Ministry of Public Works and Transportation, Lao PDR
Department of Public Works and Transportation, Luang Prabang

Verification Survey with the Private Sector for Disseminating Japanese Technologies for Low-Emission Public Transportation Systems Utilizing Electric Trikes

Summary Report

December 2016

Japan International Cooperation Agency (JICA)

Prozza Corporation

Contents

Overview of the World Heritage Town of Luang Prabang (December 2014)

Parking behavior of tourists is a serious problem when it disturbs the holy custom of *takbat* practiced by Buddhist monks. (December 2014)

Battery exchange stations are a major feature of the EV transportation system. (April 2015)

Three-wheeled Pecolos are delivered at the depot of Laogreen, the operator. (April 2015)

Local partners approve the placement of stop signs for E-Bus, the bus system using Pecolos. (June 2015)

New bus drivers being trained to keep to time schedules at every bus stop, a new concept in Luang Prabang. (June 2015)

The members of Project Implementation Unit (PIU) pose during the opening ceremony of the EV station (September 2015)

Ticket sales office in the EV station (December 2015)

An E-Bus loading passengers. E-Buses are fast becoming accepted by the locals, especially by the elderly, as a transportation means because they provide mobility to residents.

An E-Bus on the Yellow Line arrives in the EV station with passengers. (December 2015)

The Pecolo was selected to transport guests during the 20th anniversary celebration of the city's inclusion as a World Heritage Site.

An E-Bus plying the Green Line transports tourists (April 2016)

1. Background

Laos's robust economic development is expected to lead to full-scale motorization by the 2020s as evidenced by the rapid increase in the percentage of vehicles registered every year, which is at 20%. The Government of Laos imports all its petroleum requirements, and the prospect of further motorization is considered as a serious threat because it encourages overdependence on imported energy, the use of fossil fuel poses an environmental burden, and the outflow of foreign exchange has a negative impact on the national economy.

In 2013, the Lao government enacted the Environmentally Sustainable Transport (EST) Strategy, which emphasizes the need to use electric vehicles (EVs) in passenger and cargo transportation systems. The government targets to reduce by 270,000 tons its annual CO_2 emission from land transportation vehicles by 2020, while raising the share of public transportation system to 20% in urban areas.

While Laos generates hydropower 30 times more than its needs, EV usage in the country has not become popular due primarily to the limited performance and high prices of old EVs. It also did not help that the country's short experience in EV usage created a generally unfavorable impression.

Urban public transportation is still the market for EVs technically and economically speaking, because of the former's characteristics, i.e., long daily drive distances and compact service areas. Introducing Japanese EV technique in the field of public transportation service by demonstrating its high performance and low cost will make EVs acceptable to the Laotian riding public, as well as transportation operators, and, eventually, nationwide.

It is in this context that the Japan International Cooperation Agency (JICA) has provided assistance to the Lao government to determine through a survey the feasibility of introducing to Laos three-wheeled EVs produced by Prozza Corporation, a Japanese EV manufacturer.

2. Outline of the Survey

(1) Purpose

The purpose of this JICA survey comprises three elements, as follows:

1) To confirm the acceptability of the performance, design, and price/cost of Millet electric bikes and Pecolo electric trikes, as well as to verify the technical and economic feasibility of setting up a battery exchange system.
2) To conduct test drives and rides among transportation operators, the public, administrative bodies, and tourists to improve the EV system based on local needs and wants. Local EVs will serve as products of collaboration between Luang Prabang and Japan, thereby enhancing the impact of the survey among the Lao people.
3) To recommend the policy based on the survey result and to delineate the roles of public and private sectors in promoting the effectiveness and feasibility of electric trikes. In particular, the measures to be taken by the government such as providing tax breaks to operators using electric vehicles, building infrastructure for charging electricity, and on regulating vehicle inflow to cultural preservation areas, among others should be examined.

(2) Survey Activities

The Survey Team implemented the following activities to meet the purpose of the survey.

