MOEJ/GEC JCM Methodology Demonstration Study (DS) 2013
Final Report

「Promotion of Electric Vehicles Usage」
（implemented by ALMEC Corporation）

<table>
<tr><td colspan="2">Study partners</td><td>Climate Consulting, LLC, ITS Consultants Co., Ltd.
Toyota Tsusho Electronics (Thailand) Co., Ltd.</td></tr>
<tr><td colspan="2">Project site</td><td>Luang Prabang and Vientiane in Lao People's Democratic Republic</td></tr>
<tr><td colspan="2">Category of project</td><td>Transport</td></tr>
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2) This methodology is applicable for project activities introducing 2-wheels, 3-wheels and/or 4-wheels or more. This methodology is not applicable to electric motor assist cycle (with pedal), hybrid vehicles and plug-in-hybrid vehicles.
Project participants shall demonstrate in Project Design Document that the project and reference vehicles are comparable, using the following means:
(a) Project and reference vehicles belong to the same vehicle category e.g. motorcycle, bus, taxi, truck, tricycle;
(b) Project and reference vehicles categories have comparable passenger/load capacity
3) Project EVs must comply with the following condition ;
a) Vehicle standards and electricity vehicle safety standard in Lao
b) Complete vehicle registration and take out automobile insurance
c) Sign an agreement of maintenance and vehicle disposal with car dealer or EV maintenance operator.
Project participants shall demonstrate in Project Design Document that the project EV comply those conditions described on the above.
4) Project EVs must use electricity only supply from national grid in Lao</td></tr>
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Op.3: Catalogue values provided by mfr.</td></tr>
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Calculation of reference emissions

$$RE_y = \sum_i \left(SFC_i \times NCV_{RF,i} \times EF_{RF,i} \times DD_{i,y} \times N_{RF,i,y} \right)$$

RE_y	Total reference emissions in year *y* (tCO_2/year)
SFC_i	Specific fuel consumption of reference vehicle category *i* (l/km)
$NCV_{RF,i}$	Net calorific value of fossil fuel consumed by reference vehicle (MJ/l)
$EF_{RF,i}$	Emission factor of fossil fuel consumed by reference vehicle (tCO_2/MJ)
$DD_{i,y}$	Annual average distance travelled by project vehicle (km/year)
$N_{RF,i,y}$	Number of reference vehicles in category *i* in year *y*

Monitoring method

Parameter & Description	Source / Monitoring method/item
$DD_{i,y}$:Annual average distance travelled by project vehicle category *i* in the year *y* (km/year)	Monthly distances travelled of sample vehicles for each vehicle category are monitored every month and the average value is applied as the average monthly distance travelled by the vehicle category. Sample vehicle is selected under 90% confidence interval and +/- 10% error margin.
$SEC_{PJ,i,y,}$:Specific electricity consumption by project vehicle category *i* per km in year *y* in urban conditions (kWh/km)	Monthly electricity consumptions of sample vehicles for each vehicle category are monitored every month and the average value is applied as the average monthly electricity consumption by vehicle category. The average annual electricity consumption by vehicle category is calculated as the weighted average in distance travelled. The monthly electricity consumption is calculated from the record of monthly operation report.

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Result of monitoring

V.category	Drive distance(km/y)	Reference FC(km/l)	Project EC(kwh/km)
EMC	8,000	57.6	0.0206
Tuk-tuk	20,000	14.2	0.1266
Jumbo	20,000	35.5	0.1266
Pax. car	8,000	12.2	0.1200

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GHG emission reductions

Unit: tonCO2/year

Year	Reference emissions	Project Emissions	Emission Reductions
2014	602	116	486
2015	1,431	240	1,191
2016-2020	2,279	367	1,912
Total(2014-2020)	13,428	2,191	11,237

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Environmental impacts

There is no environmental impact of special. Need support for the introduction of battery recycling system.

Promotion of Japanese technologies

Low-speed electric vehicles (LSEV) is produced and sold on a small scale for the domestic market in each country. Made in China LSEV is introduced to Lao, but since there are no after-sales service selling out of the vehicle, it will not be used with the battery life. Japanese EV technology have a market advantage since it involve not only vehicle selling but also infrastructure for EV and development of personnel resources. The introduction of the import license system of LSEV subject to a quality assurance and after-sales service is required.

Sustainable development in host country

•The urban environment improvement by traffic noise reduction in particular for world heritage protected areas.
·GDP increased by decreasing fossil fuel imports results foreign currency payment reduction and monetary stability.
・EV related job creation such as battery manufacturing and electric vehicle assembly.

Development and deployment of similar projects

The countries where CO2 emission factor of Electricity is small have high potential for CO2 emission reduction by EV introduction. Paraguay, Zambia, Nepal, Albania, Tajikistan, and Costa Rica are such a country. The country of importing much petroleum products and car ownership is relative low is suitable country for EV promotion as well as Laos.

