August, 2012 28 th August, 2012 29 th August, 2012 30 th August, 2012

Source: JICA Study Team

Appendix 1.2 List of Collected Documents

APPENDIX1.2: LIST OF COLLECTED DOCUMENTS

Category	No.	Document	Source	Year
	GE01	Statistical Yearbook 1975-2005 of Lao PDR	Lao Department of Statistics	2005 Jul
	GE02	Annual Statistical Yearbook 2006 of Lao PDR	Lao Department of Statistics	2007 Jun
	GE03	Annual Statistical Yearbook 2008 of Lao PDR	Lao Department of Statistics	2009 Jun
	GE04	Statistical Yearbook 2010 of Lao PDR	Lao Department of Statistics	2011 Jun
General	GE05	Basic Statistics Data on Socio- Economic Development 2009/2010 of Vientiane Capital	Vientiane Capital	2011 Apr
General	GE06	Basic Statistics Data on Socio- Economic Development 2005/2006 of Vientiane Capital	Vientiane Capital	2007 Feb
	GE07	Basic Statistics Data 2010 of Luang Prabang Province	DPI, Luang Prabang	2011
	GE08	Statistical Yearbook 2009 of Savannakhet Province	DPI, Savannakhet	2010 Feb
	GE09	Statistical Yearbook 2010 of Champasack Province	DPI, Champasack	2011 Feb
	GE10	The Strategy for the Development of National Statistical System 2010-2020	Lao Department of Statistics	2010 May
	SE01	Laos Pilot Program for Narrowing the Development Gap towards ASEAN Integration	JICA	2010 Feb
	SE02	Socio-Economic ATLAS of the Lao PDR	NCCR/SDC	2008
	SE03	The Geography of Poverty and Inequality in the Lao PDR	NCCR/SDC	2008
	SE04	National Socio-Economic Development Plan 2006-2010	MPI	2006 Oct
	SE05	The Seventh Five- year National Socio-Economic Development Plan 2011-2015	MPI	2011 Oct
	SE06	Intermediate Goods Trade in East Asia: Economic Deepening Through FTAs/EPAs	IDE-JETRO	2011
	SE07	Lao PDR Economic Monitor May2011-Update_ Robust Growth Amidst Inflationary Concerns	WB	2011 May
	SE08	Lao PDR Economic Monitor November 2008	WB	2008 Nov
	SE09	Law on Investment Promotion No. 02/NA	LNCSEZ	2009 Jul
	SE10	Intra - and Inter - City Connectivity in the Mekong Region	IDE-JETRO	2011
	SE11	Official Gazette 9th Year 2001 Number Special	Ministry of Justice	2001 Apr
	SE12	Official Gazette 12th Year 2005 Number Special I	Ministry of Justice	2005
	SE13	Official Gazette 17th Year 2010 Number Special I	Ministry of Justice	2010
	SE14	Tariff Nomenclature of Lao PDR Based on ASEAN Harmonized Tariff Nomenclature (AHTN 2007/1)	MOF	2010 May
Socio-economic	SE15	Decree on Ministry of Industry and Commerce's Activities and Management	MOIC	2011 Dec
Socio-economic	SE16	Agreement on Department of Industry and Handicraft's Activities and Management	MOIC	2011 Oct
	SE17	Provincial Fuels Price Index 2002- 2010	Lao State Fuel Company	2012 May
	SE18	7th 5-year SEDP for Vientiane Capital	DPI, Vientiane Capital	2010 Mar
	SE19	Statistic of Basic Construction and Rural Development	Basic Construction and Rural Development office, Vientiane Capital	-
	SE20	Recent Number of Villages in Vientiane Capital	Basic Construction and Rural Development office, Vientiane Capital	_
	SE21	Summary of the Implementation of SEDP in 2008-2009 and the SEDP for 2009-2010 of Luang Prabang Province	DPI, Luang Prabang	2009 Oct
	SE22	SEDP 2011- 2012 for DPI of Savannakhet Province	DPI, Savannakhet	2012 Feb
	SE23	7th SEDP 2011- 2015 for Savannakhet Province	DPI, Savannakhet	2010 Jul
	SE24	Summary of the Implementation of the 6th 5-year SEDP 2006-2010 and Direction of the 7th 5-year Plan 2011-2015 for DPWT in Savannakhet	DPWT, Savannakhet	2009
	SE25	Summary of the Implementation of SEDP 2010-2011 and the SEDP for 2011-2012 for DPWT in Savannakhet	DPWT, Savannakhet	-
	SE26	Savannakhet Province Foreign Direct Investment Project Since 1992-2012	DPI, Savannakhet	2012
	SE27	Savannakhet Province Domestic and Foreign Investment Projects in each Districts 1989- 2010	DPI, Savannakhet	2012

Table 1.2.1 List of Collected Documents on Lao PDR

Category	No.	Document	Source	Year
	SE28	Savannakhet Chamber of Commerce and Industry's Organization Chart the 5th	DPI, Savannakhet	2012
	SE29	No. of Villages and Group of Villages in Kaysone District	Kaysone District Office	2010 Nov
	SE30	GDP in Pakse District	Pakse District Office	2011 Aug
	SE31	GDP Structure 2010/11 by constant price and current price in Champasack	DPI, Champasack	2012
	UP01	Project for Urban Development Master Plan Study in Vientiane Capital	JICA	2010 May
	UP02	Urban Regulation of Luang Prabang	IUDT/DWHLP	2012
	UP03	Preparatory Survey on Formulation of Basic Strategies for Regional Core Cities Development in Laos	JICA	2010 Jan
Urban Planning	UP04	UNOSAT Laos Elevation	UNOSAT	2007 Jan
	UP05	Strategy Plan on Land Use Management in Champasack Province 2010-2020	Provincial Land Management Agency	2010
	UP06	Water Analysis Report of Vientiane Capital	Water Supply Company	2011
	UP07	Brief Summary Report on Water Supply in Luang Prabang Province	Water Supply Company, Luang Prabang	-
	TS01	The Study of Master Plan on Comprehensive Urban Transport in Vientiane Capital	JICA	2008 Sep
	TS02	Outline Design Study Report on The Project for Improvement of Transportation Capacity of Public Bus in Vientiane Capital	JICA	2011 Feb
	TS03	Vientiane Sustainable Urban Transport Project: Technical Assistance Implementation of Asian City Transport	ADB	2010 Apr
	TS04	The project to Enhance the Capacity of Vientiane Capital State Bus Enterprise: Inception Report	JICA	2010 Jan
	TS05	The Project for Expansion of Vientiane International Airport in the Lao People's Democratic Republic	JICA	2011 Jul
	TS06	The Comprehensive Study on Logistics System in Lao PDR	JICA	2011 Jan
	TS07	Basic Study Report on Low Emission Vehicles for the World Heritage Sites: Luang Prabang Province	JICA/MPWT	2011 Nov
	TS08	Fuel Price	Lao State Fuel Company	2012 May
	TS09	National Strategy and Action Plan on Environment Sustainable Transport Lao PDR	DOT/PWTI	2011 Mar
	TS10	Effort on Environmentally Sustainable Transport "EST" in Laos	DOT/MPWT	2011 Jun
	TS11	H22 MOEJ/GEC NAMA Feasibility Study report	MOEJ	2010 Mar
	TS13	Low-emission Transport in Laos Concept Note	JICA	2010 Nov
	TS14	No. of Vehicles_2001-2011	DOT, MPWT	2001-2011
	TS15	Price of Vehicles in Vientiane	Study Team	2012
Transport	TS16	Clean Air for Smaller Cities in the ASEAN Region_ Review of Existing Transport Situation in Vientiane Lao PDR	GIZ	2011 Dec
	TS17	Situation of Tuk Tuk and Jumbo in Vientiane	Study Team	2012
	TS18	Summary of the Implementation of the Department of Communication, Transport, Post and Construction Plan 2006-07 and Direction Plan on 2007-08	SVN, DCTPC	2007 Apr
	TS19	Summary Report on Condition of the Implementation of the first 6 months DPWT SEDP and Forecast in the last Final 6 months 2005-2006	SVN, DCTPC	2006 Feb
	TS20	Registered Vehicle for Administration for Budget in 2010-2011	Dept. of Public Asset Management, MOF	2012 FEB
	TS21	Vehicles Registration of Government Organization and Grant- Aids Projects in 2010-2011	Dept. of Public Asset Management, MOF	2013 FEB
	TS22	Report on qualified open operation account and Investment qualification setting in sections of MPWT	DOT, MPWT	2011 Aug
	TS23	Vehicle Import Technical Permission Statistic in 2009	DOT, MPWT	2010 May
	TS24	Vehicle Import Technical Permission Statistic in 2010	DOT, MPWT	2010 Dec
	TS25	List of Assembly Factories in nationwide	Dept. of Industry, MOIC	2009
	TS26	List of Motorcycle and Car Assembly Factories	Dept. of Industry, MOIC	2011
	TS27	Statistic of Driving License Test Activities in 2010 (Appendix)	DOT, MPWT	2011 Feb
	TS28	Vehicles Registration Statistics in Lao PDR (as of December 2011)	DOT, MPWT	2012 Feb
	TS29	Regulation on Standard Inspection and parts of vehicles which allow to register assembly for using in Lao PDR	MCTPC	2002 Nov
	TS30	Statistic of Accident 2006-2011	DOT, MPWT	2006 Dec

Category	No.	Document	Source	Year
	TS31	Savannakhet Province: Officers and Organization Chart of Department of Public Work and Transport in Savannakhet	DPWT, Savannakhet	2012
	TS32	Savannakhet Province: Department of Transport Officers Statistic Phase III in 2011-2012	DPWT, Savannakhet	2012
	TS33	Savannakhet Province: Statistic of Number of Public Land Transport Vehicles	DPWT, Savannakhet	2012
	TS34	Notification of Renew Public Transport Fare on Northern and Southern Routes	MPWT	2011 Jan
	TS35	Champasack Province: Planning of Production Capacity of Partner Public Transport Association 2011-2012	DPWT, Champasack	2010 Aug
	TS36	Champasack Province: Summary of Traffic Management Performance in 2008	DPWT, Champasack	2009 Feb
	TS37	Pakse District: Report on Capacity of Public Transport Association in Pakse District 2009-2011	Pakse Public Transport Association	2012 Apr
	TS38	Regulation on Pakse Public Transport Association Establishment	DPWT, Champasack	2008 Apr
	TS39	Statistic of Capacity of Public Transport at Pakse Public Transport Association in 2010-2011	DPWT, Champasack	2011 Oct
	TS40	Statistic of Number Public Transport Vehicles of Champasack Province Public Transport Association (10 Districts) in 2009-2012	DPWT, Champasack	2012 Apr
	PS01	The Study on Rural Electrification Project by Renewable Energy in Lao People's Democratic Republic	JICA	2001 Feb
	PS02	Current Status of Power Sector in Laos_2nd Seminar on JICA Group Training& IPSM project	МЕМ	2011 Nov
	PS03	EDL Annual Report 2010	EDL	2010
	PS04	Existing Power System Diagram 2011	EDL	2011 Nov
	PS05	Lao PDR Maintenance Basic on Electrical Power Technology	JICA	1999 Dec
	PS06	Reviews on Micro-Grid Configuration and Dedicated Hybrid System Optimization Software Tools: Application to Laos	Engineering Journal	2010 Jul
	PS07	The project for Introduction of Clean Energy by Solar Electricity Generation System	JICA	2011 Mar
	PS08	The Study on Power Network System Plan in Lao PDR: Final Report	JICA	2010 Jan
	PS09	The Master Plan Study on Small Hydropower in Northern Laos Report	JICA	2003 Mar
	PS11	Planned Power System Diagram 2012	EDL	2012 Jan
	PS12	Rural Electrified Map 2020	EDL	2012 Jan
	PS13	Statistics of Electricity 2001	EDL	2001
	PS14	Statistics Of Electricity_Champasak_2005	EDL	2005
	PS15	Statistics Of Electricity Generation Supply Import And Export 1992-2010	EDL	2010
	PS16	StatisticsOfElectricityImport_2004-2010	EDL	2010
Power Supply	PS17	Statistics Of Electrification Rate_2009	EDL	2009
	PS18	Statistics Of Electrification Rate_2010	EDL	2010
	PS19	Summary of the Implementation of SEDP 2010- 2011 and annual plan 2011-2012 for DEM in Savannakhet	DEM, Savannakhet	2011
	PS20	Savannakhet Province: Wind Power Generation	DEM, Savannakhet	2012
	PS21	Savannakhet Province: Solar Panel Project Phase II	DEM, Savannakhet	2012
	PS22	Statistic of Energy Export by Nam Ngum and Xeset Systems 1974-2010, Statistic Yearbook 2010 P.11	EDL	2011
	PS23	Statistic of Energy Export From Neighboring Countries 1998-2010, Statistic Yearbook 2010 P.10	EDL	2011
	PS24	Report on The Implementation and Activities of Department of Energy and Mine in Savannakhet Province: Organization Chart and Officers Statistic	DEM, Savannakhet	2012 Apr
	PS25	Electricity Tariff 2006- 2011	EDL	2011
	PS26	Notification of Budget Permission on Public Investment 2011-2012 in DEM of Savannakhet	DPI, Savannakhet	2011 Oct
	PS27	Renew Electric Tariff	MEM	2012 Mar
	PS28	Power Development Plan 2010-2020_Part I Present Status	System Planning Office	2012
	PS29	Power Development Plan 2010-2020_Part I Present Status: Appendix 1 (Present Status)	System Planning Office	2012
	PS30	Statistic of Electric Use in Nationwide by Feb 2012	EDL	2012
Tourism	T01	Information Culture & Tourism Champasak Budget & Expenditure 2010,2011,2012	DOICT, Champasak	2012

Category	No.	Document	Source	Year
	T02	2009 Statistical Report on Tourism in Laos	LNTA	2010
	T03	Lao PDR Tourism Strategy 2006-2020	LNTA	-
	T04	Savannakhet Province: The Implementation of Tourism Development Plan 2006-2010 and Tourism Promotion 2011-2015	JICA	2010 May
	T05	2010 Statistical Report On Tourism in Laos	LNTA	2011
	T06	The past Organization Chart of Department of Tourism in Savannakhet Province	SVN DoT	2011
	T07	Brief Biography of Officers in Department of Tourism in Savannakhet Province	SVN DoT	2012 Mar
	T08	Champasack Province_ Report on Provincial Tourism Performance	DOICT, Champasak	-
	Т09	Communique of Visit Lao Year 2012 in Champasack Province	DOICT, Champasak	2012
	EN01	Air Quality Monitoring Plan for Vientiane Capital Lao PDR Review: Existing Air Quality Standards/Data	GIZ	2011 Sep
	EN02	Strategy on Climate Change of the Lao PDR	ADB/WREA/WB	2010 Mar
	EN03	Establishment Of Hydrological Information System Mekong River Basin project document	WMO/MRC	2006 Jul
	EN04	Country Program Strategy GEF Small Grants Program Lao PDR	UNDP	-
	EN05	LAO PDR - EUROPEAN COMMUNITY STRATEGY PAPER for the period 2007-2013	EU	-
	EN06	Evaluation of UNDP Lao PDR Environment Program Final Draft	UNDP	2009 Aug
	EN07	Lao PDR Environment Monitor 2005	WB	2005
	EN08	Laos Agreement on the National Environmental Standards 2010	PMO	2010
	EN09	Laos National Report on Protected Areas and Development Lower Mekong River Region	ICEM	2003
	EN10	MONRE Plan for 2011-2015	MONRE cabinet	2010 Jul
	EN11	Road Map Towards Clean Air Plan For Vientiane Capital	GTZ	2010 May
	EN12	Laos Country Profile 1997	JICA	1997 Mar
	EN13	The 2nd 5 Year Plan Implementation of Environment 2011-2015 in Savannakhet	SVN Water Resource and Environment Office	2010 May
- · · ·	EN14	Integrated Environment Management Plan In Champasack Province	SIDA/	2010
Environment	EN15	Environment Strategy from 2003-2020, 2010 and 5 Year Implementation of Environment (2001-2005)	SEM/ CPS	2003
	EN16	The 2nd 5 Year Plan Implementation of Environment 2011-2015 in Champasack	CPS Water Resource and Environment Office	2011 Jan
	EN17	The Agreement on the Implementation and Activity of Department of Natural Resource and Environment in Savannakhet Province	MONRE	2012 Mar
	EN18	National Greenhouse Gas Inventory for Lao PDR 2000	Water Resource and Environment Agency	2011
	EN19	Decree on Establishment and Activities of the Ministry of Natural Resources and Environment	МОНА	2011 Oct
	EN20	Tree Map of Impact on Climate Change Paper Note	MONRE	-
	EN21	Institute of Renewable Energy Promotion Structure	IREPS	2012
	EN22	Memorandum of Understanding On Environmental Protection Cooperation Between MONRE of Lao PDR and The MOEP of China	MONRE	-
	EN25	Standard For Diesel	Science, Technology and Environment Agency, PM Office	2001
	EN26	Standard For Gasoline	Science, Technology and Environment Agency, PM Office	2001
	EN31	Technical Guidelines on Compensation and Resettlement of People Affected by Development Project	WREA/PM Office	2011 Jun
	G01	DPWT Champasak : Budget 2010-2013	DPWT Champasak	2011 Nov
Governor	G02	Laos Government Chart	Web-site	-
	G03	MPWT Chart	MPWT	-
	L01	Customs Law 2005	President's Office	2005 May
Law	L02	Electricity Law 1997	President's Office	1997 May
	L03	Environmental Protection 1999	President's Office	1999 Apr