1) Planning for and Installation of the Product
   1-1) Draft an installation plan for the product
   1-2) Draft a building plan for installing and garaging of the product
   1-3) Draft a maintenance plan for the product, including staff training
   1-4) Install EVs and build an EV station
   1-5) Establish an EV maintenance system and train staff
2) EV Operational Plan and Demonstration Service
   2-1) Draft a plan on service routes and operations
   2-2) Draft a plan on operational structure and staff training
   2-3) Plan fare incomes and costs
   2-4) Implement a demonstration project
3) Monitoring of EV Operation
   3-1) Draft a monitoring plan
   3-2) Collect data on operating performance of EVs
   3-3) Collect data on actual fare incomes and costs
   3-4) Analyze monitoring data on EV operation
4) EV Promotion

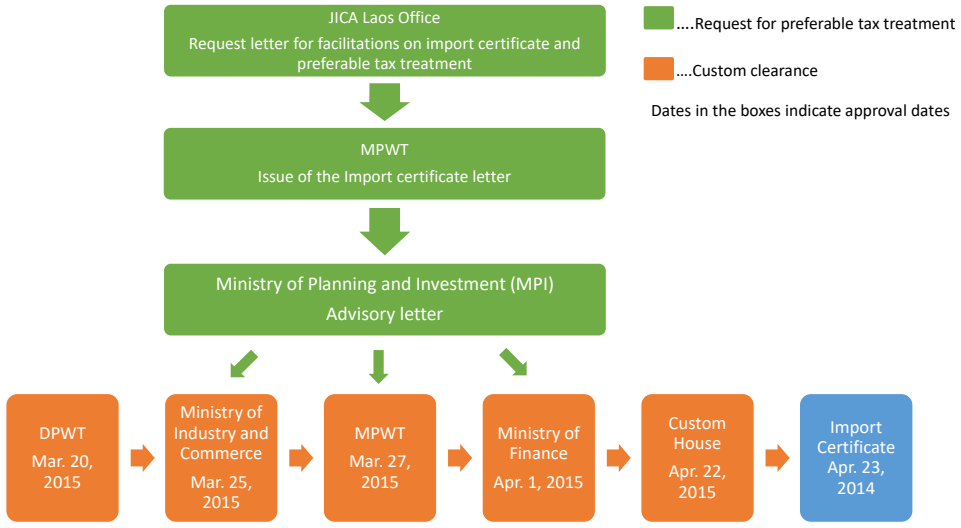
4-1) Draft a plan on EV promotion (questionnaire survey, events, and public relations)
4-2) Implement activities on EV promotion
4-3) Implement training program in Japan
4-4) Analyze results of promotional activities

5) Recommendations and Business Plan
5-1) Make recommendations for an EV public transport development policy in Luang Prabang
5-2) Draft a business development plan to promote EVs in Laos by Prozza Corporation

3. Achievement of the Survey

(1) Planning for and Installation of the Product

Through the efforts of the Ministry of Public Works and Transport (MPWT), the survey project was given tax exemption by the government. Customs clearance for survey equipment took around 30 days, which seems to be the typical length of the process (Figure 1).