JCM Methodology Demonstration Study (DS) 2013
"Promotion of Electric Vehicles Usage"

(Host country: Lao People's Democratic Republic)

Study Entity: ALMEC Corporation

1. Study Implementation Scheme

Country	Organization involved in Study	Role in Study
Japan	Climate Consulting, LLC	Development of methodology
Host County	ITS Consultants Co., Ltd.	Monitoring and Coordination of study in project site
Other County	Toyota Tsusho Electronics (Thailand) Co., Ltd.	Procurement and operation of EVs and monitoring devices

2. Overview of Proposed JCM Project

(1) Description of Project Contents:

ICA and LAO MPWT(Ministry of Public Works and Transportation) conducted "Basic Data Collection Study on Low-Emission Public Transport System in Lao PDR" in 2012 in which the road map of EV introduction in Lao has been proposed. The road map proposed model projects in Luang Prabang(LPB) and Vientiane Capital(VTE) as short-term activity for EV promotion. This proposed JCM project is intended to be a model project piloting EV promotion in whole Lao.

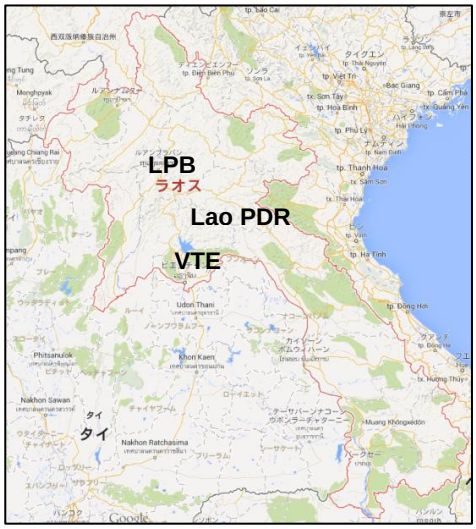
The Project JCM project activity to reduce carbon dioxide emissions by replacing the ICE(internal combustion engine using fossil fuels) to EVs.In the project Japanese EV are introduced and Laos EV companies operate it for bus service inside city under cooperation with MPWT and DPWT. Lao EV company is established in end of 2013 by tourism businessmen in Lao aiming preserve the environment through EV usage in city center.

Luang Prabang (Unit)

Year	2014	2015	2016	Total
EV-Jumbo	100	-	-	100
Electric Motor Cycle(EMC)	30	30	40	100

Vientiane (Unit)

Year	2014	2015	2016	Total
EV-Jumbo	100	150	150	400
Government Car		100	100	200
Taxi		50	50	100
Electric Motor Cycle(EMC)	30	30	40	100



(2) Situations of Host Country:

"Bilateral cooperation on the joint crediting mechanism for the low carbon growth partnership between Japan and LAO PDR" has signed by representatives of both sides in 07 August, 2013 in Vientiane. The key contents of the agreement are as follows:

1) Both sides, in order to promote investment and deployment of low carbon technologies, products, systems, services and infrastructure to achieve low carbon growth in the Lao People's Democratic Republic, establish a Joint Crediting Mechanism (hereinafter referred to as the "JCM") and implement it in accordance with the relevant domestic laws and regulations in force in respective countries.
2) Both sides work in close cooperation to facilitate financial, technological and capacity building support necessary for the implementation of the JCM.

3) Both sides aim for concrete contributions to assisting adaptation efforts of developing

3. Study Contents

The issues to be solved in Study and study contents in order to solve the issues are shown on the following table:

Issues	Objectives	Study contents
Establish the Japanese support scheme in order to realize more than 100 units of EVs introduction by Lao private EV operator.	Realize more than 100 units of EVs introduction as a JVM project	Conduct operation, charging and maintenance of 4 units of EVs newly introduced. Necessary infrastructure, relevant licensing facility, equipment are installed for experience.
	Development and demonstration the applicability of JCM methodology	The MRV methodology is applied for demonstration operation to verify the practicality and make the modification as necessary.
	Establish monitoring structure	In order to carry out monitoring, find human resources available locally. Build a human network capable for performing monitoring in actual JCM project.
Identify Laos side host party for the JCM project	Identify Laos side host party for the JCM project	Identify project participant to EV project from businessman group of local. In addition, through the experience of demonstration operation, specific roles of each participant to manage EV public transportation system is recognized and shared.. (Role sharing between public and private and coordination with existing operators)
	Identify Japanese EVs targeting to introduce into Lao	For the purpose of import Japanese technology, The number of EV and the specification are determined. Identify the Japanese EVs to meet the specification, and hearing the EV manufacturer whether the company export the EVs to Laos.
	Organize international consortium	Identify the JCM business company relevant to EV operation. such as Japanese EV manufacturer, local agent to import and inland transport vehicle and the parts, EV operation entity, EV charging and maintenance operator. Those company will be a member of international consortium for JCM project.
Establish sustainable EV public transport system model	Establish framework of PPP (public private partnership) for EV public transport promotion in cooperation with Japanese support and Lao side efforts	In order to achieve a safe and secure EV promotion in Laos, importing of EVs only is not enough. Development of necessary standards and regulations, tax exemption, charging infrastructure, training of maintenance technology and human resources must be forwarded at the same time. For this purpose, it is necessary to continue to utilize public-private partnership, and ODA support. The basic framework will be examined in this study.
	Cooperation with ODA	JICA has started study for EV promotion in Laos from 2012. It is necessary to promote in the most efficient manner as Japan, while hearing the view from JICA, cooperation measures shall be examined.