Category	No.	Document	Source	Year
	L04	Forestry Law 1996	National Assembly	1996 Oct
	L05	Government Of The Lao PDR Law 2003	President's Office	2003 May
	L06	Labor Law 2006	President's Office	2007 Jan
	L07	Land Law 2003	President's Office	2003 Nov
	L08	Land Traffic Law 2000	President's Office	2000 May
	L09	Land Transport Law 1997	President's Office	1997 May
	L10	Laos tariff and duty rates	ASEAN Secretariat	2011
	L12	Local Administration Law 2003	President's Office	2003 Nov
	L13	Mining Law 1997	President's Office	1997 May
	L14	National Heritage Law 2005	National Assembly	2005 Dec
	L15	Processing Industry Law 1999	President's Office	1999 Apr
	L16	Public Roads Law 1999	President's Office	1999 Apr
	L17	State Budget Law 2006	President's Office	2006 Jan
	L18	Tax Law 2005	President's Office	2005 May
	L19	Tourism Law 2005	President's Office	2005 Dec
	L20	Urban Plans Law 1999	National Assembly	1999 Apr
	L21	Water And Water Resources Law 1996	President's Office	1996 Nov

Source: JICA Study Team

Table 1.2.2 List of Collected Documents on Other Countries

Country	No.	Name of Documents	Source	Year
	JN01	Best Practice of EV • PHV Town Concept	METI	'10/08
	JN02	METI Journal	METI	'11/03
	JN03	City Planning with Electric Vehicle	MLIT	'11/02
	JN04	Support Business List of Promotion Business of Green Public Transportation by EV	MLIT	_
	JN05	Relation between EV and Community - Lessons learn from EV/PHV -	DBJ	'11/01
	JN06	Aichi Prefecture: Action Plan of EV • PHV Town Promotion	Aichi Prefecture	'09/06
	JN07	Aichi Prefecture: Master Plan of EV • PHV Town Promotion (Revised in 2010)	Aichi Prefecture	'11/03
	JN08	Aomori Prefecture: Action Plan of EV • PHV Town Promotion	Aomori Prefecture	'09/06
	JN09	Aomori Prefecture: Master Plan of EV • PHV Town Promotion	Aomori Prefecture	'10/02
	JN10	Kanagawa Prefecture: Action Plan of EV • PHV Town Promotion	Kanagawa Prefecture	'09/09
	JN11	Kanagawa Prefecture: Master Plan of EV • PHV Town Promotion	Kanagawa Prefecture	'10/03
	JN12	Kyoto Prefecture: Action Plan of EV • PHV Town Promotion	Kyoto Prefecture	'09/08
Japan	JN13	Tokyo Prefecture: Action Plan of EV • PHV Town Promotion	Tokyo Prefecture	'09/10
Japan	JN14	Nagasaki Prefecture: Action Plan of EV • PHV Town Promotion	Nagasaki Prefecture	'09/09
	JN15	Nagasaki Prefecture: Master Plan of EV • PHV Town Promotion	Nagasaki Prefecture	'10/02
	JN16	Niigata Prefecture: Action Plan of EV • PHV Town Promotion	Niigata Prefecture	'09/06
	JN17	Niigata Prefecture: Master Plan of EV • PHV Town Promotion	Niigata Prefecture	'10/03
	JN18	Fukui Prefecture: Action Plan of EV • PHV Town Promotion	Fukui Prefecture	-
	JN19	Fukui Prefecture: Master Plan of EV • PHV Town Promotion	Fukui Prefecture	'10/03
	JN20	Guidebook 2010 of Low emission vehicle	MOE	'10
	JN21	Economic Report: Future of Vehicle vision by low emission	Hitachi	'10/09
	JN22	Next Generation Vehicle Strategies 2010	METI	'10
	JN23	New Growth Strategy - Scenario for Revival of Vitality Japan -	PM	'10/06
	JN24	Study on Utilization of Parking Space for Charging Spot of EV	ALMEC	11/02
	JN25	Next Generation Vehicle Promotion Strategies	Research committee on strategies for next generation vehicles	'08/05

Country	No.	Name of Documents	Source	Year
	JN26	Application documents for special zone for local activation	-	-
	JN27	Questionnaire Survey Result of Concept on EV • PHV Town	Universal Energy Research Institute	10/04
	JN28	EV Project for Supporting "Shiojiri" as future environmental city	Hito • Mono organization	'11/5/20
	JN29	Town with EV/ Nagasaki EV & ITS Project	Nagasaki Prefecture	11/09
	AC01	ELCIDIS -Electric Vehicle City Distribution-	EC	'02
	AC02	Tindo -The World's First Solar Electric Bus-	ADELAIDE	-
	AC03	LISELEC: self-service electric cars - La Rochelle	penelope bacchus	'02/10
	AC04	London's Electric Vehicle Infrastructure Strategy	London	'09/12
	AC05	The Environmental Impacts on Car-sharing Use	тото	'09/06
	AC06	Action of Electric Vehicle in Europe 1 (UK, German, France)	JETRO	'11/10
Advanced	AC07	Action of Electric Vehicle in Europe 2 (Italy, Spain, Netherlands, Swiss, Austria)	JETRO	'11/10
Countries	AC08	[EU] Regulation on CO2 emission control for vehicle	National Diet Library	11/07
	AC09	Eco-car strategies of leading countries - trend of EV -	Sekio Higuchi	10/01
	AC10	One Million Electric Vehicles By 2015 (February 2011 Status Report)	US DOE	11/02
	AC11	Zweiter Bericht der Nationalen Plattform Elektromobilität (German)	Nationalen Plattform Elektromobilität	_
	AC12	Electrification Roadmap (USA)	Electrification Coalition	'09/11
	AC13	California' s Zero Emission Vehicle Program	California Air Resources Board	'09/06
	DC01	The China New Energy Vehicles Program -Challenges and Opportunities-	WB	'11/04
	DC02	Electric Bikes in the People's Republic of China -Impact on the Environment and Prospects for Growth-	ADB	'09
	DC03	Electric Two-Wheelers in India and Vietnam -Market Analysis and Environmental Impacts-	ADB	'09
Developing	DC04	E-Trikes Driving Change -Pilot results and preliminary implementation plan - for discussion	ADB	'11/07
Countries	DC05	Implementation of Asian City Transport -Promoting Sustainable Urban Transport in Asia Project	ADB	'11/07
	DC06	Environmentally Sustainable Transport and Climate Change -Experiences and lessons from community initiatives-	GEF	'06/11
	DC07	Vehicle Fuel Economy in the ASEAN and Perspectives on EV Integration	CAI	'11/07
	DC08	Introduction of electric three-wheelers in Kathmandu, Nepal	APEIS	'02
	FE01	Trend of auto-industry market in China	Sekio Higuchi	09/11
	O01	Outline of Low Speed Electric Vehicle (LSEV)	Sekio Higuchi	'11/11/08
Others	O02	Downsizing of EV in overseas market/ Possibility of domestic market from the view point of conversion	Yano Research Institute Ltd.	_
	O03	Energy Efficient Electric Vehicles	Mikio Tsunekawa	-
	O04	Energy Efficiency of fleet used electric Vehicles	Tomio Onoda	-

Source: JICA Study Team

Appendix 1.3 Driving Behavior in Vientiane Capital

APPENDIX1.3: DRIVING BEHAVIOR IN VIENTIANE CAPITAL

6.1 To get the driving pattern in Vientiane several vehicles driving behavior were monitored. This study is done by the GPS monitoring system, and also the battery temperature was acquired for electric mini bus.

6.2 The target vehicles are minibus, small e-bus, passenger car, motorcycle, taxi, songthaew, tuktuk and Jumbo. From the survey, the following items could be identified for each vehicle: speed, acceleration, braking, climbing, driving distance and driving pattern.

				Driving Dis	tance (km)		Operation		D · · · · ·	No. of	Vmax
				*1	*2	start	end	time	Driving time	Trip	km/h
		01 00 0010	Jumbo 1	110.8	108.5	8:40	19:04	10:24	5:27	6	46.3
		21-02-2012	Jumbo 2	31.5	29.3	9:12	17:07	7:55	1:58	6	29.1
		00.00.0040	Jumbo 1	71.3	69.4	8:17	13:58	5:41	2:49	3	72.2
4	h week e	22-02-2012	Jumbo 2	39.8	36.4	9:21	15:12	5:51	1:49	5	38.3
	Jumbo	25-02-2012	Jumbo 1	54.1	50.4	8:37	19:01	10:24	2:22	6	47.6
		20-02-2012	Jumbo 2	43.7	37.1	7:20	18:06	10:46	2:26	8	55.9
		26-02-2012	Jumbo 1	46.9	44.8	8:31	17:55	9:24	1:58	6	46.6
		20-02-2012	Jumbo 2	17.2	12.0	8:22	18:30	10:08	0:58	6	37.3
			Tuktuk 1	75.2	74.3	7:37	18:51	11:14	3:28	5	34.8
		23-02-2012	Tuktuk 2	101.1	100.0	11:08	18:29	7:21	4:17	3	23.4
		23-02-2012	Tuktuk 3	28.5	20.7	7:02	20:01	12:59	1:06	5	44.7
2	Tuktuk		Tuktuk 4	54.7	50.9	7:09	21:19	14:10	2:17	8	51.3
2	TUKLUK		Tuktuk 1	85.7	82.5	10:01	17:52	7:51	3:35	3	62.1
		24-02-2012	Tuktuk 2	23.0	17.8	7:43	13:50	6:07	2:01	4	38.5
		24-02-2012	Tuktuk 3	16.6	14.2	6:52	16:25	9:33	0:48	3	37.3
			Tuktuk 4	44.0	40.8	9:37	17:03	7:26	2:18	8	46.9
			Songthaew 1	96.6	95.1	6:14	18:19	12:05	5:52	4	52.0
		28-02-2012	Songthaew 2	183.2	181.1	4:19	19:45	15:26	7:53	12	76.8
		20-02-2012	Songthaew 3	78.2	70.2	5:16	16:44	11:28	4:02	10	21.3
3	Sonothoow		Songthaew 4	83.5	77.6	5:14	18:01	12:47	4:44	7	62.2
3	Songthaew		Songthaew 1	102.3	98.1	5:23	18:39	13:16	5:05	12	64.4
		29-02-2012	Songthaew 2	104.5	101.1	3:58	19:58	16:00	5:13	5	68.2
		29-02-2012	Songthaew 3	86.9	85.1	6:17	18:00	11:43	3:57	7	58.1
			Songthaew 4	101.2	100.0	11:04	18:29	7:25	4:23	3	23.4
		01-03-2012	Taxi 1	142.8	138.2	8:13	20:43	12:30	6:13	10	71.1
	Taxiand	01-03-2012	Taxi 2	90.7	86.0	7:48	19:06	11:18	7:04	7	57.1
		01-03-2012	Taxi 3	113.4	107.0	8:15	23:10	14:55	6:13	13	78.1
4		01-00-2012	Taxi4	173.5	168.8	8:07	0:00	15:53	7:52	10	65.1
4		01-03-2012	Songthaew 1	179.4	178.3	8:20	18:11	9:51	6:28	4	80.0
	Large	01-03-2012	Songthaew 2	60.9	56.4	6:55	18:16	11:21	8:07	4	65.0
	Songthaew	01-03-2012	Songthaew 1	179.8	179.0	7:36	17:52	10:16	5:46	6	60.0
		01-03-2012	Songthaew 2	305.0	303.9	6:33	18:06	11:33	6:37	5	72.9
		06-03-2012	Electric Bus 1	69.5	67.5	7:18	17:47	10:29	5:19	5	33.9
F	Electric hus	00-03-2012	Electric Bus 2	53.4	50.4	7:50	14:44	6:54	4:03	6	30.2
5	Electric bus	07 03 2012	Electric Bus 1	39.0	36.1	7:17	12:09	4:52	2:47	3	32.7
		07-03-2012	Electric Bus 2	61.8	58.8	7:54	16:14	8:20	4:46	7	31.5

Table 1.3.1 Aqcuired Data from GPS Survey

				Driving Dis	tance (km)		Operation		D	No. of	Vmax
				*1	*2	start	end	time	Driving time	Trip	km/h
		06-03-2012	Small Bus 1	152.0	151.0	6:42	17:52	11:10	9:12	7	55.2
		00-03-2012	Small Bus 2	167.4	166.9	6:30	18:01	11:31	9:07	6	53.0
		07-03-2012	Small Bus 1	167.3	166.8	6:19	17:58	11:39	9:08	6	52.2
		07-03-2012	Small Bus 2	4.8	4.0	7:05	7:29	0:24	0:24	1	60.4
			Small Bus 1	215.9	215.4	7:30	18:26	10:56	9:17	7	60.8
6	Small bus	08-03-2012	Small Bus 2	231.7	230.4	5:46	16:39	10:53	8:18	9	76.9
0	Small bus	00-03-2012	Small Bus 3	278.3	277.9	6:04	18:55	12:51	10:07	10	72.6
			Small Bus 4	170.9	170.1	6:34	14:07	7:33	6:20	7	89.7
			Small Bus 1	52.9	52.2	7:41	15:31	7:50	2:30	2	61.3
		09-03-2012	Small Bus 2	281.1	280.6	6:17	19:31	13:14	10:27	10	67.9
		09-03-2012	Small Bus 3	280.8	279.6	6:40	19:52	13:12	10:57	10	78.0
			Small Bus 4	221.9	221.7	7:21	17:21	10:00	8:02	9	70.0
			Private MC 1	44.1	41.1	10:16	20:32	10:16	2:02	6	53.0
		13-03-2012	Private MC 2	25.9	22.0	10:54	21:30	10:36	1:18	6	45.9
		13-03-2012	Private MC 3	47.6	44.1	9:36	19:10	9:34	1:58	8	50.4
7	Private		Private MC 4	47.6	44.1	9:36	19:10	9:34	1:58	8	50.4
1	motorcycle		Private MC 1	15.0	10.2	6:56	15:58	9:02	0:33	3	42.0
		14-03-2012	Private MC 2	64.8	62.2	9:20	16:44	7:24	3:14	6	48.0
		14-03-2012	Private MC 3	64.8	62.2	9:20	16:44	7:24	3:14	6	48.0
			Private MC 4	36.5	32.3	17:02	18:31	1:29	1:07	2	60.0
			Private car 1	38.0	37.7	8:13	15:41	7:28	2:03	5	71.0
		45 00 0040	Private car 2	21.1	19.9	9:14	21:57	12:43	0:50	5	64.0
		15-03-2012	Private car 3	21.6	19.6	12:18	18:16	5:58	1:01	5	65.0
8	Drivete cor		Private car 4	62.9	59.0	8:33	21:01	12:28	2:12	5	67.0
õ	Private car		Private car 1	21.2	18.1	11:44	16:05	4:21	0:49	6	57.0
		16 02 2012	Private car 2	23.0	21.1	9:02	22:10	13:08	0:58	6	54.0
		16-03-2012	Private car 3	14.6	10.9	9:05	19:00	9:55	1:01	5	45.0
			Private car 4	46.0	40.7	8:11	23:44	15:33	1:15	0	64.0

Source: Vehicle Operating Condition Survey by JICA Study Team (2012)

*1: calculated from all the GPS data

*2: calculated from the GPS data excluding less than 1.0km/h in speed

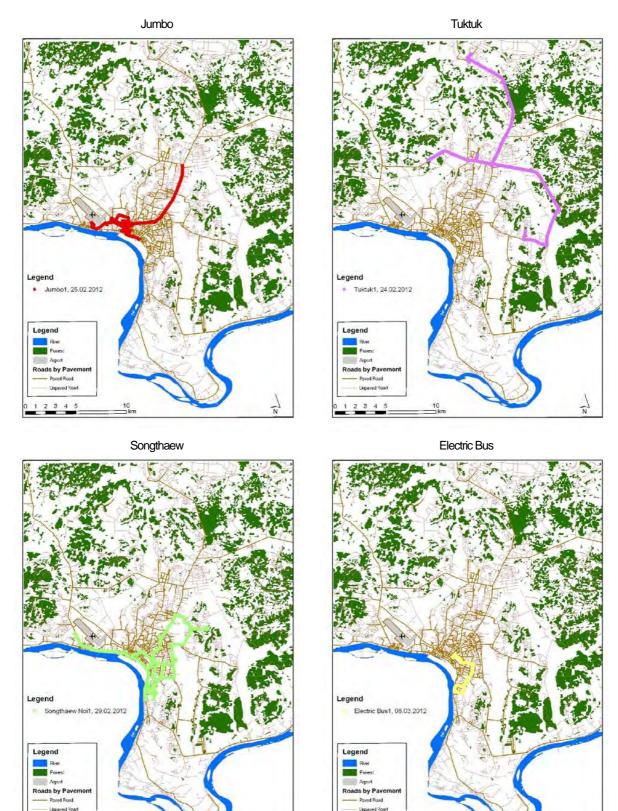


Figure 1.3.1 Route Map of Target Vehicles

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Appendix 1.4 Questionnaire Sheet for Transport Attitude Survey

APPENDIX1.4: QUESTIONNAIRE SHEET FOR TRANSPORT ATTITUDE SURVEY

PART 1 HOUSEHOLD INFORMATION

Q1.1	Name			
Q1.2	Address	a. Street	b. Village	c. District

Q1.3 Personal Information about household members (those who live with respondent)