Source: JICA Survey Team

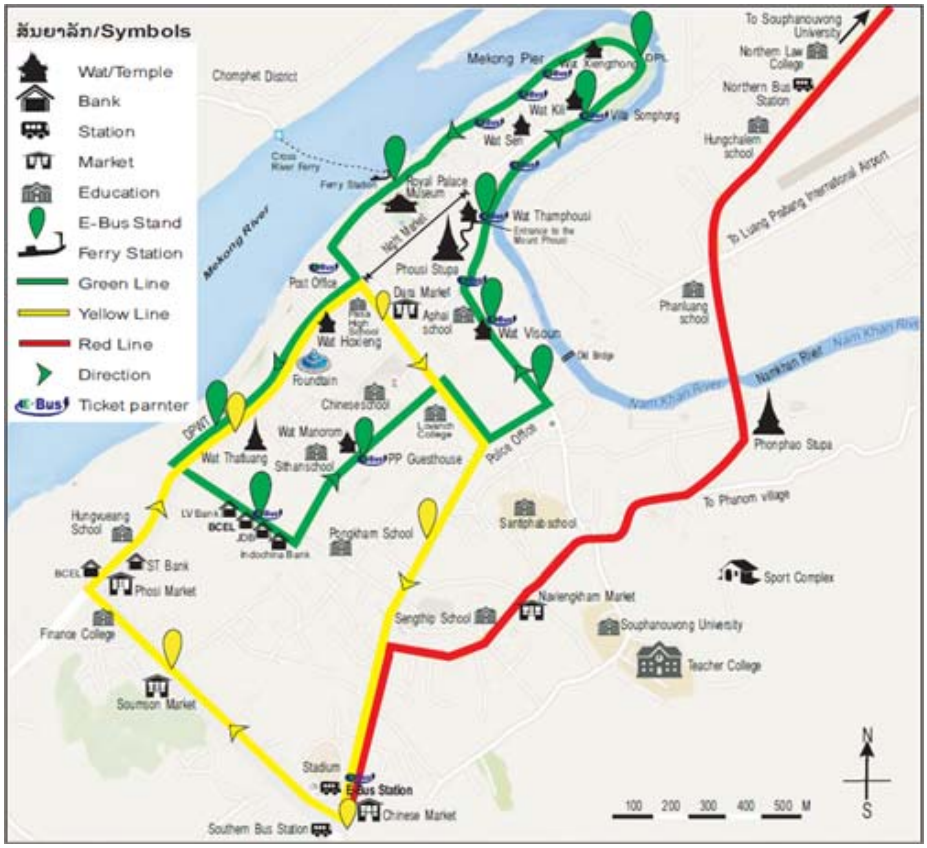
Figure 1 Procedure for Importing Survey Equipment

The Department of Public Works and Transport (DPWT) of Luang Prabang provided the Survey Team with the land, where the local operator named Laogreen and the Survey Team constructed the EV station, comprising the depot, the battery exchange station, ticket booths, and the administrative office.

The technical staff of the Survey Team conducted a maintenance training for the mechanics and management staff of Laogreen Company for seven (7) consecutive days using lectures and videos.

(2) EV Operation Plan and Demonstration Service

Laogreen Company used to operate Chinese made EVs for the shared taxi operations running on four (4) routes where passenger stop the vehicles by raising hands. The Survey Team used two of these routes, namely Green Line and Yellow Line, for Laogreen to launch an electric bus service using Japan-made EVs called Pecolo that is the first-ever public bus service in Luang Prabang. After various trials, the current bus routes are as shown in Figure 2 below.



Source: JICA Survey Team

Figure 2 Route Map of E-Bus Services

E-bus fare was set at 5,000 kip per passenger, based on survey results and discussions by the JICA Survey Team with members of the Project Implementation Unit (PIU), comprising the Governor of Luang Prabang, the DPWT, Département du Patrimoine Mondial de Luang Prabang (DPL), Laogreen Company, the tuk-tuk association, and other related bodies. In setting both routes and fares, the PIU took into the consideration the existence of other tuk-tuk services.

In the middle of the year-long test run, it became evident that the e-bus business could not make ends meet. Hence, the DPWT, Laogreen, and the JICA Survey Team launched a taxi service using the Pecolo units that were not operating to compensate for the losses incurred in the e-bus operation. Before launching the e-taxi operation, the DPWT formulated rules and regulations in operating e-taxis and prepared an employment contract for e-taxi drivers to prevent misbehavior such as overpricing or disregard to the traffic laws, given the advices from the Survey Team. The operating areas and fares for E-Taxis were also set after considering the effects on tuk-tuk services. To secure quality of service, drivers were required to prominently display in their respective vehicles their ID cards and the contact information of the company's customer service office.

