5002 Monitoring Report of Bangkok E-bus Program

Monitoring period from 01.10.2022 to 31.12.2022

Document version:	5
Date:	21 September 2023
Monitoring period (cycle)	1st monitoring period
Requested emission reductions [1]	1,916 tonnes of CO_2eq from 01.10.2022 – 31.12.2022;
Account name and account number in the Emissions Trading Registry (EHR) [2]	Thailand Voluntary Emission Reduction Program: T-VER 1. PoA 01: Bangkok Metropolitan Area E-Bus Zone 1 and 2 version 4 (registered with T-VER as PoA no. 333) 2. PoA 02: Bangkok Metropolitan Area E-Bus Zone 3 and 4 version 4 (registered with T-VER as PoA no. 334) <u>Details of Acquiring Entity</u> Account name: Stiftung Klimaschutz und CO2-Kompensation KliK Account number: CH-100-1096-0

Date Qualification decision	Date of registration as compensation project abroad with The Federal Office for the Environment (FOEN), Switzerland is 27 February 2023 Date of registration PoA 01 and PoA 02 under T-VER is 28 March 2023
Date or dates of revalidation(s)	N/A
Crediting period (current)	01.10.2022 – 31.12.2030
Date and version of the valid project/program description	MADD: Operation of e-buses on privately owned, scheduled public bus routes in the Bangkok Metropolitan area by Energy Absolute version 5.3 PoA-DD: 1. PoA 01: Bangkok Metropolitan Area E-Bus Zone 1 and 2 version 4 (registered with T-VER as PoA no. 333)

[1] In the following, the term "emission reduction" is also understood to mean the increased storage of carbon. For reasons of better readability, both concepts are not mentioned unless a distinction is explicitly necessary.

[2] Certificates are issued to this account, cf. Art. 13 para. 1 CO_2 -Ordinance.

	2. PoA 02: Bangkok Metropolitan Area E-Bus Zone 3 and 4 version 4 (registered with T-VER as PoA no. 334)

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Project developer (company)	Carbon Coordinating Managing Entity (Co) Ltd., Thailand (100% owned by South Pole Group)
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[3] Note: Should the applicant change during the course of the project, this must be communicated to the FOEN in writing.

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1 Formal information

1.1 Adjustments in the report compared to the project/program description or earlier monitoring reports

Were there any changes compared to the project/program description?

☒ Yes

☐ No

Have there been any changes since the last monitoring report?

☐ Yes

☒ No

Monitoring report in which adaptation took place	Chapter in which the adaptation took place	Description of the adaptation
1. Monitoring (from 01.10.2022 to 31.12.2022)	MADD Chapter 1.2.2 Table 2 Annex 1 part A1.2 Table A2	The specification of Li-ion battery capacity has changed from ≥150 kWh for each e-bus within the program to ≥120 kWh. This is due to an implementation assessment during the operation showing that a battery with the capacity of 120 kWh is sufficient to operate on the bus routes that are not long distance. Hence, the Program operator considers it to be appropriate to execute this change. The modified specification of battery capacity has been notified and accepted by T-VER registries.
2. Monitoring (from 01.10.2022 to 31.12.2022)	MADD Chapter 3.1.1 Table 6	Roles and responsibility of Charging station operator: The charging station network is managed by Energy Mahanakorn Co., Ltd. (EA Anywhere Brand). However, at the bus terminal station, Thai Smile Bus has signed a service agreement contract with Auto Bus Service Co., Ltd. to operate and service each of the charging stations. Auto Bus is also responsible for data collection of the e-buses' electricity consumption at each bus terminal.
3. Monitoring (from 01.10.2022 to 31.12.2022)	MADD Annex 1 part A1.2 Table A3 and A4	Details of e-bus routes in CPA1 in PoA1 and PoA2: The locations of bus terminals for each bus route have been modified from the MADD due to the appropriateness and readiness of each bus terminal. Refer to section 2.1 of this monitoring report for further details.

Monitoring report in which adaptation took place	Chapter in which the adaptation took place	Description of the adaptation
4. Monitoring (from 01.10.2022 to 31.12.2022)	MADD Annex 1 part A3.2 Table A16	1. The electricity bill from the charging station does not reflect the electricity consumption for each operational bus route. Since the electricity bill only reflects the electricity consumption of the e-bus terminal stations, it is not possible to differentiate the electricity consumption into different bus routes. Hence, only recorded data of electricity consumption shall be used. 2. The average Specific Fuel Consumption (SFC) of NGV buses is based on the data collected from available NGV buses operating on 35 routes during this monitoring period.

1.2 FARs that apply to this monitoring report

FAR
N/A

2 Details of the project/program

2.1 Description of the project/program

The Bangkok E-Bus Program ("the Program") operates on the public transport routes of Thailand. The Program was developed by the Energy Absolute Public Company Limited ("EA") that develops business operations using biodiesel, then moves to renewable energy power plants and businesses that involve other technologies. They strive to meet future energy demand by placing great importance on clean energy, safety and environmentally friendly operations.

The Program has enhanced the capability for developing public transportation projects in Thailand and for contributing to a low-carbon society. Thus, the project replaced Thailand's conventional mode of public transport of internal combustion engine vehicles (ICEVs) by the adoption of electric vehicles (EVs). As a result, it will also consequently reduce the energy consumption of, and GHG emissions from, public transport.

In this regard, the Company has cooperated with bus service providers licensed by the Department of Land Transport (DLT) to replace the ICE buses with electric buses (e-buses). During this monitoring period from 01.10.2022 to 31.12.2022, one participating bus operator, namely Thai Smile Bus Co., Ltd. ("TSB"), acted as the focal point for data collection, in cooperation with other private bus companies that have mutually signed agreement contracts with TSB. The project covers the management and operation of bus routes operated by TSB in the Bangkok Metropolitan area, which was divided into four zones by the DLT in 2019. The DLT has categorised the bus routes in relation to the zones in which they operate, starting with 1-xx, 2-xx, S-xx[4], 3-xx and 4-xx. This categorisation is shown in

Figure 1, and route S-xx is considered in the same group as routes 1-xx and 2-xx. The Program comprises e-buses and its licensed bus routes in group activities based on the purchase date and operating date in line with the allocation plan of e-bus operators.

Figure 1: Zoning areas of the Bangkok Metropolitan area[5]

[4] S-xx are the bus routes going to Suvarnabhumi international airport which is included in PoA 01.
[5] Source: Resolutions of the Meeting of Central Land Transport Control Board No. 7/2019 on 7 July 2019

Table 1 provides key milestones during this monitoring period since the first purchase agreement of the e-buses until the approval and registration of the Program under the T-VER standard. These milestones demonstrate the timeline of program implementation alongside the approval Mitigation Activity Design Document: MADD version 5.3 ("MADD").

Table 1: Project Timeline after MADD validation

Date	Event	References/evidence
29.09.2022	Submission of validated MADD to FOEN	Hard copy of validated MADD to FOEN via post
01.10.2022	Data have been monitored and collected	Data collection from TSB (bus operator)
25.10.2022	FOEN review and feedback	First round of comments from FOEN: "5002-Kommunikation_mit_PE-24-10-22_22-25-26"
05.12.2022	MADD approved	Authorization statement by FOEN; ref: Annex 1
08.02.2023	Thailand's Letter of Authorization (LoA) issuance	LoA document no. 1006.4/2810 issued by Office of Natural Resources and Environmental Policy and Planning (ONEP); ref: Reference 1
27.02.2023	Switzerland's LoA issuance and MADD registration with The Federal Office for the Environment (FOEN)	Registration of MADD along with authorisation statement on FOEN website: https://www.FOEN.admin.ch/FOEN/en/home/topics/climate/info-specialists/reduction-measures/compensation/abroad/registered-projects-abroad.html#accordion_702415665168 3753018405
28.03.2023	PoAs and CPAs officially registered with T-VER	Registration of PoA 01[6] and PoA 02[7] including the first CPA of each PoA under T-VER standard
25.07.2023	Registration of 9 additional CPAs	Registration of CPA-DD under PoA 01 and PoA 02 under T-VER standard

In this monitoring period, the Bangkok E-Bus Program covers the operation and management of 550 e-buses operated on 70 approved passenger transport licensed bus routes by the DLT in the Bangkok Metropolitan area during the Program's crediting period (1 Oct 2022 – 31 Dec 2030). Table 2 demonstrates the number of bus routes and e-buses which are registered and in operation.

[6] Source: https://ghgreduction.tgo.or.th/en/tver-database-and-statistics/program-of-activities/item/3602-bangkok-metropolitan-area-e-bus-zone-1-and-2 html

[7] Source: https://ghgreduction.tgo.or.th/en/tver-database-and-statistics/program-of-activities/item/3605-bangkok-metropolitan-area-e-bus-zone-3-and-4 html

Table 2: Number of registered e-buses with DLT and e-buses in operation

PoA/CPA		Registered with DLT		In Operation	
		routes	e-buses (vehicle)	routes	e-buses (vehicle)
PoA1	CPA1	5	92	5	80
	CPA2	18	156	18	135
	CPA3*	15	102	12	30
Total PoA 1		38	350	35	245
PoA2	CPA1	3	55	3	38
	CPA2	14	162	14	155
	CPA3	13	158	13	96
	CPA4*	10	110	5	16
Total PoA 2		40	485	35	305

*Remark: The number of bus routes demonstrated above are differed from indicated in the CPA-DD because some of E-Buses in the routes indicated has yet to be registered with DLT by the end of 2022 (within this monitoring period).

In this Monitoring Period, the program is still in the ramp-up phase. Due to the e-bus manufacturing lead time, system test, operational test and staffs training, the E-buses have been gradually added into the Program. Therefore, the numbers of registered routes and e-buses differ from the numbers in operation. In the end, the number of e-buses in operation will reach the number of the registered e-buses by replacing the conventional ICE buses 1:1.

The implementation period of e-buses on each route is in line with the CPA inclusion approach, where the CPA is grouped by the registration date of e-buses with the DLT in a timely manner and does not contradict the CPA inclusion criteria illustrated in Table 4. On the operation side, TSB (bus operator) has hired Auto Bus Service Co. to oversee the bus maintenance services and data collection in terms of power consumption, which differs to the MADD which stated that Energy Mahanakorn would be in charge of e-bus data collection and charging services. Based on the monitoring data collected from 01.10.2022 to 31.12.2022, the emissions reduction resulting from the implementation of the Program is calculated as 1,916 tCO_2, due to the fuel-switching activities. In this monitoring period, the Program does not consider the emissions reduction from the passengers' shift in modal activity.

The emissions reduction shall be verified and considered as the internationally transferred mitigation outcomes (ITMOs) in compliance with the bilateral agreement between the Thai Government and Switzerland. The process of ITMOs transfer shall be in line with "Emission Reduction Projects and Programs – the environment in practice No. 1315[8], by FOEN and "Thailand's Authorization and Recognition of International Transfer Process" by TGO[9].

2.2 Implementation of the project/program

2.2.1 Temporal aspects

Could the project/program be implemented in terms of start of implementation, start of impact and start of monitoring as foreseen in the project/program description?

☒ Yes

☐ No

[8] Source: www.FOEN.admin.ch/uv-1315-e

[9] Source: https://ercst.org/document/thailands-authorisation-and-recognition-of-international-transfer-process/

Table 3: Program implementation timeline

Dates	Date according to project/program description	Date Effective implementation	Remarks on deviations
Start of implementation	15 June 2022	15 June 2022	No deviation from the MADD
Start of operation	1 October 2022	20 August 2022[10]	The start of operation considered a pilot phase where some of the bus routes were selected – i.e. routes 2-38
Start monitoring	1 October 2022	1 October 2022	No deviation from the MADD
Other (e.g. expansion, start of next stage, etc.)	N/A	N/A	N/A

2.2.2 Content aspects: Projects in the program and fulfilment of the admission criteria

The Bangkok E-Bus Program is implemented under the T-VER standard, which aims to encourage domestic greenhouse gas (GHG) emission reductions along with the co-benefits report. Under this standard, the program has been developed as Program of activity (PoA) – a T-VER PoA – that would allow for greater scalability. However, the T-VER PoA has a maximum allowance of 60,000 tCO_2/year per PoA. Correspondingly, the program was developed to allow for greater mitigation potential while also separating the structure of the Bangkok E-Bus Program into two separate zones – Zone 1 and 2, and Zone 3 and 4. All included CPAs shall comply with the eligibility criteria of the Program, which is aligned with the T-VER standard, as indicated in the MADD. The two T-VER PoAs were developed and registered with T-VER registry as follows:

1. T-VER PoA 01[11]: titled "The Bangkok Metropolitan Area E-Bus Zone 1 and 2 (ver.4)";
2. T-VER PoA 02: titled "The Bangkok Metropolitan Area E-Bus Zone 3 and 4 (ver.4)".

In compliance with the eligibility criteria stated in the MADD, each CPA has been checked for eligibility criteria fulfilment. Every CPA included in this monitoring period has fulfilled the inclusion criteria, with supporting evidence for each criteria illustrated in Table 4.