No.	a Name	b Gender	c Age	d Relationship with HH head	e Occupation
1			0	Household (HH) Head	· · · · ·
2					
3					
4					
5					
6					
7					
8					

b. Gender	1. Male 2. Female	c. Age	Fill in the column
d. Relationship	1. Parents/Parents-in-law	3. Son/Daughter 5. Friend	7. Others
with HH Head	2. Wife/Husband	4. Relative 6. Housekeepe	r/Baby sitter (Specify)
e. Occupation	01. Agriculture (Rice)	13. Company Manager (service)	23. Sonthew Driver
	02. Agriculture (Other)	14. Company Employee (service)	24. Tuk Tuk/Jumbo Driver
	03. Husbandry	15. Public worker (National/Capital level)	25. Monk/Trainee Monk
	04. Fishery	16. Public Worker (District/Village level)	26. Housewife/Househusband
	05. Forestry	17. Teacher/Tutor	27. Primary School Student
	06. Commercial Business	18. Doctor/Dentist	28. Lower Secondary School Student
	07. Retail (small scale)	19. Civil Engineer/Architect	29. Upper Secondary School Student
	08. Restaurant/Café/Bar	20. Construction worker	30. University/College Student
	09. Hotel/Guesthouse	21. Truck Driver	31. Vocational School Student
	10. Factory Manager	22. Bus Driver	32. Retired
	11. Factory Worker		33. Others (Specify)
	12. Repairing/Mechanician		· · · ·

Q1.4 Total monthly household income (LAK)

01.	Under 299,999	05.	2,000,000 - 2,999,999	09.	8,000,000 –9,999,999
02.	300,000 – 599,999	06.	3,000,000 - 3,999,999	10.	10,000,000 – 14,999,999
03.	600,000 - 999,999	07.	4,000,000 - 5,999,999	11.	15,000,000 or more
04.	1,000,000 - 1,999,999	08.	6,000,000 - 7,999,999		

Q1.5 Housing Information

a. Year of Curre Address	nt	b. Type of House		c. Total Floor Area (m ²)	d. No. of Room		e. Ownership
							1. Own 2. Rental
b. Type of House 1. Traditional house		Traditional house	3.	5. High-rise apartment (more than 10 floors) 5.			Commercial house/town house
2. Apartment			4.	Villa/Individual house			

Q1.6 Vehicle and property ownership by household

Types of Vehicle	No.	Types of Vehicle	No.	Types of Property	No.
1) Bicycle		8) Pick-up		14) TV	
2) Electric Bicycle		9) Truck		15) Refrigerator	
3) Motorcycle (<50cc)		10) Tuk Tuk		16) Washing Machine	
4) Motorcycle (>=50cc)		11) Jumbo		17) Telephone (fixed)	
5) Electric Motorcycle		12) Sonthew		18) Computer	
6) Car (<=5pax)		13) Tractor		19) Internet Connection	
7) Van (>5pax)				20) Air-conditioning	
				21) Mobile phones	

PART 2 HOUSEHOLD MEMBER'S INFORMATION

A. Commuting Condition

Q2.1 Please fill the information about trip to work/school

		a. Street				b. Village		
1)	Address of workplace/school	c. District	c. District					
2)	Employment form (only for worker)	1. Regular	2.Contractual	;	3. Other (specify)	
3)	Working/School day				days/week			
4)	Working/School hour (24 hours)	a. From:	b. To:		(c.	hours/day	')	
5)	Commuting mode	 01. Walking 02. Bicycle 03. Motorcycl 04. Motorcycl 05. Car Drive 	le passenger	06. 07. 08. 09.	Car Passenger Minibus (<=25 p Standard Bus (> Tuk Tuk/Jumbo		10. 11. 12. 13.	Sonthew Taxi Truck Others (specify)
6)	Commuting time (house to workplace/school)	a. With normal b. With traffic c			minu minu			

B. Condition of Main Trip during Weekday

Q2.2 Please fill the information on your main trip from home on a weekday (the most recent weekday trip)

Instruction: Please choose the number from the box for PURPOSE and FACILITY

1)	Date of Trip (month/day)	1		2) Purpose			3) Facility of des		stination		
4)	Address of Destinati	estination		eet b.		b. Village		c. District		d. Province	
5)	5) Time Departure (24 hours)					6)	Time Arrival (24 I	hours)			
7)	7) Total Time Spent (min.)					8)	Total Expenses (LAK)			

Q2.3 Please fill the mode and transfer information

Instruction: Please choose the travel mode and location of transfer from the following box.

Start(Home)	First	Second	Third	Fourth	Destination
1) Travel Mode	a.	b.	с.	d.	
2) Location of Transfer		a.	b.	c.	
3) Transfer Time (minutes)		a.	b.	c.	

	TF	RIP PURP	OSE			FACIL	ITY
01.	To Home	06.	To Go Shopping/Market	01.	Residence	08.	Wholesale/Retail shop
02.	To Work	07.	To Eat (not at home)	02.	Office/Bank	09.	Restaurant/Entertainment
03.	To School	08.	Social/Recreation	03.	Public administrative	10.	Park/Green space
04.	At work/Business	09.	Other Private Purpose		offices	11.	Field/Garden/Forest
05.	To send/pick up other famil	ly		04.	Factory/Warehouse	12.	Railway station/Bus station
	member or friend			05.	School/University	13.	Others (specify)
				06.	Medical/Welfare		
				07.	Religious/Social		
	MOI	DE OF TR	AVEL		LOCA	TION OF	TRANSFER
01.	Walking	08.	Standard Bus (>25 pax)	01.	Central Bus Station	(05. Thanaleng Railway Station
02.	Bicycle	09.	Tuk Tuk/Jumbo	02.	South Bus Station	(06. Bus Stops
03.	Motorcycle driver	10.	Sonthew	03.	Northern Bus Station	(07. Others
04.	Motorcycle passenger	11.	Taxi	04.	Friendship Bridge		(specify)
05.	Car Driver	12.	Truck				
06.	Car Passenger	13.	Others				
07.	Minibus (<=25 pax)		(specify)				

Q2.4 Assessment of the trip condition

	No Problem	So-So	Problem	Sever Problem
1) Travel Time	1	2	3	4
2) Safety	1	2	3	4
3) Air Environment/Noise	1	2	3	4
4) Accessibility	1	2	3	4
5) Waiting Time	1	2	3	4
6) Parking	1	2	3	4
7) Fare	1	2	3	4

Q2.5 Please write main transportation problems which you are facing.

C. Condition of Main Trip during Weekday

Q2.6 Parking condition at home

1) Parking location	1. Own house	3. On-road parking lot	5. Sidewalk
T) Farking location	Parking location Iteration Iteration		6. Others (specify)
2) Darking charge	1. Free	3. 30,000-49,999 LAK/month	5. 100,000-149,999 LAK/month
2) Parking charge	2. Less than 30,000 LAK/month	4. 50,000-99,999 LAK/month	6. More than 150,000 LAK/month

Q2.7 Parking situation related to work trip

1) Turne of uchiele	1. Motorcycle 3. Sedan	5. Van	7. Others
1) Type of vehicle	2. Light vehicle 4. Pick-u	p 6. Truck	(specify)
2) Derking leastion	1. Parking of workplace	3. On-road parking lot	5. Sidewalk
2) Parking location	2. Other off-road parking space	4. Roadside	6. Others (specify)
2) Dedian shares	1. Free	3. 30,000-49,999 LAK/month	5. 100,000-149,999 LAK/month
3) Parking charge	2. Less than 30,000 LAK/month	4. 50,000-99,999 LAK/month	6. More than 150,000 LAK/month
4) Safety at parking	1. Very bad 2. Bad 3. So-so	4. Good 5. Very good	

Q2.8 Parking situation related to business/private trip

1)	Tupo of vohiolo	1. Motorcycle 3.	Sedan	5. Van	7. Others
1)	Type of vehicle	2. Light vehicle 4.	Pick-up	6. Truck	(specify)
2)	Darking logation	1. Parking of destination	3. On-road pa	arking lot	5. Sidewalk
2)	2) Parking location 2. Other off-road parking space		4. Roadside		6. Others (specify)
2)	Darking charge	1. Free	3. 30,000-49,	999 LAK/month	5. 100,000-149,999 LAK/month
3)	Parking charge	2. Less than 30,000 LAK/month	4. 50,000-99,	999 LAK/month	6. More than 150,000 LAK/month
4)	Safety at parking	1. Very bad 2. Bad 3. So	o-so 4. Good	5. Very good	

Q2.9 Main parking problems you are facing?

	No Problem	So-So	Problem	Sever Problem
1) Space at home	1	2	3	4
2) Space at workplace	1	2	3	4
3) Space at destination in city center	1	2	3	4
4) Safety for parking	1	2	3	4

Q2.10 Which area do you find the most difficulties in term of parking?

a. Street	b. Village	c. District
	g-	

Q2.11 How much are you willing to pay for parking?

		Less than 999	1,000 – 1,499	1,500 – 2,999	3,000 - 4,999	More than 5,000
		LAK/hour	LAK/hour	LAK/hour	LAK/hour	LAK/hour
1) On-road		1	2	3	4	5
2) Off-road	a. Open	1	2	3	4	5
	b. With shade	1	2	3	4	5
	c. Building	1	2	3	4	5

PART 3 NEEDS AND PRIORITY OF IMPROVEMENT POLICY FOR TRANSPORT

Instruction: Assess the necessity of each measure (1(lowest) to 5 (highest)) Choose 5 most important measures and check (✔) in "❑" of "B. Most Important Aspect"

	Measures			A.	Necess	sity		B. Most Important	1		
			Lowest	Lower	Fair	Higher	Highest	Aspect (choose 5 measures)		A	В
Road Facility	1) Main roa	d	1	2	3	4	5		1)		
	2) Minor roa	ad	1	2	3	4	5		2)		
	3) Pavemer	nt	1	2	3	4	5		3)		
	4) Drainage)	1	2	3	4	5		4)		
Traffic	5) Traffic sig	gnal	1	2	3	4	5		5)		
Management	6) Safety fa	cility	1	2	3	4	5		6)		
	7) Lane ma	rking	1	2	3	4	5		7)		
	8) Traffic co	ontrol/enforcement	1	2	3	4	5		8)		
	9) Driving n	nanner	1	2	3	4	5		9)		
Parking	10) Parking	a. On-road	1	2	3	4	5		10)a		
	space	b. Off-road	1	2	3	4	5		10)b		
	11) Parking f	acilities with fee	1	2	3	4	5		11)		
Public	12) Tuk Tuk/Jumbo 13) Sonthew		1	2	3	4	5		12)		
Transport Improvement			1	2	3	4	5		13)		
	14) Taxi		1	2	3	4	5		14)		
	15) Bus	a. Small	1	2	3	4	5		15)a		
		b. Large	1	2	3	4	5		15)b		
NMT Condition	16) Walking	a. More sidewalk	1	2	3	4	5		16)a		
		b. Walking condition	1	2	3	4	5		16)b		
		c. Street lighting	1	2	3	4	5		16)c		
		d. Trees/Shade	1	2	3	4	5		16)d		
	17) Bicycle	a. Bicycle lane	1	2	3	4	5		17)a		
		b. Safe parking	1	2	3	4	5		17)b		
Improvement	18) Vehicle i	nspection	1	2	3	4	5		18)		
of Vehicle Condition	19) Registrat	tion control	1	2	3	4	5		19)		
	20) Incentive vehicle	e for low-emission	1	2	3	4	5		20)		

PART 4 INTRODUCTION OF ELECTRIC VEHICLES AND FUTURE TRAVEL MODE

Q4.1. What are your preferred bus services within Vientiane?

uency:	at least		times per hour
	at most	L	AK per trip
nsfer:	at most		times per trip
house to the nearest bus stop:	at longest	meters	
g service in the morning:	at least	before	:
ating service in the evening:	at least	after	:
r	quency: nsfer: house to the nearest bus stop: ng service in the morning: nating service in the evening:	at most nsfer: at most house to the nearest bus stop: at longest ng service in the morning: at least	at mostL nsfer: at most house to the nearest bus stop: at longest meters ng service in the morning: at least before

Q4.2. What are your ideal living environments? Indicate the distance to daily facilities nearby your home.

1)	To your workplace:	at longes	st	_km	
2)	To kinder garden:		at longe	st	_km
3)	To primary school:	at longes	st	_km	
4)	To lower secondary school:		at longe	st	km
5)	To upper secondary school:	at longes	st	_km	
6)	To the market		at longe	st	_km
7)	To the park		at longe	st	km
8)	To the hospital		at longe	st	km
9)	To the nearest bus stop		at longe	st	_km
10)	To city hall	at longes	st	_km	
11)	To city center		at longe	st	km
12)	To your relatives		at longe	st	_km

Q4.3. How do you know about electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) and electric motorcycles?

Type of new vehicles		Recognition level			
1) EV: Electric Vehicle	1. Don't know	2. Know the name, but don't know how it works.	3. Know how it works.	1)	
2) PHEV: Plug-in Hybrid Electric Vehicle	1. Don't know	2. Know the name, but don't know how it works.	3. Know how it works.	2)	
3) Electric motorcycle	1. Don't know	2. Know the name, but don't know how it works.	3. Know how it works.	3)	

What are your preferred attributes of EVs/PHEVs and electric motorcycles?

Before answering this question, please first read the following statements related to EVs/PHEVs and electric motorcycles.

An EV is powered entirely by electricity via batteries instead of gasoline.
1) Current cruising range with a full charge of battery: 125-150 km
2) Battery capacity: 20-30 kWh
3) Battery charging time: 5~8 hours
4) Fuel cost: 93-124 LAK/km
5) Tailpipe emission: 0
6) Maintenance cost: lower than conventional car
7) Body price: Expensive than conventional car under the current technology level
8) Battery can be used as an alternative power supply for in-home energy usage
A PHEV is a gasoline-electric hybrid vehicle that can be recharged by connecting a plug to a normal electric wall
socket, allowing increased range and thereby reducing the cost of operation. For daily driving, usually, 80% of the
energy to drive a car comes from the battery and the remaining 20% comes from gasoline.
1) Current cruising range with a full charge of battery: 40-80 km
2) Battery capacity: 6-10 kWh
3) Battery charging time: 2~3 hours
4) Fuel cost: 93-124 LAK/km (when only electricity is used)
5)Tailpipe emission: lower than conventional car
An electric motorcycle has the same characteristics with EV: zero-emission, low-noise and high-energy
efficiency.
All the above three types of vehicles are required to be charged or batteries need to be swapped at some
places. It is expected that future technologies will further improve the performance of the above three types of

vehicles.

Assume that you want to buy an electric car, plug-in hybrid car, or electric motorcycle. Please choose FIVE important attributes respectively for car and motorcycle by ticking in the " \Box ". If there is an () after the attribute you choose, please write down your tolerance limit.

Q4.4. Please answer the important attributes of Electric/Plug-in Hybrid Cars (EV/PHEVs) for your own use.

	Attributes	A. Important or not? (tick up to FIVE)	B. Tolerance limit: An upper or lower bound beyond which EV/PHEV will be definitely rejected from consideration.	A	\
1)	Car body price		Highest acceptable price () LAK	1)	
2)	Incentive: Whether the price difference from conventional car will be subsided by government or not.		At least (%) of the price difference from conventional car should be subsided.	2)	
3)	Distance to the nearest charge station from your primary origin/destination		At longest (km)	3)	
4)	Charge time		At longest (hours)	4)	
5)	Cruising range: The distance that the EV/PHEV can be driven with a full charge of battery		At least (km)	5)	
6)	Battery life expectancy: How many years the battery can be used.		At least (years)	6)	
7)	Maintenance cost per year			7)	
8)	Fuel cost per kilometer			8)	
9)	Vehicle type: Sedan, Van, SUV, or pick-up truck, etc.			9)	
10)	Fuel type: Electric, or hybrid with gasoline			10)	
11)	Vehicle size: number of sheets		At least (seats)	11)	
12)	Acceleration: The amount of time (in seconds) that the vehicle would take to travel from 0 km/h to 60 km/h.		At longest (second)	12)	
13)	Gradability: The speed that the EV/PHEV could maintain while climbing a mountainous grade with a full load.			13)	
14)	Engine displacement		At least (cc)	14)	
15)	Brand name and model			15)	
16)	Secondary usage of battery: Work as an alternative power supply for in-home energy usage.		Available time for secondary usage: at least (hours)	16)	

	Attributes	A. Important or not? (tick up to FIVE)	B. Tolerance limit: An upper or lower bound beyond which electric motorcycles will be definitely rejected from consideration.	<u>_</u>
1)	Purchasing price		Highest acceptable price () LAK	1)
2)	Incentive: Whether the price difference from conventional car will be subsided by government or not.		At least (%) of the price difference from conventional motorcycle should be subsided.	2)
3)	Distance to the nearest charge station from your primary origin/destination		At longest (km)	3)
4)	Charge time		At longest (hours)	4)
5)	Battery life expectancy: How many years the battery can be used.		At least (years)	5)
6)	Maximum speed		At least (km)	6)
7)	Reliability of vehicle (including battery)			7)
8)	Maintenance cost per year			8)
9)	Fuel cost per travel distance			9)
10)	Vehicle type: conventional or scooter			10)
11)	Safety			11)
12)	Cruising range: The distance that the motorcycle can be driven with a full charge of battery		At least (km)	12)
13)	Acceleration: The amount of time (in seconds) that the vehicle would take to travel from 0 km/h to maximum speed.		At longest (seconds)	13)
14)	Engine displacement		At least (cc)	14)
15)	Water-proof function of battery			15)
16)	Brand name and model			16)
17)	Gradability: The speed that the electric motorcycle could maintain while climbing a mountainous grade with a full load.			17)

Q4.5. Please answer the important attributes of electric motorcycles for your own use.

Appendix 1.5 Results of Stated Preference Survey

APPENDIX1.5: RESULTS OF STATED PREFERENCE SURVEY

1. SURVEY DESIGN

1.1. Purpose

1. The purpose of a stated preference (SP) survey is to examine factors influencing the deployment of EV/PHEV in Lao PDR from the perspective of human behavior, and based on the collected SP data, to predict the vehicle ownership (passenger cars and motorcycles) and travel mode shares in Vientiane in the future.