Source: JICA Survey Team

Figure 3 Operating Areas of E-Taxis

Table 1 Fare Table of E-Taxis

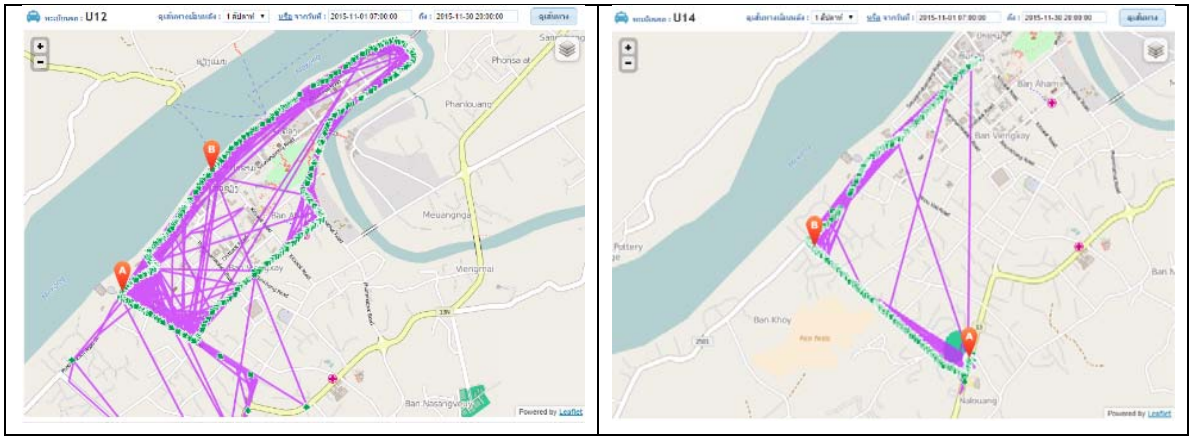
Area	Category	Fare (kip)
Basic Operating Area	Adults (aged 15 and over)	10,000
	Older Children (aged 6 to 14)	5,000
	Younger Children (under 6)	Free
Destination-specific Area	Adults (aged 15 and over)	20,000
	Older Children (aged 6 to 14)	10,000
	Younger Children (under 6)	Free

Note: USD1 equals to approx. 8,000 kip

Source: JICA Survey Team

(3) Monitoring

With assistance from the JICA Survey Team, Laogreen Company monitored the e-bus and e-taxi operations by recording trip data including traveled distance by vehicle, fare revenue, battery ID number, and others. In addition to the monitoring sheet which the company staff have to fill out, a GPS system was installed in each EV to track their respective traveled routes and current locations (Figure 4).



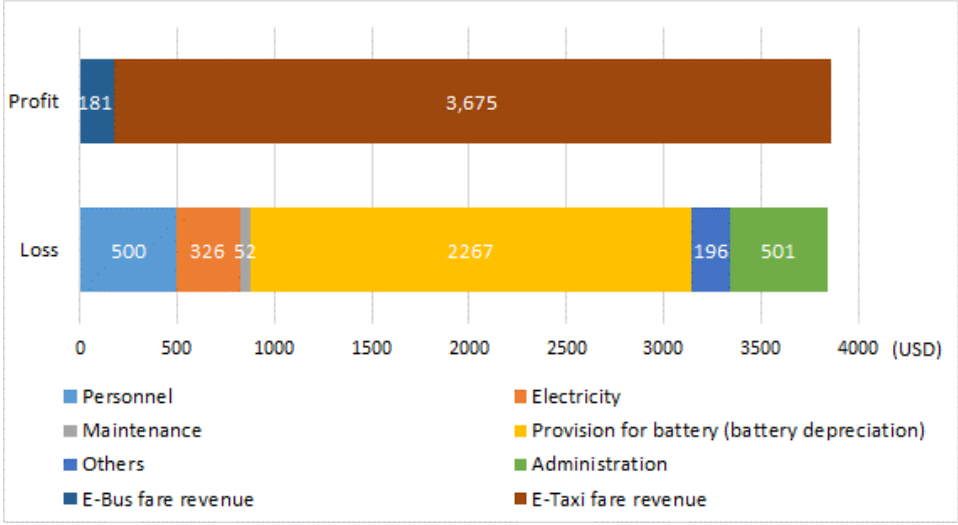
Source: JICA Survey Team

Figure 4 Track Records of EVs based on GPS Data

Monitoring results often reflected to the reviews of the operation plans when necessary. Although the E-Bus service was operated at a headway of 10 minutes from September 2015 to March 2016, it was later found out that the number of E-Bus passengers in the peak