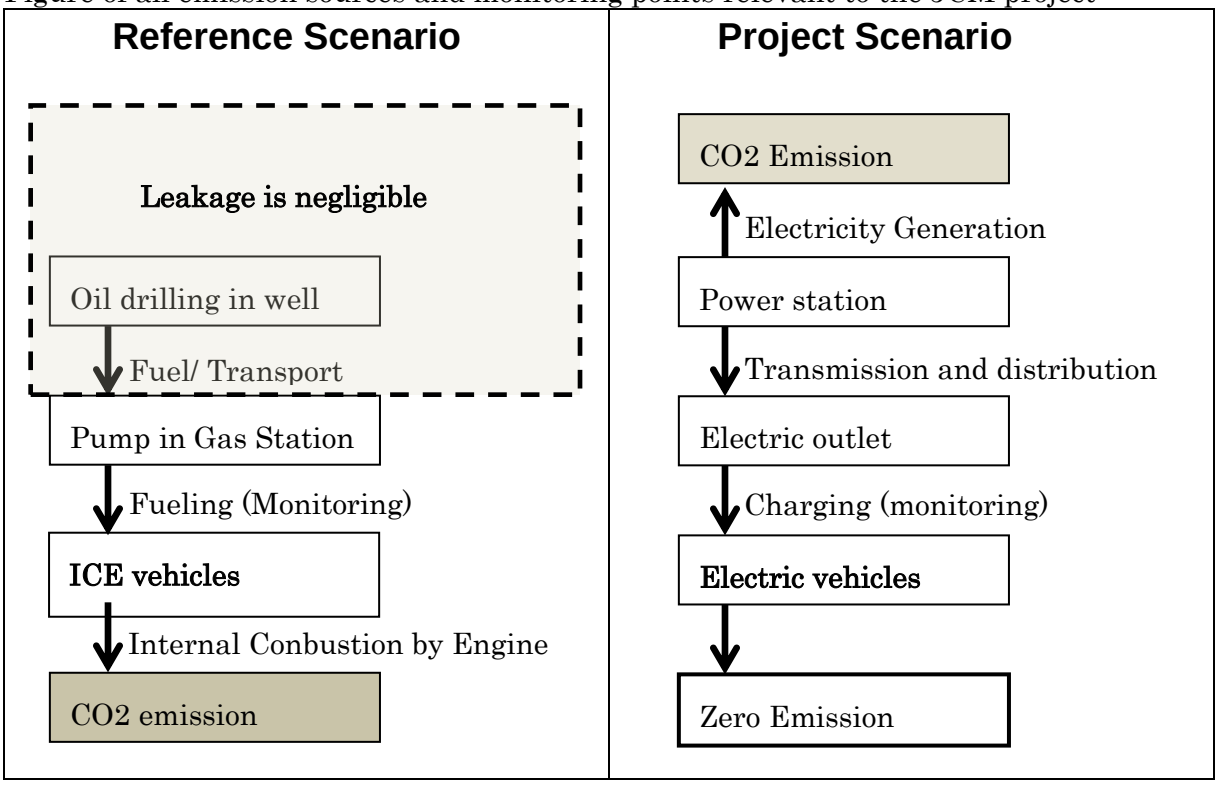
(1) JCM methodology development

a. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	This methodology is applicable for project activities introducing new electric vehicles that displace the use of fossil fuel vehicles in passenger and freight transportation.
Criterion 2	This methodology is applicable for project activities introducing 2-wheels, 3-wheels and/or 4-wheels or more. This methodology is not applicable to electric motor assist cycle (with pedal), hybrid vehicles and plug-in-hybrid vehicles. Project participants shall demonstrate in Project Design Document that the project and reference vehicles are comparable, using the following means: (a) Project and reference vehicles belong to the same vehicle category e.g. motorcycle, bus, taxi, truck, tricycle; (b) Project and reference vehicles categories have comparable passenger/load capacity
Criterion 3	Project EVs must comply with the following condition ; a) Vehicle standards and electricity vehicle safety standard in Lao b) Complete vehicle registration and take out automobile insurance c) Sign an agreement of maintenance and vehicle disposal with car dealer or EV maintenance operator. Project participants shall demonstrate in Project Design Document that the project EV comply those conditions described on the above.
Criterion 4	Project EVs must use electricity only supply from national grid in Lao