2. Applying the SP survey in this context is because EV/PHEV is currently a not-yet-existing type of vehicles in Laos. It is therefore difficult to adopt the preference for current existing gasoline-powered vehicles to predict the future demand of EV/PHEV as well as the travel mode shares, which are expected to be influenced by the deployment of EV/PHEV.

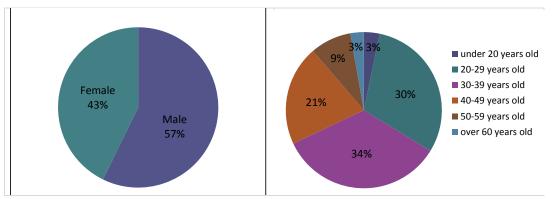
3. The SP approach, originating in mathematical psychology, has been widely used in transportation (Hensher, 1994; Kroes and Sheldon, 1988; Louviere et al., 2000; Polak and Jones, 1997), since it can measure how people choose not-yet-existing travel modes, or how people take actions in case of introducing new policies such as road pricing, introduction of intelligent transport systems, and introduction of a new travel mode. The deployment of EV/PHEV is another example that requires the application of SP approach. This approach examines individual response to a series of experimentally designed choice alternatives, which are typically described in terms of combinations of attributes with several pre-defined levels. Besides the ability to directly measure the demand/response under not-vet-existing conditions, the SP approach has some other advantages over the conventional revealed preference (RP) approach, which is based on observed choice in real situations. These advantages include the ability to control statistical problems such as multicollinearity and lack of variance in explanatory variables, the increased possibility of including subjective or qualitative factors as explanatory variables and cost-efficiency to develop models from a relatively small size of samples. In the SP survey, each respondent is usually asked to answer two or more SP questions; however, the RP survey can only obtain one answer from each respondent. In this sense, as a survey method, the SP survey is more efficient than the RP survey in order to obtain enough samples.

4. Here, vehicle choice and travel mode choice are targeted in the SP survey, where the former further includes passenger car choice and motorcycle choice.

2. AGGREGATION ANALYSIS

2.1. Individual Attributes of Respondents

5. Totally there were 1,008 respondents from Vientiane Capital taking part in the survey. As shown in Figure 1.5.1, respondents between 20s and 50s accounts for 85% and the male shares more than half of the total respondents.





6. The distribution of monthly household income is shown in Figure 1.5.2. Most of the respondents are distributed in the categories between LAK600,000 and LAK6 million, and the distribution trend is in line with reality.

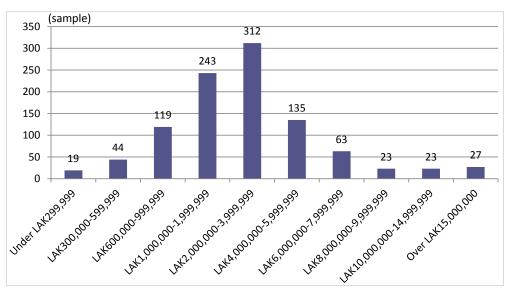


Figure 1.5.2 Distribution of Monthly Household Income

7. As shown in Figure 1.5.3, in the 1,008 respondents' households, more than half do not own a passenger car and one third own one car. However, for motorcycle, only 109 households do not own any, and near 60% own more than one.

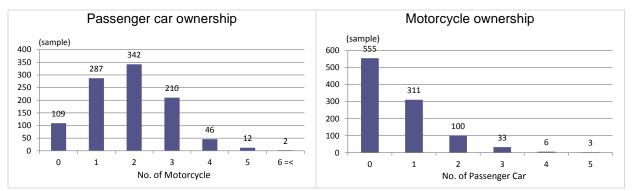


Figure 1.5.3 Vehicle Ownership Distribution

2.2. Cross-Aggregation Analysis

2.2.1. Purchase Choice of Passenger Car

8. Since every respondent faced four SP card, we got 4,032 samples. From the aggregation of the choice result shown in Figure 1.5.4, it can be seen that 67% prefer to choose EV (42%) or PHEV (25%).

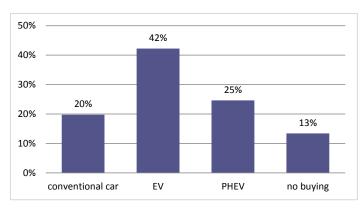
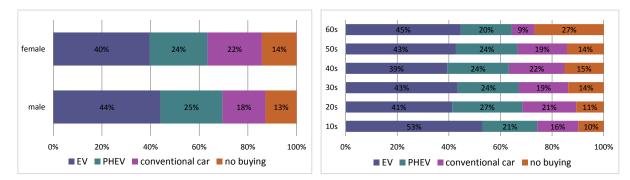


Figure 1.5.4 Purchase Choice of Passenger Car

9. It seems that younger people and males are more likely to choose EV/PHEV and the percentage of no buying increases with age.





10. The future income level assumed in SP card can impact on the choice to some extent. The higher income, the higher probability to buy PHEV; and the choice of no buying present the opposite trend. As for the current household income level, however, its relationship with the choice result is quite complicated. For mid-income people, the more their income is, the more likely to buy EV/PHEV.

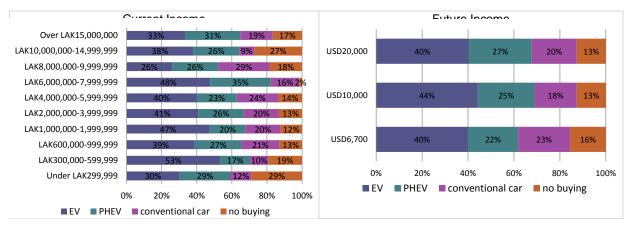


Figure 1.5.6 Relationship between Purcase Choice and Income

11. The percentage of choosing conventional car is decreasing with the current car ownership, which is probably because the richer people who already have car would like to try the new type vehicle.

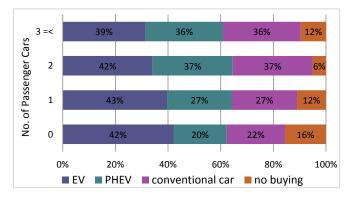
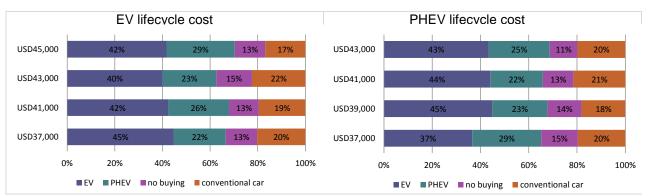


Figure 1.5.7 Relationship between Passenger Car Ownership and Purcase Choice

12. As shown in Figure 1.5.8, the lower lifecycle cost contributes to the higher percentage of corresponding type of electric vehicle.





2.2.2. Purchase Choice of Motorcycle

13. Each respondent was required to answer three SP cards, so totally we got 3,024 samples. Figure 1.5.9 shows the choice result. The share of electric motorcycle is quite high accounting 51%.

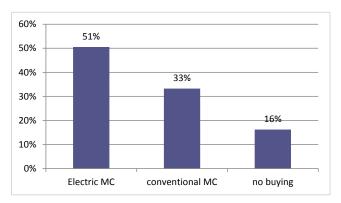


Figure 1.5.9 Purchase Choice of Motorcylce

14. From Figure 1.5.10, it can be seen that female are more likely to choose conventional motorcycle than female, but the gender does not influence on e-motorcycle choice so much. The share of no buying of mid-aged people is lower than others and their share of conventional motorcycle represents the opposite trend.

15. The influence of income level on the choice result is shown in Figure 1.5.11. The relationship between current income and the choice behavior is quadratic, which means the mid-income people prefer to choose e-motorcycle. The higher the future income is, the more likely to buy e-motorcycle.

16. The choice behavior of motorcycle is obviously influenced by the current motorcycle ownership. The more motorcycle they have in the household, the more likely to choose e-motorcycle.

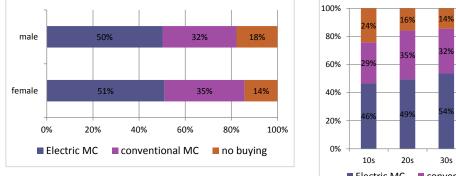
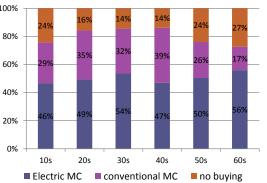
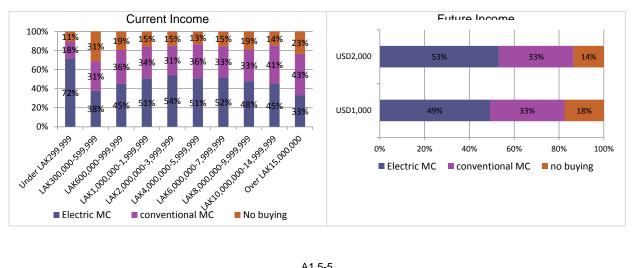
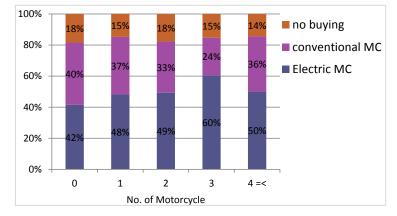


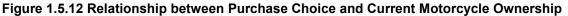
Figure 1.5.10 Relationships between Purchase Choice and Gender/Age











2.2.3. Travel mode choice

17. Since every respondent faced four SP card, we got 4,032 samples for model choice. In all these samples, respondents faced different choice set because of the attributes of car availability and motorcycle availability. The samples are aggregated by four groups which are: with car & motorcycle, with car & no motorcycle, no car & with motorcycle, and no car & no motorcycle. From the aggregation of the choice result shown in Figure 1.5.13, it can be seen that when there are five modes in the choice set, bus is the most preferred one; when car is not available, the usage of motorcycle will dramatically increase up to almost half and the following one is bus accounting for 41%; when there is no motorcycle, the situation is almost the same with the situation without car, but some of the increasing amount of bus has been traded off by tuktuk in some extent; and obviously the bus has the dominate role when there is no car or no motorcycle.

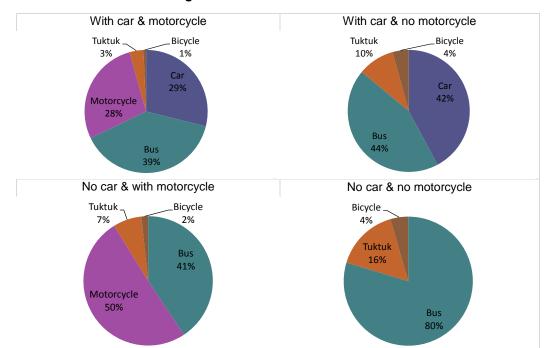
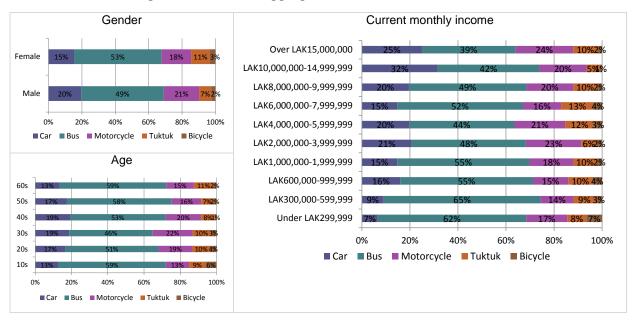


Figure 1.5.13 Travel Mode Choice

18. It seems that males are more likely to choose car and motorcycle, and female prefer to choose bus or tuktuk which implies that female choose public transport more than male. For the

mid-aged respondents, the share of each travel mode represents the same trend with male which means the mid-aged people prefer private transport. As for the current household income level, it is obvious that the richer they are, the more likely they choose car or motorcycle to travel. But for bus, it shows the opposite trend.





19. Under different assumptions of the travel condition, the choice results are different. In rainy season, the share of bus choice increases but motorcycle decreases. If the travel purpose is to work, people will prefer more to use bus or tuktuk; if it is to go shopping, the share of private vehicles such as car or motorcycle will increase. Travel distance does not have an obvious influence on the travel mode choice, but generally speaking, long distance traveler use less motorcycle and bicycle and more other modes.

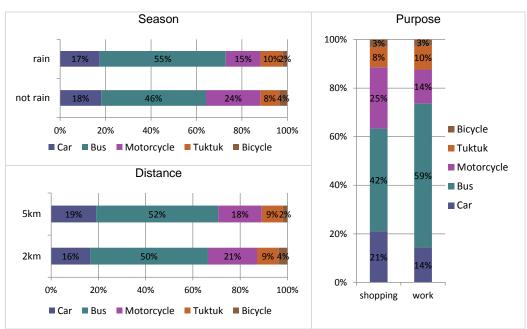


Figure 1.5.15 Travel Mode Choice by Travel Assumptions

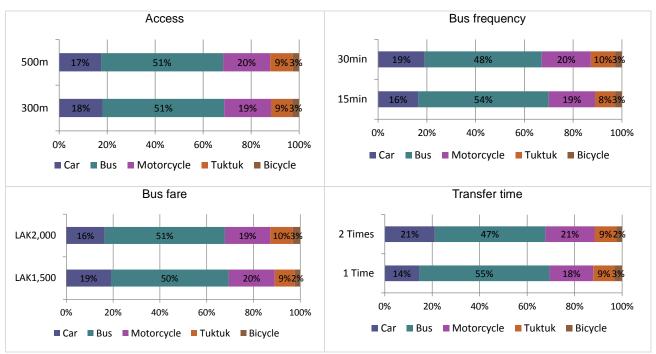


Figure 1.5.16 Travel Mode Choice by Service Level of Bus

20. As shown in Figure 1.5.16, different level of bus service will lead to different choice result. Increasing the frequency of bus and decreasing the transfer time will definitely increase the bus use percentage. Bus fare and station access distance do not have dramatic influence on the choice result.

3. SIMULATIONS FOR FUTURE

21. Here, simulations of the targeted three types of choice behavior (i.e., purchase choice of passenger car, purchase choice of motorcycle, and travel mode choice) with respect to the changes in their influencing factors are conducted based on the above-estimated multinomial logit (MNL) and nested logit (NL) models. Concretely speaking, choice probabilities of different vehicles and different travel models are calculated with respect to different sets of explanatory variables that are introduced to explain the three types of choice behavior.

22. Since the simulations are carried out based on the collected SP data, the choice probability of an alternative under study due to the change of an explanatory variable is calculated by fixing the other explanatory variables to their average values of the whole SP samples. Note that if future values of relevant explanatory variables can be properly given, demand forecasting can be done using the estimated models. In this report, only the simulation results are summarized.

3.1. Passenger Car Ownership

23. Using the NL model estimation, the simulations under different scenarios are done in this part. Here four related attributes, which are confirmed to significantly affect the passenger car ownership behavior, are separately simulated.

- Future income
- · Cruising range
- · Subsidy
- Distance to charging station

24. Since EV/PHEVs are usually expensive than conventional cars, it is expected that an EV/PHEV can be purchased only when an individual or a household has enough money. It is there necessary to clarify the buying behavior of EV/PHEV under different income levels. For other three attributes, they are related to the government policy. The simulations of these three attributes could provide some guidance for the future policy making. The average values of all attributes in the whole SP samples are shown in the following table.

Attribute	Average value	Attribute	Average value
Age ¹⁾	35.34	Income level	11,675
Gender (male 1, female 0)	0.57	Conventional car body price (USD)	20,000
Car vehicle size (seats)	6	Conventional car lifecycle cost (USD)	41,000
EV range (km)	149.31	PHEV range (km)	60.14
EV charge time (hour)	2.45	PHEV charge time (hour)	1.23
EV battery life (year)	7.50	PHEV battery life (year)	7.48
EV diffusion rate (%)	12%	PHEV diffusion rate (%)	013%
EV price (USD)	34313	PHEV price (USD)	30,118
EV subsidy (USD)	6,260	PHEV subsidy (USD)	4,611
EV lifecycle cost (USD)	41,500	PHEV operation cost (USD)	39,986
Battery capacity (kwh)	29.93	EV/PHEV size (seats)	6.02
Distance to station (Home 1, otherwise 0)	0.5		

Table 1.5.1 Average Values of Attributes

1) Age: 1: 0-19 years old, 2: 20-29 years old, 3: 30-39 years old, 4: 40-49 years old, 5: 50-59 years old, 6: more than 60.

25. The choice probabilities using the average value is 21%, 38%, 24%, and 17% for conventional car, EV, PHEV, and no buying, respectively.

> Future income

26. Under different income levels in the future, it is expected that the ownership of passenger car will change. Different values of annual income levels are assumed including the GDP predictions of the years 2020 and 2030 in Lao PDR. The results are shown in Table 1.5.2, which is re-displayed in Figure 1.5.17 for the ease of understanding. Note that the simulation was done by assuming all the other variables equal to their average values of SP samples.

27. We can see that the increase of income will surely increase the ownership of new types of passenger cars, especially EV. For conventional car, the ownership will increase before the income reaches at USD5,000-6,000 and after that it will decrease. In contrast, EV will continuously increase: it will increase to 0.6% in 2020, 4.9% in 2030, and 41.7% when the income level increases to USD20,000, while PHEV will also continuously increase: it will increase to 0.6% in 2020, 4.4% in 2030, and 25.7% when the income level increases to USD20,000.