month did not even reach 20% of the profitable line. Given this result, PIU members agreed to start an E-Taxi service to compensate the company for the losses incurred from the E-Bus operation.

After conducting a financial analysis on the results of the test run which ended in May 2016, the Survey Team suggested a right balance in the number of vehicles deployed as E-Bus and E-Taxis, to which the PIU members agreed. The target numbers of Pecolo units were 10 for e-taxi service and two for E-Bus service. This arrangement was expected to make up for the loss and to ensure funds for disposing and replacing degraded batteries in the future.



Source: JICA Survey Team

Figure 5 Projected Profit and Loss of Pecolo Department after Test Runs

(4) EV Promotion

To measure the effect of the promotional activities and to promote the use of E-Buses, the Survey Team conducted interviews among 300 persons about their thoughts on E-Buses. The respondents comprised 100 residents, 100 tourists, and 100 passengers who used E-Buses 3 times, including 1st time in Jul.–Aug. 2015, 2nd time in Jan.–Feb., 2016, and 3rd time in Apr.–May, 2016, except for the first time in which answer from the passengers could not be collected because there was not enough persons who had ever used e-bus in the early stage of the test run. The survey was not just aimed at measure the effect of promotion activity, but also aimed at promote use of E-Bus.

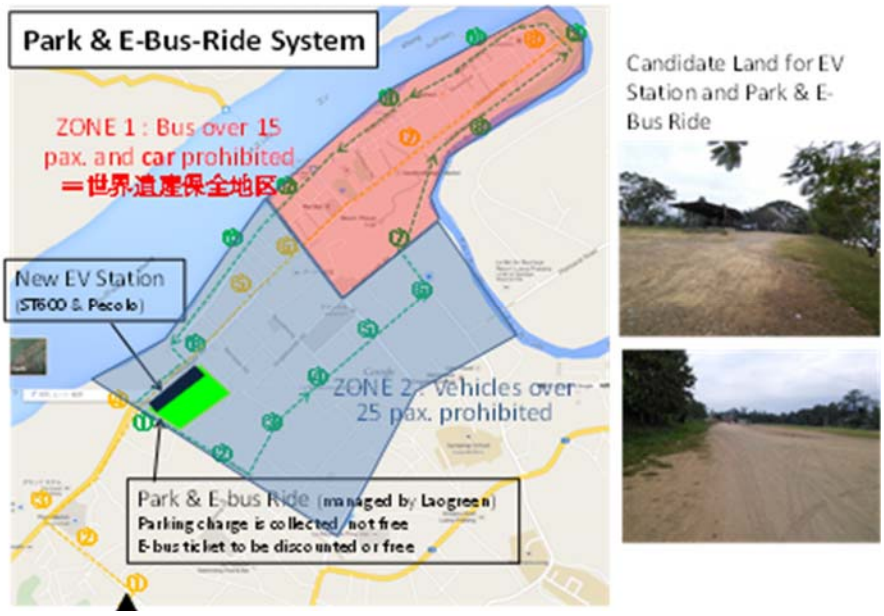
Survey results showed that on average 89% of residents and 75% of foreign tourists knew about the E-Bus. Meanwhile, 99% of residents and 75% of tourists answered “E-Bus is necessary.” Thus, it can be said that the E-Bus was embraced by both residents and tourists in Luang Prabang.