[10] Information provided by Thai Smile Bus (Bus operator)

[11] PoA1 includes bus routes S-xx

Table 4: Eligibility criteria under the T-VER standard for CPA inclusion for all CPAs

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Criteria Check	Supporting evidence for inclusion	Fulfillment of the inclusion criteria
	The type of vehicles under any CPAs shall:				
1	1. Not be modified from the existing conventional ICEV	1. Vehicles used in the project activities are not modified ICEVs	No vehicles were powered by internal combustion engine (ICE)	1. E-bus purchase agreement; ref: Reference 2	☒ Yes ☐ No
	2. Be 100% battery EV	2.Vehicles used in the project activities are all powered by electricity	2. All vehicles used in the project activities are all powered by electricity	2. Technical specifications of e-buses in the Program; ref: Reference 4	☒ Yes ☐ No
	3. Have documented measures in place in case the vehicles require a new rechargeable battery, to ensure that vehicle owners have access to replacement batteries of comparable quality	3. Project developer demonstrates the cycle of battery replacement or recycling	3. Project developer demonstrates the cycle of battery replacement or recycling	3. Electronic service agreement contract between EA and Amita (battery recycling company). The recycling or replacement of batteries is not relevant to this monitoring period as they have not reached their end of life yet; ref: Reference 5	☒ Yes ☐ No
	4. Not use the replaced vehicles in the project's boundary or other area	4. The developer ensures that the	No replaced vehicle has been used in any area	4. ICE bus salvage purchase agreement; ref: Reference 3	☒ Yes ☐ No

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Criteria Check	Supporting evidence for inclusion	Fulfillment of the inclusion criteria
	Ref: T-VER-METH-TM-05 Version 03, T-VER-METH-TM-06 Version 03	replaced vehicles will not be used in any area			
2	Vehicle specifications included in CPA shall consider the following parameters: 1. meet standard vehicle according to the DLT 2. battery capacity *Ref: MADD*	E-bus specifications included in the Program shall consider the following parameters: 1. Standard 2 (air-conditioned bus class 2) and/or Standard 3 (normal bus) 2. battery capacity ≥150 kWh	1. All buses are Standard 2 and/or Standard 3 2. Battery capacity of the bus is 120–302 kWh Note: The battery capacity of buses included in the Program has changed from ≥150 kWh to 120–302 kWh	1. Technical requirements of e-buses in the Program; ref: Reference 4 and Bus registration; ref: Annex 6 2. Notification letter regarding the change in the Program's description, which was acknowledged by TGO; ref: Annex 3	☒ Yes ☐ No
3	Public bus routes under the CPA shall comply with national laws and regulations *Ref: MADD*	All routes in the project activities must be approved by the DLT	All routes are operated according to the licences approved by DLT	The approved passenger transport licences by DLT of the included bus routes in this monitoring report; ref: Annex 2	☒ Yes ☐ No

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Criteria Check	Supporting evidence for inclusion	Fulfillment of the inclusion criteria
4	The CPA boundary is within the geographic territory of Bangkok Metropolitan area *Ref: MADD*	All routes are in Bangkok Metropolitan area shown in Figure 1	All routes are in Bangkok Metropolitan area	The approved passenger transport licences by DLT of the included bus routes in this monitoring report; ref: Annex 2	☒ Yes ☐ No
5	Each CPA shall be categorised by its area of operation	All routes are in Bangkok Metropolitan area shown in Figure 1	All routes are in Bangkok Metropolitan area	The approved passenger transport licences by DLT of the included bus routes in this monitoring report; ref: Annex 2	☒ Yes ☐ No
6	The emission reductions shall not exceed the limit stipulated under the T-VER standard criteria *Ref: Table 1 of the scheme and Regulation of the Greenhouse Gas Management Organisation on Criteria for Considering Voluntary Greenhouse Gas Reduction Projects According to Thailand Standard (T-VER) B.E. 2022, announced on 25 January 2022*	One PoA shall not exceed 60,000 tCO_2e/year after combining all CPAs under the same PoA The ex-ante calculation shall not exceed 20,000 tCO_2e/year per CPA	The emission reduction of each CPA and cumulatively in each PoA have not exceeded the T-VER criteria	Ex-post calculation based on implementation of e-buses; ref: *Ex-Post-bangkok-e-bus-rev1.xlsx* file for ex-post calculation	☒ Yes ☐ No

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Criteria Check	Supporting evidence for inclusion	Fulfillment of the inclusion criteria
7	Ownership of emission reduction / mitigation outcomes units issued *Ref: MADD*	Contractual agreement between EA and the bus operator indicating that the mitigation outcomes generated under the Bangkok E-Bus Program will be owned by EA	The contractual agreement	Contractual agreement between EA and the bus operator; ref: Reference 6	☒ Yes ☐ No
8	EA shall demonstrate that double counting of emission reductions will not occur, i.e. by monitoring data from each specific vehicle *Ref: MADD*	The Bangkok E-Bus Program mitigation activity does not and will not lead to double counting of emission reductions, since it does not and will not claim emission reductions as: • a standalone project activity; OR • as part of a bundled/grouped project activity; OR • as another registered PoA; OR as a project activity under another emission reduction crediting	The Program did not claim the emission reduction in any other form of project activities	Contractual agreement between EA and the bus operator; ref: Reference 6 Note: TSB has no right to manage the carbon credits generated by this program	☒ Yes ☐ No

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Criteria Check	Supporting evidence for inclusion	Fulfillment of the inclusion criteria
		scheme (e.g. voluntary carbon markets) during the same crediting period			
9	All CPAs shall have a crediting period not exceeding T-VER PoA duration *Ref: Table 1 of the scheme and Regulation of the Greenhouse Gas Management Organisation on Criteria for Considering Voluntary Greenhouse Gas Reduction Projects According to Thailand Standard (T-VER) B.E. 2022, announced on 25 January 2022*	The crediting period shall follow the T-VER standard for which a PoA has a 14-year period and a CPA has a 7-year period, with 1 time renewal	The crediting period of this project followed the T-VER standard, currently in its first monitoring period of the first crediting period Crediting period of PoA1 and PoA2: 01.10.2022 – 30.09.2036 (14 years)	Registration of date of CPA-DD included in this monitoring period; ref: Reference 7, where for the first crediting period each CPA registered within the crediting period of PoA: PoA1[12]: CPA1: 01.10.2022 – 30.09.2029 CPA2: 01.10.2022 – 30.09.2029 CPA3: 25.11.2022 – 24.11.2029	☒ Yes ☐ No

[12] Source: https://ghgreduction.tgo.or.th/th/tver-database-and-statistics/programme-of-activities/item/3602-bangkok-metropolitan-area-e-bus-zone-1-and-2.html

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Criteria Check	Supporting evidence for inclusion	Fulfillment of the inclusion criteria
				PoA2[13]: CPA1: 01.10.2022 – 30.09.2029 CPA2: 01.10.2022 – 30.09.2029 CPA3: 03.11.2022 – 02.11.2029 CPA4: 15.12.2022 – 14.12.2029	
10	Data collection shall be shared between EA and the bus operator *Ref: MADD*	Bus operator shall provide monitoring data to EA and the Program Coordinating and Managing Entity (CME)	Bus operator has provided monitoring data to EA and CME	Raw data provided by EA to CME for the relevant parameters used for calculation; ref: Reference 9, Reference 11, and Reference 12	☒ Yes ☐ No

[13] Source: https://ghgreduction.tgo.or.th/th/tver-database-and-statistics/programme-of-activities/item/3605-bangkok-metropolitan-area-e-bus-zone-3-and-4.html

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Criteria Check	Supporting evidence for inclusion	Fulfillment of the inclusion criteria
11	Demonstration of additionality	Additionality shall be demonstrated at CPA level	All CPAs have passed the additionality when registering for CPA-DD under the T-VER standard	Additionality demonstration of each registered CPA-DD of PoA1[14] and PoA2[15] under T-VER registry	☒ Yes ☐ No

[14] Source: https://ghgreduction.tgo.or.th/th/tver-database-and-statistics/programme-of-activities/item/3602-bangkok-metropolitan-area-e-bus-zone-1-and-2.html
[15] Source: https://ghgreduction.tgo.or.th/th/tver-database-and-statistics/programme-of-activities/item/3605-bangkok-metropolitan-area-e-bus-zone-3-and-4.html

CPAs that pass the eligibility criteria in Table 4 are included in this monitoring period. Detail of each bus route included in each CPA with number of registered e-buses with DLT by December 2022 are illustrated in Table 5 for PoA 01 and Table 6 for PoA 02.

Table 5: Details of e-bus routes and the number of e-buses included in T-VER PoA 01: Bangkok Metropolitan area e-bus Zones 1 and 2

No.	E-Bus Routes Name	E-bus Routes Identified Number	Number of E-Buses Registered with DLT	First date of E-Bus registration
CPA 1: The Bangkok Metropolitan Area E-Bus Zone 1 and 2				
1	Min Buri - Victory Monument	1-37	22	21/10/2022
2	Siam Park - Klongtoey	1-39	24	6/10/2022
3	Ministry of Public Health - Priest Hospital	2-15	13	27/10/2022
4	Happy Land - Memorial Bridge Pier	2-38	28	17/8/2022
5	Minburi - Suvarnabhumi airport	S4	5	22/12/2022
CPA 2: The Bangkok Metropolitan Area E-Bus Zone 1 and 2				
1	Rangsit - Hua Lamphong station (Tollway)	1-2E	18	29/9/2022
2	Bangkhen - Phahon Yothin Road - Hua Lamphong station	1-3	18	14/9/2022
3	Thammasat University Rangsit Campus - Bangkhen	1-4	10	19/10/2022
4	Romklao Housing - Happy Land	1-41	14	21/10/2022
5	Numkrai Industrial Estate - Min Buri	1-47	5	14/11/2022
6	KMITL - Happy Land	1-49	7	22/11/2022
7	Loop Minburi - Khubon Road - Hathairat Road	1-52	6	7/10/2022
8	KMITL - Victory Monument	1-56	11	22/11/2022
9	Siam Park - Lam Luk Ka Khlong 12	1-58	6	9/11/2022
10	Siam Park Bus Depot - Ua-Athorn Sangkasantisuk	1-59	6	9/11/2022
11	Ua-Athorn Sangkasantisuk - Min Buri	1-61	5	27/9/2022
12	Min Buri - Ministry of Commerce	1-62	5	22/11/2022
13	Patthawikorn - Rama VIII Park	1-63	7	25/11/2022
14	Loop Min Buri - Lat Krabang Industrial Estate	1-71	6	22/11/2022
15	Ua-Athorn Latkrabang 2 - Rom Klao	1-73	5	22/11/2022
16	Min Buri - Klongtoey (Additional line)	1-77	5	14/11/2022

No.	E-Bus Routes Name	E-bus Routes Identified Number	Number of E-Buses Registered with DLT	First date of E-Bus registration
17	Khlong Chan Housing - Tha Tian	2-42	15	21/9/2022
18	Loop Bang Sue BTS Station - Kasetsart University	2-17	7	27/10/2022
CPA 3: The Bangkok Metropolitan Area E-Bus Zone 1 and 2				
1	Government Complex - Khlong Luang	1-31	5	19/12/2022
2	Bangkhen -Talat Phlu BTS Station (Tollway)	1-32E	6	19/12/2022
3	Bangkhen - Bangsue Grand Station	1-33	6	22/12/2022
4	Loop Safari World - Nuuan Jan	1-64	5	30/11/2022
5	Loop Bua Khao - Min Buri	1-76	5	25/11/2022
6	Thammasat University Rangsit Campus - Thammasat University Tha Prachan Campus	1-9E	6	22/12/2022
7	Ministry of Public Health - Sanam Luang	2-11	10	8/12/2022
8	Talat Tha It - Victory Monument	2-3	12	19/12/2022
9	Tha It - Ramkhamhaeng University (Tollway)	2-18E	7	25/11/2022
10	Thanam Nonthaburi - Thanon Tok	2-22	10	19/12/2022
11	Muang Thong Thani - Bang Wa BTS Station	2-27	5	19/12/2022
12	Loop Samsen Railway Station - Din Daeng	2-34	7	22/12/2022
13	Rangsit - Siam Park - Suvarnabhumi airport (Tollway)	S3	8	22/12/2022
14	Happy Land - Suvarnabhumi airport	S5	5	22/12/2022
15	Bangkok Bus Terminal (Chatuchak) - Suvarnabhumi airport (Tollway)	S6	5	19/12/2022
Total Routes in PoA 01: Bangkok Metropolitan Area E-Bus Zone 1 and 2		**38**	**Total 350 E-buses**	

Table 6: Details of e-bus routes and the number of e-buses included in T-VER PoA 02: Bangkok Metropolitan area e-bus Zones 3 and 4

No.	E-Bus Routes Name	E-bus Routes Identified Number	Number of Buses Registered with DLT	First date of E-Bus registration
CPA 1: The Bangkok Metropolitan Area E-Bus Zone 3 and 4				
1	Rama 3 - Bangkok Bus Terminal (Chatuchak)	3-45	15	19/12/2022
2	Phra Pradaeng Pier - Bang Lamphu	4-15	20	5/9/2022
3	Taling Chan Circle - Thonburi	4-41	20	8/12/2022
CPA 2: The Bangkok Metropolitan Area E-Bus Zone 3 and 4				
1	Paknam - Memorial Bridge Pier	3-1	17	19/10/2022
2	Paknam - Lat Krabang Industrial Estate (Tollway)	3-25E	5	27/9/2022
3	Pu Chao Saming Phrai - Memorial Bridge Pier (Tollway)	3-2E	10	21/10/2022
4	Hua Mak - Sao Ching Cha	3-53	5	21/9/2022
5	Samaedam - Victory Monument (Tollway)	4-23E	27	29/9/2022
6	Bang Khun Thian - Happy Land (Tollway)	4-27E	12	23/8/2022
7	Samaedam - Victory Monument	4-28	12	7/10/2022
8	Phra Pradaeng - Victory Monument	4-3	15	5/9/2022
9	Phutthamonthon Sai 5 Road - Tha Ratcha Woradit	4-45	14	14/9/2022
10	Boromarajonani - Bangkok Bus Terminal (Chatuchak)	4-49	10	2/11/2022
11	Loop Bangkok Bus Terminal (South) - Phet Kasem Road	4-52	12	2/11/2022
12	Boromarajonani - Bangkok Bus Terminal (Eastern)	4-53	13	2/11/2022
13	KMUTT - Prachauthit - Talat Phlu BTS Station	4-17	5	27/9/2022
14	Thonburi Housing - Phra Pradaeng	4-34	5	27/9/2022
CPA 3: The Bangkok Metropolitan Area E-Bus Zone 3 and 4				
1	Bang Phli Housing - Udom Suk BTS Station	3-14	17	9/12/2022
2	Rama 3 - Tha Tian	3-35	17	2/12/2022
3	Bangkok Port (Khlong Toei) - Phasi Charoen Port	3-36	10	14/11/2022
4	Pu Chao Saming Phrai - Siam Park	3-27	5	25/11/2022