Income level (USD)	Conventional Car	EV	PHEV	No buying
20,000	19.6%	41.7%	25.7%	13.0%
18,000	19.8%	41.1%	25.5%	13.6%
16,000	20.1%	40.4%	25.2%	14.3%
14,000	20.4%	39.5%	24.8%	15.3%
12,000	20.8%	38.2%	24.3%	16.7%
10,000	21.4%	36.3%	23.5%	18.9%
8,000	22.1%	33.4%	22.1%	22.4%
6,000	22.8%	28.4%	19.7%	29.2%
5,000	22.8%	24.5%	17.5%	35.2%
4,000	22.0%	18.8%	14.1%	45.1%
3,000	18.8%	11.0%	8.9%	61.4%
2,3041)	13.4%	4.9%	4.4%	77.2%
2,000	10.1%	2.8%	2.7%	84.5%
1,495 ²⁾	4.4%	0.6%	0.6%	94.4%
1,000	0.7%	0.0%	0.0%	99.2%

 Table 1.5.2 Simulation Results of Passenger Car Choice under Different Income Levels

1) Income level predicted in 2030

2) Income level predicted in 2020

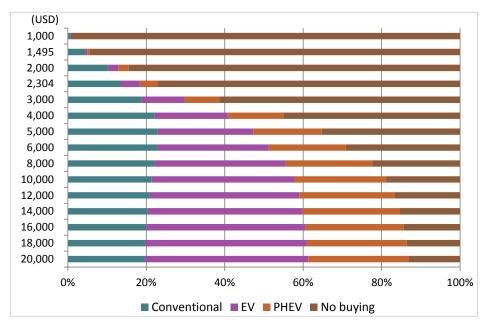


Figure 1.5.17 Simulation Results of Passenger Car Choice under Different Income Level

> Cruising range

28. Since people care about the cruising range of EVs, the simulations under different levels of cruising range of EV and PHEV are also conducted (see Table 1.5.3, Table 1.5.4 and Figure 1.5.18). Note that the simulation was done by assuming all the other variables equal to their average values of SP samples.

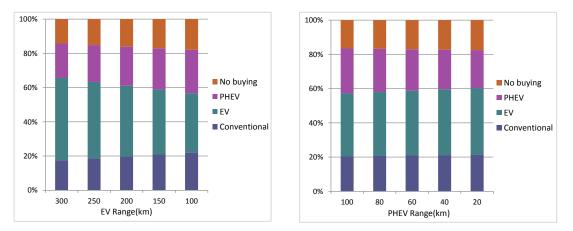
29. The result shows that increasing the cruising range of EV will surely increase the choice probability of EV and reduce the choice of other types of vehicles; while similar effects on PHEV are also observed. Concretely speaking, tripling the cruising range from 100 km to 300 km results in the increase of 13.4 points in the choice probability of EV: from 34.7% to 48.1% (increased by 37%). Increasing the cruising range of PHEV from 20 km to 100 km (five times) just leads to the increase of 4.1 points in the choice probability of PHEV: from 22.2% to 26.3% (increased by 18.5%).

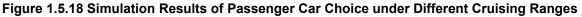
Table 1.5.3 Simulation Results of Passenger Car Choice under Different EV Cruising Ranges

EV range (km)	Conventional	EV	PHEV	No buying
300	17.5%	48.1%	20.2%	14.2%
250	18.6%	44.7%	21.5%	15.2%
200	19.8%	41.3%	22.9%	16.1%
150	20.9%	37.9%	24.1%	17.0%
100	22.0%	34.7%	25.4%	17.9%

Cable 1.5.4 Simulation Results of Passenger Car Choice under Different PHEV Cruising Ranges

PHEV range (km)	Conventional	EV	PHEV	No buying
100	20.4%	36.9%	26.3%	16.5%
80	20.6%	37.4%	25.2%	16.8%
60	20.9%	37.9%	24.2%	17.0%
40	21.2%	38.4%	23.2%	17.2%
20	21.5%	38.9%	22.2%	17.5%





> Subsidy

30. The subsidy level also has a significant effect on the choice behavior. The below gives some scenarios for subsidy level combinations of EV and PHEV. The subsidy means the percentage of vehicle body price subsidized by government, and we assumed that the subsidy level of PHEV is 40% lower than that of EV. It is assumed that the subsidy is provided to EV and PHEV purchasers simultaneously. The share of each choice is shown in Table 1.5.9 and Figure 1.5.19. Note that the simulation was done by assuming all the other variables equal to their average values of SP samples.

31. Obviously, the higher the subsidy is, the higher the choice probability is. Looking at the magnitude of choice probability, it is found that 35% increase in the EV subsidy (from 0% to 35%) results in 15.9% increase of EV choice probability, but 21% increase in the PHEV subsidy (from 0% to 21%) leads to only 0.7% increase of PHEV choice probability.

EV subsidy	PHEV subsidy	Conventional	EV	PHEV	No buying
35%	21%	19.6%	40.9%	23.6%	15.9%
30%	18%	20.0%	40.1%	23.6%	16.3%
25%	15%	20.5%	39.3%	23.6%	16.6%
20%	12%	20.9%	38.5%	23.6%	17.0%
15%	9%	21.4%	37.7%	23.6%	17.4%
10%	6%	21.8%	36.9%	23.5%	17.8%
5%	3%	22.3%	36.1%	23.5%	18.1%
0%	0%	22.8%	35.3%	23.4%	18.5%



Figure 1.5.19 Simulation Results of Passenger Car Choice under Different Subsidy Levels

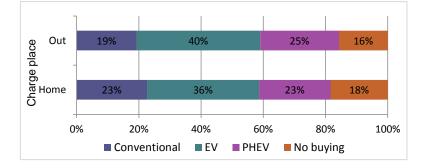
> Distance to charging station

32. People more prefer to charge their cars out of home than at home. Calculating the probability of charging at home and out of home (see Table 1.5.6 and Figure 1.5.20), we can see that the EV choice probability when charging at home is 3.7 point lower than that when charging out of home, while the PHEV choice probability changes from 23% at home to 25.3% out of home (just 2 point increase).

Table 1.5.6 Simulation Results of Passenger Car Choice under Different Charging Location

Charging Location	Conventional	EV	PHEV	No buying
Home	22.6%	36.0%	23.0%	18.4%
Out	19.3%	39.7%	25.3%	15.7%

Figure 1.5.20 Simulation Results of Passenger Car Choice under Different Charging Location



3.2. Motorcycle Ownership

33. Using the MNL model estimation, the simulations under different scenario assumptions are done in this part. Two attributes affecting on motorcycle choice behavior are separately simulated in the following section.

Future income

• Distance to charging station

34. The average values of all attributes in the whole SP samples are shown in the following table.

Attribute	Average value	Attribute	Average value
Gender (male 0, female 1)	0.43	Cruising range (km)	101.48
Age ¹⁾	3.09	Charge time (hour)	2.67
Household income level (USD)	4.87	Battery life (year)	6.11
CM efficiency (km//)	42.41	Distance to charge station	0.93
CM body price (USD)	1,300	Warning sound (with 1, without 0)	0.70
CM lifecycle cost (USD)	5,400	Diffusion rate (%)	10%
CM max speed (km/h)	105.93	EV body price (USD)	3,203.70
EM max speed (km/h)	73.33	Subsidy (USD)	320.37
Income (USD)	1,333.33	EM lifecycle cost (USD)	4783

Table 1.5.7 Average Values of Attributes

1) Age: 1: 0-19 years old, 2: 20-29 years old, 3: 30-39 years old, 4: 40-49 years old, 5: 50-59 years old, 6: more than 60.

35. The choice probabilities using the average values are 30.9%, 54.5%, and 14.6% for conventional motorcycle, electric motorcycle, and no buying, respectively.

> Future income

36. In motorcycle ownership, the simulation of different levels of annual income is also done under the consideration that different income levels will change the ownership of motorcycle. Different values of annual income levels are assumed including the GDP predictions of 2020 and 2030 in Laos. The results are shown in Table 1.5.8, which is re-displayed in Figure 1.5.21 for the ease of understanding. Note that the simulation was done by assuming all the other variables equal to their average values of SP samples.

37. The increase of income level will increase the share of e-motorcycle: it will increase to 6.4% in 2020, 18.2% in 2030, and 55.8% when the income level increases to USD20,000. In contrast, the share of conventional motorcycle will reach its peak of 37.9% at the income level of USD3,000 and after that it will decrease.

Income level (USD)	Conventional MC	Electric MC	No buying
20,000	30.3%	55.8%	13.9%
18,000	30.6%	55.2%	14.2%
16,000	30.9%	54.5%	14.6%
14,000	31.3%	53.6%	15.1%
12,000	31.8%	52.3%	15.9%
10,000	32.6%	50.5%	16.9%
8,000	33.6%	47.8%	18.6%
6,000	35.1%	43.3%	21.6%
5,000	36.1%	39.7%	24.2%
4,000	37.2%	34.5%	28.3%
3,000	37.9%	26.4%	35.7%
2,3041)	37.0%	18.2%	44.8%
2,000	35.4%	13.9%	50.7%
1,495 ²⁾	29.3%	6.4%	64.3%
1,000	16.3%	1.1%	82.6%

 Table 1.5.8 Simulation Results of Motorcycle Choice under Different Income Levels

¹⁾ Income level predicted in 2030

²⁾ Income level predicted in 2020

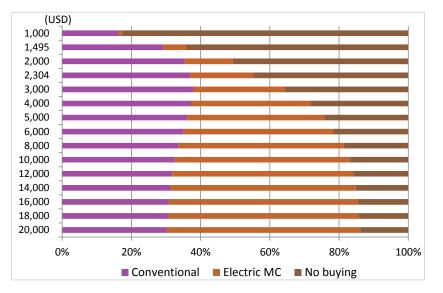


Figure 1.5.21 Simulation Results of Motorcycle Choice under Different Income Levels

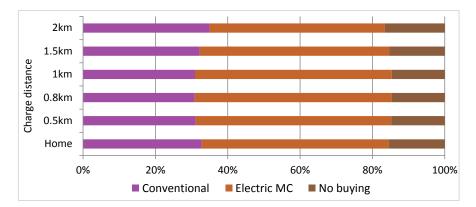
Distance to charging station

38. The choosing probability of e-motorcycle has a quadratic relationship with distance to charge station. After calculating the probability under different levels of distance to charge station (from 0 to 2km), it can be found that when the distance is 0.5 - 1.0 km, the share of e-motorcycle can reach the highest value, about 54% (54.1 - 54.6%). And the distance shorter or longer than 0.5 - 1.0 km will cause the decrease of the e-motorcycle share.

 Table 1.5.9 Simulation Results of Motorcycle Choice under Different Distances to the Chargers

Distance	Conventional	EM	No buying
Home	32.8%	51.7%	15.5%
0.5km	31.1%	54.1%	14.7%
0.8km	30.8%	54.6%	14.6%
1km	30.9%	54.4%	14.6%
1.5km	32.2%	52.5%	15.3%
2km	35.0%	48.5%	16.6%

Figure 1.5.22 Simulation Results of Motorcycle Choice under Different Charge Distances



3.3. Travel Mode Choice

39. From the MNL model, it is found that the most significant factors on mode choice are bus frequency, bus transfer times and EV ownership. Here the simulations under different scenario

assumptions of these attributes are done in this part separately. The average values of all attributes in the whole SP samples are shown in the following table.

Attribute	Average value	Attribute	Average value
Gender (male 0, female 1)	0.43	Bus fare (LAK)	1,750
Age ¹⁾	3.09	EM availability	25%
EV availability	25%	Motorcycle time (min)	4.25
Car time (min)	7.38	Motorcycle cost (LAK)	280.06
Car cost (Kip)	1,163	Tuktuk time (min)	21.25
Bus operation interval (min)	22.5	Tuktuk cost (LAK)	5,000
Bus transfer times (number of times)	1.5	Bicycle time (min)	27.5
Bus time (min)	21.25	Bicycle cost (LAK)	0

 Table 1.5.10
 Average Values of Attributes

1) Age: 1: 0-19 years old, 2: 20-29 years old, 3: 30-39 years old, 4: 40-49 years old, 5: 50-59 years old, 6: more than 60.

40. The choice probabilities using the average values are 27.3%, 30.2%, 35.6%, 5.4%, and 1.5% for car, bus, motorcycle, tuktuk, and bicycle, respectively.

Bus frequency

41. For the travel mode choice, the bus frequency is very important. Here a large range of bus departure interval is given in the following table and figure, and the corresponding mode shares are listed. Shortening the bus departure interval or increasing the bus frequency will increase the percentage of bus and decrease other modes' usage. Reducing the bus interval from 60 min to 5 min, the share of bus will increase from 19.7% to 36.1% (increased by 83%). That implies that improving bus service levels will encourage people to choose public travel modes.

Bus Interval (min)	Car	Bus	Motorcycle	Tuktuk	Bicycle
60	31.4%	19.7%	41.0%	6.2%	1.7%
50	30.4%	22.2%	39.7%	6.0%	1.7%
40	29.4%	24.9%	38.3%	5.8%	1.6%
35	28.8%	26.4%	37.6%	5.7%	1.6%
30	28.2%	27.9%	36.8%	5.5%	1.6%
25	27.6%	29.4%	36.0%	5.4%	1.5%
20	27.0%	31.0%	35.2%	5.3%	1.5%
15	26.3%	32.7%	34.4%	5.2%	1.5%
10	25.7%	34.4%	33.5%	5.0%	1.4%
5	25.0%	36.1%	32.6%	4.9%	1.4%

Table 1.5.11 Simulation Results of Travel Mode Choice under Different Bus Intervals

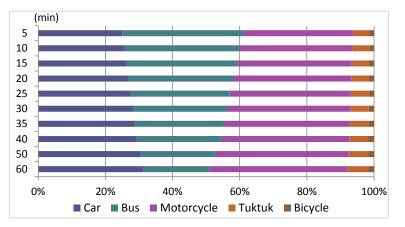


Figure 1.5.23 Simulation Results of Travel Mode Choice under Different Bus Intervals

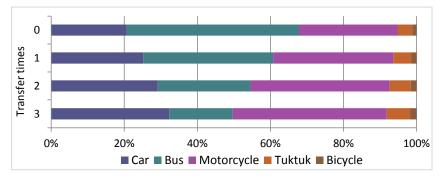
Bus transfer times

42. The number of transfer by bus is also an important factor when people choose travel modes. Under different levels of transfer times, the mode shares are calculated (see Table 1.5.12 and Figure 1.5.24). The increase of bus share is very significant (increased by 173%) as transfer times decreases (from three times to no transfer). This indicates that another good method to encourage bus usage is to optimize the bus service network to improve the convenience and decrease transfer times.

Table 1.5.12 Simulation Results of Travel Mode Choice under Different Transfer Times
--

Transfer times	Car	Bus	Motorcycle	Tuktuk	Bicycle
3	32.3%	17.3%	42.2%	6.3%	1.8%
2	29.2%	25.4%	38.1%	5.7%	1.6%
1	25.2%	35.5%	32.9%	5.0%	1.4%
0	20.7%	47.2%	27.0%	4.1%	1.1%

Figure 1.5.24 Simulation Results of Travel Mode Choice under Different Transfer Times



➢ EV ownership

43. According to the estimation results, it is obvious that the availability of EV has a significant effect on the choice of travel mode and increase the share of car. Using the simulation result of passenger car ownership under different income level (see Table 1.5.2), the percentages of these five kinds of travel modes are also simulated. The simulation results are shown in Table 1.5.13 and Figure 1.5.25.

44. The increase of future income will cause the rise of EV percentage in the total passenger car, which will increase the share of private car as a travel mode in the future and decrease those

of bus and motorcycle. It can be seen that in 2020, the predicted GDP per capita is USD1,495 and under this income level, the electric vehicle percentage will be 24%; and in 2030, GDP is predicted to reach at USD2,304 per capita, which will double the EV percentage. Under this circumstance, the car share will increase from 25.6% to 27.2% (increased by 6.25%). When the income level increases to USD20,000 per capita, the car share will dramatically increase to 33.8%.

Income level (USD)	EV Percentage	Car	Bus	Motorcycle	Tuktuk	Bicycle
20,000	71%	33.8%	27.5%	32.4%	4.9%	1.4%
18,000	71%	33.7%	27.5%	32.5%	4.9%	1.4%
16,000	70%	33.6%	27.6%	32.5%	4.9%	1.4%
14,000	69%	33.5%	27.6%	32.6%	4.9%	1.4%
12,000	67%	33.2%	27.7%	32.7%	4.9%	1.4%
10,000	65%	32.9%	27.9%	32.9%	4.9%	1.4%
8,000	62%	32.4%	28.1%	33.1%	5.0%	1.4%
6,000	56%	31.6%	28.4%	33.5%	5.0%	1.4%
5,000	51%	30.9%	28.7%	33.8%	5.1%	1.4%
4,000	44%	29.9%	29.1%	34.3%	5.2%	1.5%
3,000	34%	28.5%	29.7%	35.0%	5.3%	1.5%
2,3041)	24%	27.2%	30.2%	35.7%	5.4%	1.5%
2,000	20%	26.6%	30.5%	36.0%	5.4%	1.5%
1,495 ²⁾	12%	25.6%	30.9%	36.5%	5.5%	1.5%
1,000	4%	24.6%	31.3%	36.9%	5.6%	1.6%

Table 1.5.13 Simulation Results of Mode Choice under Different EV Availability Levels

¹⁾ Income level predicted in 2030; ²⁾ Income level predicted in 2020

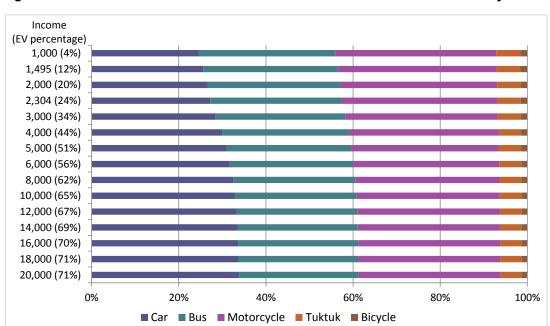


Figure 1.5.25 Simulation Results of Mode Choice under Different EV Availability Levels

EXAMPLE OF QUESTIONNAIRE SHEET OF STATED PREFERENCE SURVEY Vehicle Ownership and Travel Mode Choice Behavior in Laos

Due to the ever-increasing environmental impacts from transport sector in Vientiane, it is becoming more and more important to improve current transportation systems from various angles, such as means of daily travel and urban form. For this purpose, this questionnaire survey is implemented. The collected information will be used to identify future directions of transportation systems in Vientiane as well as other parts of Laos. The collected information will be statistically processed in order to protect your privacy.