Besides the interviews, the Survey Team promoted E-Buses by various means such as putting pamphlets in lobbies of partner hotels, restaurants, and grocery stores, as well as placing advertisements on magazines, distributing free bus tickets, and opening a Facebook page for the service.

(5) Recommendations and Business Plan

As shown in section 4. Prospects, the Survey Team recommends to the DPWT the provision of infrastructures and systems such as the installation of benches and shades at bus stops, monitoring of bus services, and official assistance to e-bus services.

In addition, the Survey Team shared the concept of an EV-oriented future transportation system, such as a park and e-bus ride system, wherein passengers transported by internal combustion engine (ICE) cars or motorbikes have to transfer to EVs in order to enter the core zone of the World Heritage Site (Figure 6).



Source: JICA Survey Team

Figure 6 Concept of Park and E-Bus Ride System

This concept is not yet official and has to be incorporated first into the urban development plan which is currently being developed in another JICA project.

4. Prospects for EV Use in Laos

(1) Impact of EV Use on Important Development Issues

The government of Lao PDR targets an annual reduction of 268,500 tons of CO_2 emissions from the land transportation sector by 2020 and savings worth 420 million liters annually from a nationwide implementation of its transportation policy named Environmentally Sustainable Transportation (EST) Strategy.

Assuming that Prozza Corporation starts selling its EVs to Laos in 2017, and that sold EVs operate in the same manner as Jumbos—those conventional gasoline-fueled, three-wheeled vehicles—operate, the Survey Team figured the impact would be as shown in Table 2.

Table 2 Expected Impact of EV Use on CO_2 Emission and Fuel Import Reduction

Year	EV Sales (No. of Vehicles)	Reduction in CO_2 Emissions (t)	Reduction in Imported Fuel (ℓ)
2017	12	12	5,556
2018	50	51	23,150
2019	180	182	83,340
2020	600	606	277,800
Total	842	851	389,846

Source: JICA Survey Team

(2) Recommendations

As a result of the survey, the test runs, as well as the dedicated effort and commitment of the Laotian government, private companies, and individuals, the use of zero-emission transportation systems (i.e., e-buses and e-taxis) in the World Heritage town of Luang Prabang proved to be realizable. Results of interviews also confirmed that these transportation systems which use EVs have been widely accepted by both the citizens of Luang Prabang and the tourists. In order to make this case a model for replication in other areas, further initiatives from both the central government and the regional government are needed.

In view of the above, the JICA Survey Team has prepared two recommendations for the MPWT and DPWT of Luang Prabang.

(a) Provision of Government Assistance to E-Bus Operators

The E-Bus can be a stepping stone for disseminating EV use nationwide; so it is expected that the DPWT will play a key role in this. Currently, Laogreen, a private company, shoulders all the risks and costs inherent to the operation. To make the E-Bus sustainable, more government assistance is required, especially in developing infrastructure and assuring users of high-quality service through a monitoring system.

It is remarkable that the operating company was able to develop its capacity to the point where city bus operation could keep to the required time table to a certain degree, which is a first in the area. However, the company's capacity in operations management is still inadequate, given the high rate of turnover and disregards to passengers among drivers. The DPWT should thus send its officers regularly into the field to monitor the operations.

The installation of bus stop facilities, including signs and benches, is also necessary. Because of strict regulations concerning construction inside World Heritage sites, private investments in building bus stop facilities cannot be expected. Therefore, it is preferable for the DPWT to invest in these facilities themselves given the fact that e-buses are a part of the World Heritage Site.

In order to develop the capacity in operations management and to develop infrastructures, the MPWT and the DPWT's commitment to improve human resources and provide funds is essential. If both cannot provide these resources, requests for assistance from development partners is an option.

(b) Provision of Government Assistance in EV Promotion

It is important for the MPWT and the DPWT to address the issue of high initial cost of promoting EV business in compliance with the EST Strategy. Although the prices of lithium-ion batteries have reportedly declined, drivers still cannot afford them at their current prices. Thus, in order to achieve the policy target of promoting EVs, the government should invest public funds in supporting the growth of EV businesses.