No.	E-Bus Routes Name	E-bus Routes Identified Number	Number of Buses Registered with DLT	First date of E-Bus registration
5	Samrong - Siam Park	3-32	6	25/11/2022
6	Loop Rama 3 - Hua Lamphong	3-52	7	2/12/2022
7	Tha Phasi Charoen - Victory Monument	3-54	5	30/11/2022
8	Sala Ya Train Station - National Stadium BTS Station	4-55	15	9/11/2022
9	Sala Ya Station - Victory Monument	4-61	26	4/11/2022
10	Suksanari Wittaya School - Hua Lam Phong	4-36	11	3/11/2022
11	Samaedam - Bangkok Bus Terminal (Chatuchak) (Tollway)	4-29E	25	30/11/2022
12	Boromarajonani - Krung Thon Buri BTS Station	4-56	9	14/11/2022
13	Suanpak - Thanon Tok	4-68	5	9/12/2022
CPA 4: The Bangkok Metropolitan Area E-Bus Zone 3 and 4				
1	Thailand Cultural Center - Sanam Chai BTS Station	3-37	15	22/12/2022
2	Thanon Tok - Si Yan	3-39	17	15/12/2022
3	Rama IX Park - National Stadium Station	3-3	14	22/12/2022
4	Samrong - Government Complex (Tollway)	3-23E	7	15/12/2022
5	Bangkok Port (Khlong Toei) - Victory Monument	3-44	7	22/12/2022
6	Bangkok Port (Khlong Toei) - Rama 7	3-55	5	22/12/2022
7	Bangna - Lat Krabang Industrial Estate (Tollway)	3-34	5	15/12/2022
8	Rai Khing temple - Krung Thon Buri BTS Station	4-46	24	19/12/2022
9	Omyai - Victory Monument (Tollway)	4-54E	10	19/12/2022
10	Sala Ya Train Station - Ministry of Commerce	4-67	6	19/12/2022
Total Routes in PoA 02: Bangkok Metropolitan Area E-Bus Zone 3 and 4		**40**	**Total 485 E-buses**	

2.3 Location and system boundary

Was the project or program implemented at the site according to the project/program description?

☐ Not relevant because it concerns projects of a program and this was not specified in the program description
☐ Yes
☒ No

The boundary of the Program, which is the Bangkok Metropolitan area, remains the same. In the implementation, the terminal stations of each bus route are subject to change due to the appropriateness and readiness of each terminal. The terminal stations for each bus route are identified by the bus operator, TSB, and the charging stations on each bus route are grouped by relative distance of the location of bus routes to the bus terminals. Details and locations of each bus route grouped by CPAs are illustrated in Table 7 and Table 8.

Table 7: Locations of e-bus terminals / charging stations of routes included in CPAs under T-VER PoA 01: Bangkok Metropolitan area e-bus Zones 1 and 2

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
CPA1			
1-37	Min Buri - Victory Monument	Bueng kum	13° 47' 16.03625", 100° 40' 39.55512" https://goo.gl/maps/AvCdPHGxksvMwaQV9
1-39	Siam Park - Klongtoey		
2-38	Happy Land - Memorial Bridge Pier	Ramkhamhaeng 74	13°46'05.95088077016181", 100°39'50.1442229159613" https://goo.gl/maps/eTTLavQuXLkNQESM7
2-15	Ministry of Public Health - Priest Hospital	Tha It	13°54'13.9320208168248", 100°28'24.2967431191243" https://goo.gl/maps/ycxKDjXmQfwCKinR9
S-4	Minburi - Suvarnabhumi airport	Minburi - Nong Chok	13°48'33.8399419086701", 100°49'57.7086681096524" https://goo.gl/maps/dz5TGZGzytYK2Mfq9
CPA2			
1-2E	Rangsit - Hua Lamphong station (Tollway)	Rangsit Bangpoon	13° 59' 49.22457", 100° 34' 56.1351" https://goo.gl/maps/4G1B8Vrm9yoBkJ8D8
1-3	Bangkhen - Phahon Yothin Road - Hua Lamphong station	Rangsit Bangpoon	13° 59' 49.22457",

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
			100° 34' 56.1351" https://goo.gl/maps/4G1B8Vrm9yoBkJ8D8
1-4	Thammasat University Rangsit Campus - Bangkhen	Rangsit 200 Years	13° 59' 46.21943", 100° 36' 9.76107" https://goo.gl/maps/9h6dQgBFcaBRYGRTA
1-41	Romklao Housing - Happy Land	Buengkum 2	13° 47' 13.04204", 100° 40' 43.28382" https://goo.gl/maps/rKXm2EFHzNb9szoX8
1-47	Numkrai Industrial Estate - Min Buri	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-49	KMITL - Happy Land	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-52	Loop Minburi - Khubon Road - Hathairat Road	Buengkum 2	13° 47' 13.04204", 100° 40' 43.28382" https://goo.gl/maps/rKXm2EFHzNb9szoX8
1-56	KMITL - Victory Monument	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-58	Siam Park - Lam Luk Ka Khlong 12	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-59	Siam Park Bus Depot - Ua-Athorn Sangkasantisuk	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-61	Ua-Athorn Sangkasantisuk - Min Buri	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-62	Min Buri - Ministry of Commerce	Minburi - Nong Chok	13° 48' 33.38873",

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
			100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-63	Patthawikorn - Rama VIII Park	Buengkum 2	13° 47' 13.04204", 100° 40' 43.28382" https://goo.gl/maps/rKXm2EFHzNb9szoX8
1-71	Loop Min Buri - Lat Krabang Industrial Estate	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-73	Ua-Athorn Latkrabang 2 - Rom Klao	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
1-77	Min Buri - Klongtoey (Additional line)	Minburi - Nong Chok	13° 48' 33.38873", 100° 49' 55.29173" https://goo.gl/maps/CKHMzSt5qhQoZTm56
2-42	Khlong Chan Housing - Tha Tian	Ramkhamhaeng 74	13° 46' 6.22412", 100° 39' 46.53427" https://goo.gl/maps/2u1HcnZzcLV7sP517
2-17	Loop Bang Sue BTS Station - Kasetsart University	Tha It	13° 53' 25.41353", 100° 27' 37.0185" https://goo.gl/maps/7VxokZosMydU5LuK6
CPA3			
1-31	Government Complex - Khlong Luang	Rangsit 200 Years	13° 59' 46.21943", 100° 36' 9.76107" https://goo.gl/maps/9h6dQgBFcaBRYGRTA
1-32E	Bangkhen -Talat Phlu BTS Station (Tollway)	Rangsit 200 Years	13° 59' 46.21943", 100° 36' 9.76107" https://goo.gl/maps/9h6dQgBFcaBRYGRTA
1-33	Bangkhen - Bangsue Grand Station	Rangsit 200 Years	13° 59' 46.21943", 100° 36' 9.76107" https://goo.gl/maps/9h6dQgBFcaBRYGRTA

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
1-64	Loop Safari World - Nuuan Jan	Buengkum 2	13° 47' 13.04204", 100° 40' 43.28382" https://goo.gl/maps/rKXm2EFHzNb9szoX8
1-76	Loop Bua Khao - Min Buri	Buengkum 2	13° 47' 13.04204", 100° 40' 43.28382" https://goo.gl/maps/rKXm2EFHzNb9szoX8
1-9E	Thammasat University Rangsit Campus - Thammasat University Tha Prachan Campus	Rangsit 200 Years	13° 59' 46.21943", 100° 36' 9.76107" https://goo.gl/maps/9h6dQgBFcaBRYGRTA
2-11	Ministry of Public Health - Sanam Luang	Tha It	13° 53' 25.41353", 100° 27' 37.0185" https://goo.gl/maps/7VxokZosMydU5LuK6
2-3	Talat Tha It - Victory Monument	Tha It	13° 53' 25.41353", 100° 27' 37.0185" https://goo.gl/maps/7VxokZosMydU5LuK6
2-18E	Tha It - Ramkhamhaeng University (Tollway)	Tha It	13° 53' 25.41353", 100° 27' 37.0185" https://goo.gl/maps/7VxokZosMydU5LuK6
2-22	Thanam Nonthaburi - Thanon Tok	Tha It	13° 53' 25.41353", 100° 27' 37.0185" https://goo.gl/maps/7VxokZosMydU5LuK6
2-27	Muang Thong Thani - Bang Wa BTS Station	Tha It	13° 53' 25.41353", 100° 27' 37.0185" https://goo.gl/maps/7VxokZosMydU5LuK6
2-34	Loop Samsen Railway Station - Din Daeng	Ramkhamhaeng 74	13° 46' 6.22412", 100° 39' 46.53427" https://goo.gl/maps/2u1HcnZzcLV7sP517
S3	Rangsit - Siam Park - Suvarnabhumi airport (Tollway)	Rangsit 200 Years	13° 59' 46.21943", 100° 36' 9.76107" https://goo.gl/maps/9h6dQgBFcaBRYGRTA

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
S5	Happy Land - Suvarnabhumi airport	Ramkhamhaeng University 2	13° 40' 23.9196", 100° 41' 28.212" https://goo.gl/maps/z5KHDcJAwJJdqrf57
S6	Bangkok Bus Terminal (Chatuchak) - Suvarnabhumi airport (Tollway)	Rangsit 200 Years	13° 59' 46.21943", 100° 36' 9.76107" https://goo.gl/maps/9h6dQgBFcaBRYGRTA

Figure 2: Example pictures of bus station in PoA 01 *'Bueng Kum E-bus station and the charging station'*

Table 8: Location of e-bus terminals / charging stations of routes included in CPAs under T-VER PoA 02: Bangkok Metropolitan area e-bus Zones 3 and 4

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
CPA1			
3-45	Rama 3 - Bangkok Bus Terminal (Chatuchak)	Phra Pradaeng	13° 39' 48.80315", 100° 30' 55.1844" https://goo.gl/maps/mbM4RvyNkknhK3eFA
4-15	Phra Pradaeng Pier - Bang Lamphu		
4-41	Taling Chan Circle - Thonburi	Pran Nok	13°45'17.4802605644302", 100°25'24.0784395243622" https://goo.gl/maps/aA5ZWbVjbCXn6wkT6
CPA2			
3-1	Paknam - Memorial Bridge Pier	Talingchan 2	13° 46' 53.2272",

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
			100° 23' 30.9804" https://goo.gl/maps/uSSU28gsu1aBJd246
3-25E	Paknam - Lat Krabang Industrial Estate (Tollway)	Pak Nam	13° 36' 57.48788", 100° 35' 36.13858" https://goo.gl/maps/rBuT3pRW4nkJehWHA
3-2E	Pu Chao Saming Phrai - Memorial Bridge Pier (Tollway)	Talingchan 2	13° 46' 53.2272", 100° 23' 30.9804" https://goo.gl/maps/uSSU28gsu1aBJd246
3-53	Hua Mak - Sao Ching Cha	Ramkhamhaeng 74	13° 46' 6.22412", 100° 39' 46.53427" https://goo.gl/maps/2u1HcnZzcLV7sP517
4-23E	Samaedam - Victory Monument (Tollway)	Saem Dam	13° 37' 32.34797", 100° 26' 19.6248" https://goo.gl/maps/WBqCch6nFst8QYLp7
4-27E	Bang Khun Thian - Happy Land (Tollway)	Saem Dam	13° 37' 32.34797", 100° 26' 19.6248" https://goo.gl/maps/WBqCch6nFst8QYLp7
4-28	Samaedam - Victory Monument	Saem Dam	13° 37' 32.34797", 100° 26' 19.6248" https://goo.gl/maps/WBqCch6nFst8QYLp7
4-3	Phra Pradaeng - Victory Monument	Phra Pradaeng	13° 39' 48.69215", 100° 30' 53.22867" https://goo.gl/maps/9PJyYs5gbEn7TRjT8
4-45	Phutthamonthon Sai 5 Road - Tha Ratcha Woradit	Wat Rai Khing	13° 45' 17.4722", 100° 17' 7.67889" https://goo.gl/maps/tPpRturFnKwHWGnQ6
4-49	Boromarajonani - Bangkok Bus Terminal (Chatuchak)	Phutthamonthon Sai 2	13° 43' 53.49", 100° 23' 48.174" https://goo.gl/maps/Xz9C4CRhoDKDVZKR8