Your kind cooperation and active participation will be highly appreciated.

>>> Please answer the survey questions from here <<<

Part I

Your Current Vehicle Ownership and Usage.

1. Does your household currently own any vehicle?

□ Yes (Go to the next question) □ No (Go to *Question* 4)

2. If "Yes" in the above question 1, please fill in the following table.

Type of vehicle	How many vehicles in total?
1) Passenger car (e.g., sedan, pick-up, jeep)	()
2) Motorcycle	()
3) Bicycle	

3. If "Yes" in the above question 1, please fill in the following table.

Note: please answer the following questions with respect to the most frequently used vehicles, if you have two or more for each type of vehicle.

Item	Passenger car	Motorcycle
When did you buy this car?	Year	Year
When the vehicle was produced	Year	Year
Price of this vehicle	()Kip	()Kip
Brand name (e.g., NISSAN) & model name (e.g., Bluebird)		
Engine displacement	CC	CC
Fuel type	□Gasoline □ Diesel	□Gasoline □ Diesel
	□ Others	□ Others
	()	()
Fuel efficiency:	() km per liter	() km per liter
Number of seats	seats	
Annual travel distance	km	km
Average car usage frequency	() times/week	() times/week
Main purpose of vehicle usage	 Commuting, school or business Shopping Recreation, leisure Private business, etc. 	 Commuting, school or business Shopping Recreation, leisure Private business, etc.
When you plan to replace or dispose this car?	Years later	Years later

4. Please report your daily trip information.

Trip purpose	How far from your home to	Main travel model	Frequency using main travel
	the destination?		mode
1) Work	To your workplace, if you	Fill in the number of the main	() times
	have a job:	travel mode ()	per (week) or (month)
	Aboutkm; About		
	minutes		
2) School	To your school, if you are a	Fill in the number of the main	() times
	student:	travel mode ()	per (week) or (month)
	Aboutkm; About		
	minutes		
Shopping	To the shopping place that	Fill in the number of the main	() times
	you often visit:	travel mode ()	per (week) or (month)
	Aboutkm; About		
	minutes		
4) Recreation,	To the recreation, leisure	Fill in the number of the main	() times
leisure	place that you often visit:	travel mode ()	per (week) or (month)
	Aboutkm; About		
	minutes		
5) Other	To the other place that you	Fill in the number of the main	() times
purposes	often visit:	travel mode ()	per (week) or (month)
	Aboutkm; About		
	minutes		



1. Walk	2. Bicycle	3. Motorcycle	4. T	uk Tuk	5. Mini Bus	6. Large Bus	7. Pick up
8. Taxi	9. Private car	10. Light truck (2 axle)		11. Heavy	truck (3 axle)	12. Trailer	13. Others

Part II

Choices of Electric Vehicles (EV), Plug-in Hybrid Vehicles (PHEV) and Electric Motorcycles in Future

In this part, several *hypothetical* questions about electric vehicles (EV), plug-in hybrid vehicles (PHEV) and electric motorcycles, which are, in fact, not available in Laos, will be asked. The *hypothetical* questions are given by considering the possible situations in future. You are kindly requested to answer the following questions ONLY based on the given information. Before answering the questions, please carefully read the following instructions one by one.

- 1) Assume that with your future income, you can buy any given vehicles.
- 2) Carefully read each hypothetical question.
- 3) Choose the ONE hypothetical vehicle that you would be MOST LIKELY to purchase in future (as your next replacement vehicle if you now have a vehicle, or as your new vehicle if you do not have any now).
- 4) Tick the **□** corresponding to your chosen vehicle in the question table.
- 5) Continue to other questions by repeating the above steps.

1. Choices of Electric Vehicles (EV), Plug-in Hybrid Vehicles (PHEV) and Conventional Cars in Future

The meanings of some terms in the question tables are briefly explained below.

- Subsidy level: The subsidy provided to compensate the price difference of EV/PHEV from conventional cars by government. This is because EV/PHEV are more expensive than conventional cars under the current technological level. The changing level is set because the price difference might be partially traded off by cheaper operation cost. Secondary usage of battery is another advantage of EV.
- *Diffusion rate in market*: The percentage of the people in market who have already bought the vehicle under question.
- Cruising range: The distance that the EV/PHEV can be driven with a full charge of battery.
- Distance of charge station from origin/destination: Just like filling in gasoline to conventional car, EV/PHEV needs to be charged somewhere. The distance mentioned here refers to the distance to the nearest charge station from your primary origin / destination.
- Secondary usage of battery: EV battery can be used as alternative power supply for in-home energy usage. This is one of remarkable differences of EV from conventional car and PHEV.
- Battery capacity for secondary usage: The maximal *kwh* of EV battery that can be used for in-home energy usage.
- *Total cost*: The 12-year lifecycle cost includes vehicle body price, operation cost, maintenance cost and insurance, and battery replacement cost for one time, by subtracting the subsidy (only for EV/PHEV). The operating cost is under the condition that the vehicle will run 10,000km per year.

1.1. In this question, your future income level is assumed (*shown as one of Common Attributes*). By carefully comparing the attributes of each car, which car you would be MOST LIKELY to purchase in future. (*Example*)

Attributes		Alternative 1	Alternative 2	Alternative 3	Alternative 4
(Bold & italic ty cards)	ype: values change across SP	Conventional car	EV	PHEV	
Attributes of	Engine displacement	1500 cc	No difference of maximum speed and acceleration from conventional car & PHEV	1500 cc	
conventional car	Fuel efficiency	10 km//	Electricity: 5 km/kwh	Gasoline: 10 km// Electricity: 5 km/kwh	
	Fuel type	Gasoline	Electricity	Gasoline + Electricity	
	Cruising range		200 km	40 km	Do not
	Charge time of battery		3 h	1.5 h	buy
Attributes of	Battery life		5 yrs	5 yrs	any car
EV/PHEV	Distance of charge station from origin/destination		1 km	1 km	
	Diffusion rate in market		20%	5%	
Secondary	Secondary usage of vehicle battery		Yes		
usage of EV battery	Battery capacity for secondary usage		30-40 kwh	No secondary usage of battery	
	Your annual income level in future (US\$)		6,700		
Common	Vehicle body price (US\$)	20,000	35,000	33,000	
attributes	Subsidy level by government (US\$)	No subsidy	3,500	6,600	
	Total cost for 12 years (US\$) 1)	41,000	45,000	41,000	
	Vehicle size	7 seats	5 seats	5 seats	
	CHOICE: Check only one box				

Tick the **D** corresponding to your chosen vehicle in the question table.

1) Total cost includes vehicle body price, operation cost, maintenance cost and insurance, and battery replacement cost for one time by subtracting the subsidy (only for EV/PHEV).

2. Choices of Electric Motorcycles and Conventional Motorcycles in Future

2.1. In this question, your future income level is assumed (*shown as one of Common Attributes*). By carefully comparing the attributes of each motorcycle, which motorcycle you would be MOST LIKELY to purchase in future. (*Example*)

Attributes		Alternative 1	Alternative 2	Alternative 3
(Bold & italic t	ype: values change across SP card)	Conventional motorcycle	Electric motorcycle	
Attributes of	Engine displacement	125 CC	Battery: 2-5 kwh	
conventional	Fuel efficiency	35 km/l	20 km/kwh	
motorcycle	Fuel type	Gasoline	Electricity	
	Cruising range		150 km	
	Charge time of battery		4 h	
Attributes of	Battery life		5 yrs	
Electric	Distance of charge station from	\times	Charge at	Do not
motorcycle	origin/destination		origin/destination	buy
	Engine sound for traffic warning		with	any
	Diffusion rate in market		5%	motorcycle
	Your monthly income level in future (US\$)	1,000		
	Vehicle body price (US\$)	1,300	3,200	
Common	Subsidy level by government (US\$)	No subsidy	640	
attributes	Total cost for 10 years (US\$)	5,400	4,460	
	Emission	with tailpipe emission	without tailpipe emission	
	Maximum speed (km/h)	120	100	
	CHOICE: Check only one box			

Tick the \Box corresponding to your chosen vehicle in the question table.

1) Total cost includes vehicle body price, operation cost, maintenance cost and insurance, and battery replacement cost for one time by subtracting the subsidy (only for EV/PHEV).

Part III Choices of Travel Modes in Future

In this part, several hypothetical situations are given with respect to the choice of travel models in future by considering various possible levels of transport services and attributes of EV/PHEV and electric motorcycles as well as Tuk Tuk in future. You are kindly requested to answer the following questions ONLY based on the given information. Before answering the questions, please carefully read the following instructions one by one.

- 1) Assume that with your future income, you can use any given travel modes in each case.
- 2) Carefully read each hypothetical question.
- 3) Choose only ONE travel mode that you would be MOST LIKELY to use in future.
- 4) Tick the \Box corresponding to your chosen travel mode in the question table.
- 5) Continue to other questions by repeating the above steps.

3.1

(Example)

Assuming that, in a <u>raining</u> day, you want to commute from your home to <u>shopping mall</u>, which is about <u>5km</u> far away from your home, and available travel modes are shown below (the first column of the following table).

Alternative Travel modes	Level of BUS service	Vehicle type	Travel time (min.)	Cost (Kip)	Your choice
Car	_	Conventional	12	5,250	
Bus	Frequency <u>15 min</u> Transfer times <u>2 times</u> Access distance <u>500 m</u>	Gasoline- powered	35	2,000	
Tuk-tuk		Electric	25	5,000	
Bicycle	—	Man- powered	40	0	٦

Please carefully compare the attributes of each travel mode and choose your most preferred one.

Pa	rt IV Individual and Ho	ousehold Attrib	butes
1.	Your gender	Male	Female
2.	Your age		years old
3.	Your job		
	_	ment, special int	terest organization, firm executive mangers
	Professionals		Technical and associate professionals
	Clerical worker		Service workers, shop & market workers
	Farmers, forestry v		
	□ Traders & related v		Plant & machine operators & assemblers
	Laborers & unskille		Teacher & school workers
	Student (under hig	h school)	Student (university level or above)
	Housewife		Jobless
	Others (specify)
4.	Driving license		
	Car driving license	\rightarrow Dura	ration of ownership:years
	Motorcycle license	\rightarrow Dura	ration of ownership:years
	Other license		
	Don't have any lice	ense	
5.	Residential location		
0.			
	No. / Street		Village
	Estate/ District		Province
6.	How many people re	side in your ho	ousehold? (Answer all, please)
	1) Under 5years old:		MaleFemaleTotal
	2) 6 years old and at	oove:	MaleFemaleTotal
	3) Household helpers	s (exclude Maid)	d):MaleFemaleTotal
7.	Your household inco	me level	
	🗖 Under 299,999 Kip)	300,000-599,999 Kip
	□ 600,000-999,999 k	Kip	□ 1,000,000-1,999,999 Kip
	□ 2,000,000-3,999,9	99 Kip	□ 4,000,000-5,999,999 Kip
	G 6,000,000-7,999,9	99 Kip	8,000,000-9,999,999 Kip

8.	Type of your present house?			
	Owned (detached home)	Owned (apartment)		
	Rented (detached home)	Rented (apartment)		
	Others (specify			_)
9.	How long have you lived in your pre	sent house?	Years	

10. Percentage of household income spent on each of the following expenditure

1) Housing rent	%
2) Water, electricity, gas	%
3) Health care or medical treatment	%
4) Foods	%
5) Clothes	%
6) Education of children	%
7) Recreational, leisure, social activities	%
8) Telephone and communication	%
9) Saving	%
10) Other	%
In total	100%

Appendix 1.6 Questionnaire Sheet for Urban Transport Condition Survey

APPENDIX1.6: QUESTIONNAIRE SHEET FOR URBAN TRANSPORT CONDITION SURVEY

Questionnaire for Current EV Users (Residents)

Q1. Respondent Profile

1.	Name of Respondent					
2.	Address of Resident	District,		Village		
3.	Age					
4.	Gender	1. Male 2. Female				
5.	Occupation					(choose from the below box)
6.	Total monthly household income (LAK/month)	 01. Under 299,999 02. 300,000 - 599,999 03. 600,000 - 999,999 04. 1,000,000 - 1,999,999 	06. 3,000 07. 4,000),000 – 3,999,999	09. 10. 11.	8,000,000 –9,999,999 10,000,000 – 14,999,999 15,000,000 or more

OCCUPATION	01.	Agriculture (Rice)	13.	Company Manager (service)	23.	Sonthew Driver
	02.	Agriculture (Other)	14.	Company Employee (service)	24.	Tuk Tuk/Jumbo Driver
	03.	Husbandry	15.	Public worker (National/Capital	25.	Monk/Trainee Monk
	04.	Fishery		level)	26.	Housewife/Househusband
	05.	Forestry	16.	Public Worker (District/Village	27.	Primary School Student
	06.	Commercial Business		level)	28.	Lower Secondary School Student
	07.	Retail (small scale)	17.	Teacher/Tutor	29.	Upper Secondary School Student
	08.	Restaurant/Café/Bar	18.	Doctor/Dentist	30.	University/College Student
	09.	Hotel/Guesthouse	19.	Civil Engineer/Architect	31.	Vocational School Student
	10.	Factory Manager	20.	Construction worker	32.	Retired
	11.	Factory Worker	21.	Truck Driver	33.	Others (Specify)
	12.	Repairing/Mechanician	22.	Bus Driver		

7. Vehicle ownership of household (fill the number of units. If none, fill "0")

	No. of Units			
	Conventional	Electric		
1. Bicycle	2			
2. Motorcycle	2			
3. Car	2			
4. Others ()				

Q2. Recognition of Electric Vehicles

Q21. Recognition and Experience of EV

			Recognition		Experience			
		Know well	Know well Know by name Don't know Ne		Never tried	Tried several times	Place of Experience ¹⁾	
1.	EV in general	1	2	3	1	2		
2.	Electric bicycle	1	2	3	1	2		
3.	Electric motorcycle	1	2	3	1	2		
4.	EV minibus	1	2	3	1	2		
5.	EV car	1	2	3	1	2		
6.	Others (specify)	1	2	3	1	2		

1) 1= in Vientiane, 2= Luang Prabang, 3= other places in Laos, 4=abroad

Q22. What is the main purpose of use EVs? (choos	e maximum three)
01. To Home	06. To Go Shopping/Market
02. To Work	07. To Eat (not at home)
03. To School	08. Social/Recreation
04. At work/Business	09. Other Private Purpose
05. To send/pick up other family member or friend	
Q23. Assessment of EV	

Please choose the type of EV which you usually use, and assess it.

0. Vehicle Type

1.	E-bicycle	2.	E-motorcycle	3. E-car	4. E-minibus
----	-----------	----	--------------	-----------------	---------------------

	Very good	Good	So-so	Bad	Very bad
1. Overall impression	1	2	3	4	5
2. Riding comfort	1	2	3	4	5
3. Travel speed	1	2	3	4	5
4. Vehicle design	1	2	3	4	5
5. Price of EV/Fare of E-bus	1	2	3	4	5
6. Charging time (except e-minibus)	1	2	3	4	5
7. Others()	1	2	3	4	5

Q3. Comments on the government policy to realize electric vehicle transport

Q31. Do you agree to the policy to realize electric vehicle transport in Laos?

Q32. Does the following policy encourage you to use EV?

		Yes	No
1.	Tax reduction on electric vehicle/motorcycle purchase	1	2
2.	Tax increase on gasoline/diesel vehicle purchase	1	2
3.	Tax reduction on corporation tax for using electric vehicle/motorcycles	1	2
4.	Increase in fuel price	1	2
5.	Reduction on electric tariff	1	2
6.	Provision of parking space for electric vehicle/motorcycle in city center	1	2
7.	Entering restriction of gasoline/diesel vehicle in city center	1	2
8.	Provision of priority lane for electric vehicle/motorcycle along major roads	1	2
9.	Provision of free charging stations in the public spaces	1	2
10.	Provision of low insurance cost for electric vehicle/motorcycle	1	2

Q33. Please write your comments freely on the policy to realize electric vehicle transport in Laos.

No

2.

1.

Yes

Questionnaire for Potential Use of EV (Households)

Q1. Household Profile

1.	Name of Respondent					
2.	Address of Resident		District,	Village		
3.	Age					
4.	Gender	1. Male	2. Female			
5.	Occupation					(choose from the below box)
6.	No. of Household Members					
7.	Total monthly household income (LAK/month)	01. Under 299,999 02. 300,000 - 599, 03. 600,000 - 999, 04. 1,000,000 - 1,5	999 (999 (2,000,000 - 2,999,999 3,000,000 - 3,999,999 4,000,000 - 5,999,999 6,000,000 - 7,999,999	09. 10. 11.	8,000,000 –9,999,999 10,000,000 – 14,999,999 15,000,000 or more

5 Occupation	01.	Agriculture (Rice)	13.	Company Manager (service)	23.	Sonthew Driver
	02.	Agriculture (Other)	14.	Company Employee (service)	24.	Tuk Tuk/Jumbo Driver
	03.	Husbandry	15.	Public worker (National/Capital	25.	Monk/Trainee Monk
	04.	Fishery		level)	26.	Housewife/Househusband
	05.	Forestry	16.	Public Worker (District/Village	27.	Primary School Student
	06.	Commercial Business		level)	28.	Lower Secondary School Student
	07.	Retail (small scale)	17.	Teacher/Tutor	29.	Upper Secondary School Student
	08.	Restaurant/Café/Bar	18.	Doctor/Dentist	30.	University/College Student
	09.	Hotel/Guesthouse	19.	Civil Engineer/Architect	31.	Vocational School Student
	10.	Factory Manager	20.	Construction worker	32.	Retired
	11.	Factory Worker	21.	Truck Driver	33.	Others (Specify)
	12.	Repairing/Mechanician	22.	Bus Driver		

Q2. Current Use of Vehicles in Your Household

Vehicle Type ¹⁾	No.	Main Purpose ²⁾ (<i>multiple answer up to</i> 3)	Frequency of Use ³⁾	Ave. Driving Distance ⁴⁾ (km/day)	Ave. Driving Time ⁵⁾ (hrs/day)	Availability of Parking ⁶⁾
1.						
2.						
3.						
4.						
5.						