Figure of all emission sources and monitoring points relevant to the JCM project



b. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
$NCV_{RF,i}$	Net calorific value of fossil fuel consumed by reference vehicle category *i* (MJ/l)	Country or neighboring countries specific data or IPCC default value e.g. 31.48 MJ/liter (Thailand data, Ministry of Thailand)
$EF_{RF,i}$	Emission factor of fossil fuel consumed by reference vehicle category *i* (tCO_2/MJ)	Country specific data or IPCC default value e.g. 69,300 $kgCO_2$/TJ (IPCC 2006)
SFC_i	Specific fuel consumption of reference vehicle category *i* (l/km)	Shall be determined in order of the following three options. The default values are shown in "Section F". Op.1: Conservative default values based on field measurements Op.2: Conservative default values based on existing data Op.3: Catalogue values provided by manufactures

c. Result of actual monitoring

Summary of Monitotring Records

category	specification	Plate Number	September Drive Range km	September Fuel consume l/month	September Fuel Economy km/l	October Drive Range km	October Fuel consume l/month	October Fuel Economy km/l	November Drive Range km	November Fuel consume l/month	November Fuel Economy km/l	December Drive Range km	December Fuel consume l/month	December Fuel Economy km/l	Total Drive Range km	Total Fuel consume l/month	Total Fuel Economy km/l	Odometer Beginning September	Odometer end December
ICE with Odometer																			
Jumbo 1	150cc	0722	1,919	68.2	28.1	1954	49.2	39.7	2223	56	39.7	2364	72.2	32.7	8,723	245.6	35.5	12,472	21,195
Tuktuk(4wh) 1	800cc	0509	1,063	69.3	15.3	1369	128.38	10.7	1328	129.06	10.3	1281	150.8	8.5	5,154	477.54	10.8	24,708	29,862
Tuktuk(4wh) 2	800cc	4838	757	29.3	25.8	649	54.13	12	674	57.58	11.7	819	83.1	9.9	2,096	224.11	9.4	28,942	31,038
Tuktuk(4wh) 3	800cc	0494	762	52	14.7	995	87.6	11.4	1150	99.3	11.6	1407	137.6	10.2	4,465	376.5	11.9	126,936	131,401
Total/Average			2,582	151	17.1	3,013	270	11.2	3,152	286	11	3,507	372	9.4	11,715	1,078	10.9	180,586	192,301
motorbike 1	Honda 100cc	6075	516	10.1	51.1	820	16.54	49.6	617	12.25	50.4	455	13.4	34	2,513	52.29	48.1	58,468	60,981
motorbike 2	Honda 100cc	New/Somsai	588	8.2	71.7	715	11.7	61.1	583	8.85	65.9	713	14.5	49.2	2,668	43.25	61.7	7,141	9,809
motorbike 3	Honda 100cc	1287	659	11.5	57.3	842	14.68	57.4	1054	16.46	64	595	12.3	48.4	3,270	54.94	59.5	31,510	34,780
motorbike 4	Honda 125cc	New/Kissia	1,106	19.7	56.1	1503	26.24	57.3	1127	16.09	70	1121	23.9	46.9	4,883	85.93	56.8	262	5,145
motorbike 5	Honda 100cc	3283	662	13.2	50.2	698	13.51	51.7	899	13.28	67.7	784	18.4	42.6	3,160	58.39	54.1	77,247	80,407
motorbike 6	Chinease	3963	N/A	N/A		566	14.58	38.8	424	9.8	43.3	444	14.6	30.4	1,624	38.98	41.7	12,856	14,480
motorbike 7	Honda 100cc	2913	992	12.2	81.3	1175	16.82	69.9	902	13.63	66.2	268	15.4	17.4	3,413	58.05	58.8	171	3,584
motorbike 8	Honda 110cc	2165	677	8.9	76.1	1224	17.24	71	165	9.86	16.7	188	11.2	16.8	3,350	47.2	71	15,945	19,295
Total/Average			5,200	84	62.1	7543	131.31	57.4	5771	100.22	57.6				24881	439.03	56.7	203,600	228,481

EV — Distance: Gothic ; Odometer, else:GPS

category	specification		September Drive Range km	September Fuel onsumptio l/month	September Fuel Economy km/l	October Drive Range km	October Electricity onsumptio kwh/month	October Electricity Economy km/kwh	November Drive Range km	November Electricity onsumptio kwh/month	November Electricity Economy km/kwh	December Drive Range km	December Electricity onsumptio kwh/month	December Electricity Economy km/kwh	Total Drive Range km	Total Electricity onsumptio kwh/month	Total Electricity Economy km/kwh
WST0-0044	EV(TICOST-600)	-	N/A	N/A	N/A	912	119.7	7.6	1072	126.1	8.5	746.9	100.4	7.4	2,731	346.2	7.9
WT-2370	EV(ST-600)	กจ-6274	N/A	N/A	N/A	875	240.3	3.6	1134	212.8	5.3	1058	221.9	4.8	3,067	675	4.5
						1,444	240.3	6	**1466**	212.8	6.9	1490	221.9	6.7	4,400	675	6.5
WT-1883	EV(SB-1400)	กจ-7370	N/A	N/A	N/A	869	227.8	3.8	1163	219.5	5.3	830.5	163.9	5.1	2,862	611.2	4.7
						1,174	227.8	5.2	**1154**	219.5	5.3	820.2	163.9	5	3,148	611.2	5.2
	EMC1		N/A	N/A	N/A	**340**	9.1	37.4	**437**	6.9	63.3			#DIV/0!	777	16	48.6

ICE without Odometer

category	specification		September Drive Range km	September Fuel onsumptio l/month	September Fuel Economy km/l	October Drive Range km	October Fuel onsumptio l/month	October Fuel Economy km/l	November Drive Range km	November Fuel onsumptio l/month	November Fuel Economy km/l	December Drive Range km	December Fuel onsumptio l/month	December Fuel Economy km/l	Total Drive Range km	Total Fuel onsumptio l/month	Total Fuel Economy km/l
WT-3821	Jumbo	สก-0129	N/A	N/A	N/A	1518.3	117.06	13	2197	155.05	14.2	2051.4	126.6	16.2	5,767	398.71	14.5
WT-1467	TUKTUK	สก-0673	N/A	N/A	N/A	893.55	74.05	12.1	1554	82.4	18.9	1501.6	109.1	13.8	3,949	265.55	14.9
WT-0597	TUKTUK	สก-0643	N/A	N/A	N/A	1735.97	135.57	12.8	2515	159.14	15.8	2036.4	138.5	14.7	6,287	433.21	14.5
WT-2372	Taxi-van	กก-0509	N/A	N/A	N/A	1096.69	N/A	#VALUE!	4	N/A	#VALUE!			#DIV/0!	0	0	#DIV/0!
WT-1726	Jumbo	สก-0190	N/A	N/A	N/A	2313.16	N/A	#VALUE!	532	60.83	8.7		88.7	0	532	149.53	3.6

The monitoring method/item of each data and parameter set ex-post is listed as below:

Parameter	Description of data	Source / Monitoring method/item
$DD_{i,y}$	Annual average distance travelled by project vehicle category *i* in the year *y* (km/year)	Monthly distances travelled of sample vehicles for each vehicle category are monitored every month and the average value is applied as the average monthly distance travelled by the vehicle category. Sample vehicle is selected under 90% confidence interval and +/- 10% error margin.
$SEC_{PJ,i,y,}$	Specific electricity consumption by project vehicle category *i* per km in year *y* in urban conditions (kWh/km)	Monthly electricity consumptions of sample vehicles for each vehicle category are monitored every month and the average value is applied as the average monthly electricity consumption by vehicle category. The average annual electricity consumption by vehicle category is calculated as the weighted average in distance travelled. The monthly electricity consumption is calculated from the record of monthly operation report.
$N_{RF,i,y}$	Number of reference vehicles in category *i* in year *y*	Basically equal to $N_{PJ,i,y}$. In case, replacing with multiple vehicles by one project vehicle (e.g. replacing two Jumbo by one electric vehicle), $N_{RF,i,y}$ can be estimated as $N_{RF,i,y}$ = A * $N_{PJ,i,y}$ (e.g. A=2)
$N_{PJ,i,y}$	Number of operational project vehicles in category *i* in year *y*	Based on annual sales records or official data on registered project vehicles.
$EF_{elect,y}$	CO_2 emission factor of electricity consumed by project vehicle category *i* in year *y* (tCO_2/kWh)	Calculated based on CDM Methodological tool "Tool to calculate the emission factor for an electricity system, Version 03.0.0".
TDL_y	Average technical transmission and distribution losses for providing electricity in the year	Official value of the EDL. In case the data will not be obtained, the default value of 20% in the CDM Methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01) can be applied. *10.32% in 2012 for EDL grid (Source: Electricity Statistics 2012, EDL)

Prime parameters set ex-post are preset based on monitoring results as follows:

Table Preset values of prime parameters set ex-post

Reference vehicle	Project electricity consumption rate (kwh/km)	Annual drive distance (km/year)
Jumbo（PJ：e-tuktuk）	0.1266	20,000
ICE car（1500cc）（PJ：EV government car）	0.12	8,000
ICE car（1500cc）（PJ：EV taxi）	0.12	20,000
Motorcycle（100～125cc）（PJ：Electric Motorcycle）	0.0206	20,000

d. Calculation of GHG emissions (including reference and project emissions)

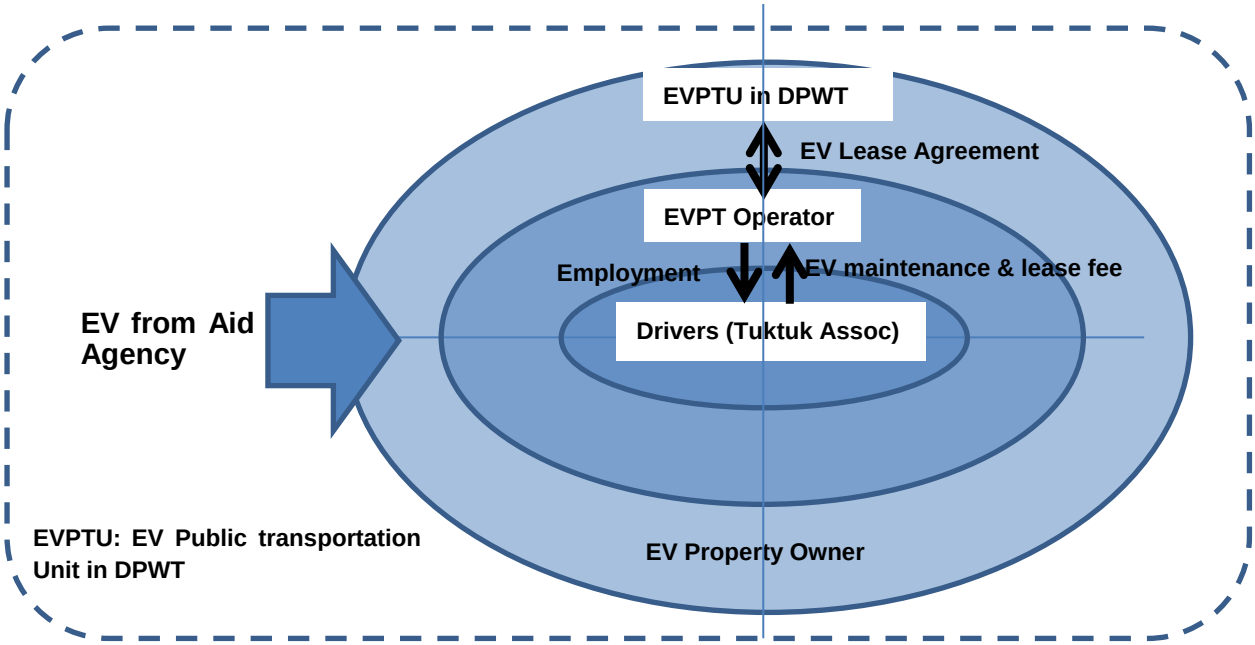
Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2013			
2014	602.4	115.6	486.8
2015	1,431.0	240.0	1,191.0
2016	2,279.8	366.4	1,913.4
2017	2,279.8	366.4	1,913.4
2018	2,279.8	366.4	1,913.4
2019	2,279.8	366.4	1,913.4
2020	2,279.8	366.4	1,913.4
Total (tCO_{2e})	13,432.2	2,187.6	11,244.6

(2) Development of JCM Project Design Document (PDD)

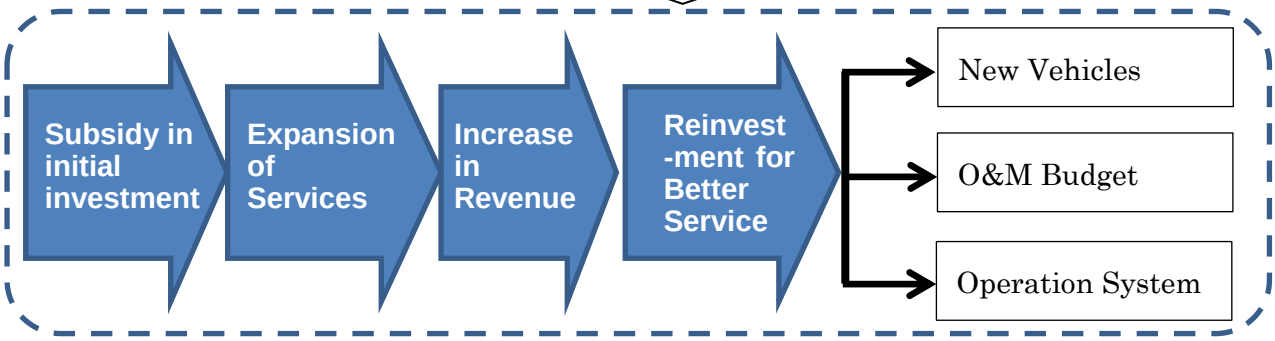
1)Concept for establish JCM project structure

Concept for establish JCM project structure leading to sustainable EV public transport model is organized as shown in the table below. In accordance with this concept, an agreement on the role sharing and collaboration of project participants are settled.

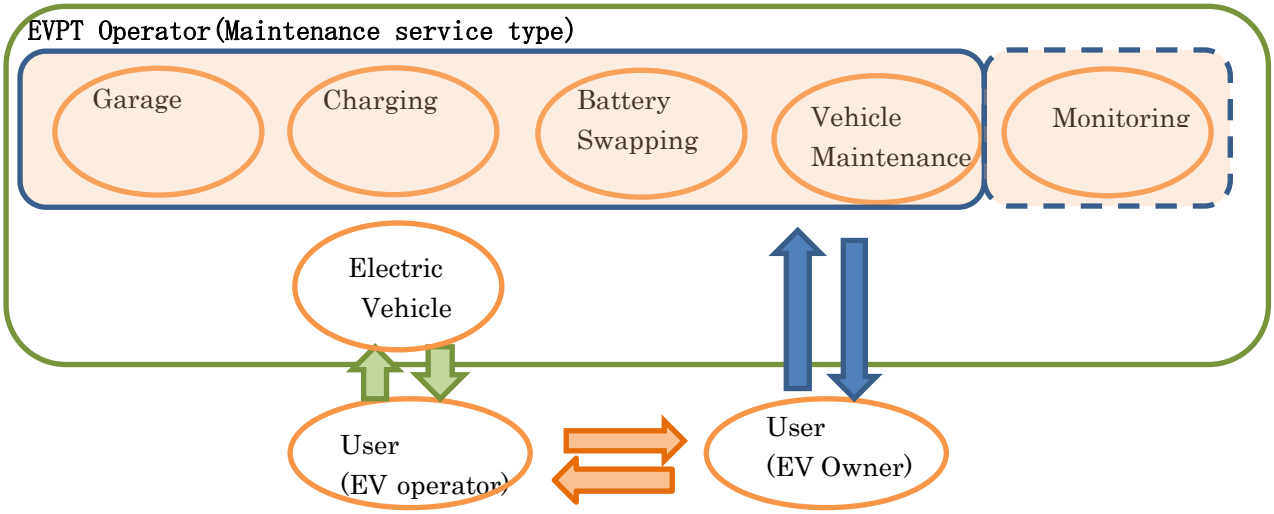
Concept for establish JCM project structure (FY2014)



sustainable EV public transport model

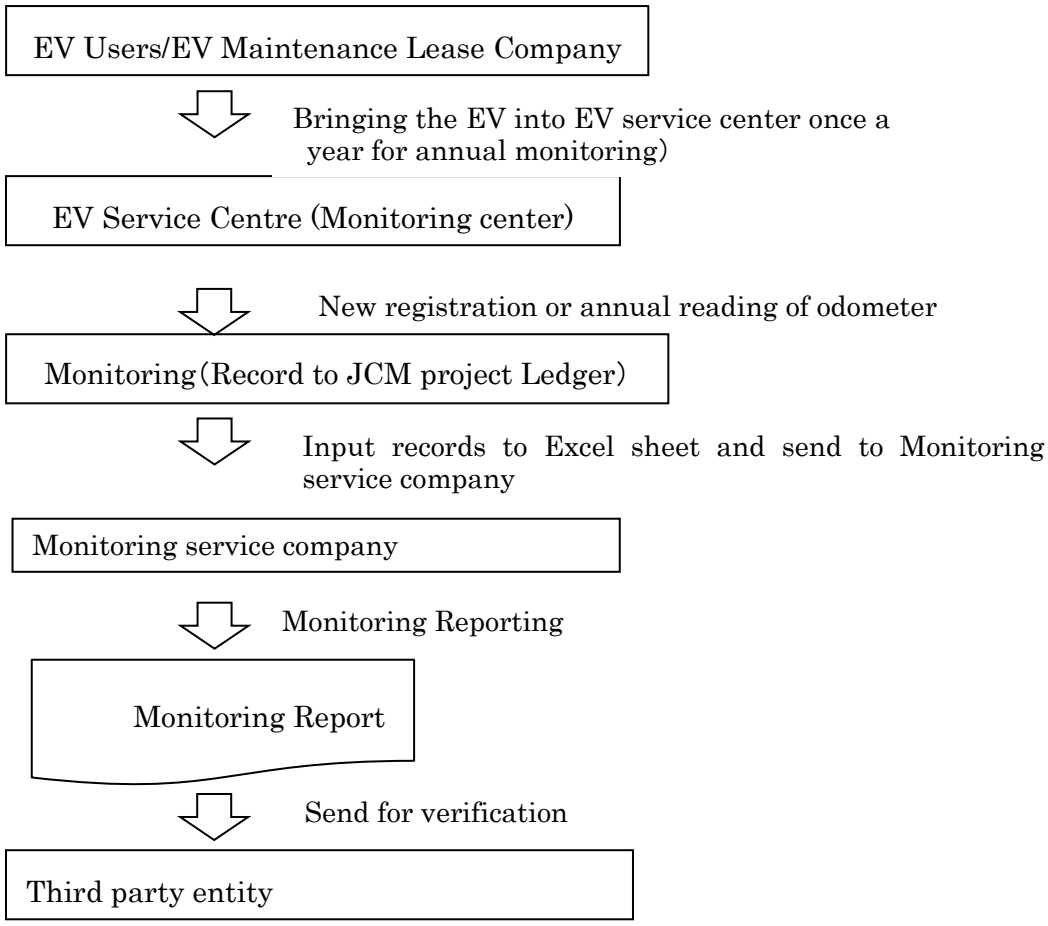


EVPT Operator (maintenance lease type)



2)Monitoring Structure

Monitoring Structure is shown in the following diagram below:



Responsible personnel	Role
Project Manager	Responsible for project planning, implementation, monitoring results and reporting.
Project Deputy Manager	Apponited to be in charge of approving the archived data after being checked and corrected when necessary.
Facility Manager	Appointed to be in charge of monitoring procedure (data collection and storage), including monitoring equipments and calibrations, and training of monitoring personnel.
Operators	Appointed to be in charge of checking the archived data for irregularity and lack.
Accountant	Appointed to be in charge of checking the monthly monitoring data from monetary view.

3) comments from local stakeholders

Local stakeholders comments is collected on site study showing the results of the study and plan for next step. Summary of comments received and their consideration are as follows:

Stakeholders	Comments received	Consideration of comments received
MPWT	MPWT will support and assist new project in next FY. Tax exemption to EV for project is no problem. Import permit to tricycle to be discussed with Minister.	All the parties concern to next step project are collaborative. We must try to our best to proceed to next step.
DPWT	DPWT feels no problem about the bus service, but for operation of EV-Jumbo, the driver should be provided from tuktuk association. DPWT commits that it will facilitate this promotion from government stand points and to help advice Lao Green on various related regulations to implement EV tuktuk in LPB.	
Laogreen	LaoGreen will willing to attend the next step project in the following manner A) Own, operate and maintenance EVs as a EV operator B) Own, maintenance and lend EVs to driver as a EV maintenance lease company Lao Green commits that it will work close with DPWT and Tuktuk Association to make the introduction of EV tuktuk to LPB goes smooth in that Lao Green will become member of Tuktuk Association and to discuss on various issues to make replacement of EV tuktuk for conventional jumbo and tuktuk smooth including the method to have existing jumbo and tuktuk drivers to move to drive EV tuktuk.	
Tuktuk Association	TA feels no problem about bus operation by Laogreen. But in EV-taxi operation, Laogreen's driver should join to TA and cooperate with other driver. Lao Green commits that it will work close with DPWT and Tuktuk Association to make the introduction of EV tuktuk to LPB goes smooth in that Lao Green will become member of Tuktuk Association and to discuss on various issues to make replacement of EV tuktuk for conventional jumbo and tuktuk smooth including the method to have existing jumbo and tuktuk drivers to move to drive EV tuktuk.	
EV mfr	Hope to success in demonstration project. If the constant demand for EV is created, assemble factory can be established.	

(3) Project development and implementation

a. Japan's contribution

Low-speed electric vehicles (LSEV) is produced and sold on a small scale for the domestic market in each country. Made in China LSEV is introduced to Lao, but since there are no after-sales service selling out of the vehicle, it will not be used with the battery life. Japanese EV technology have a market advantage since it involve not only vehicle selling but also infrastructure for EV and development of personnel resources. The introduction of the import license system of LSEV subject to a quality assurance and after-sales service is required.

b. Environmental integrity

•The urban environment improvement by traffic noise reduction in particular for world heritage protected areas.
·GDP increased by decreasing fossil fuel imports results foreign currency payment reduction and monetary stability.
・EV related job creation such as battery manufacturing and electric vehicle assembly.

c. Sustainable development in host country

The countries where CO2 emission factor of Electricity is small have high potential for CO2 emission reduction by EV introduction. Paraguay, Zambia, Nepal, Albania, Tajikistan, and Costa Rica are such a country. The country of importing much petroleum products and car ownership is relative low is suitable country for EV promotion as well as Laos.