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
4-52	Loop Bangkok Bus Terminal (South) - Phet Kasem Road	Phutthamonthon Sai 2	13° 43' 53.49", 100° 23' 48.174" https://goo.gl/maps/Xz9C4CRhoDKDVZKR8
4-53	Boromarajonani - Bangkok Bus Terminal (Eastern)	Talingchan 2	13° 46' 53.2272", 100° 23' 30.9804" https://goo.gl/maps/uSSU28gsu1aBJd246
4-17	KMUTT - Prachauthit - Talat Phlu BTS Station	Saem Dam	13° 37' 32.34797", 100° 26' 19.6248" https://goo.gl/maps/WBqCch6nFst8QYLp7
4-34	Thonburi Housing - Phra Pradaeng	Saem Dam	13° 37' 32.34797", 100° 26' 19.6248" https://goo.gl/maps/WBqCch6nFst8QYLp7
CPA3			
3-14	Bang Phli Housing - Udom Suk BTS Station	Bangpli	13° 35' 14.97603", 100° 48' 0.73846" https://goo.gl/maps/ASaYpZvmt86jQmsj7
3-35	Rama 3 - Tha Tian	Phra Pradaeng	13° 39' 48.69215", 100° 30' 53.22867" https://goo.gl/maps/9PJyYs5gbEn7TRjT8
3-36	Bangkok Port (Khlong Toei) - Phasi Charoen Port	Thonburi Housing	13° 39' 1.90485", 100° 25' 7.9758" https://goo.gl/maps/Nm48XjHhJQhFaAzF9
3-27	Pu Chao Saming Phrai - Siam Park	Pak Nam	13° 36' 57.48788", 100° 35' 36.13858" https://goo.gl/maps/rBuT3pRW4nkJehWHA
3-32	Samrong - Siam Park	Ramkhamhaeng University 2	13° 40' 23.9196", 100° 41' 28.212" https://goo.gl/maps/z5KHDcJAwJJdqrf57
3-52	Loop Rama 3 - Hua Lamphong	Phra Pradaeng	13° 39' 48.69215", 100° 30' 53.22867" https://goo.gl/maps/9PJyYs5gbEn7TRjT8

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
3-54	Tha Phasi Charoen - Victory Monument	Thonburi Housing	13° 39' 1.90485", 100° 25' 7.9758" https://goo.gl/maps/Nm48XjHhJQhFaAzF9
4-55	Sala Ya Train Station - National Stadium BTS Station	Salaya	13° 48' 21.15028", 100° 16' 11.7317" https://goo.gl/maps/tSUz2qcCgf9eZviv6
4-61	Sala Ya Station - Victory Monument	Wat Rai Khing	13° 45' 17.4722", 100° 17' 7.67889" https://goo.gl/maps/tPpRturFnKwHWGnQ6
4-36	Suksanari Wittaya School - Hua Lam Phong	Ekachai	13° 34' 35.91356", 100° 18' 36.10437" https://goo.gl/maps/uyAF4RmGyLUQTMJv6
4-29E	Samaedam - Bangkok Bus Terminal (Chatuchak) (Tollway)	Saem Dam	13° 37' 32.34797", 100° 26' 19.6248" https://goo.gl/maps/WBqCch6nFst8QYLp7
4-56	Boromarajonani - Krung Thon Buri BTS Station	Talingchan 2	13° 46' 53.2272", 100° 23' 30.9804" https://goo.gl/maps/uSSU28gsu1aBJd246
4-68	Suanpak - Thanon Tok	Talingchan 2	13° 46' 53.2272", 100° 23' 30.9804" https://goo.gl/maps/uSSU28gsu1aBJd246
CPA4			
3-37	Thailand Cultural Center - Sanam Chai BTS Station	Talingchan 2	13° 46' 53.2272",100° 23' 30.9804" https://goo.gl/maps/uSSU28gsu1aBJd246
3-39	Thanon Tok - Si Yan	Phra Pradaeng	13° 39' 48.69215", 100° 30' 53.22867" https://goo.gl/maps/9PJyYs5gbEn7TRjT8
3-3	Rama IX Park - National Stadium Station	Ramkhamhaeng University 2	13° 40' 23.9196", 100° 41' 28.212" https://goo.gl/maps/z5KHDcJAwJJdqrf57

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus terminals	GPS coordinate location
3-23E	Samrong - Government Complex (Tollway)	Phra Pradaeng	13° 39' 48.69215", 100° 30' 53.22867" https://goo.gl/maps/9PJyYs5gbEn7TRjT8
3-44	Bangkok Port (Khlong Toei) - Victory Monument	Ramkhamhaeng 74	13° 46' 6.22412", 100° 39' 46.53427" https://goo.gl/maps/2u1HcnZzcLV7sP517
3-55	Bangkok Port (Khlong Toei) - Rama 7	Talingchan 2	13° 46' 53.2272",100° 23' 30.9804" https://goo.gl/maps/uSSU28gsu1aBJd246
3-34	Bangna - Lat Krabang Industrial Estate (Tollway)	Ramkhamhaeng University 2	13° 40' 23.9196", 100° 41' 28.212" https://goo.gl/maps/z5KHDcJAwJJdqrf57
4-46	Rai Khing temple - Krung Thon Buri BTS Station	Wat Rai Khing	13° 45' 17.4722", 100° 17' 7.67889" https://goo.gl/maps/tPpRturFnKwHWGnQ6
4-54E	Omyai - Victory Monument (Tollway)	Phutthamonthon Sai 2	13° 43' 53.49", 100° 23' 48.174" https://goo.gl/maps/Xz9C4CRhoDKDVZKR8
4-67	Sala Ya Train Station - Ministry of Commerce	Salaya	13° 48' 21.15028", 100° 16' 11.7317" https://goo.gl/maps/tSUz2qcCgf9eZviv6

Figure 3: Example pictures of bus station in PoA 02 ***'Phra Padaeng E-bus station and the charging station'***

Does the system boundary of the implemented project/program and the projects of the program correspond to that in the project/program description?

☒ Yes

☐ No

2.4 Technology used

If first monitoring period after a validation: Does the implemented project/program technically correspond to the project/program according to the project/program description?

The technology implemented in the Program has deviated from the MADD, in terms of battery capacity as previously indicated. The battery capacity in the implementation could be 120 kWh to operate shorter bus routes. Hence, the bus operator deems it appropriate to operate e-buses with lower battery capacity but the same dimensions and model, as shown in Figure 4. Technical requirements included in this monitoring period are shown in Table 9.

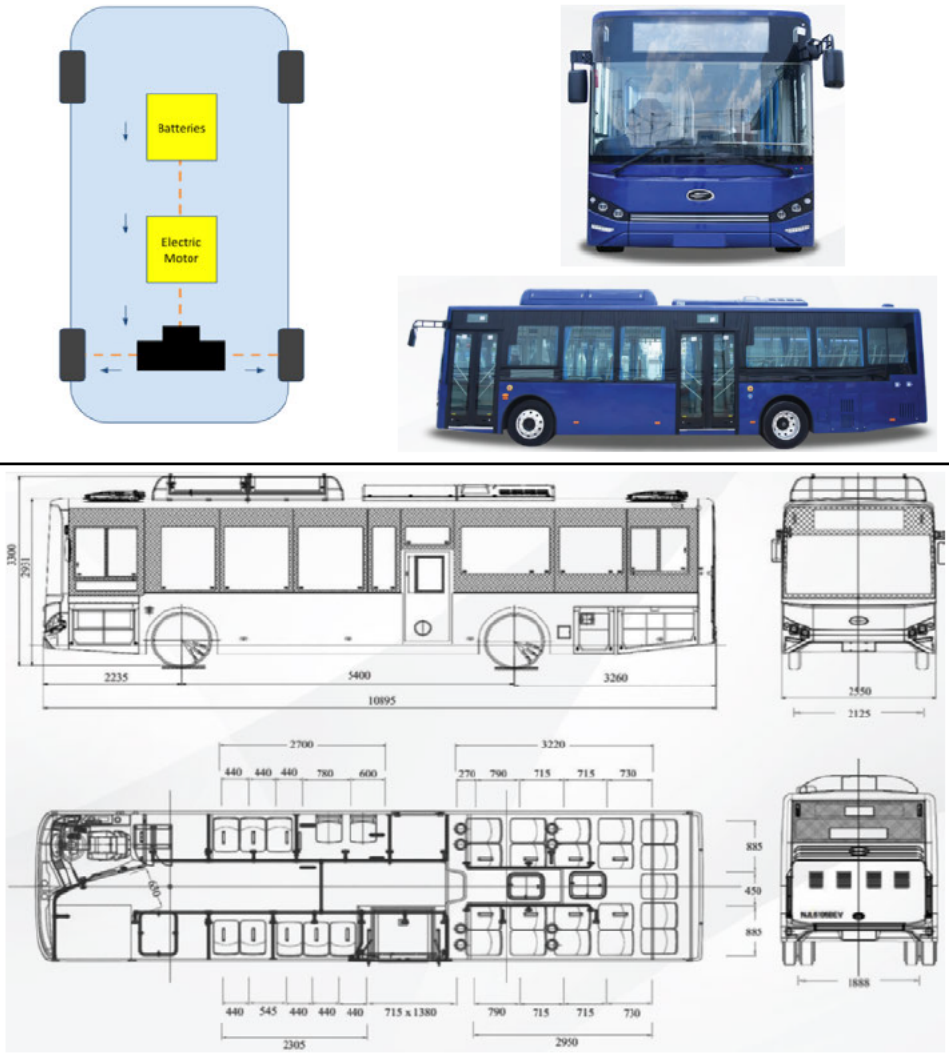


Figure 4: E-Bus model and dimension

Table 9: Technical requirements of electric buses in the program

Item	Detail
Model	XML6115JEV
Size	10,950 x 2,550 x 3,420 mm
Battery capacity	From 120 kWh to 302 kWh

The other technology that is also considered necessary component in this program is the charging station. The charging stations have been installed at each of the e-bus terminal that are directly connected to the grid. The charging capacity of the charging stations are separated into 2 models: 300 kW and 360 kW. The difference between two models of the charging stations is the charging time period where 360 kW is able to charge faster than the 300 kW charging station, but the charging procedure remain the same. The general specification of the charging stations is as illustrated in Table 10 and Figure 5. Information regarding the locations and quantity of each charging stations, refers to Table 11.

Table 10: Technical specification of charging stations in the program

Item	Detail	
Capacity	300 kW	360 kW
Model	EVD 300D	EVD 360D
Dimension	1,190 x 1,000 x 2,195	1,190 x 1,000 x 2,200

EVD 300 D

EVD 360 D

Figure 5: Charging station for 300 kW and 360 kW models

Table 11: Number of charging stations by terminal

No.	Bus terminal	DC 300 kW	DC 360 kW	Total Chargers by terminal
1	Ekachai	9	0	9
2	Phra Pradaeng	11	6	17
3	Pran Nok	8	0	8
4	Rangsit Bangpoon	6	0	6
5	Bangpli	6	0	6
6	Phutthamonthon Sai 2	9	11	20
7	Ramkhamhaeng 74	5	10	15
8	Minburi - Nong Chok	0	10	10
9	Talingchan 2	0	10	10
10	Buengkum 2	10	0	10
11	Thonburi Housing	10	0	10
12	Saem Dam	10	0	10
13	Ramkhamhaeng University 2	0	10	10
14	Rangsit 200 Years	0	8	8
15	Wat Rai Khing	8	0	8
16	Salaya	0	5	5
17	Tha It	0	10	10
18	Pak Nam	0	15	15
Total		**92**	**95**	**187**

3 Differentiation from climate or energy policy instruments and avoidance of double counting

This project is implemented under the Paris Agreement 6.2 scheme. It is in line with the bilateral agreement between Switzerland and Thailand. Hence, aside from transferring ITMOs generated from this Program, there is no other subsidy to this Program.

3.1 Grants

If first monitoring period after validation: Do the received grants and non-repayable cash benefits, for which an impact assessment is necessary, correspond to the information in the project/program description?

This program does not receive any grants or non-payable cash benefits from any counterparty.

If further (not first after validation) monitoring period: Do the grants received, as well as non-repayable cash benefits, for which a breakdown of impact is necessary, correspond to the information in the last monitoring report?

☒ Not relevant
☐ Yes
☐ No

3.2 Distinction from companies that are exempt from the CO_2 levy

If first monitoring report after validation: Does the demarcation to companies exempt from CO_2 tax match the demarcation set out in the project/program description?

This section is not relevant as the Bangkok E-Bus Program is an abroad program that is implemented in Thailand.

If further (not first after validation) monitoring report: Does the delineation to companies exempt from CO_2 tax match the delineation presented in the last monitoring report?

☒ Not relevant
☐ Yes
☐ No

3.3 Double counting due to other compensation for ecological added value

If first monitoring period after a validation: Do the facts regarding double counting of emission reductions correspond to the presentation in the project/program description?

Because the Bangkok E-Bus Program is registered under the T-VER standard, which has a double-counting prevention measure, the risk of double counting is kept at a minimum. The prevention measures from the T-VER standard are as follows:

1) Preventing double counting from request for credits issuance:

- The project participants and project implementers shall not request for credits issuance activities in the same project boundary from any other GHG emission reduction program.
- In case there is another project implemented in the same area owned by the same juristic person/individual but registered with another GHG emission reduction program or certification

system, the project participants shall address the details in Project Design Document (PDD) under the section of double counting.

2) Preventing double counting from reporting or declaring voluntary GHG emission reduction performance:

After the carbon credits have been transferred to another juristic person/individual, the project participants and project operators are not able to claim the right over the carbon credits.

3) Prevention double counting from Renewable Energy Certificate (REC) certification:

In the case of a project that produces electricity from renewable energy and a REC was issued, carbon credits from the project activity during the same period as the REC certificate cannot be issued.

Moreover, there is a unique serial number for every credit issued. In the case of the transfer of ITMOs, corresponding adjustment (CA) will be addressed in compliance with CMA 3[16] towards the achievement of NDC. Since the Program is registered under the T-VER standard, which is operated and managed by TGO, the transfer of ITMOs shall follow the "Carbon Credit Management Guideline and Mechanism" regulated by ONEP to avoid double counting.

If further (not first after validation) monitoring period: Do the facts regarding double counting of emission reductions correspond to the presentation in the last monitoring report?

☒ Not relevant
☐ Yes
☐ No

If first monitoring period after a validation: Are the measures to avoid double counting due to other compensation of the ecological added value implemented according to the project/program description?

Yes, it is implemented as described in the MADD.

If further (not first after validation) monitoring period: Are the measures to avoid double counting due to other compensation of the ecological added value according to the last monitoring report implemented?

☒ Not relevant
☐ Yes
☐ No

[16] Source: https://unfccc.int/sites/default/files/resource/cma3_auv_12a_PA_6.2.pdf

4 Implementation monitoring

4.1 Detection method and data collection

If first monitoring period after validation: Does the applied detection method correspond to the method described in the monitoring concept of the project/program description, if necessary also with regard to scientific monitoring?

The monitoring concept corresponds and aligns with the description in the registered MADD. And since this is the first monitoring period, the monitoring method for data collection is deviated from the monitoring plans, as shown in Table 12. Refers to Annex 5 for the monitoring procedures of data collection.

Table 12 Deviation of data collection approach regarding MADD

Stated in MADD	Actual implementation
1. Energy Mahanakorn Co. Ltd. is responsible for the service and data collection of e-buses at every terminal station (refers to Table 6 of MADD)	1. TSB signed an agreement contract with Auto Bus Service Co. for bus terminal services – for example, charging services, bus maintenance and data collection for electricity consumption of each bus
2. The electricity bill from Metropolitan Electricity Authority, Provincial Electricity Authority can be used for electricity consumption data (refers to section A3.2 Monitoring Plan of MADD ver. 5.3)	2. The electricity bill from the charging station does not reflect the electricity consumption separated by the operational bus routes. Since the electricity bill only reflects the electricity consumption of the e-bus terminal stations, it is not possible to differentiate the electricity consumption into different bus routes. Hence, only data recorded of electricity consumption shall be utilised.

4.2 Formulas for calculating the ex-post emission reductions achieved

If first monitoring period after a validation: Do the formulas for calculating the achieved emission reductions correspond to the method described in the monitoring concept of the project/program description?

The calculation formula corresponds and aligns with the monitoring concept and methodology described in the registered MADD, part 2.5.1.

4.3 Parameters and data collection

4.3.1 Fixed parameters

Fixed parameter: NCV_{NGV}	Detail
Parameter description	Net calorific value of natural gas vehicle (NGV)
Value	36.67
Unit	MJ/kg

Data source	Energy statistics report from the Department of Alternative Energy Development and Efficiency, Ministry of Energy From Energy Statistics of Thailand 2021 (https://www2.energy.go.th/th/annual-energy-statistics-report) NCV_NGV (dry) = 1.02 MJ/scf NGV consumption (Feb 2565) – (http://www.eppo.go.th/index.php/th/petroleum/gas/ngv/ngv-unit) NGV conversion = 27.81873313 tonne/mmscf

Fixed parameter: $EF_{CO2,x}$	Detail
Parameter description	Emission factor of NGV
Value	0.056
Unit	$kgCO_2/MJ$
Data source	Table 1.4 2006 IPCC Guidelines for National GHG Inventories

Fixed parameter: $FC_{BL,i,NGV}$	Detail
Parameter description	Quantity of fuel consumption of the NGV of the ICEV in the public transport system on route i in the baseline
Measured value and unit	1,807,213 kg_{NGV} in this monitoring period
Data source / document	Calculated by multiplying (i) the specific fuel consumption[17] (unit fuel/distance) of the monitoring data for at least 3 months continuously and backdated for at most 2 years after replacement by an EV, (ii) the number of operating vehicles, and (iii) total distance travelled per year per vehicle. Refer to Reference 8 for the source of calculated data.

Fixed parameter: $L_{BL,i}$	Detail
Parameter description	Annual distance (round trip) on route 'i' in the baseline scenario.
Measured value and unit	Total distance of 3,235,254 km in this monitoring period
Data source / document	This shall be equal to $L_{PJ,i,y}$ since the project is a 1:1 replacement, as mentioned in the registered MADD.

[17] Specific fuel consumption shall also be considered as a parameter that has to be monitored throughout the crediting period. The average data of specific fuel consumption in this monitoring period come from the collected data of existing NGV buses from 35 bus routes. The determination of the specific fuel consumption of baseline vehicles shall follow the methodology of AMS.III-C section 5.4.4 option (4): Using data from a control group of vehicles.

Fixed parameter: $N_{BL,i}$	Detail
Parameter description	Number of ICEV on route 'i' in the baseline situation.
Measured value and unit	Total operation of 550 vehicles in this monitoring period
Data source / document	This shall be equal to $N_{PJ,i,y}$ since the project is a 1:1 replacement, as mentioned in the registered MADD.

4.3.2 Dynamic Parameters and measured values

If first monitoring period after a validation: Do the dynamic parameters for calculating emission reductions correspond to those in the project/program description?

The dynamic parameter corresponds and aligns with the monitoring concept and methodology described in the registered MADD, part 2.5.1.

Measured value / dynamic $L_{PJ,i,y}$	Detail
Parameter description	Annual distance of electric vehicles in route i year y.
Measured value and unit	Total distance of 3,235,254 km in this monitoring period
Data source / document	Record of monitored value of total distance travelled on a daily basis. Refer to Reference 8 and Reference 11 for annual distance value in route 'i'

Measured value / dynamic $N_{PJ,i,y}$	Detail
Parameter description	Number of electric vehicles in route i year y.
Measured value and unit	Total operation of 550 vehicles in this monitoring period
Data source / document	Record of monitored value of number of electric vehicles on a daily basis. Refer to Reference 8 for number of vehicles in route 'i'

Measured value / dynamic $EC_{PJ,i,j,y}$	Detail
Parameter description	Annual electricity consumption for charging EV number j on route i during year y
Measured value and unit	Total electricity consumption of 3,700,279 kWh in this monitoring period
Data source / document	Data that shows the electricity consumption from EV charging, which shall be reported on a monthly basis. Refer to Reference 8 for electricity consumption for EV number 'j' on route 'i'

Measured value / dynamic $EF_{EC,y}$	Detail
Parameter description	Grid Emission factor.

Measured value and unit	0.4758 tCO_2/MWh
Data source / document	In the case of using electricity from the national grid system, $EF_{EC,y}$ shall refer to TGO's latest $EF_{EC,y}$ value for the monitoring period. Nonetheless, if there is not any supersede during the monitoring period, TGO's latest value for $EF_{EC,y}$ shall be referred to.

Other Data Dynamic parameters stated in MADD section A3.2 monitoring plan

Measured value / dynamic NGV buses	Detail
Parameter description	Number of ICE buses in the public transport system of Bangkok and metropolitan area
Measured value and unit	8,102 ICE vehicles in Bangkok Metropolitan's public transportation system as of 31 Dec 2022 where most of the fuel types are Diesel, CNG, and CNG-Gasoline
Data source / document	https://web.dlt.go.th/statistics/

Measured value / dynamic Operational license	Detail
Parameter description	Validity of passenger transport license monitored annually
Data source / document	Passenger transport license for each bus routes refers to Annex 2, as example

Measured value / dynamic IR_i	Detail
Parameter description	Technology improvement factor for vehicle category i per year
Measured value and unit	Default value 0.99 in case of no available data from country specific data
Data source / document	UNFCCC-CDM-Tool 18 version 01

Measured value / dynamic SDG 8	Detail
Parameter description	Number of employees of TSB as of December 2023
Measured value and unit	TSB employees
Data source / document	Refer to Reference 10 for employees' data by bus terminal

Male	Female	Disable	Underage
1,842	1,600	0	0

<table>
<tr><td>Measured value / dynamic
SDG 11</td><td>Detail</td></tr>
<tr><td>Parameter description</td><td>Ambient annual PM_x level in Bangkok Metropolitan</td></tr>
<tr><td>Measured value and unit</td><td>Average ambient air quality from 12 locations around Bangkok from October 2022 to December 2022. The information was retrieved and calculated from Thailand’s pollution control department.
<table>
<tr><td>Month - 2022</td><td>PM_{10} ($\mu g/m^3$)</td><td>$PM_{2.5}$ ($\mu g/m^3$)</td></tr>
<tr><td>October</td><td>44.2</td><td>25.0</td></tr>
<tr><td>November</td><td>47.7</td><td>26.2</td></tr>
<tr><td>December</td><td>52.1</td><td>28.9</td></tr>
</table>
Note: no tailpipe emission from E-Bus in the program.</td></tr>
<tr><td>Data source / document</td><td>http://air4thai.pcd.go.th/webV2/history/</td></tr>
</table>

Measured value / dynamic SDG 13	Detail
Parameter description	Quantity of emission reduction in this monitoring period (01.20.2022 – 31.12.2022)
Measured value and unit	1,916 tCO_2e
Data source / document	Ex-post calculation.xlsx file

4.3.3 Plausibility check of dynamic parameters or measured values

If first monitoring period after a validation: Was the plausibility check carried out according to the specification of the project/program description?

A plausibility check is carried out for fundamental dynamic parameters as indicated in the following tables.

Parameters for plausibility check	$L_{BL,i,y}$
Parameter description	Annual distance of Electric Vehicles in route i year y.
Value	3,235,254
Unit	km/this monitoring period
Data source	GPS data of distance travelled on a daily basis refers to Reference 11 for GPS exported data
Parameter plausibilised with this parameter	N/A

Parameters for plausibility check	$EC_{PJ,i,j,y}$
Parameter description	Annual electricity consumption for charging EV number j on route i in the operating year y.
Value	3,700,279
Unit	kWh/this monitoring period
Data source	Data that shows the electricity consumption from EV charging, which shall be reported on a monthly basis. Refers to Reference 8 for electricity consumption data recorded.
Parameter plausibilised with this parameter	N/A

Parameters for plausibility check	$FC_{BL,i,NGV}$
Parameter description	Quantity of Fuel consumption of the NGV of the ICEV in the public transport system on route i in the baseline
Value	1,807,213
Unit	kg_{NGV}/year
Data source	Calculated by multiplying (i) the specific fuel consumption[18] (unit fuel/ distance) of the monitoring data for at least 3 months continuously and backdated for at most 2 years after replacement by an EV, (ii) the number of existing vehicles, and (iii) the average total distance travelled per year per vehicle.
Parameter plausibilised with this parameter	$SFC_{NGV,y}$ derived from average NGV fuel consumption based on data from the 35 bus routes that are still in operation with NGV buses in this monitoring period. The determination of the $SFC_{i,y}$ parameter complied with specific fuel consumption determination according to CDM-AMS-III.C version 16, paragraphs 37 and 38. Refers to Reference 9 for fuel consumption of the existing NGV bus.

Are all the parameters listed under 4.3.1 and 4.3.2 plausible?

☒ Yes
☐ No

Parameters Justification:
$L_{BL,i,y}$: is cross-checked with the mileage record that is manually recorded in the logbook by the bus driver on a daily basis. Example of mileage logbook refers to Annex 4

$EC_{PJ,i,j,y}$ is cross-checked with the electricity data that is manually recorded on a daily basis. Example of electricity consumption logbook refers to Reference 12

[18] Specific fuel consumption shall also be considered as a parameter that has to be monitored throughout the crediting period. The average data of specific fuel consumption in this monitoring period come from the collected data of existing NGV buses from 35 bus routes. The determination of the specific fuel consumption of baseline vehicle shall follow the methodology of AMS.III-C section 5.4.4 option (4): Using data from a control group of vehicles.

$FC_{BL,i,NGV}$ is calculated from average $SFC_{NGV,y}$ data, which is the recorded distance travelled, to identify the baseline emissions of the Program refers to Reference 9.

4.3.4 Examination of influencing factors

Does the situation of the influencing factors of the implemented project/program correspond to that in the project/program description?

☐ Examination not foreseen
☐ Yes
☒ No

Influencing factor	Number of operating E-buses
Description of the influencing factor	Number of Electric Vehicles in route i year y.
Impact on project emissions or the emissions of the projects in the program or the reference development	The project emission was expected to vary from the ex-ante as described in the MADD due to the difference in number of e-buses operating during this monitoring period. The number of e-buses operating proportionally reflects upon the overall energy consumption from the charging activity in this program. Hence, the higher number of e-buses operating, the higher the project emission in the program.
Development of the influencing factor during the present monitoring period	In this monitoring period, the influencing factor regarding the number of e-buses operating was lower than expected in the MADD as it was the starting phase of the program where e-buses are gradually included.
Data source, references	GPS data and logbook of monthly operation schedule of each bus terminal. Refers to Reference 11 and Annex 4 for example of GPS interface and mileage logbook

Value in project/program description	Effective value	Justification/assessment of the deviation
1,005 vehicles	550 vehicles	The effective value is less than the value mentioned in the program description as this MP was in the e-buses fleet roll out phase. E-buses have not completely been filled the bus routes yet.
Description of why and how the reference development was adjusted		
The adjustment to the number of e-buses depends on the demand for buses on specific routes, which could differ from the MADD where the number of buses was estimated from the minimum number that are needed to comply with the passenger transport licence.		

4.4 Special features of monitoring

Special features of monitoring are not relevant to this Program.

4.5 Scientific monitoring

If the project/program has introduced scientific monitoring, has this reduced the uncertainty in the quantification of emission reductions to such an extent that scientific monitoring could be discontinued?

☐ Yes

☒ No

4.6 Process and management structure, responsibilities

If first monitoring period after a validation: Do the established process and management structures correspond to the structures defined in the project description?

The process and management structures of the party responsible for data collection have deviated from the MADD. In the MADD, it is stated that Energy Mahanakorn Co. Ltd. (EA Anywhere Brand) is the charging station operator who is responsible for the charging services at each bus terminal station and also submits the data to Carbon Coordinating and Managing Entity Co., Ltd. (CCME) periodically. In the implementation during this monitoring period, the bus operator, TSB has engaged with another bus service company called Auto Bus to take care of the charging services, and daily collect the power consumption data of each E-Bus in the logbook to EA to provide data to CCME.

Responsibilities

If first monitoring period after a validation: Are the responsibilities for data collection, quality assurance and data archiving perceived as defined in the project/program description?

The data has been collected from monitoring points, i.e. charging stations and GPS data, by the Program manager from EA, and provide data to CCME to further used for calculation of the overall program emission reduction. EA is responsible for data collection and its quality assurance. CCME takes the role of data compilation, conducts emission reduction calculation and compiles the monitoring report. Data collection flow refers to Reference 13 and Annex 5.

4.7 Program structure

If first monitoring period after validation: Is the program structure (e.g. infrastructure for managing data on individual projects) unchanged from the structure set out in the program description?

The infrastructure for managing the Program's data is unchanged from the Program description, the MADD, refer to Section 2.3

If first monitoring period after a validation: Is the process unchanged for the new projects to be included in the program compared to the process described in the program description?

The process of the new CPAs to be included in the PoA remains unchanged. Refers to Table 4 for CPAs inclusion criteria.

5 Ex-post calculation of eligible emission reductions

5.1 Calculation of the achieved emission reductions

Emission reduction calculation from 01.10.2022 to 31.12.2022

In this monitoring period, only the emission reduction from fuel-switching activity is considered. Hence, the emission reduction formula is as follows:

$$ER_{total,y} = BE_{FFy} - PE_{FF,y} \quad \text{Formula [1]}$$

where,

$ER_{total,y}$ = Overall emission reduction in year y (tCO_2/ year).
$BE_{FF,y}$ = Total baseline emissions in year y (tCO_2/ year).
$PE_{FF,y}$ = Total project emissions in year y (tCO_2/ year)

Baseline emissions for fuel switch

$$BE_{FF,y} = \sum_i \sum_x [(FC_{BL,i,x} \times NCV_x \times EF_{CO2,x}) \times ADJ_{i,y}] \times 10^{-9} \quad \text{Formula [2]}$$

where,

$BE_{FF,y}$ = Total baseline emissions in year y (tCO_2/year)
$FC_{BL,i,x}$ = Quantity of fossil fuel consumption type x of the ICEV in the public transport system on route i in the baseline (unit/year)
NCV_x = Net calorific value of fossil fuel type x
$EF_{CO2,x}$ = Emission factor of fossil fuel type x
$ADJ_{i,y}$ = Correction factor for route i in year y

The baseline emissions for fuel switching also consider the technology improvement factor. In the context of emission reduction calculations for the transportation sector in Thailand, TGO realised the importance of the technology improvement factor, hence considering technological improvement at the default rate of 1% annually using the default factor from CDM-AMS.III-C. Moreover, if there are new NGV buses included in the Bangkok public transportation system, the Program plans to monitor these new buses (and their fuel consumption) to monitor the fuel consumption rate on a yearly basis to see if it changes from the baseline emission assumption data and how it impacts the overall baseline emission.

whereby $ADJ_{i,y}$ is calculated as:

$$ADJ_{i,y} = (N_{PJ,i,y} \times L_{PJ,i,y}) / (N_{BL,i} \times L_{BL,i}) \quad \text{Formula [3]}$$

where,

$ADJ_{i,y}$ = Correction factor for route i during year y
$N_{PJ,i,y}$ = Number of EVs on route i during year y
$L_{PJ,i,y}$ = Average annual distance of EVs on route i during year y
$N_{BL,i}$ = Number of ICEVs on route i in the baseline situation
$L_{BL,i}$ = Annual distance (round trip) on route i in the baseline scenario

Regarding the $ADJ_{i,y}$ parameter, as indicated in the MADD a service extension could occur in the baseline, since there is space for new buses to be included before reaching the maximum number of buses as per the passenger transport licence. Also as mentioned, the ADJ is the correction factor for when there are more e-buses put into operation than envisaged in the baseline. The higher number of e-buses would be treated as e-buses operating on new routes where, if no e-buses were in operation, the bus operator would fill the routes with NGV buses. It infers that the higher number of e-bus replaces the NGV buses. The Program only considers NGV buses for conservativeness (since there is no regulation on fuel type of bus) of the baseline calculation. Hence, the correction factor of this Program shall remain as 1 as it is a 1:1 replacement.

Project emissions for fuel switch

$$PE_{FF,y} = \sum_i \sum_j (EC_{PJ,i,j,y} - EC_{RE,PJ,i,j,y}) \times EF_{EC,y} \times 10^{-3} \quad \text{Formula [4]}$$

$PE_{FF,y}$ = Total project emissions in year y (tCO_2/year)
$EC_{PJ,i,j,y}$ = Annual electricity consumption for charging EV number j on route i during year y
$EC_{RE,PJ,i,j,y}$ = Annual electricity consumption from renewable energy sources for the charging of the project's EV number j on route i during year y
$EF_{EC,y}$ = Grid emission factor

5.2 Impact distribution

This Program does not receive any grants or non-payable cash benefits from any counterparty, aside from revenue from carbon credits. Hence, impact distribution is not relevant to the Program.

5.3 Overview

The applicant requests the issuance of the following certificates:

Calendar year	*Achieved* emission reductions *without* impact splitting in t CO eq_2	*Creditable* emission reductions *with* impact distribution in t CO eq_2
2022 from 01.10.2022 – 31.12.2022	1,916 tCO_2	N/A

6 Emission reductions and significant changes

Were there any significant changes during the monitoring period that affected the economic analysis, the emission reductions achieved or the technique or technology used?

☐ Yes
☒ No

6.1 Comparison of ex-post achieved and ex-ante expected emission reductions

Calendar year	Planned Component of implementation (CPAs)	Ex-post emission reductions achieved without impact splitting in t CO_2 eq	Ex-ante expected emission reductions without impact splitting in t CO_2 eq	Deviation and justification / assessment (detailed if the deviation is >20%)
PoA 01				
2022 from 01.10.2022 – 31.12.2022	CPA1	281	857	The deviation of ex-post emission reduction is significantly lower than the ex-ante due the start of operational date of the buses in each CPA. Also, due to the inadequate data collection of some of the monitoring parameter, those data were excluded from the calculation.
	CPA2	616	1,590	
	CPA3	22	938	
PoA 02				
2022 from 01.10.2022 – 31.12.2022	CPA1	117	519	
	CPA2	715	1,942	
	CPA3	155	1,265	
	CPA4	10	362	
Total		**1,916**	**7,473**	

The deviation mainly resulted from the number of buses included in the program. The ex-ante estimate was based on the assumption that the number of operational e-buses in the program would be equal to the minimum bus number on the passenger transport licenses from day 1 of this monitoring period. However, in actuality, e-buses were gradually included in the program, and the number of e-buses in most routes did not reach the transport license minimum number from day 1. Some routes even reached the minimum passenger transport license number in late December 2022. Additionally, the ex-ante estimate also included emission reduction from modal shift activity, in addition to fuel switching activity, while the ex-post value in this monitoring period only considered emission reduction from fuel switching activity.

6.2 Comparison of costs and revenues

In this monitoring period, it is still considering in the beginning phase of operation where the IRR projection is not feasible as the net revenue is still in the negative value. This is due to the following reasons:

- Number of E-buses in operation were not fully deployed due to early stage of implementation
- This monitoring period was considered only 3 months of operation
- Revenues were not yet reflecting full operation e.g. fare and advertisement revenues
- Operating expense and capital expenditure were not yet reflecting full operation

Hence, the comparison of costs and revenues shall be concludable in the next monitoring period.

6.3 Comparison of planned and deployed technology and techniques

The deployed technology specification is slightly different from the MADD, where the specification of battery capacity is about 150 kWh at a minimum. However, due to an implementation assessment during the operation, it was found that a battery with a capacity of 120 kWh is sufficient to operate on routes that are not long distance. This change does not have any impact on the amount of GHG emissions because the amount of electricity charged only depends on the electricity consumption for each trip. The higher battery capacity will only affect the charging frequency of the e-bus but not the overall power consumption.

Table of abbreviations

CME	Program Coordinating and Managing Entity
CCME	Carbon Coordinating and Managing Entity Co., Ltd.
CPA	Component project activity
DLT	Department of Land Transportation (Thailand)
EA	Energy Absolute Public Company Limited
EVs	Electric Vehicles
FOEN	Federal Office for the Environment
GHG	greenhouse gas
ICE	internal combustion engine
ICEV	internal combustion engine vehicles
ITMOs	International Transferred Mitigation Outcomes
LoA	Letter of Authorization
MADD	Mitigation Activity Design Document
MP	Monitoring Period
NGV	Natural Gas Vehicle
ONEP	Office of Natural Resources and Environmental Policy and Planning
PoA	Program of Activities
T-VER	Thailand Voluntary Emission Reduction Program
TGO	Thailand Greenhouse Gas Management Organisation

Annex

Annex 1– Authorization statement by FOEN

Annex 2 – Example of DLT approved passenger transport license

Annex 3 – Letter of acknowledgement by TGO to the use of battery capacity 120 kWh in the project

Annex 4 – Example of Mileage logbook

Annex 5 – TSB's management structure corresponds to the e-buses data monitoring

Annex 6 – Example of bus registration license

Annex 7 – List of References

Annex 1– Authorization statement by FOEN

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of the Environment, Transport, Energy and Communications DETEC

Federal Office for the Environment FOEN

AUTHORIZATION STATEMENT
BY THE FEDERAL OFFICE FOR THE ENVIRONMENT
OF THE SWISS CONFEDERATION

Authorization statement reference number: *5002, 2023*

Acting as the authorized entity of the Swiss Government, the Federal Office for the Environment (FOEN)[1] hereby authorizes per Article 6.3 of the *Paris Agreement* and per Article 5.1 of the *Implementing Agreement between the Swiss Confederation and the Kingdom of Thailand* signed on 24th June 2022 (hereafter referred to as the *Implementing Agreement*) the international transfer and use of Internationally Transferred Mitigation Outcomes (ITMOs) specified in this statement. The provisions of the *Implementing Agreement* apply.

I. **Date of authorization (date of signature of this authorization statement)**: 27.02.2023

II. **Entity authorized (to transfer)**: Energy Absolute Public Company Ltd, Bangkok

III. **ITMO uses authorized**: ITMOs are authorized for use towards NDC, as specified in the authorization statement by the Ministry of Natural Resources and Environment of the Kingdom of Thailand (MONRE).

IV. **Definition of first transfer**: The first transfer, triggering corresponding adjustments by the host Party is defined by the recognition of the occurred international transfer of an ITMO under the Implementing Agreement (Article 8).

V. **Authorized mitigation activity:** "Bangkok e-bus Program" (project ID number 5002) as determined below and in the annexed Mitigation Activity Design Document (MADD). Applied standards and baseline methodologies as well as requirements for monitoring and verification, including for contributions to sustainable development, apply as specified in the MADD.

Total cumulative maximum amount of Mitigation Outcomes for which international transfer and use is authorized: 500'000 of t CO_2eq

VI. **Authorized crediting period:** 1 October 2022 – 31 December 2030

VII. **NDC period(s) during which the Internationally Transferred Mitigation Outcomes (ITMOs) are authorized for use, as appropriate:** 2021 – 2030

VIII. **Corresponding Authorization from MONRE[2], where applicable:** https://www.onep.go.th/letter-of-authorization/

[1] According to Article 13.2 of the Implementing Agreement.
[2] According to Article 13.1 of the Implementing Agreement.

Federal Office for the Environment FOEN
Compensation Office
3003 Berne
Tel. +41 58 46 538 15
carbonoffset@bafu.admin.ch
https://www.bafu.admin.ch/emission-reduction-certificates

IX. **The following method for corresponding adjustment will be applied by the Swiss Confederation pursuant to 2/CMA.3 paragraph 7 of the Annex (Art 6.2 guidance)**: trajectory approach as defined in paragraph 7.a.i for the single year target of Switzerland's NDC (minus 50 percent in 2030 compared to 1990) and 7.b for the multi-year target of Switzerland's NDC (minus 35 percent over the period 2021-30 compared to 1990)

In accordance with Article 1.3 of the *Implementing Agreement*, this Authorization Statement guarantees the recognition of the international transfer of Mitigation Outcomes specified in this Statement, pending fulfillment of positive examination statements pursuant to Article 7 of the *Implementing Agreement* issued by FOEN and MONRE.

Pursuant to Article 5.4 of the *Implementing Agreement*, this Authorization Statement enters into force thirty calendar days after its date of signature. In case of issuance of a statement of inconsistency by MONRE during this period of thirty calendar days, this Authorization Statement remains invalid pursuant to Article 5.4 of the *Implementing Agreement*.

Pursuant to Article 5.5 of the Implementing Agreement this Authorization Statement may be updated or changed. Such changes or updates can only be made upon request of the entity authorized to transfer. Updates or changes of Authorization Statements become valid within 30 calendar days after their date of issuance, unless the other Party to the *Implementing Agreement* issues a notification of inconsistency per Article 5.4 of the *Implementing Agreement*.

The authorization statement is signed by Reto Burkard, head of climate division of FOEN.

Reto Burkard
Head of climate division

Issuing authority:
Federal Office for the Environment
Woblentalstrasse 68
3003 Bern
Switzerland
carbonoffset@bafu.admin.ch

Annex: MADD " Bangkok e-bus Program" (project ID number 5002)

Annex 2 – Example of DLT approved passenger transport license

ขส.บ. 12 ก.

ใบอนุญาตประกอบการขนส่งประจำทาง
ด้วยรถที่ใช้ในการขนส่งผู้โดยสาร

ใบอนุญาตที่ กก.83/2565

นายทะเบียนออกใบอนุญาตให้ บริษัท ราชาโรัด จำกัด
สำนักงานชื่อ บริษัทราชาโรัด จำกัด
อยู่เลขที่ 41/249
แขวงบางแค เขตบางแค จังหวัดกรุงเทพมหานคร
มีสิทธิประกอบการขนส่งประจำทาง ในเส้นทางหมวด 1 สายที่ S6
สถานีขนส่งผู้โดยสารกรุงเทพฯ (จตุจักร) - ท่าอากาศยานนานาชาติสุวรรณภูมิ (ทางด่วน)
ใบอนุญาตฉบับนี้ให้มีอายุ 7 ปี นับตั้งแต่วันที่ 28 **เดือน** เมษายน **พ.ศ.** 2565
ถึงวันที่ 27 **เดือน** เมษายน **พ.ศ.** 2572
โดยให้ปฏิบัติตามกฎหมายและเงื่อนไขที่นายทะเบียนกำหนดตามมาตรา 31 แห่งพระราชบัญญัติการขนส่งทางบก พ.ศ. 2522 ในใบอนุญาตนี้

ให้ไว้ ณ วันที่ 28 **เดือน** เมษายน **พ.ศ.** 2565

(นางชะไมพร โชติมัยยงค์)
ผู้อำนวยการสำนักการขนส่งผู้โดยสาร
ปฏิบัติราชการแทน นายทะเบียนกลาง

เลขที่ 57- 0005705

(นางสาวราตรี บุญนิคณี)
หยก.

ตารางเลขที่ ๑/๐๒๒๘/๒๕๖๔

ตารางการเดินรถโดยสารประจำทางในเขตกรุงเทพมหานครและจังหวัดที่มีเส้นทางต่อเนื่อง
หมวด ๑ สายที่ S๖ ชื่อเส้นทาง สถานีขนส่งผู้โดยสารกรุงเทพฯ (จตุจักร) - ท่าอากาศยานนานาชาติสุวรรณภูมิ (ทางด่วน)
โดยอนุมัติคณะกรรมการควบคุมการขนส่งทางบกกลาง ในการประชุมครั้งที่ ๘/๒๕๖๔ เมื่อวันที่ ๖ ตุลาคม ๒๕๖๔

ช่วงการเดินรถ	ระยะทาง (กม.)	จำนวนเที่ยวการเดินรถขั้นต่ำต่อวัน (เที่ยว) ตั้งแต่เวลา ๐๕.๐๐น.ถึงเวลา ๒๒.๐๐ น.			จำนวนรถ (คัน)
		ไป	กลับ	รวม	
สถานีขนส่งผู้โดยสารกรุงเทพฯ (จตุจักร) - ท่าอากาศยานนานาชาติสุวรรณภูมิ (ทางด่วน)	๓๗	๑๐	๑๐	๒๐	๕ - ๓๔

หมายเหตุ ๑. ลักษณะรถมาตรฐาน ๒ (รถโดยสารปรับอากาศชั้น ๒) และหรือ
รถมาตรฐาน ๓ (รถโดยสารธรรมดา)
๒. ยกเลิกตารางการเดินรถเดิมและให้ใช้ตารางนี้แทน

เอกสารนี้เป็นเงื่อนไขในใบอนุญาตฯ
ตามมาตรา ๓๑ (๑) (๒)
แห่ง พ.ร.บ.การขนส่งทางบก พ.ศ.๒๕๒๒

ตรวจสอบถูกต้องแล้ว

(นางบุศรา สมใจคิด)
นักวิชาการขนส่งชำนาญการ
๘ ตุลาคม ๒๕๖๔
สำนักการขนส่งผู้โดยสาร
กรมการขนส่งทางบก

Annex 3 - Letter of acknowledgement by TGO to the use of battery capacity 120 kWh in the project

องค์การบริหารจัดการก๊าซเรือนกระจก (องค์การมหาชน)
THAILAND GREENHOUSE GAS MANAGEMENT ORGANIZATION (PUBLIC ORGANIZATION)
The Government Complex, Ratthaprasasanabhakti Bldg., 9th Fl., 120 Chaengwattana Rd., Laksi, Bangkok 10210, Thailand
Tel +66 2141 9790 Fax +66 2143 8400 www.tgo.or.th

ที่ อบก ๒๕๖๖.๐๔/๕๖๙

๑๖ พฤษภาคม ๒๕๖๖

เรื่อง รับทราบการแจ้งเปลี่ยนแปลงรายละเอียดโครงการ

เรียน กรรมการผู้จัดการบริษัท บริหารโครงการคาร์บอน จำกัด

อ้างถึง หนังสือบริษัท บริหารโครงการคาร์บอน จำกัด ที่ ๔๐๖๑/๐๐๕๒๓ ลงวันที่ ๘ พฤษภาคม ๒๕๖๖

ตามหนังสือที่อ้างถึงบริษัท บริหารโครงการคาร์บอน จำกัด ได้ขอแจ้งการเปลี่ยนแปลงรายละเอียดโครงการลดก๊าซเรือนกระจกภาคสมัครใจตามมาตรฐานของประเทศไทยแบบมาตรฐาน (Standard T-VER) ชื่อ "โครงการรถโดยสารไฟฟ้า กรุงเทพมหานครและปริมณฑล โซน ๑ และ ๒ (Bangkok Metropolitan Area E-Bus Zone 1 and 2)" และ "โครงการรถโดยสารไฟฟ้า กรุงเทพมหานครและปริมณฑล โซน ๓ และ ๔ (Bangkok Metropolitan Area E-Bus Zone 3 and 4)" ซึ่งได้รับการขึ้นทะเบียนเป็นโครงการ T-VER เมื่อวันที่ ๒๘ กุมภาพันธ์ ๒๕๖๖ และต่อมาได้มีการเปลี่ยนแปลงรายละเอียดโครงการ ความละเอียดแจ้งแล้ว นั้น

องค์การบริหารจัดการก๊าซเรือนกระจก (องค์การมหาชน) หรือ อบก. รับทราบการแจ้งการเปลี่ยนแปลงรายละเอียดการปรับขนาดของความจุแบตเตอรี่จากเดิมที่ระบุความจุเท่ากับหรือมากกว่า 150 kWh เป็นความจุเท่ากับหรือมากกว่า 120 kWh ทั้งนี้ อบก. จะมีการติดตามประเมินผลโครงการประจำปีในโอกาสต่อไป

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

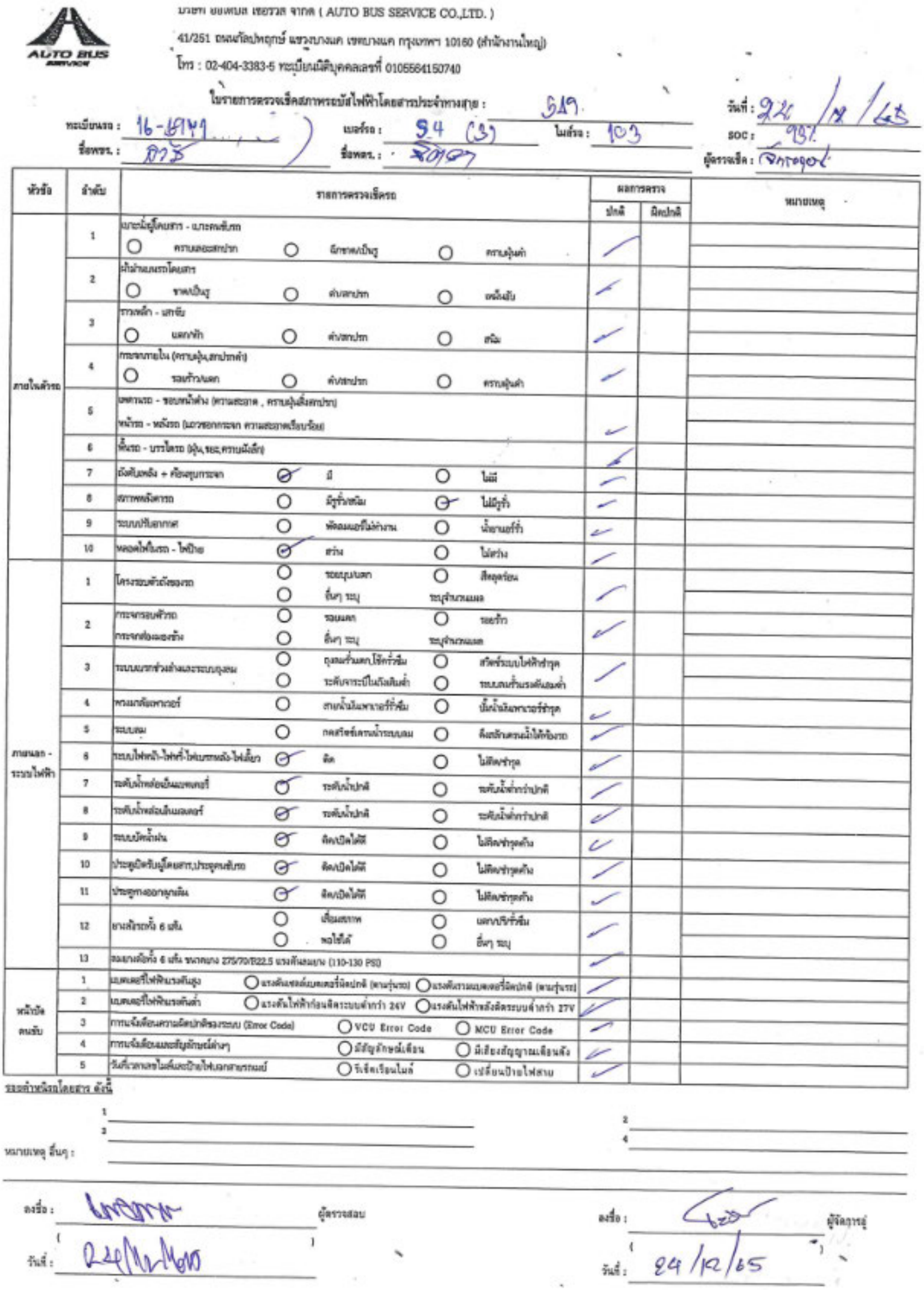
(นายเกียรติชาย ไมตรีวงษ์)
ผู้อำนวยการองค์การบริหารจัดการก๊าซเรือนกระจก

สำนักรับรองคาร์บอนเครดิต
โทรศัพท์ ๐ ๒๑๔๑ ๙๘๔๖
โทรสาร ๐ ๒๑๔๓ ๘๔๐๔

"TGOร่วมสร้างไทย โปร่งใส ไร้ทุจริต"

Monitoring report of projects/programs to reduce emissions and increase sink performance

Annex 4 – Example of Mileage logbook



(AUTO BUS SERVICE CO.,LTD.)

41/251 ... 10160

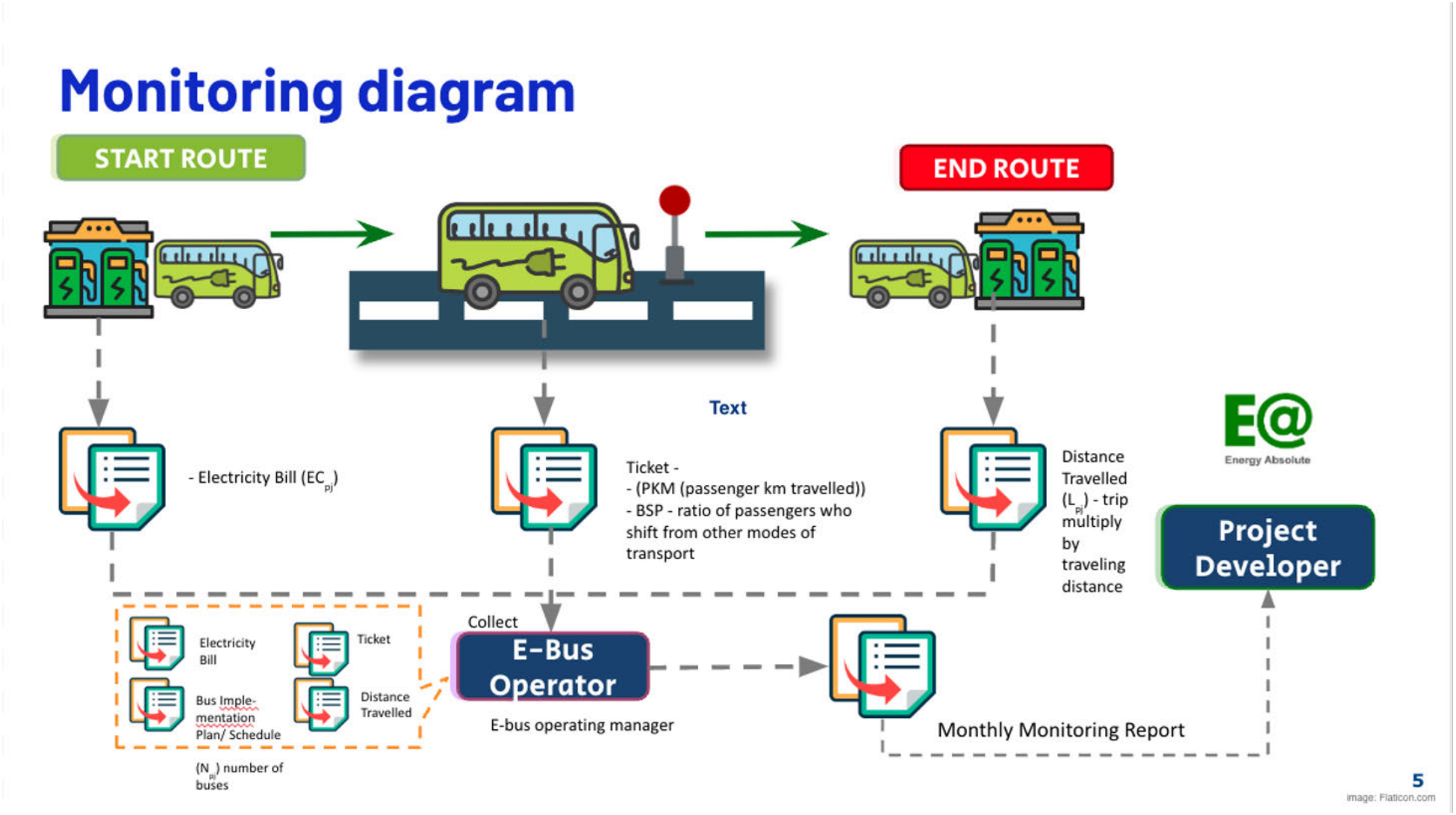
โทร : 02-404-3383-5 ทะเบียนนิติบุคคลเลขที่ 0105564150740

ใบรายการตรวจเช็คสภาพรถบัสไฟฟ้าโดยสารประจำทางสาย : 519

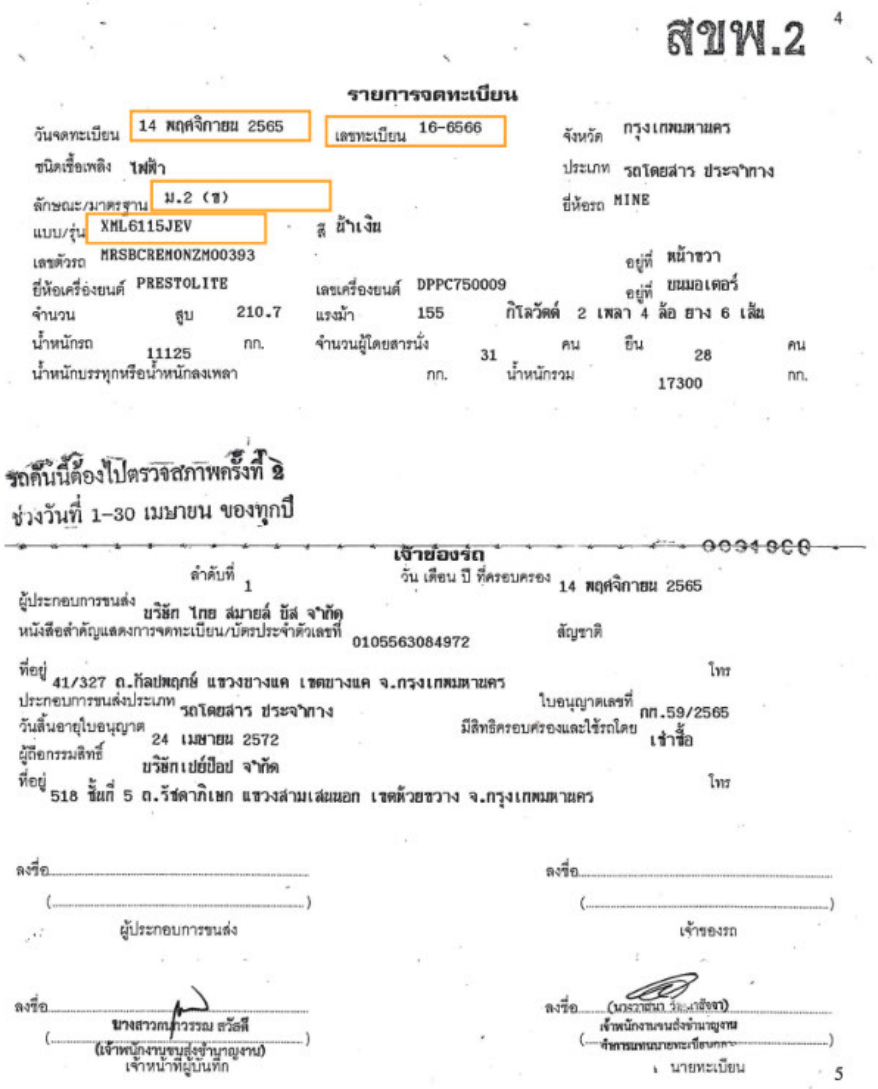
วันที่ : 24/12/65

SOC : 95%

Annex 5 – TSB's management structure corresponds to the e-buses data monitoring



Annex 6 – Example of bus registration license



สขพ.2

รายการจดทะเบียน

วันจดทะเบียน 14 พฤศจิกายน 2565 เลขทะเบียน 16-6566 จังหวัด กรุงเทพมหานคร

ชนิดเชื้อเพลิง ไฟฟ้า ประเภท รถโดยสาร ประจำทาง

ลักษณะ/มาตรฐาน ม.2 (ข) ยี่ห้อรถ MINE

แบบ/รุ่น XML6115JEV สี ฟ้าเงิน

เลขตัวรถ MRSBCREMONZM00393 อยู่ที่ หน้าขวา

ยี่ห้อเครื่องยนต์ PRESTOLITE เลขเครื่องยนต์ DPPC750009 อยู่ที่ ขณมอเตอร์

จำนวน สูบ 210.7 แรงม้า 155 กิโลวัตต์ 2 เพลา 4 ล้อ ยาง 6 เส้น

น้ำหนักรถ 11125 กก. จำนวนผู้โดยสารนั่ง 31 คน ยืน 28 คน

น้ำหนักบรรทุกหรือน้ำหนักลงเพลา กก. น้ำหนักรวม 17300 กก.

รถคันนี้ต้องไปตรวจสภาพครั้งที่ 2

ช่วงวันที่ 1-30 เมษายน ของทุกปี

00314CC

เจ้าของรถ

ลำดับที่ 1 วัน เดือน ปี ที่ครอบครอง 14 พฤศจิกายน 2565

ผู้ประกอบการขนส่ง บริษัท ไทย สมายล์ บัส จำกัด

หนังสือสำคัญแสดงการจดทะเบียน/บัตรประจำตัวเลขที่ 0105563084972 สัญชาติ

ที่อยู่ 41/327 ถ.กัลปพฤกษ์ แขวงบางแค เขตบางแค จ.กรุงเทพมหานคร โทร

ประกอบการขนส่งประเภท รถโดยสาร ประจำทาง ใบอนุญาตเลขที่ กก.59/2565

วันสิ้นอายุใบอนุญาต 24 เมษายน 2572 มีสิทธิครอบครองและใช้รถโดย เช่าซื้อ

ผู้ถือกรรมสิทธิ์ บริษัทเปย์ป้อย จำกัด

ที่อยู่ 518 ชั้นที่ 5 ถ.รัชดาภิเษก แขวงสามเสนนอก เขตห้วยขวาง จ.กรุงเทพมหานคร โทร

ลงชื่อ.....

(.....)

ผู้ประกอบการขนส่ง

ลงชื่อ.....

(.....)

เจ้าของรถ

ลงชื่อ.....

(นางสาวณัฐวรรณ สวัสดี)

(เจ้าพนักงานขนส่งชำนาญงาน)

เจ้าหน้าที่ผู้บันทึก

ลงชื่อ.....

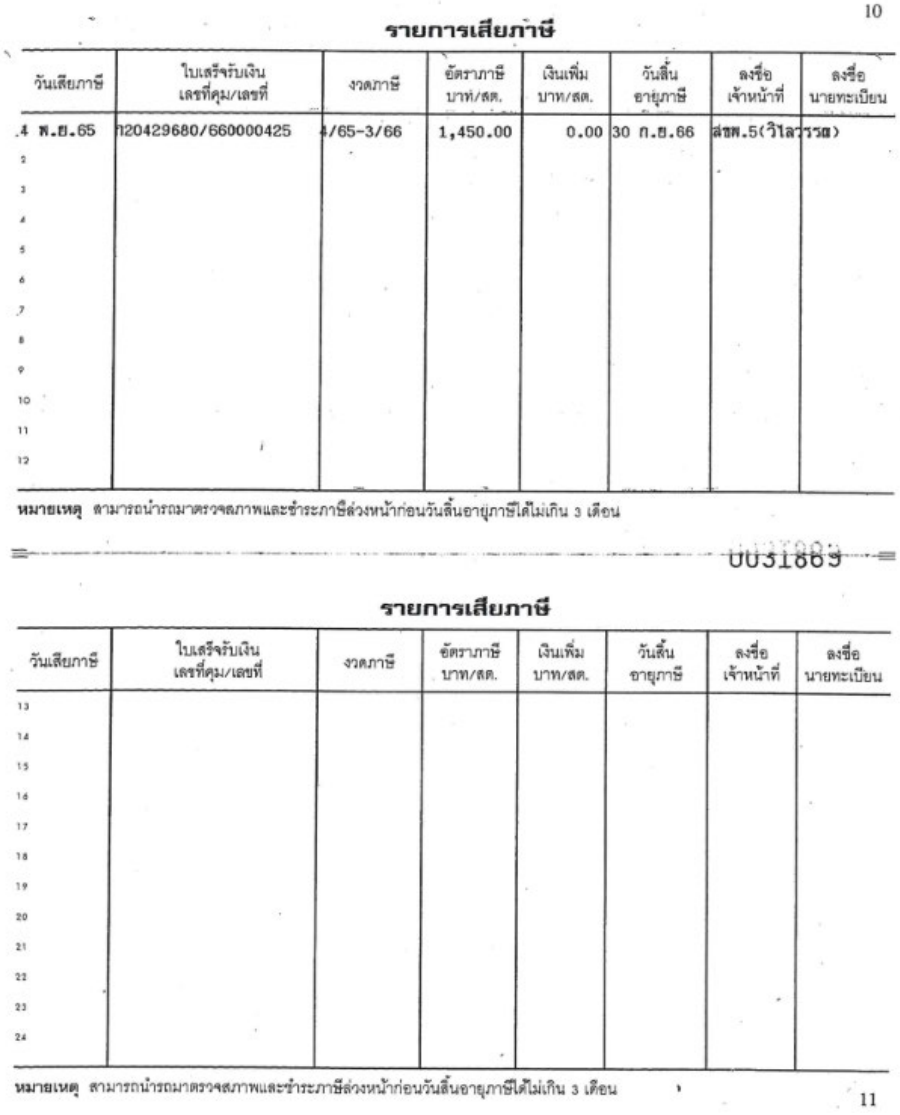
(นายวรเดช วิมลชัยชาญ)

เจ้าพนักงานขนส่งชำนาญงาน

จำการแทนนายทะเบียนกรุงเทพมหานคร

นายทะเบียน

5



10

รายการเสียภาษี

วันเสียภาษี	ใบเสร็จรับเงิน เลขที่คุม/เลขที่	งวดภาษี	อัตราภาษี บาท/สด.	เงินเพิ่ม บาท/สด.	วันสิ้นอายุภาษี	ลงชื่อ เจ้าหน้าที่	ลงชื่อ นายทะเบียน
4 พ.ย.65	120429680/660000425	4/65-3/66	1,450.00	0.00	30 ก.ย.66	สขพ.5(วิโลวรรณ)	
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หมายเหตุ สามารถนำรถมาตรวจสภาพและชำระภาษีล่วงหน้าก่อนวันสิ้นอายุภาษีได้ไม่เกิน 3 เดือน

00318C9

รายการเสียภาษี

วันเสียภาษี	ใบเสร็จรับเงิน เลขที่คุม/เลขที่	งวดภาษี	อัตราภาษี บาท/สด.	เงินเพิ่ม บาท/สด.	วันสิ้นอายุภาษี	ลงชื่อ เจ้าหน้าที่	ลงชื่อ นายทะเบียน
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หมายเหตุ สามารถนำรถมาตรวจสภาพและชำระภาษีล่วงหน้าก่อนวันสิ้นอายุภาษีได้ไม่เกิน 3 เดือน

11

Annex 7 – List of References

Reference 1 : Letter of Authorization
Reference 2 : Purchase orders of e-buses
Reference 3 : NGV bus salvage purchase agreement
Reference 4 : Technical specifications of e-buses
Reference 5 : Electronic service agreement contract between EA and Amita
Reference 6 : Contract agreement between EA and the bus operator (TSB)
Reference 7 : Proof of CPAs registration under T-VER standard
Reference 8 : List of monitoring data provided by the bus operation (TSB)
Reference 9 : Average specific fuel consumption calculation
Reference 10 : Employment data of the bus operator (TSB)
Reference 11 : GPS exported data
Reference 12 : Electricity Consumption data and logbook
Reference 13 : Data collection for electricity consumption procedure