Instruction

1) Vehicle Type						
1.	Motorcycle	7. Medium Bus (15 – 44 seats)				
2.	Tuk Tuk/Jumbo	8. Large Bus (more than 45 seats)				
3.	Sedan	9. Light Truck (3.5 – 7 tons)				
4.	Pick- up	10. Medium Truck (7 – 15 tons)				
	Small Van (less than 7 seats)	11. Heavy Truck (more than 15 tons)				
	Van (7-15 seats)	12. Other()				

	2) Main Purpose					
10.	To Home	06.	To Go Shopping/Market			
11.	To Work	07.	To Eat (not at home)			
12.	To School	08.	Social/Recreation			
13.	At work/Business	09.	Other Private Purpose			
14.	To send/pick up other family member or friend					

3) Frequency	4) Ave. Driving Distance	5) Ave. Driving Time
no. of days/week	average kilometerage/vehicle/day	average hours of use/vehicle/day

6) Availability of Parking				
1. own parking space/facilities2. off-road parking space outside-own compound3. nearby vacant lands				
4. nearby road space	5. others			

Q3. Assessment on vehicle use conditions

	No Problem	So-So	Problem	Sever Problem
1. Gasoline/diesel price	1	2	3	4
2. Maintenance of vehicle	1	2	3	4
3. Distance to gas stations	1	2	3	4
4. Parking space at company	1	2	3	4
5. Parking space at destination	1	2	3	4
6. Traffic congestions	1	2	3	4
7. Traffic enforcement by traffic police	1	2	3	4
8. Road condition	1	2	3	4

Q4. Recognition of Electric Vehicles

Q41. Recognition and Experience of EV

		Recognition			Experience			
		Know well	Know by name	Don't know	Never tried	Tried several times	Place of Experience ¹⁾	
1.	EV in general	1	2	3	1	2		
2.	Electric bicycle	1	2	3	1	2		
3.	Electric motorcycle	1	2	3	1	2		
4.	EV minibus	1	2	3	1	2		
5.	EV car	1	2	3	1	2		
6.	Others (specify)	1	2	3	1	2		

1) 1= in Vientiane/Laos, 2= abroad

Q42. Assessment of EV (those who had experience of EV riding)

		Very good	Good	So-so	Bad	Very bad
1.	Overall impression	1	2	3	4	5
2.	Riding comfort	1	2	3	4	5
3.	Travel speed	1	2	3	4	5
4.	Vehicle design	1	2	3	4	5
5.	Others()	1	2	3	4	5

Q5. Willingness to Use EV

Q51. Are you interested in EV?

1.	Yes		2.	No

Q52. If YES, what types of vehicle and for what purpose are you interested for your company

activities?	>
-------------	---

Type of Vehicle
 Purpose

Q53. If NO, please give reasons.

Q6. Comments on the government policy to realize electric vehicle transport

Q61. Do you agree to the policy to realize electric vehicle transport in Laos?

No

3.

Yes

Q62. Does the following policy encourage you to use EV?

4.

	Yes	No
1. Tax reduction on electric vehicle/motorcycle purchase	1	2
2. Tax increase on gasoline/diesel vehicle purchase	1	2
3. Tax reduction on corporation tax for using electric vehicle/motorcycles	1	2
4. Increase in fuel price	1	2
5. Reduction on electric tariff	1	2
6. Provision of parking space for electric vehicle/motorcycle in city center	1	2
7. Entering restriction of gasoline/diesel vehicle in city center	1	2
8. Provision of priority lane for electric vehicle/motorcycle along major roads	1	2
9. Provision of free charging stations in the public spaces	1	2
10. Provision of low insurance cost for electric vehicle/motorcycle	1	2

Q63. In order to reduce the number of gasoline motorcycles, do you agree to regulate importing

the number of gasoline motorcycle to Laos?

1.

Yes

2.

Q64. If electric public transport vehicles are introduced, do you want to use?

No

		No	Yes	Yes, if service quality is improved
1.	Motorcycle Taxi	1	2	3
2.	Tuktuk/Jumbo	1	2	3
3.	Songthew	1	2	3
4.	Taxi	1	2	3
5.	Public Bus	1	2	3

Q65. Please write your comments freely on the policy to realize electric vehicle transport in Laos.

Questionnaire for Tourists

Q1. Profile of Respondents

1. Nationality							
2. Main place	for residents						
3. Age			4. Gender	1. Male	2. F	emale	
5. Occupation	ı					(choose fro	om the below box)
Tour Type	6. Group tour	1. Yes			2. No		
	7. With family	1. Yes			2. No		
	8. With friends	1 . Yes			2. No		
	9. Alone	1. Yes			2. No		
Entry to Laos	10. Entry point						
	11. Travel mode	1. Air		2. Land		3. River	
Stay in Laos	12. Total No. of days						
	13. Accommodation	1. Hotel		2. Friend's house		3. Others	

OCCUPATION	01.	Agriculture	11.	Repairing/Mechanician	21.	Public Transport Driver
	02.	Husbandry	12.	Company Manager (service)	22.	Monk/Trainee Monk
	03.	Fishery	13.	Company Employee (service)	23.	Housewife/Househusband
	04.	Forestry	14.	Public worker (National/Capital level)	24.	Primary School Student
	05.	Commercial Business	15.	Public Worker (District/Village level)	25.	Lower Secondary School Student
	06.	Retail (small scale)	16.	Teacher/Tutor	26.	Upper Secondary School Student
	07.	Restaurant/Café/Bar	17.	Doctor/Dentist	27.	University/College Student
	08.	Hotel/Guesthouse	18.	Civil Engineer/Architect	28.	Vocational School Student
	09.	Factory Manager	19.	Construction worker	29.	Retired
	10.	Factory Worker	20.	Truck Driver	30.	Others (Specify)

Q2. Tourism Destinations Visited or to be Visited

	Tourism Destinations	Visited (🖌)	Plan to visit (🗸)	Travel Mode	Accommodation
Vientiane	1. Wat Si Saket				
Capital	2. Haw Pha Kaeo				
	3. Patuxai				
	4. Lao National Museum				
	5. Wat Si Muang				
	6. Pha That Luang				
	7. Buddha Park				
	8. Talat Sao				
	9. Others ()				
Luang Prabang	10. Royal Palace Museum				
	11. Pha Bang				
	12. Wat Mai				
	13. Phu Si				
	14. Pak Ou Cave				
	15. Tat Kuang Si				
	16. Tat Sae				
	17. Others ()				
18. Others ()				

	Travel Mode							
01.	Walking	05.	Car Driver	09.	Tuk Tuk/Jumbo	13.	Others (specify)	
02.	Bicycle	06.	Car Passenger	10.	Sonthew			
03.	Motorcycle driver	07.	Minibus (<=25 pax)	11.	Taxi			
04.	Motorcycle passenger	08.	Standard Bus (>25 pax)	12.	Truck			

Q3. Assessment on Transport Service and Introduction of EV for Tourism Activities in Laos

		Used	(1:	Assessment Very Good ~ 5: Very B	ad)		Introduction of EV	,
		(~)	Safety	Comfort	Price	Yes	Not Necessary	Don't Know
Airport/ Bus Terminal –	1. Motorcycle Taxi							
City Center	2. Taxi							
	3. Hotel Car							
	4. Car Rental							
	5. Tuktuk/ Songthew							
	6. Bus							
	7. Others ()							
Within City	8. Walking							
	9. Bicycle							
	10. Motorcycle							
	11. Tuktuk/ Songthew							
	12. Mini bus							
	13. Taxi							
	14. Car Rental							
	15. Others ()							
Between City	16. Motorcycle							
Center and Nearby	17. Tuktuk/ Songthew							
Tourist Sites	18. Mini bus							
	19. Taxi							
	20. Car Rental							
	21. Others ()							

Appendix 1.7 Survey Sheet on Capacity to Introduce and Promote EVs

APPENDIX1.7: SURVEY SHEET ON CAPACITY TO INTRODUCE AND PROMOTE EVS

Q1. Company Profile

1.	Name of Company		
2.	Name of Respondent		
3.	Position of Respondent		
4.	Location of Company	District,	Village
5.	Telephone No. of Company		
6.	Type of Business		
7.	No. of Employee		

Q2. Current Use of Vehicles in Your Company

Vehicle Type ¹⁾	No.	Main Use ²⁾	Frequency of Use ³⁾	Ave. Driving Distance ⁴⁾ (km/day)	Ave. Driving Time ⁵⁾ (hrs/day)	Availability of Parking ⁶⁾
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

Instruction

	1) Vehicle Type							
1.	Motorcycle	7. Medium Bus (15 – 44 seats)						
2.	Tuk Tuk/Jumbo	8. Large Bus (more than 45 seats)						
3.	Sedan	9. Light Truck (3.5 – 7 tons)						
4.	Pick- up	10. Medium Truck (7 – 15 tons)						
5.	Small Van (less than 7 seats)	11. Heavy Truck (more than 15 tons)						
6.	Van (7-15 seats)	12. Other()						

2) Main Use
1. Passenger transport
2. Goods delivering
3. Both

3) Frequency	4) Ave. Driving Distance	5) Ave. Driving Time	
no. of days/week	average kilometerage/vehicle/day	average hours of use/vehicle/day	

5) Availability of Parking						
1. own parking space/facilities	2. off-road parking space outside-own compound	3. nearby vacant lands				
4. nearby road space	5. others					

Q3. Assessment on vehicle use conditions

	No Problem	So-So	Problem	Sever Problem
1. Gasoline/diesel price	1	2	3	4
2. Maintenance of vehicle	1	2	3	4
3. Distance to gas stations	1	2	3	4
4. Parking space at company	1	2	3	4
5. Parking space at destination	1	2	3	4
6. Traffic congestions	1	2	3	4
7. Traffic enforcement by traffic police	1	2	3	4
8. Road condition	1	2	3	4

Q4. Recognition of Electric Vehicles

Q41. Recognition and Experience of EV

			Recognition		Experience			
		Know well	Know by name	Don't know	Never tried	Tried several times	Place of Experience ¹⁾	
1.	EV in general	1	2	3	1	2		
2.	Electric bicycle	1	2	3	1	2		
3.	Electric motorcycle	1	2	3	1	2		
4.	EV minibus	1	2	3	1	2		
5.	EV car	1	2	3	1	2		
6.	Others (specify)	1	2	3	1	2		

1) 1= in Vientiane/Laos, 2= abroad

Q42. Assessment of EV (those who had experience of EV riding)

	Very good	Good	So-so	Bad	Very bad
1. Overall impression	1	2	3	4	5
2. Riding comfort	1	2	3	4	5
3. Travel speed	1	2	3	4	5
4. Vehicle design	1	2	3	4	5
5. Others()	1	2	3	4	5

Q5. Willingness to Use EV

Q51. Are you interested in EV?

1. Yes 2. No

Q52. If **YES**, what types of vehicle and for what purpose are you interested for your company activities?

1. Type of Vehicle	
2. Purpose	

Q53. If **NO**, please give reasons.

Q54. What are the important conditions for the use of EVs?

2.

		Highly critical	Critical	So-so	Not so critical	Not critical
1.	Price	1	2	3	4	5
2.	Charging facilities	1	2	3	4	5
3.	Driving distance	1	2	3	4	5
4.	Electricity fee	1	2	3	4	5
5.	Others (1	2	3	4	5

Q6. Comments on the government policy to realize electric vehicle transport

Q61. Do you agree to the policy to realize electric vehicle transport in Laos?

No

1. Yes

Q62. Does the following policy encourage you to use electric vehicle/electric motorcycle in your company?

		Yes	No
1.	Tax reduction on electric vehicle/motorcycle purchase	1	2
2.	Tax increase on gasoline/diesel vehicle purchase	1	2
3.	Tax reduction on corporation tax for using electric vehicle/motorcycles	1	2
4.	Increase in fuel price	1	2
5.	Reduction on electric tariff	1	2
6.	Provision of parking space for electric vehicle/motorcycle in city center	1	2
7.	Entering restriction of gasoline/diesel vehicle in city center	1	2
8.	Provision of priority lane for electric vehicle/motorcycle along major roads	1	2
9.	Provision of free charging stations in the public spaces	1	2
10.	Provision of low insurance cost for electric vehicle/motorcycle	1	2

Q63. Please write your comments freely on the policy to realize electric vehicle transport in Laos.

Appendix 1.8 Study Team Members

APPENDIX 1.8: STUDY TEAM MEMBERS

Name	Designation
JICA	
1. Dr. Masato TOGAWA	Chief Representative, JICA Laos
2. Mr. Susumu YUZURIO	Senior Representative, JICA Laos
3. Mr. Noriyuki MORI	JICA Expert
JICA Study Team	
1. Dr. Shizuo IWATA	Team Leader/Transport Plan
2. Mr. Mitsuro YAJIMA	Sub-team Leader/Infrastructure Plan of Low Emission Public Transportation System
3. Mr. Hirokazu HIRANO	Introduction Plan of Low Emission Vehicle (1)
4. Mr. Kazuo CHIBA	Introduction Plan of Low Emission Vehicle (2)
5. Dr. Junyi ZHANG	Traffic Survey/Demand Forecast (1)
6. Ms. Chika WATANABE	Traffic Survey/Demand Forecast (2)
7. Dr. Rene SANTIAGO	Economic and Financial Analysis
8. Dr. Yasuki SHIRAKAWA	Environmental and Social Analysis
9. Mr. Osamu ABE	General Coordination of Model Project
10. Dr. Tuenjai FUKUDA	Promotion of Understanding
11. Mr. Yasuhiro OKADA	Database Establishment (1)
12. Dr. Toshio IIJIMA	Database Establishment (2)

Table 1.8.1 JICA Study Team Members

Table 1.8.2 National Consultants

Name	Designation
1. Mr. Sengratry KYTHAVONE	Traffic Survey
2. Mr. Phetsaphone BOONYANITH	Demand Forecast
3. Mr. Phongsavanh INTHAVONGSA	Economic and Financial Analysis
4. Mr. Khontisack BUALAPHA	General Coordination of Model Project
5. Mr. Khambong THEPBANDITH	Website creation

Appendix 4.1 Comparison of Vehicle Operating Cost

APPENDIX4.1: COMPARISON OF VEHICLE OPERATING COST

1. Representative Vehicle Models

1. In order to compare the vehicle operating cost (VOC) of EVs with ICE vehicles, the available ICE vehicles in Lao PDR and the available EVs in Japan were selected for motorcycles, passenger cars, three-wheelers, mini-buses and medium buses as representative vehicle models. However, since the models of e-tuktuks, e-mini buses and e-medium buses in Japan are limited, Pilipino e-trike and Chinese e-mini and e-medium buses were also compared together with Japanese one. The representative vehicle models are as shown below (see Table 4.1.1 to Table 4.1.5).

	Item	ICE-MC (Wave 100)	EV-MC (SEED48)	EV-MC (EC-03)
Image		1	15	ditte
Manufactu	ırer	HONDA	Terra Motors	YAMAHA
Sales pric	e including tax (USD)	1,485 ¹⁾	1,257 ²⁾	3,174 ²⁾
Fuel effici	ency (km/l, km/kWh)	45	41.7	61.4
Cruising r	ange (km)	50-55	35-45	43
Passenge	r capacity (person)	2	1	1
Maximum	speed (km/h)	≈ 95	45	45
Gradabilit	y (°)	-	10	9
Weight (kg	g)	≈ 90	86	56
	Туре	-	Silicon	Li-ion
Battery	Capacity (kWh)	-	0.96	0.70
	Charging time (h)	-	7-9	6

Table 4.1.1 Representative Model of Motorcycles

Source: Web-site of manufactures

1) Sales price in Lao PDR, 2) Sales price in Japan.

	Item	ICE-Car (Corolla)	EV-Car (i-MiEV (M))	EV-Car (LEAF (S))	PHEV (Prius PHV (L))
Image					
Manufact	urer	ΤΟΥΟΤΑ	MITSUBISHI	NISSAN	ΤΟΥΟΤΑ
Sales p (USD)	price including tax	33,500 ¹⁾	32,7462)	42,185 ²⁾	38,413 ²⁾
Fuel effici	iency (km/l, km/kWh)	12.6	9.1	8.8	8.7
Cruising r	range (km)	630	120	228	26 .4 ²⁾
Passenge	er capacity (person)	5	4	5	5
Maximum	n speed (km/h)	284	130	140 <	180
Weight (k	(g)	1,375	1,070	1,705	1,675
	Туре	-	Li-ion	Li-ion	Li-ion
Battery	Capacity (kWh)	-	10.5	24.0	4.4
	Charging time (h)	-	4.5	8	1.5

Table 4.1.2 Representative Model of Passenger Cars

Source: Web-site of manufactures

1) Sales price in Lao PDR, 2) Sales price in Japan, 3) cruising range as an electric vehicle

	Item	Tuktuk	E-trike (Terra Motors ¹⁾)	E-trike (Philippine)	
Image					
Manufacturer		(originally from Thailand)	Terra Motors	(Pilipino company)	
Sales price including tax (USD)		≈ 2,000 ²⁾	≈ 4,000 ³⁾	5,389 ⁴⁾	
Fuel effic	iency (km/l, km/kWh)	10.0	27.8	12.8	
Cruising	range (km)	-	80	40 – 50	
Passeng	er capacity (person)	8 – 10	7	6 – 8	
Maximun	n speed (km/h)	-	55	-	
Weight (k	(g)	-	500	-	
	Туре	-	Silicon	Lead-acid	
Battery	Capacity (kWh)	-	2.9	3.0	
	Charging time (h)	-	-	6 – 8	

Table 4.1.3 Representative Model of Three Wheelers

Source: Web-site of manufactures

1) under development, 2) Purchase price of exiting tuktuk in Lao PDR, 3) target price by Terra Motors, 4) initial investment cost of e-trike in Philippines.

	Item	ICE-minibus (HIACE)	E-minibus (MAYU)	E-minibus (VSCBE)
Image				
Manufac	turer	ΤΟΥΟΤΑ	thinktogether	Lubao
Sales pri	ce including tax (USD)	39,500 ¹⁾	≈125,945 ²⁾	11,573 ³⁾
Fuel effic	ciency (km/l, km/kWh)	16.4	7.7	5.1
Cruising	range (km)	≈ 1,100	40	70
Passeng	er capacity (person)	15	10	12
Maximun	n speed (km/h)	≈ 160	19	35
Gradabili	ity (°)	-	-	11.3
Weight (H	kg)	2,965	-	1,940
	Туре	-	Li-ion polymer	Lead-acid
Battery	Capacity (kWh)	-	5.2	13.7
	Charging time (h)	-	8	8 – 10

Table 4.1.4 Representative Model of Mini-buses

Source: Web-site of manufactures, Gunma University

1) sales price in Lao PDR, 2) project cost in Japan, 3) purchase price of VCSBE.

Item ICE-medium Bus (Poncho) E-medium Bus (WEB-03) E-medium Bus (K9) Image Sales price including tax (USD) 200,3461) 881,6122) 316,6383) Fuel efficiency (km/l, km/kWh) 6.5 1.8 1.0 Cruising range (km) 65 250 -36 25 Passenger capacity (person) 32 70 Maximum speed (km/h) --7,331 18,000 Weight (kg) -Li-ion Type -Li-ion Battery Capacity (kWh) 44 324 -1.5 – 2 6 Charging time (h) -

Table 4.1.5 Representative Model of Medium Buses

Source: Web-site of manufactures, Waseda University

1) sales price in Japan, 2) project cost in Japan, 3) sales price in China.

2. Basic Data for VOC Estimation

2.1. Tax Rates

2. The tax rates in the amended Tax Law and Tariff Nomenclature of Lao PDR were applied to each vehicle as follows;

- (i) Motorcycle: The excise tax rate on e-motorcycles is clearly mentioned in the amended Tax Law saying that the excise tax law on e-motorcycles is 20% lower than that of conventional motorcycles.
- (ii) Car: The preferential tax treatment is given for four-wheel EVs now, which is 1% of import tax. Therefore, this preferential tax treatment is applied for electric car. In addition, the excise tax rates on cars are defined based on the size of displacement, so that the lowest tax rate is applied for electric car.
- (iii) The amended Tax Law does not mention about tax rates on tuktuks because they are already restricted to import to Lao PDR. Therefore, the previous tax rates on tuktuks are applied to both ICE and electric tuktuks.
- (iv) Mini bus and medium bus: In the same as electric cars, the preferential tax treatment of import tax was applied.
- 3. Each tax is calculated as follows;
- (i) Import tax = CIF x import tax rate
- (ii) Excise tax = (CIF + import tax) x excise tax rate
- (iii) VAT = (CIF + import tax + excise tax) x VAT rate

Vehicle	Motor	cycle	Ca	ar	Tuk	tuk	Min	Bus	Mediu	n Bus
Туре	ICE	EV	ICE	EV	ICE	EV	ICE	EV	ICE	EV
Import	40%	40%	40%	1%	40%	40%	20%	1%	20%	1%
Excise	10%	8%	75%	60%	20%	20%	25%	25%	25%	25%
VAT	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

Table 4.1.6 Tax Rates on Vehicles

Source: Amended Tax Law, Tariff Nomenclature of Lao PDR Based on ASEAN Harmonized Tariff Nomenclature

2.2. Price of Vehicles

4. The Purchase price of vehicles is composed of the CIF price, taxes and margin (10%) (see Table 4.1.7 and Table 4.1.8). The data for CIF price of EVs is not available, so that it is assumed that the CIF price is the same as purchase cost excluding taxes in the original country of the representative EVs (i.e., Japan, Philippine and China).

5. The annualized cost with 8% of interest is calculated by the following equation.

Annualized cost = Purchase Price $\times \frac{8(1+8)^n}{(1+8)^{n-1}}$ n = lifecycle of vehicles

Vehicle Type	Motorcycle			Car			
Model	Wave100	SEED48	EC-03	Corolla	i-MiEV (M)	LEAF	Prius PHV
CIF (USD)	797	1,197	3,023	11,300	31,187	40,176	36,584
Tax (USD)	553	794	2,005	19,154	24,251	31,241	28,448
Margin (USD)	135	199	503	3,045	5,544	7,142	6,503
Purchase Price (USD)	1,485	2,190	5,530	33,500	60,981	78,559	71,535
Annualized Cost (USD)	221	326	824	4,445	8,092	10,424	9,492
Lifecycle (year)	10	10	10	12	12	12	12

Table 4.1.7 Purchase Price of Motorcycles and Cars in Lao PDR

Source: JICA Study Team

Table 4.1.8 Purchase Price of Public Transport Vehicles in Lao PDR

Vehicle Type		Tuktuk		Min Bus			Medium Bus		
Model	Existing	Terra Motors	E-trike	HIACE 15	MAYU	VCSBE	Poncho	WEB-03	K9 (BYD)
CIF (USD)	984	3,810	5,132	21,763	119,948	7,576	190,806	839,630	301,560
Tax (USD)	834	3,230	4,352	14,146	46,630	2,945	124,024	326,406	117,231
Margin (USD)	182	704	948	3,591	16,658	1,052	31,483	116,604	41,879
Purchase Price (USD)	2,000	7,744	10,433	39,500	183,235	11,573	346,312	1,282,641	460,671
Annualized Cost (USD)	298	1,154	1,555	5,241	24,314	1,536	37,966	140,615	50,503
Lifecycle (year)	10	10	10	12	12	12	17	17	17

Source: JICA Study Team

2.3. Battery Cost

6. The battery cost of ICE vehicles is applied the actual cost in Lao PDR.

Table 4.1.9 Batter Cost of ICE Vehicles

	Motorcycle	Car	Tuktuk	Min Bus	Medium Bus
Battery Cost (USD/year)	20	75	50	60	75
Source: Surveyed by JICA Study	y Team				

7. The battery cost of EVs is varied by the manufactures, and it is not opened in public yet. Therefore, in this Study, it is assumed that 700Wh of Li-ion battery costs USD500. On the other hand, the actual costs of e-motorcycles and e-trike of Terra Motors, e-trike in Philippines, mini-bus of thinktogether and e-buses of VCSBE were able to be collected by the Study Team. So the actual costs were applied for them.

Table 4.1.10 Purchase	Price of Ba	atteries for EVs
-----------------------	-------------	------------------

Vehicle Type	Moto	rcycle		Car		Tuk	tuk	Min	Bus	Mediu	m Bus
Model	SEED48	EC-03	i-MiEV (M)	LEAF	Prius PHV	Terra Motors	E-trike	MAYU	VCSBE	WEB-03	K9
Turno	Silicon	Li-ion	Li-ion	Li-ion	Li-ion	Silicon	Lead-	Li-ion	Lead-	Li-ion	Li-ion
Туре							acid	Polymer	acid		
Capacity (kWh)	0.96	0.70	10.5	24.0	4.4	2.9	3.0	5.2	13.7	44	324
Lifespan (year)	4	4	6	6	6	6	2	6	1	6	6
Cost (USD)	637	666	9,983	22,817	4,183	1,912	748	4,944	2,356	41,831	308,031
Annualized Cost (USD)	60	63	671	1,534	281	181	261	332	1,856	3,500	25,766

Source: JICA Study Team

2.4. Prices of Fuels and Spare Parts

8. The unit prices of fuel, spare parts and insurances are applied the actual prices in Lao PDR (see Table 4.1.11). Based on the following unit prices and vehicle performances, the running cost of each vehicle was calculated (see Table 4.1.13). Regarding the fuel efficiency of ICE vehicles and electric efficiency of EVs, the figures in the catalogue are generally higher than actual condition. Therefore, the fuel efficiency of each vehicle was obtained through GPS survey by JICA Study Team, and the electric efficiency of each EVs was simulated based on the fuel efficiency in Lao PDR (see Table 4.1.12).

		Price
Fuel	Gasoline	1.37
(USD/I)	Diesel	1.2
Electric tarif	0.127	
Lubricant	for gasoline vehicle	9.1
(USD/I)	for diesel vehicle	5.2
	Motorcycle	29.4
Tire	Car	316.5
(USD/set)	Tuktuk	237.4
	Mini/Medium bus	940.0

Table 4.1.11 Unit Prices of Fuels and Spare Parts

Source: Surveyed by JICA Study Team

Table 4.1.12 Performance of Vehicles

	Motorcycle	Car	Tuktuk	Mini Bus	Medium Bus
Fuel efficiency (km/l)	30.0	10.0	10.0	8.0	6.0
Electric efficiency (km/kWh)	13.0	6.5	9.5	6.0	2.0
Lubricant (I/000 km)	0.66	1.32	1.32	5.00	7.15
Tire (set/0000 km)	0.01	0.02	0.02	0.03	0.31
Service life (year)	10	12	17	12	17
Yearly driving distance (km/year)	5,840	9,125	16,425	43,800	43,800
Insurance (USD/year)	9	23	22	40	40

Source: JICA Study Team

Vahiala Tura	Motor	cycle	Ca	ar	Tuł	duk	Min	Bus	Mediu	n Bus
Vehicle Type	ICE	EV	ICE	EV	ICE	EV	ICE	EV	ICE	EV
Fuel/Electricity	247	43	1,159	135	2,086	166	2,620	292	8,384	2,336
Lubricant	35	-	109	-	196	-	475	-	1,630	-
Tyre	0.2	0.2	6	6	8	8	51	51	1,260	1,260
Maintenance1)	24	24	1,130	1,130	30	30	653	653	5,724	5,724
Insurance ²⁾	9	9	23	23	40	40	40	40	40	40
Total	318	79	2,427	1,294	2,359	243	3,840	1,036	17,038	9,360

Source: JICA Study Team

1) assuming 3% of ICE vehicles

2) applied the insurance provided by AGL

3. Vehicle Operating Cost

9. The vehicle operating cost (VOC) can be calculated as sum of the annualized cost (vehicle and battery) and running cost (see Table 4.1.14 to Table 4.1.18).

	literee	ICE-MC	EV-	MC
Item		(Wave 100)	(SEED48)	(EC-03)
Annualized	Vehicle	221	326	824
Annualized	Battery	20	60	63
Cost (USD)	Sub-total	241	387	887
	Fuel/Electricity	247	43	43
Dunning	Lubricant	35	-	-
Running Cost	Tyre	0.2	0.2	0.2
	Maintenance	24	24	24
(USD/year)	Insurance, Others	9	9	9
	Sub-total	316	77	77
Total (USD/yea	ar)	557	463	964

Table 4.1.14 VOC of Motorcycles

Source: JICA Study Team

Table 4.1.15 VOC of Passenger Cars

	14	ICE-Car		EV-Car	
Item		(Corolla)	(i-MiEV (M))	(LEAF)	Prius PHV
Appualized	Vehicle	4,445	8,092	10,424	9,492
Annualized Cost (USD)	Battery	75	671	1,534	281
Cost (USD)	Sub-total	4,520	8,763	11,958	9,773
	Fuel/Electricity	1,159	135	135	135
Duranina	Lubricant	109	-	-	-
Running	Tyre	6	6	6	6
Cost	Maintenance	1,130	1,130	1,130	1,130
(USD/year)	Insurance, Others	23	23	23	23
	Sub-total	2,427	1,294	1,294	1,294
Total (USD/ye	ar)	6,947	10,057	13,253	11,068

Source: JICA Study Team

Table 4.1.16 VOC of Trikes

	ltom	ICE-trike	E-tr	rike
Item		(Tuktuk)	(Terra Motors)	(Philippine)
Americal	Vehicle	298	1,154	1,555
Annualized	Battery	50	181	261
Cost (USD)	Sub-total	348	1,335	1,816
	Fuel/Electricity	2,086	8	8
Duraciana	Lubricant	196	-	-
Running	Tyre	8	8	8
Cost	Maintenance	30	30	30
(USD/year)	Insurance, Others	40	40	40
	Sub-total	2,359	243	243
Total (USD/ye	ar)	2,707	1,578	2,059

Source: JICA Study Team

Item		ICE-minibus	E-mini bus							
		(HIACE)	(MAYU)	(VCSBE)						
Annualizad	Vehicle	5,241	24,314	1,536						
Annualized	Battery	60	232	1,856						
Cost (USD)	Sub-total	5,301	24,647	3,392						
	Fuel/Electricity	2,620	292	292						
Duracian	Lubricant	475	-	-						
Running	Tyre	51	51	51						
Cost (USD/year)	Maintenance	653	653	653						
(USD/year)	Insurance, Others	40	40	40						
	Sub-total	3,840	1,036	1,036						
Total (USD/year)		9,141	25,683	4,428						

Table 4.1.17 VOC of Mini-buses

Source: JICA Study Team

Table 4.1.18 VOC of Medium Buses

ltere		ICE-medium bus	E-medium Bus						
	Item	(Poncho)	(WEB-03)	(K9)					
Annualized	Vehicle	37,966	140,615	50,503					
	Battery	75	3,500	25,776					
Cost (USD)	Sub-total	38,041	144,115	76,279					
	Fuel/Electricity	8,384	2,336	2,336					
Duraciana	Lubricant	1,630	-	-					
Running	Tyre	1,260	1,260	1,260					
Cost (USD/year)	Maintenance	5,724	5,724	5,724					
(USD/year)	Insurance, Others	40	40	40					
	Sub-total	17,038	9,360	9,360					
Total (USD/year)		55,079	153,476	85,406					

Source: JICA Study Team

Appendix 4.2 Assessment Sheet on Proposed Strategies and Project by Stakeholders

APPENDIX4.2: ASSESSMENT SHEET ON PROPOSED STRATEGIES AND PROJECT BY STAKEHOLDERS

Low-emission Transport Study Questionnaire

We are in the process of introducing low-emission transport systems in Laos. Please find attached a questionnaire that we are collecting in order to get opinions and ideas of stakeholders about introducing low-emission transport systems that we would like to propose. The collected information will be used to elaborate the strategies and model projects to introduce low-emission transport system in Laos. The collected information will be statistically processed in order to protect your privacy.

Please take time to complete the enclosed questionnaire and hand in it to reception before you leave. Your opinion on the matter is very important to us and we would like to hear it.

We thank you for your time and cooperation in providing your valuable suggestions for the next step of this Study for the developing strategies and model projects to introduce low-emission transport system.



Part I: Your Assessment of proposed strategies and actions

Instruction: Please "✔"for each of your answer (1: Low – 5: High)

			Rapid Evaluation														
Proposed Actions and Projects			Im	portan	ice			A	dequa	су		Priority					
				3	4	5	1	2	3	4	5	1	2	3	4	5	
Strategy 1	1.1 Organize "preparatory LEV taskforce"																
	1.2 Prepare a Master Plan																
	1.3 Work on ASEAN Secretariat																
Strategy 2	2.1 Prepare EV infrastructure plan																
	2.2 Prepare a guideline for private sector investment																
Strategy 3	3.1 Establish common database on EVs																
	3.2 Provide the data and information																
	3.3 Include LEV/EV in school curriculum																
Strategy 4	4.1 Prepare and update list and profile of EV projects																
	4.2 Establish one-stop window																
	4.3 Provide necessary support awareness																
Strategy 5	5.1 Establish channels to international organizations																
	5.2 Organize international conferences, etc.																
	5.3 Establish a EV R&D center																
Strategy 6	6.1 To formulate LEV plan for main urban centers																
	6.2 To formulate LEV plan for main roads																
	6.3 To formulate LEV plan for rural areas																
Strategy 7																	

Part II: Your Assessment of model projects

Instruction: Please "✔"for each of your answer (1: Low – 5: High)

			Rapid Evaluation														
Proposed Actions and Projects			Im	portar	ice			A	dequa	су		Priority					
			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Vientiane	1.	100 EV pioneer program															
Capital	2.	E-paratransit program															
	3.	E-commercial program															
	4.	E-mobility zone program															
	5.	EST lane program															
Luang	1.	EV pioneer program															
Prabang	2.	Tourism EV program															
	3.	E-mobility zone program for core zone															
Savannakhet/	1.	E-transit program															
Pakse	2.	E-bike program															
	3.	EV remodeling center program															
Transport	1.	Develop model EV Michi-no-Eki															
Corridor	2.	E-road project															
Rural Area	1.	Program on introduction of EV for bike, multi-purpose vehicle															
	2.	E-paratransit program.															
	3.	E-agricultural machine program															

Part III: Please write your comments on this Project or introducing electric vehicles in Laos

Part IV: Personal Information

1. Name of province where you live:

2. Name of your organization/agencies:

