MADD for the "Bangkok e-bus Program"

1 Activity Overview

1.1 Basic information and Summary

Table 1: Basic information of MADD for the "Bangkok e-bus Program"

Transferring Country	Thailand
Mitigation Activity Name	Short: "Bangkok e-bus Program" Long: "Operation of e-buses on privately owned, scheduled public bus routes in the Bangkok Metropolitan area by Energy Absolute"
Programme Owner (Proponent)	For the Bangkok e-bus Program, there is the project activity operator and the program management and coordinating entity (collectively known as the Proponent), described as follow. **Project Activity Operator**[1] Energy Absolute Public Company Ltd 16th floor, AIA Capital Center Building 89 Ratchadaphisek Road, Dindaeng Bangkok 10400 Mr. Norasak Suphakorntanakit, Assistant Vice President, Strategy Development and Investment Planning Department, tel: +66(0)2 248-2488-92 (ext. 19518), email: norasak.sup@energyabsolute.co.th **Program Management and Coordinating Entity** Carbon Coordinating Managing Entity (Co) Ltd, Thailand (100% owned by South Pole Group) Unit 3A, Evergreen Place, 318 Phaya Thai Rd, Khwaeng Thanon Phetchaburi, Ratchathewi, Bangkok 10400 Mr. Renat Heuberger, Chief Executive Officer tel: +66 (0)2 219 3791; email: registries@southpole.com
Sector	Public transport (E-mobility)
Geographical boundaries	The geographical boundaries of the proposed activity are the Thailand, Bangkok Metropolitan Region (for project activities), and the national boundaries of Thailand
Type of Gases	Carbon dioxide (CO_2) (no other gases)
Summary	• This Activity will replace the use of conventional (diesel & natural gas) buses with e-buses on a minimum number of 122 (existing and new) privately operated bus routes that provide a regular, scheduled service within the Bangkok Metropolitan area. (Refer to Annex 1 for further details.) • In addition to reducing GHG emissions, the project will improve service quality, reduce commuting times, local air and noise pollution while maintaining bus ticket prices. • Swiss carbon finance from the purchase of up to 500,000 mitigation outcome units that are authorised for International Transferred Mitigation Outcomes (ITMO) within Thailand's first NDC period (including 2030 vintage) shall be used to levelise the total cost of ownership differential between baseline buses and the project e-buses.

[1] Entity that claims the (i) right to request the creation and transfer of ITMOs and (ii) legal right on the mitigation outcomes.

<table>
<tr><td></td><td>

The mitigation outcome units from this project are inside Thailand's NDC and surplus to its unconditional NDC.
The Bangkok e-bus Program will be implemented in accordance with the: (i) United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement Article 6, (ii) Nationally Determined Contributions of Thailand (Thailand's NDC), and (iii) Bilateral Agreement between Switzerland and Thailand.

</td></tr>
<tr><td>Timeframe of implementation</td><td>15 June 2022 – 31 December 2030
<u>Note:</u>
The start date of implementation refers to the date that the significant financial commitment was made on 15 June 2022 which was the date that first purchase order was issued.
At the time of writing, the first batch of e-buses comprising 154 e-buses plying 8 routes is currently being deployed, and is targeted for complete deployment by 1 October 2022, in time for the start date of the crediting period. And the following batch will be later included as another planned component activity under the program.
The programme is expected to include the total of 122 bus routes with the minimum of 1,913 e-buses in the programme. By which the crediting period of the mitigation outcome units will be until 31 December 2022.</td></tr>
<tr><td>Volumes</td><td>Expected an average of 74,286 emission reduction units annually, with estimation of emission reduction from fuel switching and modal shift mitigation activity with 612,861 units of emission reduction until 2030. Refer to part 2.5 for methodologies involved in the mitigation activities.
<table>
<tr><th>Year</th><th>Expected Emission Reduction [tCO_2e]</th></tr>
<tr><td>01 Oct 2022 – 31 Dec 2022</td><td>10,383</td></tr>
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<tr><td>01 Jan 2030 – 31 Dec 2030</td><td>73,935</td></tr>
</table>
Note: the transferred of mitigation outcome is up to 500,000 mitigation outcome units between 2022 and 2030.</td></tr>
<tr><td>Version of document</td><td>V5.3</td></tr>
<tr><td>Date and place</td><td>21 November 2022, Bangkok, Thailand</td></tr>
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1.2 Activity description

1.2.1 Nature of the Activity

The "Bangkok e-bus Program" aims to promote the potential and capability in the development of public transportation project in Thailand and to become a part of a low-carbon society. This can be realised through the adoption of electric vehicles (EV) in public transport, thereby replacing the conventional transport mode of internal combustion engine (ICE) vehicles. From the replacement of public transport, the mitigation activities that reduce emissions can be identified through:

i ***higher energy efficiency:*** e-buses are more energy efficient compared to the internal combustion engine (ICE) buses they are replacing;

ii ***lower carbon intensity***: e-buses use primary energy (electricity) with a lower carbon intensity compared to the internal combustion engine (ICE) buses (diesel or natural gas) they are replacing (this impact will increase over time as the emission factor of the Thai electricity grid has been

decreasing and is expected to decrease further over time as the share of renewable energy being fed into the grid increases); and

iii ***modal shifting from higher carbon intensity transport modes***: by providing a better passenger experience and better transport connectivity than the existing bus networks, at a similar price, the activity encourages a modal shift from users of fossil-fuelled individual transport to electric public passenger transport.

1.2.2 System boundaries

The boundary of the programme revolves around the utilisation of EV for public transport or e-bus, which considers the emission reduction from two processes: 1 replacement of ICE bus with e-bus 2. Shifting in mode of transportation of passengers to e-bus. The detail and schematic diagram are included in Annex 1 part A.15 Greenhouse gases mitigation activity and the description regarding programme boundary is presented in Table 2 below.

Table 2: Boundary of MADD for the "Bangkok e-bus Program"

Dimension	Boundary setting
Geographical	The geographical boundaries of the proposed Activity are the Thailand, Bangkok Metropolitan Region (for project activities) and the national boundaries of Thailand
System boundaries	The project boundary includes: a) existing and new bus routes that are converted to e-bus routes, ● Existing bus route defines as bus routes that have been operating with conventional ICE bus within Thailand, Bangkok Metropolitan Region prior to the reformation of bus system (approved by national cabinet resolution on 27 September 2016) to the present day. ● New bus route defines as additional bus routes that have been added into the bus system after the reformation, also including bus route that don't have capacity to operate prior to the reformation. b) the Thai power grid that provides electricity for e-bus charging, c) the associated avoided tailpipe emission reductions from ICE buses by implementing e-buses, and d) the avoided tailpipe emissions from passengers in other mode of transportation that modal-shifted to e-buses. The criteria for participation in the Activity, i.e. the inclusion of bus routes, is detailed in section 1.2.5
Temporal	The Activity start date is defined in compliance with criteria set by: a) International transfer authorisation rules set by FOEN and ONEP, and b) T-VER program rules (as the project activity is using the T-VER Standard to create mitigation outcome units). The transferable crediting period ends 31 December 2030 (aligned with Thailand's first NDC period) but can be renewed and extended subject to mutual agreement. The option to purchase mitigation outcome (MO) units beyond 2030 is limited to the end of the project activity's crediting period under the T-VER Standard.
Sector[2]	Public transport (E-mobility)

[2] Source: https://ghgreduction.tgo.or.th/en/methodology/methodology-for-voluntary-emission-reduction/transportation-management.html

Dimension	Boundary setting
Emission gases	Carbon dioxide (CO_2) (no other gases)
Technology	E-buses: 100% electric buses manufactured in Thailand Batteries: Li-Ion, ≥150 kWh capacity

1.2.3 Participants: State and non-state actors involved in the implementation of the Activity

Table 3: Roles and involvement of key stakeholders

Name of Participant	Role and Involvement
Project Activity Operator (Entity Authorised to Transfer) Energy Absolute Public Company Limited (EA)	The project is operated by a number of associated companies with Energy Absolute Public Company Limited (EA). The principal actors (in contract agreement with EA) are: Thai Smile Bus: operator of e-buses and bus routes (also include companies that operate under Thai Smile Bus) and the entity that submits activity data to the CME for mitigation outcome origination. Energy Mahanakorn: owner and operator of charging station networks that exclusively charge the e-buses under the Brand “EA Anywhere”
Program Coordinating & Managing Entity (CME) Carbon Coordinating and Managing Entity Co., Ltd. (CCME Co., Ltd.), fully owned subsidiary of South Pole Group	The CME is a professional service provider that coordinates and manages the registration and operation of the Bangkok e-bus Program of Activities into which this project activity is included. The CME collects and monitors activity data from this project activity. Next, applies the relevant methods and processes to the Validation, Verification and issuance of the T-VER standard. CME also assists with the completion of the authorisation and fulfilment process to complete international transfers.
Carbon Standard (MO Issuer) Thailand Greenhouse Gas Management Organization (TGO), the governance entity of the T-VER Standard. TGO is an issuer of TVER units and owner of the T-VER registry. In addition, TGO is the regulatory authority of Thailand in tracking the international carbon credit authorisation, transferring, and executing the relevant fulfilment services.	Registers program and project activity, issues carbon credits, operates a carbon credit registry, initiates the transfer of carbon credit units between registry accounts.

Name of Participant	Role and Involvement
Authorising Entity of the Host Country (Transferor) The Office of Natural Resources and Environmental Policy and Planning (ONEP) of Thailand which is the mandatory organisation of Thailand in authorising the international carbon credit policy and transfer.	Responsible for the authorisation of project activities that are authorised to produce carbon credits for international transfer and for the authorisation of international transfers of carbon credits from such projects.
Entity in charge of approving the passenger transport licenses Department of Land Transportation (DLT)	Responsible for executing regulations regarding land transport, and conducting the monitoring and inspection to ensure the conformity with land transport relevant rules and regulations, and to grant operation on passenger transport licenses to be qualified for bus operators.
Entity in charge of policy and transportation planning Office of Transport and Traffic Policy and Planning (OTP)	Responsible for suggesting policy measures, standards, and integration of transport and traffic plan including driving into practice and assessing the outcome of bilateral agreement on the Bangkok e-bus Program to ensure that mitigation outcomes will not be covered in NDC.
Authorising entity of the Buyer Country (Acquirer) Federal Office for the Environment (FOEN)	Responsible for the authorisation of project activities and international transfers on behalf of the buyer country
Purchaser of Carbon Credits (Acquiring Entity) KliK Foundation, acting under a mandate of the Swiss CO_2 Law	Acting as a purchaser of carbon credits from the project activity

1.2.4 Beneficiaries / target group

The main beneficiaries of this Activity are the existing and future users of scheduled e-bus services within the Bangkok Metropolitan area. They benefit from:

i unchanged low bus use ticket prices (one of the main design criteria of the project was to maintain current ticket prices);
ii a higher quality service (air-conditioned buses instead of ambient temperature (hot) buses, no exposure to outside air pollution (traffic exhaust);
iii reduced travel times as a result of synchronised scheduling and better route planning (rider app that shows real time bus schedules); and
iv improved mobility access as a result of a denser bus transport system.

Indirect beneficiaries include the residents and users of the roads used by the scheduled bus service. They benefit from:

i reduced noise and air pollution as a result of absence of engine noise (especially during acceleration after bus stops at stations and traffic lights), and tail-pipe emissions; and
ii reduced traffic as a result of modal shifting (reduced use of private mobility (motorbikes, taxis, cars).

1.2.5 Selection criteria for participation in the Activity

The participation of a bus route in the activity is subject to the following selection criteria:

i has an operating licence from the DLT;
ii is operated by Thai Smile Bus or other operators that agree to provide the data that is required for the origination of mitigation outcomes in accordance with relevant methods and data transfer protocols;
iii originated, ends or passes through the Bangkok Metropolitan area;
iv operates on a regular scheduled service basis; and
v demonstrates additionality for the inclusion of e-bus for every planned component activity that wish to participate. The demonstration of additionality shall cover the economic feasibility and common practice, as explained in detail in 2.6 and Annex 1.

1.2.6 Expected ITMO Volume

The project activity operator seeks to deliver up to 500,000 mitigation outcome units from this Activity, subject to successful issuance of mitigation outcome units and authorisation for international transfer of mitigation outcomes (ITMO) generated before the end of 2030. The proponent understands that the Thai government is not liable for meeting the specified amount of delivery of the said mitigation outcome units. The expected emission reduction volume is expected an average of 74,286 tCO_2e per year or 612,861 tCO_2e in total until 2030 after the e-buses are in operation for every bus routes as follows:

Year	Expected Emission Reduction [tCO_2e]
01 Oct 2022 – 31 Dec 2022	10,383
01 Jan 2023 – 31 Dec 2023	61,411
01 Jan 2024 – 31 Dec 2024	80,712
01 Jan 2025 – 31 Dec 2025	79,554
01 Jan 2026 – 31 Dec 2026	78,407
01 Jan 2027 – 31 Dec 2027	77,273
01 Jan 2028 – 31 Dec 2028	76,149
01 Jan 2029 – 31 Dec 2029	75,037
01 Jan 2030 – 31 Dec 2030	73,935

Note: the amount of expected volume of emission reduction is estimated on minimum-buses on the passenger transport license (e-buses are still being added from 2022 – mid 2023 according to the operation plan). Emission reduction from year 2022 – the end of Q2 2023 is assumed and estimated at half capacity comparing to the full operation as buses are continuously being included in the program and will reach full capacity at Q3 2023 based on the operational plan. Information regarding the calculation is included in the Annex 1 Part A3.

1.2.7 Role of Carbon

Swiss carbon finance is used to fund the total cost of ownership (TCO) by financing both the purchasing cost and the post ownership cost to close financial gap.

Carbon finance ensures that the total cost of ownership (TCO) of e-buses is equal to the total cost of ownership of “baseline buses” (see section on baseline) (which is referred to as the “TCO gap”). The TCO gap has been quantified via a financial analysis. Hence, the result from the financial analysis reflects that carbon finance will raise the IRR of the programme to be higher than the benchmark, which makes the program economically feasible.

As the TCO will be borne by the project activity operator, the beneficiary of the payments is the project activity operator.

1.2.8 Sustainable, long-term operation of the Activity

Swiss carbon finance closes the existing TCO gap for the initial batch of 154 e-buses (plying 8 routes) that are to be put into operation. The carbon finance will allow to adhere to existing bus ticket prices, thus ensuring a viable, commercial operation of this initial fleet.

In relation to the sustainability of the operation of the Activity beyond the beyond the term of the Mitigation Outcome Purchase Agreement (MOPA) with the KliK Foundation (i.e. after 2030), the period of the assessment for the additionality analyses in Annex 1 part A2, is taken as 14 years in line with the expected

operational lifetime of the equipment (i.e. e-buses) of the Activity. Hence, based on the results of the analyses, carbon finance will be required as the Activity would not generate sufficient returns to be considered financially viable.

For future fleet expansion beyond the 14-year period, it is expected that the TCO gap can be reduced and the marginal revenue be increased, as explained below, to ensure the future fleet's commercial operation.

TCO gap reduction as a result of:

i expected battery cost reductions and improved battery performance;
ii increasing ridership (better acceptance, service, convenience by riders over time); and
iii acceptable/moderate ticket price increases (higher willingness to pay for a better service).

Marginal revenue encouragement as a result of:

i Potential acceleration of e-buses and green infrastructure.

2 Methodological Approach

2.1 Baseline for determination of mitigation outcomes

2.1.1 Autonomous development ("business as usual")

Bus routes in the Bangkok Metropolitan Area are operated on a passenger transport license-basis, in which private bus operators have a passenger transport license on operating buses on certain predefined routes. The passenger transport license imposes no specific type of fuel used requirements on vehicle standards. Nonetheless, the penetration rate of e-bus prior in Thailand, Bangkok Metropolitan Region was very small (less than 2%, refer to section 2.6 for additional information).

In the absence of the Activity and short of bus failure and rising maintenance costs, there is no incentive for private bus operators to invest in new buses. In the case where a replacement bus is required, private bus operators would choose the lowest CAPEX bus option in the market with limited consideration of operating costs.

As a result, the business-as-usual scenario would comprise (a) the continued operation of older ICE buses, or (b) their placement with new ICE buses, continuing a trajectory of fossil fuel combustion and negative health impacts for urban residents in the densely populated project area. In addition, no modal shifting is expected to take place as there is no improvement in the convenience and comfort of private buses.

2.1.2 Existing/planned policies and NDC implementation strategies potentially impacting the Activity

Policy/law or measure No. 1	
Description	Thailand updated Nationally Determined Contributions (NDC)
Type	Policy
Impact	Thailand's updated NDC sets out an economy-wide target of reducing greenhouse gas (GHG) emissions by 20% from the projected business-as-usual (BAU) levels by 2030. This target could increase up to 25%, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity building support.
Implementation plan / schedule	The updated NDC was published in October 2020, which sets out an economy-wide target of reducing greenhouse gas (GHG) emissions by 20% from the projected business-as-usual (BAU) levels by 2030.
Assessment of impact on the proposed Activity	As the NDC implementation is carried out through two planning documents – the NDC Roadmap and (sector specific) NDC Sectoral Action Plans, please refer to the below measures for assessment of the impact on the proposed Activity.

Policy/law or measure No. 2	
Description	Thailand's NDC Roadmap
Type	Policy
Impact	Thailand's NDC Roadmap identifies an emission reduction potential of 41 $MtCO_2$ by 2030 in the transportation and logistics sector, outlining two primary target areas - 1) increase the energy efficiency in transportation by increasing the efficiency of gasoline- and diesel-engines and encouraging public transportation, 2) use of biofuels as an alternative fuel.

Policy/law or measure No. 2	
Implementation plan / schedule	In line with the NDC, the aim is for the sectors to achieve the stated emission reductions by 2030.
Assessment of impact on the proposed Activity	The Bangkok e-Bus Program is not within the scope of the NDC roadmap.

Policy/law or measure No. 3	
Description	NDC Transport Sectoral Action Plan "Thailand Greenhouse Gas Reduction Action Plan 2021-2030"
Type	Plan
Impact	The action plan identifies concrete mitigation plans and measures, segregated in three groups of plans and measures, towards realising this reduction potential - Group 1 and 2 include 'existing' and 'planned/recommended' plans and measures with specific projects and their respective emission reduction potential identified; and Group 3 includes additional projects and measures but without a quantified mitigation potential, due to lack of baseline data. Of the two target areas identified, increasing energy efficiency in transportation has an overall higher mitigation potential of 31 $MtCO_2$. The introduction and promotion of electric vehicles is part of the energy efficiency improvement related target in the Sectoral Action Plan, contributing to 'improve the efficiency of public transport in urban areas'. However, no projects and measures are planned towards the conversion of privately-owned buses running in designated routes for public transport. The operation of privately operated public transport buses, are outside the current scope of measures planned towards implementation of Thailand's current NDC submission.
Implementation plan / schedule	In line with the NDC and the NDC roadmap, the aim is for the identified projects to be implemented from 2021 and to achieve the stated emission reductions by 2030.
Assessment of impact on the proposed Activity	The Bangkok e-Bus Program is not within the scope of the NDC Transport Sectoral Action Plan.

2.1.3 Impact of existing and/or planned policies and NDC implementation strategies on the Activity

The project is not within the scope of any NDC unconditional measures at the time of submission of this MADD.[3]

2.1.4 Crediting baseline

The crediting baseline is defined in accordance with the T-VER carbon standard which has been selected for the origination of mitigation outcome units for this Activity, and related authorisation requirements.
The crediting baseline in accordance with T-VER Standard considers the following:

1 the continued use of existing or new ICE buses (diesel or natural gas) along public transport bus routes operation. This also takes into account for the potential increasing number of ICE buses in in each bus routes as for each bus route is not currently operate at maximum capacity according with the passenger transport license, and

[3] This is to the best of our knowledge and based on a review of key policies set out towards NDC implementation in Thailand's transport sector at the time of writing.

2 The continued use of the conventional modes of transport (e.g. private vehicles, taxi, motorcycle) by passengers along the predefined bus routes.

2.2 Crediting period

The crediting period for this Activity: 01/10/2022 – 31/12/2030
Determined in accordance with:

1. T-VER rules; as well as the
2. Transferors' authorisation criteria (as mentioned in Annex 2).

The crediting period under the T-VER Standard is limited to seven years from the Activity start date plus one renewal by seven years[4]. As per the Transferor's authorisation criteria in Annex 2, the international transfer authorisation period is limited to the end of Thailand's first NDC period as Thailand does not allow the authorisation of international transfers post 2030[5]. This means that the crediting period for mitigation outcome units that are authorised for international transfer currently ends on 31 December 2030.

Should the international transfer authorisation period be extended into the second NDC period, the MO transfer period would be limited by the crediting period of the Activity in accordance with T-VER rules.

Based on the above-mentioned considerations, the expected start date of the initial crediting period for the Activity is 01 October 2022 – 31 December 2030. Please refer to Annex 1 for more details around the expected start date.

2.3 Avoiding double claiming

2.3.1 International and domestic public/private climate finance and governmental support

The e-buses are privately owned, operated and financed. No climate finance or government finance is used to fund the purchase and operation of project assets. As the project scales up there is a theoretical chance for support from such sources that might impact the calculation that was used to determine the mitigation outcome purchase price.

2.3.2 Carbon finance contributions

Avoidance of double counting: Mitigation outcome units from this Activity are tracked in the T-VER registry operated by TGO. In addition, the (forthcoming) Guideline and Mechanism for carbon credits management in Thailand[6] (approved by the National Climate Change Committee on 16th March) mandates TGO to track the international transfer authorisation status of mitigation outcome units.

This means that TGO is a central gatekeeper to ensure that mitigation outcome units from a mitigation activity in Thailand can neither be issued under multiple carbon standards nor double claimed.

Carbon finance contributors: The project activity operator intends to deliver up to 500,000 mitigation outcome units authorised for international transfer from this project activity to the KliK Foundation.

Fair Share[7]: The "fair share" of mitigation outcomes is a requirement as per the (forthcoming) regulation on the Guidance and Mechanism of Carbon Credits Management in Thailand. It stipulates that the share of internationally transferable mitigation outcomes generated by the project shall correspond to the ratio of investment by the project developer.

The project activity developer invests 100% of the capital into this project and bears all associated business risks, and requires 100% of the generated mitigation outcomes to narrow/close the Total Cost of Ownership (TCO) gap between e-buses and baseline buses.

[4] Program's planned component that is registered under T-VER standard prior to 01 Jan 2024 shall go through the re-validation process with TGO at the end of each program's planned component crediting period, since the crediting period will end prior to 2030 if the program's planned component registers before the mentioned date.

[5] This is to the best of our knowledge at the time of writing.

[6] Source: https://www.onep.go.th/wp-content/uploads/2022/05/20220525-carbon-credit-2.pdf

[7] This is in line with the coming regulation on the guidance and management mechanism of carbon credits in Thailand.

2.3.3 Attribution of mitigation outcomes

The Activity is financed through a blend of financial instruments (incl. equity and loans). Any mitigation outcome related claim by a financial partner would require a related contract, assigning rights to mitigation outcomes to them, making explicitly clear whether the provision of finance and return expectations are linked to rights to mitigation outcomes.

The project activity operator has not included any rights to mitigation outcomes from this Activity to any financial partner nor entered into any other sales agreement related to any of the mitigation outcomes that are eligible for international transfer authorisation.

2.4 Promoting sustainable development and good governance

2.4.1 SDG priorities in the transferring country

Thailand's updated NDC (October 2020) identified energy, transport, industry and waste management as the key sectors for climate mitigation action. The NDC explicitly states the need for technology development and transfer to support their mitigation ambitions. This includes advances in energy storage systems, demand-side management, battery charging technologies and the electrification of transport as sectors that require additional support.[8]

On the adaptation side of the NDC ambitions, Thailand identified six key sectors: 1) Water resources management; 2) Agriculture and food security; 3) Tourism; 4) Public health; 5) Natural resources management and 6) Human settlements and security.

Additionally in the context of in lining with the SDG. Thailand has integrated all 17 SDGs into the 20-Year National Strategy, which is the country's main development framework, identified as follows:
GOAL 1: No Poverty
GOAL 2: Zero Hunger
GOAL 3: Good Health and Well-being
GOAL 4: Quality Education
GOAL 5: Gender Equality
GOAL 6: Clean Water and Sanitation
GOAL 7: Affordable and Clean Energy
GOAL 8: Decent Work and Economic Growth
GOAL 9: Industry, Innovation and Infrastructure
GOAL 10: Reduced Inequality
GOAL 11: Sustainable Cities and Communities
GOAL 12: Responsible Consumption and Production
GOAL 13: Climate Action
GOAL 14: Life Below Water
GOAL 15: Life on Land
GOAL 16: Peace and Justice Strong Institutions
GOAL 17: Partnerships to achieve the Goal

2.4.2 Consistency of the Activity with SDG priorities

The mitigation effect of this Activity targets polluting fossil-fuelled buses – reducing levels of hazardous local air pollution levels contributing to SDG 11 – Sustainable cities and communities and SDG 13 – climate action.

The Activity improves the passenger experience with air conditioning, more connections to modal hubs and on-demand services, while the activity operator is committed to maintaining the same (low) bus fares. Therefore, the activity improves accessibility and commuting times for existing passengers at no additional cost. Not only the activity improves the passengers' experience, it also contributes to SDG 8: Decent work and economic growth in job creation in the Bangkok Metropolitan area.

[8] Source: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Thailand%20First/Thailand%20Updated%20NDC.pdf

The assessment of the Activity on the above-mentioned SDG priorities are further elaborated in Annex 3: Environmental and Social Management Framework (ESMF) assessment forms, which details the compliance with environmental and social requirements of the TGO.

2.4.3 SDG Contributions of the Activity

SDG contributions	Relevance, target indicator and monitoring parameter
SDG 8: Decent work and economic growth	Target 8.5: *By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value* Indicator 8.5.2: *Unemployment rate, by sex, age and persons with disabilities* Monitoring parameter: The Activity contributes to the economic growth through the creation of green jobs with higher wages for the bus driver and assistant (as compared to other bus operator in the Bangkok Metropolitan area) through attractive incentives e.g. attendance premium, profit-sharing model based on tickets sold, discounts for employees and families. The number of staff operating the Bangkok e-bus Program by gender and wages for staff (e.g. bus driver and bus assistant) will be monitored.
SDG 11: Sustainable cities and communities	Target 11.6: *By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management* Indicator 11.6.2: – *Annual mean levels of fine particulate matter (e.g. $PM_{2.5}$ and PM_{10}) in cities (population weighted)* Monitoring parameter: The Activity contributes to the reduction to environmental impact of cities, especially to the ambient air quality, in particular particulate matter of less than 2.5 microns in diameter ($PM_{2.5}$) through the elimination of tailpipe emissions from ICE buses (from the replacement with e-buses). Data relating to the ambient annual $PM_{2.5}$ levels in Bangkok Metropolitan area, as published by the Bangkok metropolitan authorities, will be monitored.
SDG 13: Climate action	Target *13.2: Integrate climate change measures into national policies, strategies and planning* Indicator 13.2.2: – *Total greenhouse gas emissions per year* Monitoring parameter: The Activity contributes to the overall reduction in GHG emissions which will be quantified with the applicable methodologies under T-VER standard. The Activity could contribute to the minimum emission reduction of an average of 74,286 tCO_2 per year. The justification of applicability has already been demonstrated in section Annex 1 and the emission calculation spreadsheet is submitted along with this document.

2.4.4 Compliance with environmental and social requirements

The compliance of the Activity with environmental and social requirements is established via the Environmental and Social Management Framework (ESMF) of TGO. The ESMF is a tool for assessing city greenhouse gas mitigation projects for eligibility under T-VER Program and enhancing stakeholders' participation. It is included in the MADD as Annex 3.

2.4.5 Safeguarding of human rights

The Activity adheres to the Environmental and Social Management Framework (ESMF) of TGO. The ESMF is a tool for assessing city greenhouse gas mitigation projects for eligibility under T-VER Programs and enhancing stakeholders' participation. The six assessment forms from the ESMF are filled-out and added as an annex to the MADD (see Annex 3). Bangkok e-bus Program scores especially well on social benefits such as inclusion, job creation, poverty alleviation, health and safety benefits, cooperation, and people empowerment. Also, in accordance with the Labour Protection Act, employees have the rights to file complaints or raise issues through the company, and the company shall address the issue accordingly. The overall conclusion is that there are no negative human rights impacts from Bangkok e-bus Program activities.

2.4.6 Avoidance of corruption and bad governance

The Activity is based on results-based payments. These payments will be made directly to EA, the project activity operator from the Klik Foundation as the acquiring entity, on the basis of transparent and accountable procedures as outlined in their contractual agreement. All related revenues will be reported in the annual financial reporting of Energy Absolute Public Company Limited (EA), a publicly listed company in Thailand, subject to regulatory oversight by the Securities and Exchange Commission, Thailand (SEC).

Additionally, EA recognizes the importance of corporate governance, or good corporate governance, and thus adopts the "Good Corporate Governance" set by the Stock Exchange of Thailand. The implementation of "Good Corporate Governance" has established to guide the company's operations in order to enable effective and transparent management, ensuring trust and confidence among shareholders, investors, stakeholders, and all related parties.

2.4.7 Stakeholder/Beneficiary engagement

The main stakeholders of this project are:

i bus operators (management and conductors)
ii charging station operators
iii bus users / passengers
iv the communities along the bus routes
v Government sectors

<u>i Bus operators</u>

A first stakeholder consultation involving 55 private sector bus operator representatives (EV manufacturers, fleet owners, charge point operators, among others) was organised in early August 2019 to explore the possibility and interest to develop and implement the Activity. The stakeholder consultation confirmed that:

- The lack of policy support was a key barrier to accelerate EV deployment and thus this initiative which would combine international financial support with domestic policy support, was possibly ideal to achieve the desired result while being completely consistent with the intended purpose of cooperative action under the Paris Agreement.
- There was concrete interest among relevant implementation partners in the Activity.
- The expressed interest from the relevant implementation partners indicated the potential to reach the required scale of the Activity, in terms of total quantity of delivered mitigation outcomes, within a reasonable time frame.

<u>ii Charging station operators</u>

Thai Smile Bus as the project activity operator has provided its employees, benefits and competitive wage salary, and communication channels (internal board conference session) for employees to express any concern and issue. Also, in accordance with the Labour Protection Act, employees can file complaints or raise issues through the administration team at each charging station, where the complaint or issue will be transferred to the Thai Smile Bus head office for further action. Based on the project activity operator's interactions with the private bus operators, the partnering bus operators who participate in the Activity have not expressed any particular concern regarding the project and have indicated to the project activity operator that they were willing to collaborate on data sharing for the benefit of the carbon program.

iii & iv Bus users/passengers and communities along the bus routes

In addition, bus users and communities along bus routes as key beneficiaries of the project, were surveyed by Thai Smile Bus during October 2021 to April 2022 as part of a sampling survey required for TM06 to estimate the proportion of number of passengers who are willing to change their mode of transport to e-bus. From the survey, a significant number of respondents indicated their agreement to the development of the Bangkok e-Bus Program, and there was no objection or concern about the development of the Bangkok e-Bus Program.

To ensure bus users/passengers' satisfaction during the implementation of the Activity, the project activity operator will provide communications channels i.e. call centre and website for the filing of complaints as an appeal/grievance measure. Information on the communications channels will also be made available on each e-bus for easy access. Thai Smile Bus as the bus operator will collect and review any complaints on a weekly basis for investigation and corrective action. Any investigation and correction action will be closely monitored by a designated team in Thai Smile Bus.

v Government sectors

The Activity was further studied and designed together with the relevant stakeholders including the Government sectors. Together with the Thai Government, periodic meetings were organised for the project activity operator, CME, and the following government sectors: ONEP, DLT, and OTP throughout the project development process and up until 2nd of August 2022 where several critical issues were addressed:

1. the number of bus routes applicable to be included in the Activity;
2. roles and responsibility of DLT and OTP; and
3. application of the updated versions of the methodologies (which have been incorporated into this MADD document).

2.4.8 Transformational Change

The Activity contributes to transformational change in the use of electric vehicles within the public transport infrastructure in Thailand as follows:

i It introduces new technology to the Thai public, showcasing the benefits of clean, quiet public transport solutions, thus increasing their social acceptability.

ii It contributes to advances to manufacturing of EVs and batteries in Thailand, reaching scale and resulting cost reductions, thus closing the CAPEX gap between e-buses and conventional buses over time. This trend can be observed internationally as well.[9]

iii With increasing network size, incremental additions to the infrastructure, following the initial investments with the support of carbon finance/KliK will become financially viable much faster.

In relation to the sustainability of the Activity beyond the term of the Mitigation Outcome Purchase Agreement (MOPA) with the KliK Foundation (i.e. after 2030), the period of the assessment for the additionality analyses in Annex 1, is taken as 14 years.

In line with the expected operational lifetime of the equipment (i.e. e-buses) of the Activity. Hence, based on the results of the analyses, carbon finance will be required as the Activity would generate a positive cash flow but it is not feasible compared to the Benchmark. . As a result, the activity still able to maintain the operation to a self-sustaining mode after the support of KliK cease as mentioned as of the section 2.6.

[9] Source: https://theicct.org/publications/update-US-2030-electric-vehicle-cost

2.5 Determination, monitoring and reporting of mitigation outcomes

2.5.1 Mitigation outcomes

Mitigation outcomes are measured through applying T-VER methodologies:

1. T-VER-METH-TM-05 Version 03 – Use of Electric Vehicles in Public Transportation System (TM-05); and
2. T-VER-METH-TM-06 Version 03 – Modal Shift from Private Vehicles to Public Passenger Transportation with Electric Vehicles (TM-06).

Whereby TM-05 models the ex-ante emission reductions occurring from the fuel switch of fossil fuels to electricity and TM-06 models the ex-ante emission reductions occurring from the modal shift of passengers from private fossil-fuelled transport to electric powered buses. Emission reductions are calculated by deducting the project emissions and leakage emissions from the baseline emissions. The calculations below outline the steps in the process.

Baseline Emission

$$BE_{total,y} = BE_{FFy} + BE_{shift,y}$$ Formula [1]

Project Emission

$$PE_{total,y} = PE_{FFy} + PE_{shift,y}$$ Formula [2]

Mitigation outcomes from the fuel switch of fossil to electric:

T-VER-METH-TM-05 ver.03

"Use of Electric Vehicles in Public Transportation System"

Baseline emissions for fuel switch

Whereby $BE_{FF,y}$ is calculated as:

$$BE_{FF,y} = \sum_i \sum_x [(FC_{BL,i,x} \times NCV_x \times EF_{CO2,x}) \times ADJ_{i,y}] \times 10^{-9}$$ Formula [3][10]

Where:

Parameters	Unit	Description	Source	Monitored, Fixed, Calculated (M/F/C)
BE_{FFy}	tCO_2/ year	Total baseline emissions in year y.	Calculated from Formula [3]	C
$FC_{BL,i,x}$	unit/year	Quantity of fossil fuel consumption type 'x' of the ICEV in the public transport system on route 'i' in the baseline	**Existing routes scenario** - Total quantity of fossil fuel consumption data of ICEV categorised by the type of fossil fuel must be collected for at least 3 months continuously, and the historical data since replacement period to EV shall not be more than 2 years, or;	F

[10] The baseline emission from fuel switch also considers technology improvement factor. In the context of emission reduction calculations of the transportation sector in Thailand, TGO realised the importance of the technology improvement factor, hence considering the technological improvement at the default rate of 1% annually using reference from the default factor from CDM-AMS.III-C. Moreover, the programme plan on monitoring the new NGV buses (and their fuel consumption) to be included in the Bangkok public transportation system, refers to Annex 1 Part 3 for detail.

Parameters	Unit	Description	Source	Monitored, Fixed, Calculated (M/F/C)
			- Calculated by multiplying the specific fuel consumption[11] (unit fuel/ distance) of the monitoring data for at least 3 months continuously and dated back for at most 2 years after replacement with EV, with the number of existing vehicles and average total travelling distance per year per vehicle. **New route scenario**[12] - Data from reliable sources, for example, International Energy Agency (IEA), which the data shall not be more than 2 years from the date of commissioning of EV in the project boundary. In case of more than one sources which could be referred to, the principle of conservativeness shall be considered; or - Monitoring data from the operator for at least 3 months continuously and dated back shall not be more than 2 years from the date of commissioning of EV in the project boundary. In case of more than one monitoring dataset from the operator(s), the principle of conservativeness shall be considered.	
NCV_x	MJ/kg	Net calorific value of fossil fuel type 'x'.	**Option 1** Calorific value that indicated in invoice from fuel supplier **Option 2** Monitoring data **Option 3** Energy statistic report form the Department of Alternative Energy Development and Efficiency, Ministry of Energy	F
$EF_{CO2,x}$	$kgCO_2/TJ$	Emission factor of fossil fuel type 'x'	Table 1.4 2006 IPCC Guidelines for National GHG Inventories	F
$ADJ_{i,y}$	factor	Correction factor[13] for route 'i' in year 'y'	Calculated from Formula [4]	C

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

[12] For new bus route scenario, if no e-buses are in operation, the bus operator will fill in the bus routes with NGV buses. Hence, it infers that the increasing number of e-bus is replacing the intended NGV buses. Also in regards to the implementing buses, it is specified in the passenger transport license that only standard 2 buses can be included in each bus route, which only considers NGV buses for conservativeness of baseline calculation.

[13] Service extension could happen in the baseline, since the passenger transport license of each route allow for minimum and maximum number of buses. Because every bus route doesn't operate on maximum capacity of the license, there are rooms for new bus to be included. Also, as mentioned that the ADJ is the correction factor in case that there is more implementing number of e-buses than baseline. The increasing number of e-buses would be treated as e-buses operating on new routes where if no e-buses are in operation, the bus operator will fill in the bus routes with NGV buses. (continue next page)

Whereby $\mathbf{ADJ_{i,y}}$ is calculated as:

$$\mathbf{ADJ_{i,y} = (N_{PJ,i,y} \times L_{PJ,i,y}) / (N_{BL,i} \times L_{BL,i})} \quad \text{Formula [4]}$$

Where:

Parameters	Unit	Description	Source	Monitored, Fixed, Calculated (M/F/C)
$ADJ_{i,y}$	factor	Correction factor for route 'i' in year 'y'	Calculated from Formula [4]	C
$N_{PJ,i,y}$	unit	Number of Electric Vehicles in route i year y.	Document which demonstrates the operating routes of public transportation system Monitored value: Summary of total travelling distance (round trip) on annually basis	M
$L_{PJ,i,y}$	km	Average annual distance of Electric Vehicles in route i year y.	Document which demonstrates the operating routes of public transportation system Monitored value: Summary of total travelling distance (round trip) on annually basis	M
$N_{BL,i}$	unit	Number of ICEV on route 'i' in the baseline situation.	**Existing routes scenario** Summary report or document on the public transportation route **New route scenario** Shall equal to $N_{PJ,i,y}$	F
$L_{BL,i}$	km	Annual distance (round trip) on route 'i' in the baseline scenario.	**Existing routes scenario** Summary report or document on the public transportation route **New route scenario** Shall equal to $L_{PJ,i,y}$	F

It infers that the increasing number of e-bus is replacing the intended NGV buses. In regard to the implementing buses, it is specified in the passenger transport license that only standard 2 buses can be included in each bus route, which the programme only considers NGV buses for conservativeness (since there is no regulation on fuel type of bus) of baseline calculation. Nonetheless, the programme plan on monitoring the new NGV buses to be included in the Bangkok public transportation system, refers to Annex 1 Part 3 for detail. Hence, the correction factor of this programme shall remain as 1 as it is 1:1 replacement.

Project emissions for fuel switch

$$PE_{FF,y} = \sum_i \sum_j (EC_{PJ,i,j,y} - EC_{RE,PJ,i,j,y}) \times EF_{EC,y} \times 10^{-3}$$ Formula [5]

Where:

Parameters	Unit	Description	Source	Monitored, Fixed, Calculated (M/F/C)
$PE_{FF,y}$	tCO_2/ year	Total project emissions in year y.	Calculated from Formula [5].	C
$EC_{PJ,i,j,y}$	kWh/year	Annual electricity consumption for charging EV number 'j' on route 'i' in the operating year 'y'.	Report to electricity consumption for EV charging Monitored value: Record data that shows the quantity of electricity consumption from EV charging which shall be reported on monthly basis	M
$EC_{RE,PJ,i,j,y}$	kWh/year	Annual electricity consumption from renewable energy sources for the charging of the project's EV number 'j' on route 'i' in operating year 'y'	Report of electricity consumption that is generated from renewable energy for EV charging Monitored value: Record data that shows the quantity of electricity consumption from renewable energy for EV charging.	M
$EF_{EC,y}$ Remark: Emission factor from renewable energy source is equal to zero refers to CDM-ACM0002 "Grid-connected electricity generation from renewable sources "	tCO_2/MWh	Grid Emission factor.	Thailand Grid Emission Factor[14], dated 24/01/2022 Monitored value: - In case of using the electricity from the national grid system, '$EF_{EC,y}$ value' shall refer to the latest TGO's $EF_{EC,y}$ value of the monitoring period. Nonetheless, if there is not any supersede during the monitoring,the latest value of TGO's $EF_{EC,y}$ shall be referred to. - In case of using electricity from other producer, '$EF_{EC,y}$ value' shall refer to the calculation of $EF_{EC,y}$ value from the latest T-VER-ENERGY-TOOL-01 - In case of using electricity from renewable energy source, the PE is equal to zero. This infers that the emission factor from RE is equal to zero, refering to CDM-ACM0002 version 20 "*Grid-connected electricity generation from renewable sources*", paragraph 31.	M

[14] Grid emission factor will refer to the Thailand Grid emission factor published by TGO on 24/01/2022 (the latest version available at the time of writing). However, the update on the grid emission factor by TGO shall be considered.

Mitigation outcomes from the modal shift of private ICE to public EV transport:

T-VER-METH-TM-06

"Modal Shift from Private Vehicles to Public Passenger Transportation with Electric Vehicles."

Note: Emission reduction regarding modal shift activity will only consider the mitigation activity of additional passengers who shifted to e-bus on the existing routes, since it shall consider claiming twice if modal shift also claims emission reduction on new routes. Also, from the emission reduction calculation, using fuel switch methodology on new route is more conservative.

Baseline emissions from modal shift

Whereby $\mathbf{BE_{shift,y}}$ is calculated as:

$$\mathbf{BE_{Shift,y}} = \sum_i [\mathbf{CT_{BL,i,y}} \times \sum_j (\mathbf{PKM_{PJ,i,j,y}} - \mathbf{PKM_{BL,i}})] \times \mathbf{10^{-6}} \quad \text{Formula [6]}^{15}$$

Where:

Parameters	Unit	Description	Source	Monitored, Fixed, Calculated (M/F/C)
$BE_{shift,y}$	tCO_2/ year	Baseline emissions per vehicle in year y.	Calculated from Formula [6].	C
$CT_{BL,i,y}$	gCO_2/passenger-km	Emission factor per passenger-km travelled on route 'I' as baseline scenario in year 'y'	Calculated from Formula [7].	C
$PKM_{PJ,i,j,y}$	passenger-km/year	Travelling distance of passengers riding on EV number 'j' on route 'I' of the public transportation system in year 'y' (passenger-km/year)	Report of passengers' travelling distance data. Monitored value: Option 1 Monthly record of the travelling distance and number of passengers from bus ticket machine or electronic tickets Option 2 In case of the increasing ticket fee as per the travelling distance, collect the evidence of tickets sold and calculate travelling distance from the shortest distance on specific price range on monthly basis.	M
$PKM_{BL,i}$	passenger-km/year	Travelling distance of passengers who already use the public transport on route 'I' as their means	Calculated from the total number of passengers and the average distance travelled of passengers, or report of	F

[15] The baseline emission from modal shift also considers technology improvement factor. In the context of emission reduction calculations of the transportation sector in Thailand, TGO realised the importance of the technology improvement factor, hence considering the technological improvement at the default rate of 1% annually using reference from the default factor from CDM-TOOL 18. Moreover, the programme plan on monitoring the new NGV buses (and their fuel consumption) to be included in the Bangkok public transportation system, refers to Annex 1 Part 3 for detail.

Parameters	Unit	Description	Source	Monitored, Fixed, Calculated (M/F/C)
		for transportation in the baseline	passengers' distance travelled data.	

Whereby $\mathbf{CT_{BL,y}}$ is calculated as:

$$\mathbf{CT_{BL,i,y} = \sum_x (BSP_{x,y} \times EF_{PKM,x}[16]) / \sum BSP_{x,y}} \quad \text{Formula [7]}$$

Where:

Parameters	Unit	Description	Source	Monitored, Fixed, Calculated (M/F/C)
$CT_{BL,y}$	gCO_2/passenger-km	Emission factor per passenger-km travelled on route 'I' as baseline scenario in year 'y'	Calculated from Formula [7].	C
$BSP_{x,y}$	%	Mode of transportation ratio of vehicle type 'x' of passengers who shift to EV for public transit in year 'y'	Survey of the passengers who use the EV for public transit[17] Monitored value: Sampling survey shall be conducted in annually	M
$EF_{PKM,x}$	gCO_2/passenger-km	Emission factor of the passenger travelled with vehicle 'x'	T-VER-METH-TM06 ver.03 calculated from the reference data from ● Department of Highways, 2008 ● Office of Transport Policy and Planning (OTP), 2020 ● Department of Land Transport, 2021	F

Type of other vehicles used	Emission factors (gCO_2/passenger-km)
Motorbike	43.06
Private car	127.10
Taxi	155.94
Three wheels taxi	105.53
Minibus	22.55
Public van	41.11

[16] $EF_{PKM,x}$ will be updated in accordance to T-VER-METH-TM-06 if there is any value update in the next version of methodology.

[17] T-VER-METH-TM06 version 3 does not consider the fraction of non-motorised mode. Though, T-VER-METH-TM06 version 03 derives from AM0031 and Tool 18, TGO also took into consideration of local passengers' transportation behaviour where non-motorised activities would not consider riding on the bus due to the short distance and the waiting time of the bus. That would be the reason that non-motorised activity is not relevant to the Shift activity in Thailand. However, this non-motorised factor shall be included in the survey used for ex-post calculation in the monitoring period for the accuracy of the calculation, and the survey frequency is every year.

Project emissions from modal shift

Since the Activity emission is the same to T-VER-METH-TM-05 ver.03 as stated in the annotation of the methodology, the project emission shall not be considered.

Hence, $PE_{shift,y} = 0$

Net emission reductions fuel switch and modal shift

Emission reductions are calculated by extracting the project emissions from the baseline emissions, using the formula:

$$\mathbf{ER_{total,y} = BE_{total,y} - PE_{total,y} - LE_{total,y}}$$ Formula [8]

Whereby:

Parameters	Unit	Description	Source	Monitored, Fixed, Calculated (M/F/C)
$ER_{total,y}$	tCO_2/year	Emission reduction in year y.	Calculated from Formula [8].	C
$BE_{total,y}$	tCO_2/year	Baseline emissions in year y.	Calculated from Formula [7].	C
$PE_{total,y}$	tCO_2/year	Project emissions in year y.	Calculated from Formula [7].	C
$LE_{total,y}$	tCO_2/year	Leakage in year y.	Refers to section 2.5.2 Carbon Leakage	C

2.5.2 Carbon Leakage

Leakage emissions from fuel switch

No relating activity (replaced vehicles shall not be used within the project's boundary and other areas)

Leakage emissions from modal shift

Leakage emission shall be considered only the CO_2 emission from the change in load factor of passengers in the public transportation system. This includes the reduction of other public transport vehicle on the road, taxi, and road congestion as the consequence of modal shift from other mode of transportation to EV for transit.

In accordance with the T-VER-METH-TM-06 version 03, the project developer is allowed to use the default factor to estimate the leakage emissions from the mitigation activity, which equal to 2.64% of baseline emissions, where the values are demonstrated in Annex 1 Part A3.

2.5.3 Data acquisition

Mitigation outcomes and attribution

Fuel switch Mitigation Outcomes

The data collection process for the quantities of energy consumption of e-buses will be monitored and recorded from a charging meter, for each e-bus, on a daily basis. The data can be compared against a monthly electricity bill from Metropolitan Electricity Authority, Provincial Electricity Authority for accuracy. Also, the number of buses and the travelling distance of each bus will be recorded on daily basis regarding how many trips each bus travels and the distance shall be calculated as per number of trips. The information will be recorded by the bus operation manager of the bus operator. Nonetheless, Thai Smile bus (bus operator) has the plan to digitalise and automate of the data collection process where they implement the real time data collection with the e-tickets system. Detail regarding monitoring parameters is demonstrated in Annex 1 Part A3.2.

Modal shift Mitigation Outcomes

For the calculation of modal shift emissions reductions, data on the number of passengers on board will be distributed over a ratio of different transport modes to determine the share of the passengers who used a transport mode other than bus prior to project implementation. The ratio will be determined by a baseline survey among passengers at a sample size of bus stops along the project bus routes. The sampling approach outlined in TGO TM-06 methodology will be used to determine the sample size of passengers and location of the bus stops. Following the sampling guidelines and regulations a survey will be conducted among a sample population that lives within 1 km radius from the selected bus route. The survey shall be done once in the first year and every 4 years after the start of the project. The survey will be conducted on a sampling size of between 5-10% of the daily passengers (depending on the average amount of passengers per day) and be performed at different times of the day (e.g. rush hour, weekends).

Project vehicles will have a digital ticketing system in place, by which passengers would check in and check out when embarking or alighting at the bus stop. The electronic ticket system is expected to be fully operational by 2023. During the transition from paper tickets to the digital ticketing system, analogue records of ticket-sales will be used to monitor the number of passengers on board. Ticket sales data will be combined with the modal shift ratio from the survey. Sharing these monitoring parameters will be a requirement for a bus operator to participate in the Bangkok e-bus Program and is recorded in an agreement that secures a continuous supply of data. From 2023 onwards, data on passenger distances can be collected in greater detail. Details regarding monitoring parameters are demonstrated in Annex 1 Part A3.2.

2.5.4 Reporting of mitigation outcomes

The tables in section 2.5.1 indicate the sources of fixed, calculated, ex-ante and monitored values that need to be reported. Raw monitoring data is received digitally from the vehicle data logger or smart meter and is stored in a centralised and secure database on a cloud server. To safeguard its integrity, processed data and raw data will be stored separately in the database to ensure auditing capability and avoid data tampering. A purpose-built digital platform that is owned and operated by CCME will perform automated data checks on the raw parameter data and flag inconsistencies and statistical outliers. Verified data will flow into the calculation engine of the digital platform that uses the calculation formulas as prescribed by TGO's TM-5 and TM-06 methodologies to calculate emission reductions.

Validation and Verification bodies authorised by TGO, would be consulted in the process, to validate the algorithms behind the platform. Standardised emission reduction reports would automatically be generated using report templates in line with monitoring report forms of the TGO. As part of the mitigation activity, a procedure shall be designed together with TGO and related stakeholders to certify technology platforms for use under the T-VER standard.

Any requirements to report mitigation outcomes to the respective national authorities towards both Parties' reporting requirements under the Article 6.2 guidelines agreed by the Conference of Parties serving as the meeting of the Parties to the Paris Agreement, in CMA.3[18] and those mandated under the bilateral agreement between Thailand and Switzerland can be complied with.

[18] Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on its third session, held in Glasgow from 31 October to 13 November 2021. Source: https://unfccc.int/sites/default/files/resource/cma2021_10a01E.pdf

2.6 Additionality of Activity and individual projects

Programme's planned component activities additionality

Additionality of activity is demonstrated into 2 criteria, (1) economic feasibility analysis and (2) common practice analysis. In accordance with the FOEN's Emission Reduction and Carbon Storage Projects and Programmes (published June 2022)[19], additionality is at the level of the programme's planned component. The Bangkok e-Bus program refers to the initial batch of 154 e-buses (plying 8 routes) that are implementing as per the operational plan covered to 1 planned component of each programme (CPA1 of PoA1 and CPA1 of PoA2). (Annex 1 Part A2 Additionality)

Economic feasibility analysis

According to the FOEN Emission Reduction and Carbon Storage Projects and Programmes publication, it mentioned that the economic feasibility analysis could be demonstrated using different analysis methods: (i) simple cost analysis, (ii) investment comparison analysis or (iii) benchmark analysis. The Chosen method is benchmark analysis, in accordance with "UNFCCC's tool for the demonstration and assessment of additionality" (version 07.0.0) and the "CDM guidelines on the assessment of investment analysis", because it covers the simple cost analysis and illustrates the financial indicator (i.e. Internal Rate of Return - IRR). The IRRs of the planned component activity, both with and without carbon revenue, were then used to compare with the weighted average cost of capital (WACC) of the company. The WACC is a company-specific benchmark that has been applied consistently in the past. Therefore, the benchmark analysis is assessed as the most appropriate approach to conduct economic feasibility analysis.

The economic feasibility analysis was conducted using 2 project scenarios: (1) project scenario without the revenue from the sale of attestations and the (2) project scenario with the revenue from the sale of attestations under the same cost and revenue structure. For example, the cost of E-Bus, maintenance cost of each E-Bus and number of staffs of each bus is kept constant for both project scenarios. The result of the economic feasibility analysis indicated that the IRR is 1.33% without carbon revenue, while the outcome of the IRR of the programme with expected carbon revenue is 9.30%, which is an increase of 7.97 percentage points from the first project scenario.

The total cost of ownership provided the financial analysis to compare the total cost of ownership (TCO) between e-buses and baseline buses. As a result, the TCO elaborates the carbon pricing analysis under the project boundary which is an essential indicator to the economic feasibility analysis for the scenario with carbon revenue. The carbon revenue as determined by the TCO increases the IRR to 9.30%, which is higher than the benchmark and economically feasible. (Also refer to Annex 1 section 2.1.2.)

For the benchmark analysis, the IRR is compared with a reference value in accordance with section of 6.3 of the FOEN Emission Reduction and Carbon Storage Projects and Programmes publication, i.e. a company-specific benchmark that has been applied consistently in the past (e.g., WACC). According to the CDM tool 27, the appropriate benchmark is WACC that equal to 5.24% at the time of decision making. (Please see Annex 1 Part A2 Additionality for further information.)

Sensitivity analysis performed a maximum scenario, +10% and a minimum scenario, -10% for each of the main parameters, CAPEX, OPEX and revenue, is subjected to a maximum variation of +10% and a minimum variation of -10%. The result of the analysis indicates that a maximum IRR of 5.14% under the programme without ITMOs would still fall below the benchmark, 5.24%Moreover, the sensitivity analysis considers especially to the carbon revenue with the variation of +/- 30% which would affect to the project's operation significantly. The fluctuation of carbon revenue could be caused from the amount of ITMOs generation and market price that might happen as an expected circumstance in the future. (Please see Annex 1 Part A2 Additionality for further information.) .
Finally, a breakeven analysis was conducted to ascertain the scenario where the project IRR would pass the benchmark, and the likelihood of the occurrence of that scenario. From the analysis, it is concluded that the assumptions used in the investment analysis are suitable and the project activity (without ITMOs) does not generate sufficient returns to be considered financially viable. (Please see Annex 1 Part A2 Additionality for further information.)

[19] Source: https://www.bafu.admin.ch/dam/bafu/en/dokumente/klima/uv-umwelt-vollzug/projekte-und-programme-zur-emissionsverminderung-und-erhoehung-der-senkenleistung-kop22.pdf.download.pdf/UV-1315-E_KOP2022.pdf

Common practice analysis

Common practice analysis indicates the penetration of a technology or activity of the total market. The common practice of the project activity relates to the penetration rate of e-buses and conventional ICE buses operating in Metropolitan Bangkok. In this instance, Thailand is a late-comer to e-mobility, the penetration rates before the time of decision making are 1.3%, 115 of e-buses compared and 8,831 registered public buses in Bangkok Metropolitan area (refer to Annex 1). This is because (a) Thailand is a manufacturing hub for conventional vehicles (cars, motorcycles), creating strong vested interests, and (b) no relevant support/public incentives to switch to e-bus exist. Due to the higher CAPEX costs of e-bus, a high level of e-bus penetration can only be observed in countries that provide substantial public support.

As per the explanation above, the proposed mitigation activity cannot be considered financially attractive and is therefore not common practice.

3 Institutional Setup

3.1 Activity governance

3.1.1 Lead Institutions and participants involved in the Activity

The diagram shows the business structure of the activity. EA Public Company limited is the activity owner and counterpart of the transaction with the KliK Foundation. EA is partnering with the Bus Operator (Holding) (Thai Smile Bus[20]) who operates the bus routes through its subsidiary bus route operating licence holders. E-buses are charged using dedicated charging stations located at the terminus stations of every bus route and operated by Energy Mahanakorn.

The Activity is implemented through a program of activity, considering that the project activity operator will convert bus routes over an extended period of time; a programmatic approach facilitates the inclusion of new bus routes as they become operational.

The program is operated by CCME Co Ltd[21], a Thai company that is accredited as qualified managing entity of programs of activities by TGO. EA entered into a service agreement with CCME to facilitate the origination of mitigation outcome units from this project activity.

Under this agreement, CCME receives activity data from the bus operator as well as the charging station operator. Using additional third-party data and approved methods, CCME produces the documents that are required to request the issuance of TVERs as well as MO transfer recognition.

TVERs are then issued by TGO into the registry account of the project activity owner (EA), from where they are transferred into the account of the acquiring entity (KliK).

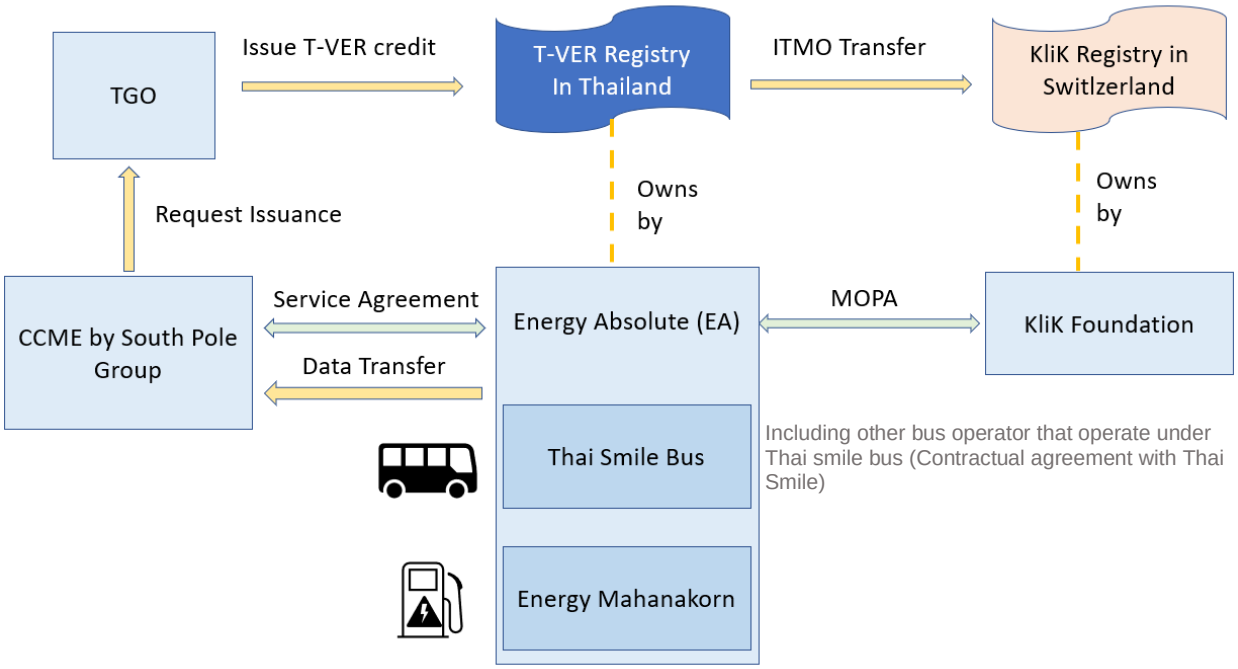

Figure 1: business structure of the activity

A more detailed description of the entities involved in the activity is in Table 6.

[20] In case that other privately own bus operator wish to participate in the program, they shall establish a contract agreement with Thai Smile Bus or provide evidence that Thai Smile bus is the majority shareholder of the company.

[21] A fully owned subsidiary of the South Pole Group.

Table 6: Roles and involvement of participants in the project activity

Role and Involvement	Name of Participant
(1) Project Activity Owner ● To be the project developer and partners with all other companies that operate the activities. ● Acts as activity supervisor and is the contractual counterparty of KliK Foundation	Energy Absolute Public Company Limited
(2) Bus Operator (Holding) ● Holds directly the operating licences for bus routes or is a joint venture partner of subordinated companies that hold such licences. ● Collects activity data from all e-bus operations. ● Submit activity data to CCME periodically using approved data transfer protocols.	Thai Smile Bus Co., Ltd.
(3) Charging Station Operator ● Operates the charging station network that service all e-buses on an exclusive basis. Charging stations are located at the terminus stations of every bus route. ● Submits charging data to CCME periodically using approved data transfer protocols.	Energy Mahanakorn Co., Ltd. (EA Anywhere Brand)
(4) Program Coordinating & Managing Entity (CME) ● Coordinates & manages the inclusion and operation of the project activity ● Collects activity data from project activity and manages the T-VER origination process. ● Requests the issuance and authorisation of carbon credits for international transfers.	Carbon Coordinating and Managing Entity Co., Ltd. (CCME Co., Ltd.), 100% owned by South Pole Group

3.1.2 Activity supervisor

Energy Absolute is the activity supervisor and assumes contractual liability.

3.1.3 Key representatives for the revision of the MADD

Table 7: Roles and involvement of participants in the MADD, Term Sheet (TS), and MOPA context

Participant Name	Role in the MADD, TS, MOPA Context
KliK Foundation Jacqueline Jakob Michael Brennwald	● Technical inputs ● Coordination and main contact
TGO Kiatchai Maitriwong	● Alignment with bilateral agreement and authorisation requirements
ONEP Phirun Saiyasitpanich	● Coordinate review and approval for Thailand
FOEN Aric Gliesche Simon Fellermeyer	● Coordinate review and approval for Switzerland

Participant Name	Role in the MADD, TS, MOPA Context
Swiss Embassy Thailand Vicky Faye Janssens	● Local coordination
Energy Absolute Norasak Suphakorntanakit Chatrapon Sripratum	● Technical inputs, financial analysis for MADD review, data sharing agreement, internal coordination. ● Commercial issues, external coordination
CCME Ladaporn Khunikakorn	● EA advisor ● MADD coordination and supervision ● Document “owner”, technical analysis, stakeholder coordination ● TGO & ONEP coordination to prepare T-VER documentation

3.2 Interaction with Transferring Country

3.2.1 Envisioned coordination structure

The Activity is implemented in accordance with the Bilateral Agreement between Switzerland and Thailand and in accordance with the T-VER Carbon Standard governed by TGO. The flowchart included in Annex 2 of this document shows the interaction between the involved entities over the life of the project activity.

3.2.2 Overview of nesting process and existing exchange with transferring government

The development of this transaction / mitigation activity has facilitated the bilateral agreement negotiation process as well as the Thai regulation on the management of carbon credits in Thailand which has been approved by the NCCC on 16th of March 2022.

3.3 Interaction with KliK

The MADD has been developed by CCME in close cooperation with EA and KliK. ONEP, TGO and FOEN have been consulted throughout this process. The cooperation between the core team (CCME, EA, KliK) has been organised via a weekly, tripartite meeting and real-time sharing of key documents, including a draft MADD document.

As for the MOPA with Klik, the counterparty is EA; and EA would execute a separate carbon asset management / service agreement with CCME.

Annex 1 – Details of the Mitigation Activity

Objective

Annex 1 aims to provide the detailed description of the Bangkok e-bus program, vis-à-vis:

i Overview and description of how the Mitigation Activity has been designed and how the emission reduction units / mitigation outcomes units have been calculated under the Thailand Verified Emission Reduction (T-VER) standard developed by the Thailand Greenhouse Gas Management Organisation (TGO) to encourage domestic GHG emission reductions along with co-benefits through the certification of carbon credits (In this particular case, the T-VER standard is applied for the validation and verification of mitigation outcomes.); and

ii Additional details of the Bangkok e-bus Program line with the latest publication published by the Federal Office for the Environment (FOEN) in June 2022, the Emission Reduction and Carbon Storage Projects and Programmes, to align with the updated enforcement practices, additional information on enforcement practices for projects carried out abroad, like this particular one in Thailand, as well as to adjust to the details of the enforcement process.

Background

The Mitigation Activity Design Document (MADD) for the Bangkok e-bus Program has been prepared based on the MADD template (version 4, 12 April 2022) provided by the KliK Foundation.

The MADD for the Bangkok e-bus Program was submitted to the KliK Foundation and the Office of Natural Resources and Environmental Policy and Planning (ONEP), Thailand on 27 May 2022 for their pre-review and presented to the Subcommittee of the National Climate Change Committee (NCCC) in Thailand for further revision. On 1 June 2022, the Subcommittee of NCCC sent their review to adjust the document and it was approved by the NCCC on 17 June 2022.

Subsequently on 23 June 2022, Thailand and Switzerland signed the bilateral agreement in Bern that governs the cooperation between the two countries under Article 6.2 of the Paris Agreement on cooperative approaches.

In the same month, the Federal Office for the Environment (FOEN), Switzerland issued a communication in its capacity as enforcement authority of the CO_2 Ordinance for Emission Reduction and Carbon Storage Projects and Programmes. This publication includes an update of enforcement practices, additional information on enforcement practices for projects carried out abroad, as well as details of the enforcement procedure. The communication also incorporates the amendments to the revised CO_2 Ordinance, which came into force on 1 June 2022, where changes have been made to the structure and wording with the aim of simplifying and clarifying the enforcement process.

In order to align the MADD with the latest regulations, including the process to be followed under the CO_2 Ordinance for projects carried out abroad and after the bilateral agreement was signed between the two countries, **additional information has been included in Annex 1 and 2 to provide further data linked to the description of the Bangkok e-bus Program and the calculation of emission reductions**. This information has been added to facilitate the revision and validation of the document.

According to the “Emission Reduction and Carbon Storage Projects and Programmes” published by the FOEN, the decision on the qualification of a project or programme abroad is called “authorisation”, where the documents to be provided for project or programme authorisation include the duly validated and signed project or programme description. A binding project or programme description form provided by the FOEN must be used; all forms are published on the FOEN website at www.bafu.admin.ch/compensation.

In lieu of the Projektbeschreibung (Vorlage v6.0) (i.e. Project description (template v6.0) published by the FOEN on www.bafu.admin.ch/compensation, the compliance of this document, **MADD for the Bangkok e-bus Program**, to the requirements of the programme description for authorisation is detailed in the table below.

Table A0: Switzerland Authorisation Criteria and their application to the project activity

Switzerland Authorisation Criteria for International Transfers (based on the Emission Reduction and Carbon Storage Projects and Programmes publication pertaining to the requirements for the "Project or Programme Description")	**How the Project Activity complies with the requirements of the "Project or Programme Description"**
VALIDATED PROGRAMME DESCRIPTION	
1. Project/program summary	
1.1. Type, form of implementation and technology used	Fully addressed in MADD Annex 1 Part A1
1.2. Initial situation	Fully addressed in MADD section 2.1 and Annex 1 Part A1
1.3. Project/program objective	Fully addressed in MADD section 2.6 and Annex 1 Part A1
1.4. Reference scenario	Fully addressed in MADD section 2.1 and Annex 1 Part A1
1.5. Description of proof of additionality	The programme's planned component level additionality, including Economic feasibility analysis and common practice analysis are described in MADD section 2.6.
1.6. Description of monitoring	The T-VER methodologies, TM05 and TM06, are used to determine, monitor, and report the mitigation outcomes, as per MADD section 2.5. Further information on the monitoring plan is in Annex 1 Part A3.
2. Type and form of implementation	As per Appendix L of the "Emission Reduction and Carbon Storage Projects and Programmes" guidance, the project type is under "3. Abroad: Permissible project and program types – i.e. electric mobility"
3. Project location	The project location is in Bangkok Metropolitan area, Thailand.
4. Description of the project/program	
4.1. Initial situation	Fully addressed in MADD section 2.1 and Annex 1 Part A1
4.2. Project/program aim	Fully addressed in MADD section 2.6 and Annex 1 Part A1
4.3. Technology	Fully addressed in MADD section 2.6 and Annex 1 Part A1
4.4. Compliance with relevant legal provisions	Fully addressed under compliance with the T-VER standard in MADD Annex A Part A1
4.5. Program specific aspects	Descriptions of the: i actors involved, ii program structure (roles, coordination of implementation) iii process for registering and including projects in the program iv list of criteria for inclusion of operations are addressed under MADD section 3 and Annex 1 Part A1.
5. Reference scenario	Fully addressed in MADD section 2.1 and Annex 1 Part A1
6. Deadlines	The validated project or programme description is submitted to the FOEN no later than three months after the start date of implementation.
7. Reference scenario and expected emission reductions	
7.1. System boundary and emission sources	Fully addressed in MADD Annex 1 Part A3.
7.2. Influencing factors	The possible influencing factors that presumably influence the project emissions, or the emissions of the projects in the program, or the reference development are fully addressed in MADD Annex 1 Part A3.
7.3. Leakage	Fully addressed in MADD Annex 1 Part A3
7.4. Project emissions	Fully addressed in MADD Annex 1 Part A3
7.5. Reference development	Fully addressed in MADD Annex 1 Part A3
7.6. Expected emission reductions (ex-ante)	Fully addressed in MADD Annex 1 Part A3
7.7. Permanence of carbon storage	Not applicable as this is not a CO2 storage project or programme.
8. Proof of additionality	Fully addressed in MADD Annex 1 Part A2

Switzerland Authorisation Criteria for International Transfers (based on the Emission Reduction and Carbon Storage Projects and Programmes publication pertaining to the requirements for the "Project or Programme Description")	**How the Project Activity complies with the requirements of the "Project or Programme Description"**
9. Structure and implementation of the monitoring 9.1. Description of selected detection method 9.2. Ex-post calculation of eligible emission reductions 9.2.1. Formulas for ex-post calculation of achieved emission reductions 9.2.2. Sharing of effects 9.3. Data Collection and Parameters 9.3.1. Fixed parameters 9.3.2. Dynamic parameters and measured values 9.3.3. Plausibility check of the data and calculations 9.3.4. Review of the influencing factors and the ex-ante defined reference development	The parameters based on the T-VER methodology, TM05 and TM06, will be used determine, monitor, and report the mitigation outcomes are detailed in MADD Annex 1 Part A3. Under the monitoring plan, the (i) selected detection method and (ii) data collection of each dynamic parameter are described under the (i) source of information and (ii) monitoring approach respectively, Sharing of effects is fully addressed in MADD section 2.3. The monitoring plan, addressing data collection and parameters, is incorporated in MADD Annex 1 Part A3.
10. Process and management structure 10.1. Quality assurance and archiving 10.2. Responsibilities and institutional arrangements	The monitoring plan, addressing the process and management structure, is incorporated in MADD Annex 1 Part A3.
11. Communication on the application and signatures 11.1. Declaration of consent to publication of the documents 11.2. Signatures	Not addressed in this MADD. Please refer to separate report appended.
DULY SIGNED MONITORING PLAN	
Monitoring plan, including the calculation method for determining emission reductions in the form of calculation table(s)	Fully addressed in MADD section 2.5 and Annex 1 Part A3
DULY SIGNED VALIDATION REPORT	
Validation report	Not addressed in this MADD. Please refer to separate report appended.

Basic information and Programme owner (Proponent) contact information

Basic Information	
Title of the mitigation activity	**Bangkok e-bus Program**: introducing privately owned and operated electric buses into public transport networks in the Bangkok Metropolitan area
Version number of the MADD	5.3
Completion date of the MADD	21 November 2022
Coordinating/managing entity	Carbon Coordinating and Managing Entity Co., Ltd. (CCME Co., Ltd.), 100% owned by South Pole Group
Host Parties	Energy Absolute Public Company Ltd
Applied methodologies	T-VER-METH-TM-05 - Use of Electric Vehicles in Public Transportation System ver. 03
	T-VER-METH-TM-06 Modal Shift from Private Vehicles to Public Passenger Transportation with Electric Vehicles ver.03
Sectoral scope[22]	Transportation Management

Project Activity Operator (Entity authorised to transfer)	
Project developer	Energy Absolute Public Company Ltd
Project coordinator	Norasak Suphakorntanakit
position	Assistant Vice President
Address	Energy Absolute Public Company Ltd 16th floor, AIA Capital Center Building 89 Ratchadaphisek Road, Dindaeng Bangkok 10400
Contact number	+66(0)2 248-2488-92 (ext. 19518)
E-mail	norasak.sup@energyabsolute.co.th

Program Management and Coordinating Entity (CME)	
Project developer	Carbon Coordinating and Managing Entity Co., Ltd. (CCME Co., Ltd.), 100% owned by South Pole Group
Project coordinator	Renat Heuberger
Position	CEO - General Management
Address	Evergreen Place Building - 318 Phayathai Road Ratchathewi - 10400 Bangkok
Contact number	+66 2 219 3791
E-mail	registries@southpole.com

[22] Source: https://ghgreduction.tgo.or.th/en/methodology/methodology-for-voluntary-emission-reduction/transportation-management.html

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Tables and figures

Part A1. The Bangkok e-bus Program

A1.1 General information

The Bangkok e-bus Program ("the Program") operates on the public transport routes of Thailand. The program is developed by the Energy Absolute Public Company Limited ("the Company") that develops business operations in biodiesel, then moving to renewable energy power plants and businesses that involve other technologies. This is to meet future energy needs with the consideration of the importance of clean energy, safety, and environmentally friendly operations.

The escalating climate change situation caused by greenhouse gas (GHG) emissions from human activities have resulted in catastrophic impacts all over the world. The company realises the importance of its responsibility in reducing GHG emissions and promoting the creation of a low-carbon society.

This Program aims to promote the potential and capability in the development of public transportation project in Thailand and to become a part of a low-carbon society. This can be realised through the adoption of electric vehicles (EV) in public transport, thereby replacing the conventional transport mode of internal combustion engine (ICE) vehicles. This would also reduce the energy consumption and GHG emissions from public transport.

In this regard, the Company has cooperated with bus service providers licensed by the Department of Land Transport to replace the ICE buses with electric bus (e-buses). Currently, there is one bus operator participating in the project, namely Thai Smile Bus Co., Ltd. The project covers the management and operation of e-bus routes operated by Thai Smile Bus in the Bangkok Metropolitan area, where it is divided in four zones according to the Department of Land Transport (DLT). The DLT has categorised the bus routes which are identified in relation to the zones they ply, starting with 1-xx, 2-xx, S-xx[23], 3-xx and 4-xx. This categorisation is shown in the figure below, and route S-xx shall consider in the same group as routes 1-xx and 2-xx.

Figure A1: Zoning areas of the Bangkok Metropolitan area[24]

The mitigation outcomes arising from this Program considers the number of e-buses used in the bus routes licensed by the DLT at present, and the additional bus routes that would be licenced in the future. The Program comprises e-buses and its licenced bus routes into group activities based on the purchase date and the operating date in line with the allocation plan of e-bus operators.

[23] S-xx are the bus routes going to Suvarnabhumi international airport which is included in PoA1.
[24] Source: Resolutions of the Meeting of Central Land Transport Control Board No. 7/2019 on 7 July 2019

A1.2 Detailed description of the Bangkok e-bus Program

The Bangkok e-bus Program covers the operation and management of 1,913 e-buses- more in the future - on the 122 approved passenger transport license bus routes from DLT licenced in Bangkok Metropolitan area within the Program's crediting period. The range between the amount of buses operative depends on the deployment plan that Energy Absolute and the Thai Smile Bus expects for this year (2022) and subsequent years.

Based on this implementation plan and considering crediting period[25] (from 2022 up until 2030), it is expected that the Bangkok e-bus Program Mitigation Activity generates annual average of 74,286 tCO_2e/year. Considering this estimate over the entire crediting period, the Mitigation Activity would achieve the amount of 500,000 mitigation outcome units the Thai Government agreed to transfer under the bilateral agreement with Switzerland.

The Bangkok e-bus Program will be implemented under the T-VER standard, which aims to encourage domestic GHG emission reductions along with co-benefits. Under this standard, there is the option of developing a Programme of Activities (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. This implies that **two T-VER PoAs would need to be developed in order to allow for greater mitigation potential** while also considering the structure of the Bangkok e-bus Program into two separate zones – Zone '1 and 2' and Zone '3 and 4'.

Two T-VER PoAs are developed in the Program:

1. T-VER PoA 1[26]: titled "The Bangkok Metropolitan Area E-Bus Zone 1 and 2";
2. T-VER PoA 2: titled "The Bangkok Metropolitan Area E-Bus Zone 3 and 4".

The details of E-bus routes and the minimum number of E-buses included in T-VER PoA 1 ("The Bangkok Metropolitan Area E-Bus Zone 1 and 2") and in T-VER PoA 2 ("The Bangkok Metropolitan Area E-Bus Zone 3 and 4") are shown in Table A1.

Each T-VER PoA will include several planned component activities, referred to in the T-VER standard as Component Project Activities (CPA), which have common emission reduction measures to enhance emission reduction outcomes. As to the procedure for registering planned CPA into the Program, the T-VER standard is flexible to allow the inclusion of additional CPA(s) with similar planned component activities to be included after the validation and registration of the T-VER PoA. TGO would review the validated PoA-DD for inclusion of planned component activities (CPA) into programme. One important requirement is for the project developer to consider the eligibility criteria for CPA inclusion according to the T-VER standard to ensure compliance with the standard and to be able to add future CPAs. The standard has also stipulated the maximum allowance of 20,000 tCO_2 per year per CPA.

Therefore, based on the eligibility criteria, two CPAs are developed:

1. CPA 1 under T-VER PoA 1 - covers 5 E-bus routes and operating by 99 E-buses.
2. CPA 1 under T-VER PoA 2 - covers 3 E-bus routes and operating by 55 E-buses.

The details of the conditions in eligibility criteria for grouping component project activities (CPA) are shown in Table A2, and the details of E-bus routes and the number of e-buses that are grouped into two CPAs are shown in Table A3 and Table A4 respectively.

[25] The 7-year renewal crediting period is in accordance with the T-VER standard for component project activities (CPA).

[26] PoA1 includes bus routes S-xx

Table A1: Details of E-bus routes and the number of E-buses included in T-VER PoA 1 ("The Bangkok Metropolitan Area E-Bus Zone 1 and 2") and in T-VER PoA 2 ("The Bangkok Metropolitan Area E-Bus Zone 3 and 4")

No.	E-Bus Routes Name	E-bus Routes Identified Number	Distance (KM)	Minimum Bus Trips per day (Return Trips)	Minimum E-Buses
T-VER PoA 1 ("The Bangkok Metropolitan Area E-Bus Zone 1 and 2")					
1	Bangkhen - Viphawadee Road - Hua Lamphong	1-1	24	160	40
2	Rangsit - Hua Lamphong station (Tollway)	1-2E	46	70	18
3	Bangkhen - Phahon Yothin Road - Hua Lamphong station	1-3	19	70	18
4	Thammasat University Rangsit Campus - Bangkhen	1-4	25	40	10
5	Rangsit - Victory Monument	1-5	29	100	32
6	Pak Kret Pier - Bangkok Bus Terminal (Chatuchak)	1-6	22	50	12
7	Thammasat University Rangsit Campus - Thammasat University Tha Prachan Campus	1-9E	48	24	6
8	Government Complex - Khlong Tun	1-13	26	56	18
9	Pak Kret Pier - Klong Tun	1-15	28	60	15
10	Ua-Athorn Klong 3 - Victory Monument	1-17	37	160	40
11	Rangsit - Bang Rak (Toll)	1-18E	36	160	40
12	Lak Si - Bangkok Bus Terminal (South)	1-23	28	100	24
13	Rajamangala University of Technology - Priest Hospital	1-24E	45	120	36
14	Government Complex - Khlong Luang	1-31	36	20	5
15	Bangkhen -Talat Phlu BTS Station (Tollway)	1-32E	41	24	6
16	Bangkhen - Bangsue Grand Station	1-33	18	24	6
17	Min Buri - Victory Monument	1-37	28	80	22
18	Siam Park - Klongtoey	1-39	32	80	24
19	Romklao Housing - Happy Land	1-41	32	54	14
20	Minburi - Hua Lamphong	1-44	31	56	18
21	Siam Park - Bang Rak	1-45	27	56	12
22	Numkrai Industrial Estate - Min Buri	1-47	23	24	5
23	KMITL - Happy Land	1-49	27	30	7
24	Loop Minburi - Khubon Road - Hathairat Road	1-52	23	24	6
25	KMITL - Victory Monument	1-56	30	40	11
26	Siam Park - Lam Luk Ka Khlong 12	1-58	34	24	6
27	Siam Park Bus Depot - Ua-Athorn Sangkasantisuk	1-59	28	24	6
28	Ua-Athorn Sangkasantisuk - Min Buri	1-61	29	20	5
29	Min Buri - Ministry of Commerce	1-62	33	20	5
30	Patthawikorn - Rama VIII Park	1-63	30	30	7
31	Loop Safari World - Nuuan Jan	1-64	27	20	5
32	Loop Min Buri - Lat Krabang Industrial Estate	1-71	35	24	6
33	Ua-Athorn Latkrabang 2 - Rom Klao	1-73	23	20	5
34	Loop Bua Khao - Min Buri	1-76	34	20	5
35	Min Buri - Klongtoey (Additional line)	1-77	32	20	5
36	Talat Tha It - Victory Monument	2-3	25	44	12
37	Pak Nam Temple Nonthaburi - Bangkok Bus Station South (Phra Pin Klao)	2-4	27	96	20
38	Prang Luang Temple - Bang Khen	2-8	33	40	10
39	Ministry of Public Health - Sanam Luang	2-11	27	40	10
40	Tha It - Ramkhamhaeng University	2-13	34	120	30
41	Ministry of Public Health - Priest Hospital	2-15	21	50	13
42	Pak Kret Pier - Bangkok Bus Terminal (Chatuchak)	2-16	20	100	24
43	Loop Bang Sue BTS Station - Kasetsart University	2-17	24	30	7
44	Tha It - Ramkhamhaeng University (Tollway)	2-18E	37	30	7
45	Talat Bang Bua Thong -	2-19	31	100	24

No.	E-Bus Routes Name	E-bus Routes Identified Number	Distance (KM)	Minimum Bus Trips per day (Return Trips)	Minimum E-Buses
46	Thanam Nonthaburi - Thanon Tok	2-22	23	40	10
47	Thanam Nonthaburi - Pattanakarn	2-26	32	100	26
48	Muang Thong Thani - Bang Wa BTS Station	2-27	36	20	5
49	Loop Samsen Railway Station - Din Daeng	2-34	20	30	7
50	Prachaniwet 3 - Thewet	2-35	22	60	14
51	Happy Land - Memorial Bridge Pier	2-38	26	80	19
52	Khlong Chan Housing - Tha Tian	2-42	28	64	15
53	Happy Land - Bangkok Bus Terminal (Chatuchak)	2-48	22	70	16
54	Rangsit - Raminthra Road - Suvanabhumi Airport (Toll)	S2	46	60	16
55	Rangsit - Siam Park - Suvarnabhumi airport (Tollway)	S3	54	30	8
56	Minburi - Suvarnabhumi airport	S4	17	20	5
57	Happy Land - Suvarnabhumi airport	S5	22	20	5
58	Bangkok Bus Terminal (Chatuchak) - Suvarnabhumi airport (Tollway)	S6	37	20	5
59	Suvarnabhumi airport (Tollway) - Thonburi Housing	S7	54	40	10
Total 59 Routes in PoA1					**Total 810 E-buses**
No.	**E-Bus Routes Name**	**E-bus Routes Identified Number**	**Distance (KM)**	**Minimum Bus Trips per day (Return Trips)**	**Minimum E-Buses**
T-VER PoA 2 (“The Bangkok Metropolitan Area E-Bus Zone 3 and 4”).					
1	Paknam - Memorial Bridge Pier	3-1	30	64	17
2	Pu Chao Saming Phrai - Memorial Bridge Pier (Tollway)	3-2E	32	40	10
3	Rama IX Park - National Stadium Station	3-3	22	54	14
4	Patumkongka Schoool Samutprakan - Bangkok Bus Station (Ekamai)	3-6	29	90	22
5	Ramkhamhaeng University (Bangna Campus) - Victory Monument	3-8	26	96	20
6	Ramkhamhaeng University (Bangna Campus) - Tha Chang	3-11	30	110	26
7	Sam Rong - Bangkok Bus Station (South)	3-13	34	110	28
8	Bang Phli Housing - Udom Suk BTS Station	3-14	32	64	17
9	Bang Phli Housing - Ekamai BTS Station	3-15	88	120	34
10	Samrong - Government Complex (Tollway)	3-23E	36	30	7
11	Paknam - Lat Krabang Industrial Estate (Tollway)	3-25E	44	20	5
12	Pu Chao Saming Phrai - Siam Park	3-27	34	20	5
13	Samrong - Siam Park	3-32	34	24	6
14	Bangna - Lat Krabang Industrial Estate (Tollway)	3-34	30	20	**5**
15	Rama 3 - Tha Tian	3-35	14	70	17
16	Bangkok Port (Khlong Toei) - Phasi Charoen Port	3-36	14	40	10
17	Thailand Cultural Center - Sanam Chai BTS Station	3-37	16	60	15
18	Thanon Tok - Si Yan	3-39	24	70	17
19	Bangkok Port (Khlong Toei) - Victory Monument	3-44	16	30	7
20	Rama 3 - Bangkok Bus Terminal (Chatuchak)	3-45	23	60	15
21	Loop Rama 3 - Hua Lamphong	3-52	22	30	7
22	Hua Mak - Sao Ching Cha	3-53	24	20	5
23	Tha Phasi Charoen - Victory Monument	3-54	22	20	5
24	Bangkok Port (Khlong Toei) - Rama 7	3-55	20	20	5

No.	E-Bus Routes Name	E-bus Routes Identified Number	Distance (KM)	Minimum Bus Trips per day (Return Trips)	Minimum E-Buses
25	Phra Pradaeng Pier - Bang Lamphu	4-1	40	150	38
26	Phra Pradaeng - Victory Monument	4-3	20	60	15
27	Thonburi Housing - Bang Lamphu	4-8	64	90	24
28	Sao Ching Cha - Tha Phra	4-10	17	110	28
29	Suksanari School - Thewet	4-11	28	130	32
30	Phra Pradaeng Pier - Bang Lamphu	4-15	20	80	20
31	Phra Pradaeng - Thonburi BTS Station	4-16	19	60	16
32	KMUTT - Prachauthit - Talat Phlu BTS Station	4-17	24	20	5
33	BTS Talat Phu Loop - Victory Monument	4-19	28	130	38
34	Samutsakorn - Ban Khaek Intersection	4-21	76	100	26
35	Samaedam - Victory Monument (Tollway)	4-23E	30	44	12
36	Loop Thonburi Housing - Bangkhae	4-25	30	180	45
37	Thonburi Housing - Lumphini MRT	4-26	21	50	14
38	Bang Khun Thian - Happy Land (Tollway)	4-27E	40	50	12
39	Samaedam - Victory Monument	4-28	30	50	12
40	Samaedam - Bangkok Bus Terminal (Chatuchak) (Tollway)	4-29E	43	98	25
41	Thonburi Housing - Phra Pradaeng	4-34	31	20	5
42	Suksanari Wittaya School - Hualampong	4-36	56	120	26
43	Kalpapruek - Samsen Train Station	4-37	22	80	20
44	Bangkok Bus Station (South) - Chandrakasem Rajabhat University	4-38	24	160	40
45	Bangkok Bus Station (South) - Bangkok Bus Station (Ekamai)	4-39	28	160	40
46	Krung Thon Bridge Loop - Bang Lam Phu	4-40	36	60	16
47	Taling Chan Circle - Thonburi	4-41	28	80	20
48	Wor Por Or Village - Suan Luang Rama 8	4-44	62	80	20
49	Phutthamonthon Sai 5 Road - Tha Ratcha Woradit	4-45	36	56	14
50	Rai Khing temple - Krung Thon Buri BTS Station	4-46	35	90	24
51	Bangkok Bus Station (South) - Rajamangala University of Technology (Bangkok Campus)	4-47	31	120	30
52	Boromarajonani - Bangkok Bus Terminal (Chatuchak)	4-49	26	40	10
53	Omyai - Tha Ratcha Woradit	4-50	39	100	25
54	Ua-Athorn Salaya - Sanam Luang	4-51	28	60	16
55	Loop Bangkok Bus Terminal (South) - Phet Kasem Road	4-52	30	50	12
56	Boromarajonani - Bangkok Bus Terminal (Eastern)	4-53	30	50	13
57	Omyai - Victory Monument (Tollway)	4-54E	55	40	10
58	Sala Ya Train Station - National Stadium BTS Station	4-55	40	60	15
59	Boromarajonani - Krung Thon Buri BTS Station	4-56	32	34	9
60	Sala Ya Station - Victory Monument	4-61	32	100	26
61	Ua-Athorn Salaya - Tanon Tok	4-63	37	80	20
62	Sala Ya Train Station - Ministry of Commerce	4-67	33	24	6
63	Suanpak - Thanon Tok	4-68	26	20	5
Total 63 Routes in PoA2					**Total 1,103 E-buses**

Table A2: Eligibility criteria under the T-VER standard for CPA inclusion

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	The type of vehicles under the CPA shall: 1. Not be modified from the existing conventional Internal combustion engine vehicle (ICEV) 2. be 100% battery electric vehicles (EV) 3.have documented measures in place in case the vehicles replace a re-chargeable battery to ensure that vehicle owners have access to replacement batteries of comparable quality 4.not used the replaced vehicles in the project's boundary or other area *Ref: T-VER-METH-TM-05 Version 03, T-VER-METH-TM-06 Version 03*	1. Vehicles used in the project activities are not modified from combustion engine vehicles. 2.Vehicles used in the project activities are all powered by electric power. 3. Project developer demonstrates the cycle of battery replacement or recycling. 4. The developer shall make sure that the replaced vehicles will not be used in any area	1. An electric bus purchase order document showing details of the production date or the vehicle delivery note. 2. Technical specifications of electric buses in the project, such as battery capacity or battery power. 3. Electronic waste management plan or contract of an agency appointed as a battery service facility and battery waste management facility. 4. Evidence suggests the decommissioning of the replaced vehicles
2	Vehicles specifications included in CPA shall consider the following parameters: - meet standard vehicle according to the Department of Land Transport - battery capacity *Ref: The Mitigation Activity Design Document (MADD)*	E-buses specifications included in the program shall consider the following parameters: - Standard 2 (air-conditioned bus class 2) and/or standard 3 (normal bus) - Battery capacity ≥150 kWh.	Technical requirements of electric buses in the project and the approved passenger transport licenses by DLT.
3	Public bus routes under the CPA shall comply with national laws and regulations *Refer: The Mitigation Activity Design Document (MADD)*	All routes in the project activities must be approved by the Department of Land Transport.	The approved passenger transport licenses by DLT.
4	The CPA boundary is within the geographic territory of Bangkok Metropolitan area *Refer: The Mitigation Activity Design Document (MADD)*	All routes are in Bangkok metropolitan area shown in figure A1.	The approved passenger transport licenses by DLT.
5	Each CPA shall be categorised by its area of operation *Refer: The E-buses program description in Section A1 of this Annex.*	All routes are in Bangkok metropolitan area shown in figure A1.	The approved passenger transport licenses by DLT.

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
6	The amount of emission reductions shall not exceed the limit stipulated under the T-VER standard criteria. *Ref: Table 1 details of the criteria for considering the T-VER project, 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.	Ex-ante calculation based on the passenger transport license of each bus route in CPA1 under PoA1 and CPA1 under PoA2 (Shown in section 3A of this Annex)
7	Ownership of emission reduction / mitigation outcomes units issued *Ref: The Mitigation Activity Design Document (MADD)*	Contractual agreement between EA and the bus operator indicating that the mitigation outcomes generated under the Bangkok e-bus program will be EA's ownership	Contractual agreement between EA and the bus operator
8	EA shall demonstrate that double counting of emission reductions will not occur i.e. monitoring data of each specific vehicle *Ref: The Mitigation Activity Design Document (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 project activity under another emission reduction crediting scheme (e.g. voluntary carbon markets) during the same crediting period	Contractual agreement between EA and the bus operator Note: the contract shall include the declaration and steps to prevent the bus operator from claiming emission reductions under another carbon standard in order to avoid double counting
9	All CPAs shall have crediting period not exceeding T-VER PoA duration. *Ref: Table 1 details of the criteria for considering the T-VER project, 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 24 January 2022.*	Crediting period shall follow T-VER standard for which PoA has 14 years period and CPA has 7 years period with 1 time renewal.	Approved CPA-DD from TGO
10	Data collection shall be shared between EA and the bus operator *Ref: The Mitigation Activity Design Document (MADD)*	Bus operator shall provide monitoring data to EA and the CME	Data set according to the monitoring plan (Shown in section 3A of this Annex)

#	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
11	Demonstration of Additionality *Refer: The E-buses program description in Section 2A of this Annex.*	Additionality shall be demonstrated at CPA level.	Financial analysis and common practice on each including CPA of PoA1 and PoA 2 (Shown in section 2A of this Annex)

Table A3: Details of E-bus routes and the number of E-buses that are grouped into CPA1 under T-VER PoA 1

No.	E-Bus Routes Name	E-bus Routes Identified Number	Minimum E-Buses
1	Min Buri - Victory Monument	1-37	22
2	Siam Park - Klongtoey	1-39	19
3	Happy Land - Memorial Bridge Pier	2-38	40
4	Ministry of Public Health - Priest Hospital	2-15	13
5	Minburi - Suvarnabhumi airport	S4	5
			Total 99 E-buses

The location of the E-bus station and the charging station of the routes in **the CPA 1 under T-VER PoA 1** are shown as follows.

E-bus Routes Identified Number	E-Bus Routes Name	Name of e-bus station and the charging station	GPS coordinate location
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	Pak Kret	13° 55' 15.98918", 100° 31' 3.20561" https://goo.gl/maps/RvvqD1ateefxH4fD6
2-15	Ministry of Public Health - Priest Hospital	Bueng kum	13° 47' 16.03625", 100° 40' 39.55512" https://goo.gl/maps/AvCdPHGxksvMwaQV9
S-4	Minburi - Suvarnabhumi airport		

Figure A2: Bueng Kum E-bus station and the charging station

Table A4: Details of E-bus routes and the number of E-buses that are grouped into CPA1 under T-VER PoA 2

No.	E-Bus Routes Name	E-bus Routes Identified Number	Minimum E-Buses
1	Rama 3 - Bangkok Bus Terminal (Chatuchak)	3-45	15
2	Phra Pradaeng Pier - Bang Lamphu	4-15	20
3	Taling Chan Circle - Thonburi	4-41	20
			Total 55 E-buses

The location of the E-bus station and the charging station of the routes in **the CPA 1 under T-VER PoA 2** are shown as follows.

E-bus Routes Identified Number	E-Bus Routes Name	Name of E-bus station and the charging station	GPS coordinate location
3-45	Rama 3 - Bangkok Bus Terminal (Chatuchak)	Suthisan	13°47'10.0", 100°33'33.5" https://goo.gl/maps/cuaMDZLmPSRzCx3A9
4-15	Phra Pradaeng Pier - Bang Lamphu	Phra Pradaeng	13° 39' 48.80315", 100° 30' 55.1844" https://goo.gl/maps/mbM4RvyNkknhK3eFA
4-41	Taling Chan Circle - Thonburi	Taling Chan	13° 46' 54.78765", 100° 23' 32.08532" https://goo.gl/maps/2813mbcpT38hCXbm8

Figure A3: Phra Padaeng E-bus station and the charging station

A1.3 Emission Mitigation Technology

The technology used in the Program refers to the replacement of buses with internal combustion engines that use natural gas fuel with electric motors. The electric current stored in the batteries draws power from the batteries to the motor to drive the vehicle as shown in Figure A4.

Technical requirements of the 2 CPAs, 154 electric buses are shown in Table A5.

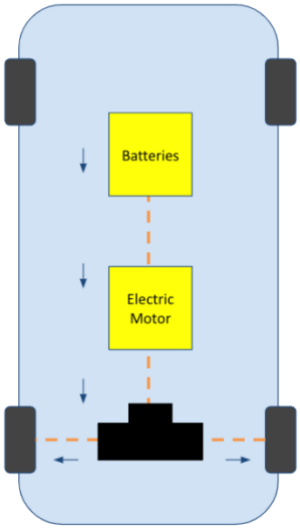


Figure A4: Electric motors driven by batteries

Table A5: Technical requirements of electric buses in the project

Item	Detail
Model	XML6115JEV
Size	10,950 x 2,550x 3,420 mm.
Battery capacity	151.07 to 302.14 kWh

The business model diagram and the relationship between the project developer and the owner of the CPAs (bus operator[27]) is shown in the diagram in Figure A5.

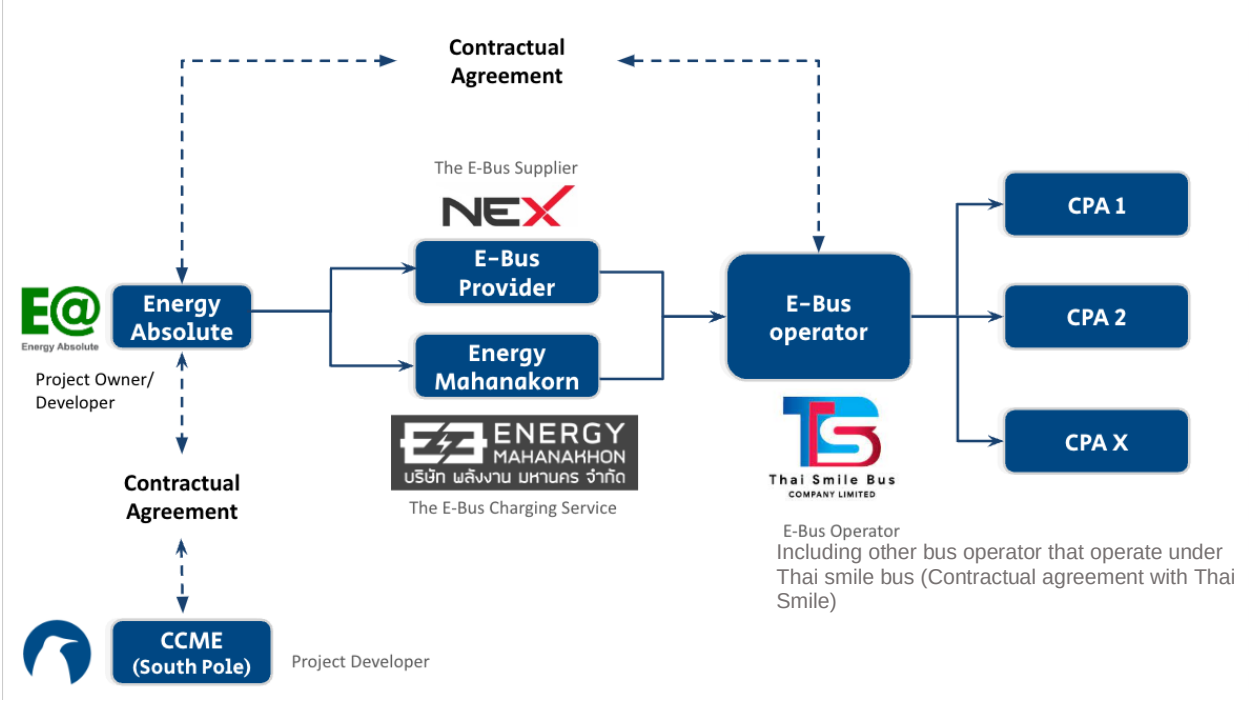


Figure A5: The business model diagram and the relationship between the project developer and the owner of the CPAs is shown in the diagram

A1.4 Project investment

Energy Absolute Public Company Limited is a sole investor and owner in the implementation of the Bangkok e-bus program under the Voluntary Greenhouse Gas Reduction Program (T- VER) PoA 1 and PoA 2 on the bus routes licensed by the Department of Land Transport at present - and more in future - and the sole benefit from carbon finance relating to the implementation of the Bangkok e-bus program.

A1.5 Greenhouse gases mitigation activity

Fuel Switch Mitigation Activity

Greenhouse Gases mitigation activity arises from the process of operating electric buses instead of using the combustion engine using natural gas fuel for conventional bus vehicles. This is because the amount of greenhouse gases generated from electricity generation is less than that of fossil fuel in conventional bus operation. The mitigation activity covers both existing and new bus routes, where for existing bus route the replacement is 1:1 from NGV bus to E-bus. For new bus routes, the e-bus will replace the intended inclusion of NGV bus based on the passenger transport license as NGV bus is still considered as common practice in Thailand (refers to section 2.5 for further detail).

[27] In case that other privately own bus operator wish to participate in the program, they shall establish a contract agreement with Thai Smile Bus or provide evidence that Thai Smile bus is the majority shareholder of the company.

Modal Shift Mitigation Activity

It also changes the mode of travel from private vehicles or others to e-bus that would increase transportation efficiency and reduce traffic congestion. This has resulted in reductions in greenhouse gas emissions from the reduction of fossil fuel use in personal vehicles and others. This mitigation activity only considers the emission reduction that arises from passengers switching from ICE vehicle to EV bus on the existing routes to avoid the double claiming the amount of emission reduction on the new routes. (refers to section 2.5 for further detail).

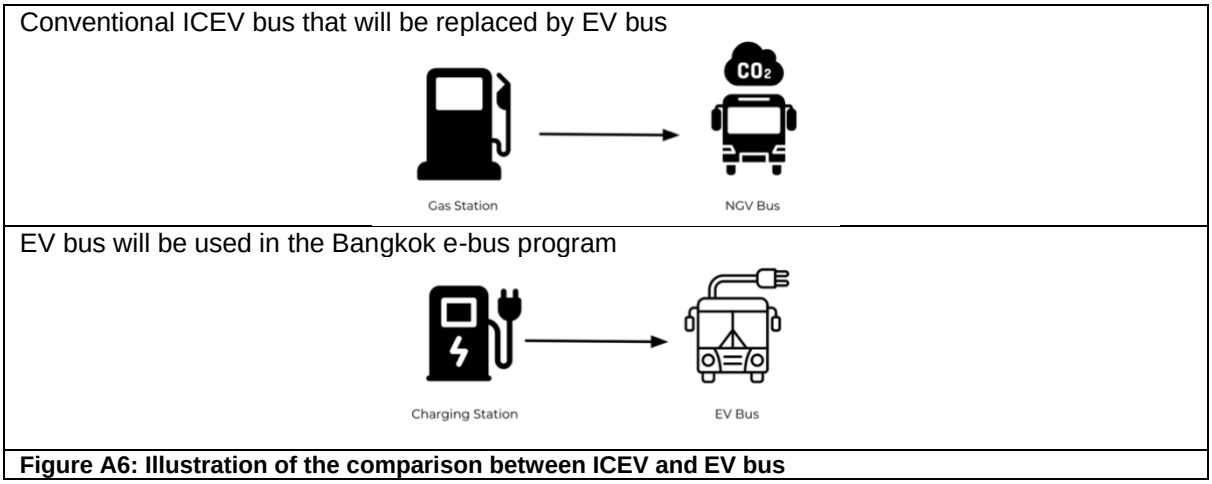


Figure A6: Illustration of the comparison between ICEV and EV bus

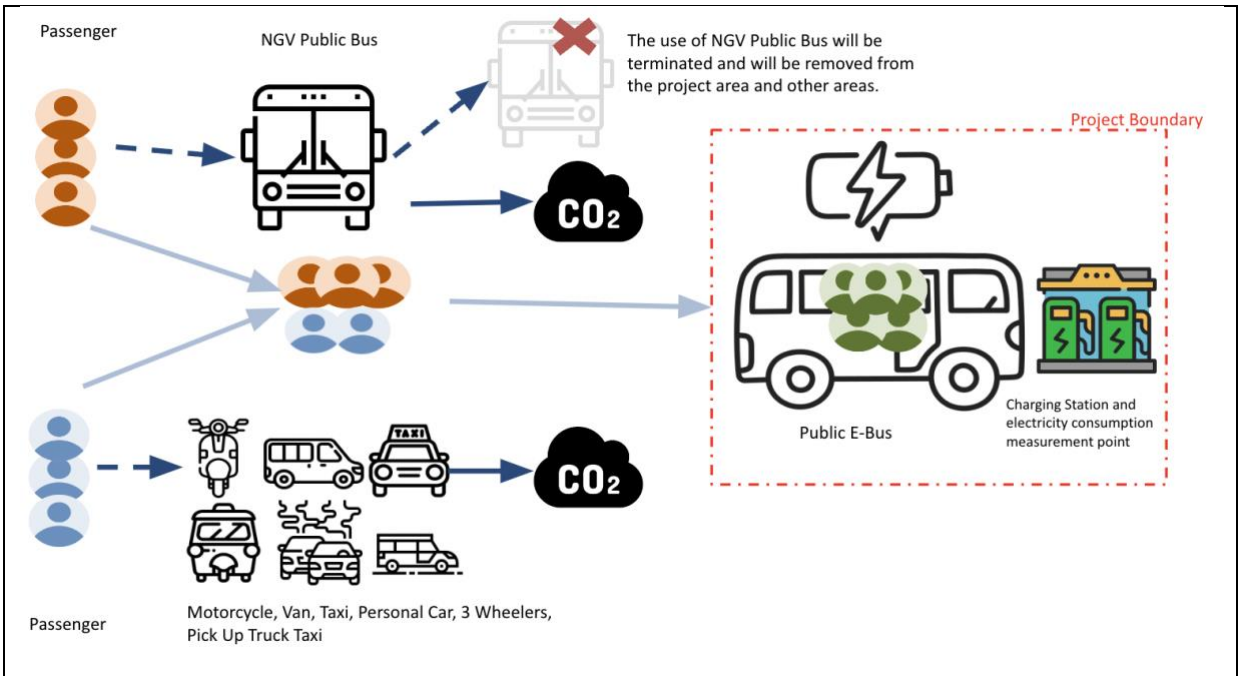


Figure A7: Illustration of the Mitigation Activity that arises from cancelation of ICEV bus by replacing with EV bus, and changing mode of transportation from ICE vehicles to EV bus

A1.6 Methodologies and Tools

Mitigation outcomes are measured through applying T-VER methodologies and versions:

1. T-VER-METH-TM-05 version 03 - Use of Electric Vehicles in Public Transportation System

2. T-VER-METH-TM-06 version 03 - Modal Shift from Private Vehicles to Public Passenger Transportation with Electric Vehicles

Whereby TM-05 models the ex-ante emission reductions occurring from the fuel switch of fossil fuels to electricity and TM-06 models the ex-ante emission reductions occurring from the modal shift of passengers from private fossil-fuelled transport to electric powered buses. Emission reductions are calculated by deducting the project emissions and Leakage emissions from the baseline emissions, as per formulas in section 2.5.1 of the MADD.

Justifications of adopting the methodologies are declared below.

Table A6: Justifications of adopting the methodologies

Project conditions of adopting T-VER-METH-TM-05 Version 03, and T-VER-METH-TM-06 Version 03	Justification
'1. The EV for public transit shall not be modified from the existing ICEV public transit	E-buses operated in the Bangkok e-bus program are newly manufactured.
'2. EV must rely on 100% electrical energy from Battery Electric Vehicle (BEV)	E-buses operated in the Bangkok e-bus program rely on 100% electrical energy from battery electric vehicle.
'3. Project owner must demonstrate the guideline for battery waste management for the damaged or expired battery	Guidelines for handling damaged or end-of-life electric vehicles are listed in the Co-Benefit whitepaper and includes evidence of government mandated handling for disposal at the end of its useful life.
'4. In the case where methodology "*Modal Shift from Private Vehicles to Public Passenger Transportation with Electric Vehicles*" (T-VER-METH-TM-06) is also included within the project, the project developer shall apply the baseline emission calculation under scenario 2 of T-VER-METH-TM-06 as addition to the baseline emission of this methodology.	Activities under the Bangkok e-bus program consists of the use of electric buses and changing the mode of travel from private vehicles and others to use electric buses. By which, the program will only consider emission reduction of modal shift activity from the existing route under scenario 2 of T-VER-METH-TM-06, and will not claim for the new route scenario to avoid the double claiming the amount of emission reduction on the new routes from fuel switch activity as stated earlier.

Part A2 Additionality

The mitigation activity reduces Greenhouse Gas (GHG) emissions from the fossil fuel combustion of the public buses by replacing the electric buses. The benefits from carbon finance are integrated into part of the viability of the project. The following provides key milestones in the development of mitigation activity and discussion on additionality with respect to the investment barriers.

Table A7: Project timeline

Date	Event	References/evidence
23/11/2021	Agreement on the collaboration between Energy Mahanakorn and Thai Smile Bus of the development of E-Mobility in public transport sector	MoU between EA Mahanakorn and TSB
06/01/2022	E-Bus Battery pack analysis	Battery pack Quotation
10/01/2022	Employment Structure	Salary Structure
08/03/2022	Initial Business Evaluation	TSB Business Plan
06/05/2022	Bus Depot Information analysis	Construction Quotation
09/05/2022	E-Bus Maintenance Evaluation	Service Contracts
23/05/2022	Investment Decision Making	General Meeting of Shareholders No 5/2022
27/05/2022	MADD submission to NCCC	MADD
15/06/2022	Technology expenditure commitment	E-Bus Purchase Agreement

Section 6 of the "Emission Reduction and Carbon Storage Projects and Programmes" publication states that "*the applicant must demonstrate the additionality of the project or programmes*" (Art. 5 para.1 let. B Nº1 CO_2 Ordinance). The demonstration of additionality for this mitigation activity is conducted according to the following sections: the (i) economic feasibility analysis and the (ii) common practice analysis as below.

A2.1 Economic feasibility analysis

A2.1.1 Tool for demonstration and assessment of additionality

The economic feasibility analysis is carried out according to the "UNFCCC's tool for the demonstration and assessment of additionality" (version 07.0.0) and the "CDM guidelines on the assessment of investment analysis (version 11.0)". The comparison of the benchmarks approach is selected in order to prove that the project's return on investment is insufficient.

The mitigation activity generates income from selling bus tickets whose price is in line with the requirement of ICE bus's operation regulated by DLT. In the absence of the mitigation activity, the project proponent would not have made any investment for the operation of the electric vehicle for the purpose of public transportation.

A2.1.2 Benchmark analysis

Financial indicator calculation:

The financial indicator chosen for the mitigation activity is the pre-tax IRR of the mitigation activity's operation. The period of assessment is taken as 14 years in line with the expected operational lifetime of the equipment in the project activity. As per the guideline, depreciation and other non-cash items are not

included in the analysis. The loan repayment and interest are not included in the calculation of project IRR. The following table summarises the main points about investment analysis:

Table A8: Parameters of the chosen financial indicator

Parameter	Value	Reference to "Guideline on the assessment of investment analysis"
Period of assessment	14 years	Guidance 3 – The period of assessment should not be limited to proposed crediting period.
Taxation	Excluded	Guidance 5 – The benchmark is not intended for post-tax comparison.
Depreciation	Excluded	Guidance 5 – The project IRR does not include taxes and is compared to a pre-tax benchmark and therefore depreciation is excluded.
Loan repayment and interest	Excluded	Guidance 9 – The loan repayment and interest are excluded to avoid double counting in the investment analysis. Furthermore, a pre-tax benchmark is applied.

Input values used in the investment analysis were valid at the time of investment decision taken by the project participant. Most of the input values are taken from the proposals supplied by the technology provider to the project participant and conventional buses historical data. The determination of the analysis focuses on the operation of 154 e-buses which will be launched under the T-VER development of PoA 1 BKK e-bus CPA1 (99 e-buses) and PoA 2 BKK e-bus CPA2 (55 e-buses).

Table A9a: Input values of the programme's planned component without Carbon Finance

Description	Value (THB)	References
Total investment cost (THB) of 154 e-buses	1,005,926,276	E-Bus purchase agreement and construction proposal
Total operation and maintenance cost (THB/year)	-125,244,168	TSB Expected Cost & Historical Data
Total expected revenue (THB/year)	212,622,500	Historical Data of ICE buses operation

Table A9b: Input values of the programme's planned component with Carbon Finance

Description	Value (THB)	References
Total investment cost (THB) of 154 e-buses	1,005,926,276	E-Bus purchase agreement and construction proposal
Total operation and maintenance cost (THB/year)	-125,244,168	TSB Expected Cost & Historical Data
Total expected revenue (THB/year)	255,780,963	Historical Data of ICE buses operation and Expected ITMOs

The total cost of an electric bus would be THB 6.5 million per bus for 302 kWh and THB 5.8 million per bus for 151 kWh. The capital expense is taken from the purchase agreement between the technology suppliers and the project participant. The estimated number of tickets sold per trip would be 52 tickets with 20 THB per ticket. As a result, the estimated annual revenue is 212,622,500 THB and 255,780,963 THB with carbon revenue. Based on the input values outlined above, the pre-tax IRR of mitigation activity is calculated as 1.33%, without carbon revenue and 9.30%, with carbon revenue.

A2.1.3 Selection of appropriate benchmark

As per section of 6.3 of the FOEN Emission Reduction and Carbon Storage Projects and Programmes publication, the company-specific benchmark that has been applied consistently in the past (e.g., WACC), is the WACC of 5.24% The WACC analysis inline to the CDM's tool 27[28], Investment analysis version 11.0 The ratio of dept and equity referred to the amount of expected cash and loan of the programme's, 30% of equity and 70% of loan. Cost of equity is a default value that mentioned specifically for the transport project in Thailand. Cost of debt was the company's, EA at the time before investment decision making loan interest rates, 3.44%. Last, the corporate tax rate referred to the Revenue department of Thailand[29], 20%.

WACC	
Parameters	**Value**
re (Cost of equity)	11.04%
We (Percentage of financing that is equity)	30.00%
rd (Cost of debt)	3.44%
Wd (Percentage of financing that is debt)	70.00%
Tc (Corporate tax rate)	20.00%
WACC	**5.24%**

As a result, the IRR of the mitigation activity has been calculated as 1.33%, which is lower than the benchmark of 5.24%. In addition, the IRR of the mitigation activity with carbon finance has been calculated as 9.30%. which is higher than the benchmark.

A2.1.4 Sensitivity analysis

A sensitivity analysis is performed to determine in which scenario the project activity would pass the benchmark. The following table outlines the parameters on which sensitivity analysis has been performed and the results. The parameters have been subjected to a variation of +/- 10% to determine the effect on the project IRR both with and without carbon revenue.

Table A10a: Sensitivity analysis without Carbon Revenue

IRR_Without Carbon Carbon Revenue					
Sensitivity analys	**-10%**	**-5%**	**0%**	**5%**	**10%**
Total cost	3.00%	2.13%	1.33%	0.60%	-0.08%
O&M	3.90%	2.63%	1.33%	0.01%	-1.36%
Ticket Sold	-2.78%	-0.67%	1.33%	3.27%	5.14%

The following figure plots the above data:

[28] Methodological tool: TOOL27: Investment analysis Version 11.0, on site: Clean Development Mechanism.

[29] Corporate income tax, on site: The Revenue Department.

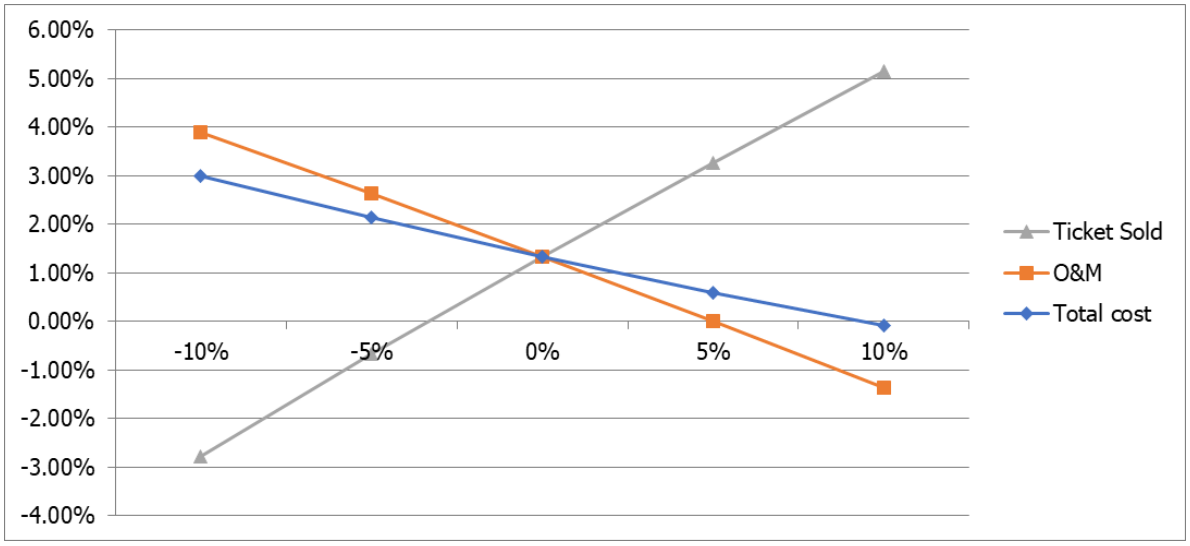
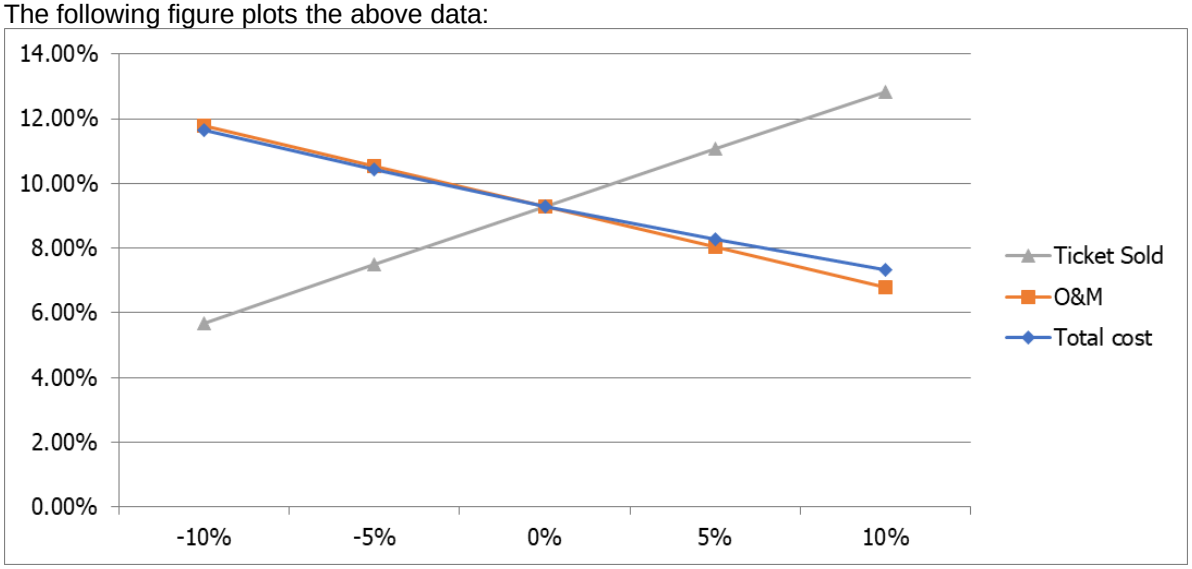


Table A10b: Sensitivity analysis with Carbon Revenue

IRR_With Carbon Carbon Revenue (Operational Cost and Income Variation)					
Sensitivity analysi	**-10%**	**-5%**	**0%**	**5%**	**10%**
Total cost	11.65%	10.42%	9.30%	8.28%	7.35%
O&M	11.77%	10.54%	9.30%	8.05%	6.78%
Ticket Sold	5.68%	7.50%	9.30%	11.07%	12.84%

The following figure plots the above data:

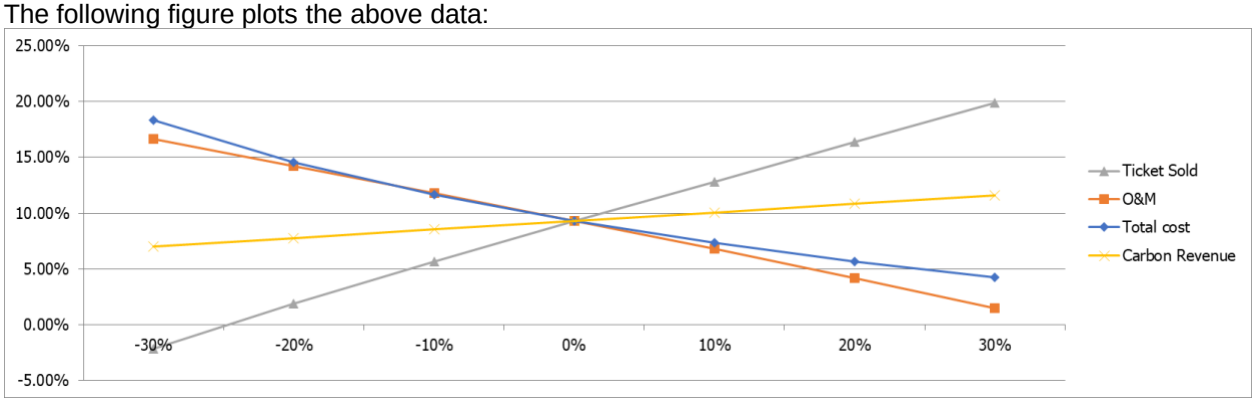


Aside from conducting the sensitivity analysis with and without carbon revenue, the sensitivity analysis also taken into consideration of the fluctuation of carbon revenue to project IRR with the variation of +/- 30%. The factors that can influence the fluctuation of the ITMOs price are carbon market price, demand, and situation of climate change topic. These factors are the key indicators to determine the ITMOs price, which is one of the key components to demonstrate feasibility of the program.

Table A10c: Breakeven analysis

IRR_With Carbon Carbon Revenue (Carbon Revenue Variation)							
Sensitivity analysis	**-30%**	**-20%**	**-10%**	**0%**	**10%**	**20%**	**30%**
Total cost	18.35%	14.57%	11.65%	9.30%	7.35%	5.69%	4.25%
O&M	16.62%	14.21%	11.77%	9.30%	6.78%	4.18%	1.50%
Ticket Sold	-2.15%	1.90%	5.68%	9.30%	12.84%	16.35%	19.88%
Carbon Revenue	6.98%	7.76%	8.53%	9.30%	10.06%	10.82%	11.58%

The following figure plots the above data:



It is therefore clear from above that variation in the critical parameters gives a maximum project IRR of 5.14%, which is still below the benchmark. This concludes that carbon finance plays very significant role in determining the feasibility of the program.

Further, a breakeven analysis has been conducted to ascertain the scenario where the project IRR would pass the benchmark, and the likelihood of the occurrence of that scenario.

Table A11: Breakeven analysis

Variable	Variation needed	Project IRR	Comments
Total cost	-21.10%	5.25%	The total project cost will have to decrease by 21.30% for the project IRR to cross the benchmark of 5.24%. According to the technology provider quotation, purchase agreement, project's invoices and other payment evidence, it is not possible that the unit cost of the project activity falls within the range.
O&M cost	-14.65%	5.24%	The O&M cost will have to decrease by 14% which is a highly unlikely scenario. This can be concluded based on the positive inflation rate in Thailand. The current inflation rate as per Bank of Thailand[30] is 0.2% for core inflation and 1.2% for Headline inflation. Therefore, given that inflation is on the rise, it is impossible that operation and maintenance cost will reduce by 14%.
Ticket Sold	+10.25%	5.24%	An increase of 10% in the number of tickets sold would mean that the total passenger per bus would reach 60 passengers. It is a highly unlikely scenario because the bus capacity is 31 seats based on the bus specification. On the other hand, the most challenging ticket price is limited to 25 THB maximum which is mentioned in the passenger transport license. Hence, increasing of load factor of bus up to 100% is seems to be an impossible scenario.

Based on the above discussion, it can be concluded that the assumptions used in the investment analysis are suitable and the project activity does not generate sufficient returns to be considered financially viable.

[30] The headline and core inflation rate for 2021, on site: Bank of Thailand.

A2.2 Common practice analysis

As mentioned in section 2.6 of MADD, the penetration rate of e-buses is lower than 2% or buses operating in Metropolitan Bangkok, 115 vehicles compared to all registered public buses. According to the DLT database[31], there are now 8,831 registered public buses operating within the Bangkok Metropolitan area in which the majority of them are ICE buses.

Part A3 Emission reductions calculation

A3.1 Results from GHG emissions reduction activities in PoA and CPA

The amount of emission reduction from the project is calculated according to the methodology mentioned in section 2.5.1 of the MADD document. The concluded amount of GHG emissions reduction resulting from PoA 1 and PoA 2 is expected to be **83,063** mitigation outcome tCO_2e/year once every bus routes are in full operation as shown in Table A12 below without considering technological improvement factor. For ex-ante result with the inclusion of technological improvement factor, refers to Table 1.

The detailed emission reduction calculations are in the detailed Excel spreadsheets attached to this MADD.

Crediting Period Starts: 01 October 2022
Crediting Period Ends: 30 September 2029
Crediting Period: 7 Years
(Note: the crediting period of CPA according to T-VER)

Table A12: Annual GHG emissions reduction from project PoA 1 and PoA 2 within the crediting period (fully operated estimation on minimum number of buses for each passenger transport license)

PoA	Number of e-bus route	Number of e-buses vehicle	Baseline Emission (tCO_2e)	Project Emission (tCO_2e)	Leakage Emission (tCO_2e)	Estimated Emission Reduction (tCO_2e)
PoA 1	59	810	50,869.90	15,313.44	168.38	35,388
PoA 2	63	1,103	67,720.62	19,774.53	271.07	47,675
Total	**122**	**1,913**	**118,590.52**	**35,087.97**	**439.45**	**83,063**

Table A13: Total GHG emission reduction calculation based on CPA 1 of PoA 1 and CPA 1 of PoA 2 within the crediting period

CPA	Number of e-bus route	Number of e-buses vehicle	Baseline Emission (tCO_2e)	Project Emission (tCO_2e)	Leakage Emission (tCO_2e)	Estimated Emission Reduction (tCO_2e)
CPA1 under PoA 1	5	99	32,031	9,071	175	22,785
CPA1 under PoA 2	3	55	19,622	5,726	95	13,802
Total	**8**	**154**	**51,654**	**14,797**	**270**	**36,587**

[31] Number of Vehicle Registered in Thailand as of 31 May 2022, on site: Department of Land Transport.

Table A14: Ex-ante GHG emission reduction of CPA 1 under PoA 1 each year

Year	Baseline Emission (tCO_2e)	Project Emission (tCO_2e)	Leakage Emission (tCO_2e)	Emission Reduction (tCO_2e)
01/10/2022 - 31/12/2022	1,187.66	323.97	6.51	857
01/01/2023 - 31/12/2023	4,703.14	1,295.86	25.76	3,381
01/01/2024 - 31/12/2024	4,656.11	1,295.86	25.50	3,334
01/01/2025 - 31/12/2025	4,609.55	1,295.86	25.25	3,288
01/01/2026 - 31/12/2026	4,563.46	1,295.86	25.00	3,242
01/01/2027 - 31/12/2027	4,517.82	1,295.86	24.75	3,197
01/01/2028 - 31/12/2028	4,472.64	1,295.86	24.50	3,152
01/01/2029 - 30/09/2029	3,320.94	971.90	18.19	2,330
Total (tCO_2eq)	**32,031**	**9,071**	**175**	**22,785**
Number of Years	7 Years			
Average Per Year (tCO_2eq/year)	**4,576**	**1,296**	**25**	**3,254**

Table A15: Ex-ante GHG emission reduction of CPA 1 under PoA 2 each year

Year	Baseline Emission (tCO_2e)	Project Emission (tCO_2e)	Leakage Emission (tCO_2e)	Estimated Emission Reduction (tCO_2e)
01/10/2022 - 31/12/2022	727.57	204.49	3.52	519
01/01/2023 - 31/12/2023	2,881.18	817.95	13.95	2,049
01/01/2024 - 31/12/2024	2,852.37	817.95	13.81	2,020
01/01/2025 - 31/12/2025	2,823.84	817.95	13.67	1,992
01/01/2026 - 31/12/2026	2,795.61	817.95	13.54	1,964
01/01/2027 - 31/12/2027	2,767.65	817.95	13.40	1,936
01/01/2028 - 31/12/2028	2,739.97	817.95	13.27	1,908
01/01/2029 - 30/09/2029	2,034.43	613.46	9.85	1,411
Total (tCO_2eq)	**19,623**	**5,726**	**95**	**13,802**
Number of Years	7 Years			
Average Per Year (tCO_2eq/year)	**2,803**	**818**	**14**	**1,971**

A3.2 Monitoring Plan

Energy Absolute Public Company Limited (EA) has appointed Business Development Manager – Battery Project to be responsible for gathering information prior to preparing for the annual report in order to submit the project developer to calculate the year's GHG emission reduction and to further develop a Monitoring Report with the collaboration of bus operation department of the e-bus operator.

The project's e-bus operator, which currently only consists of Thai Smile Bus Company Limited, has appointed the manager of the bus operation department to be responsible for planning and reviewing e-bus routes monthly. The manager should plan the number of e-buses and trips on each route to be sufficient and appropriate on weekdays and public holidays according to the plan and requirements from the passenger transport license. In addition, the manager shall gather and concluded required information including weekly and monthly frequency and continuity and examine the accuracy in order to report to the e-bus operator's executive board and to communicate the information with the Business Development Manager – Battery Project of Energy Absolute Company Limited as requested the information in each year.

List of required information for monitoring is as follows: and a brief explanation according to Table A16 and Figure A8 on the next page

Table A16: List of information for monitoring and person in charge

Monitoring parameters for Emission Reduction Calculation				
Name	**Data Source**	**Measurement Interval**	**Person In Charge (Position)**	**Ex-ante parameter source**
1. Electricity Consumption Record ($EC_{PJ,i,j,y}$ and $EC_{RE,PJ,i,j,y}$)	- Raw data from e-bus daily charging usage from public grid	Monthly, and summarize Annually	Bus Operation Manager or Assigned person	Confirmation letter from e-bus manufacturer with the average of power consumption ranged from 0.7 – 1.1 kWh/km, which is 0.9 kWh/km
	- Electricity bill from Metropolitan Electricity Authority, Provincial Electricity Authority, or	Monthly, and summarize Annually	Bus Operation Manager or Assigned person	
	- Raw data from e-bus daily charging usage from renewable energy sources that are known to have an emission factor of 0 tCO_2e/kWh	Monthly, and summarize Annually	Bus Operation Manager or Assigned person	
	- Power meter of electricity consumption from renewable sources from charging station operator that are known to have an emission factor of 0 tCO_2e/kWh	Monthly, and summarize Annually	Bus Operation Manager or Assigned person	
	- Evidence of renewable energy certificates, virtual power purchase agreement or peer to peer power purchase agreement	Monthly, and summarize Annually	Bus Operation Manager or Assigned person	
2. Number of e-bus ($N_{PJ,i,y}$)	- Record of number of e-bus operating each day, sorted by their routes and battery size (recorded for each bus)	Monthly, and summarize Annually	Bus Operation Manager or Assigned person	minimum-buses on the passenger transport license (e-buses are still being added from 2022 – mid 2023 according to the operation plan). Emission reduction from year 2022 – the end of Q1 2023 is assumed and estimated at half capacity comparing to the full operation as buses are continuously being included in the program and will reach full capacity at Q2 2023 based on the operational plan.
	- Bus operating plan for each month	Monthly, and summarize Annually	Bus Operation Manager	
	- Bus implementation plan for each month – if any changes occurred	Monthly, and summarize Annually	Bus Operation Manager	
3. Bus Trips and Distance ($L_{PJ,i,y}$)	- Record the number of trips that each e-bus has operated each day and clearly indicate the respective number of their e-bus route	Monthly, and summarize Annually	Bus Operation Manager	Minimum number of trips and distance of each route on the passenger transport license are used for estimation.
	- Record the mileage of the e-bus (to confirm the distance measured from GPS and/or compare with the distance stated in the passenger transport license	Monthly, and summarize Annually	Bus Operation Manager or Assigned person	
	- Distance detected through GPS in each day for each e-bus and the number of e-bus routes must be indicated clearly	Monthly, and summarize Annually	Bus Operation Manager or Assigned person	

4. Number of passengers traveling with e-bus ($PKM_{PJ,i,j,y}$)	- For e-ticket, record the distance and amount of passengers through e-bus ticket machine, or electronic card reader to report detailed information in a monthly basis	Annually	Bus Operation Manager or Assigned person	Initial sampling survey report from Thai smile bus which conducted based line study on 122 bus routes within the program from October 2021 – April 2022.
5. Portion of passenger shifting towards e-bus from different modes of transportation ($BSP_{x,y}$)	- Research report of public transport passenger who uses e-bus	Annually	Bus Operation Manager or Assigned person	Initial sampling survey report from Thai smile bus which conducted based line study on 122 bus routes within the program from October 2021 – April 2022.
6. Emission factor from transmission and distribution line for electricity users ($EF_{EC,y}$)	- Announcement from Thailand Green House Gas Management Organisation (https://ghgreduction.tgo.or.th/th/)	Annually	Project Activity Operator or CME to update reference value acknowledged by TGO	Grid emission factor refers to Thailand, published by TGO on 24/01/2022 (the latest version available at the time of writing). However, the update on the grid emission factor by TGO shall be considered.
7. Specific fuel consumption (SFC) of NGV buses	- Records of quantity of fuel consumption of the NGV buses in each monitoring period	Annually	Bus Operation Manager or Assigned person	The average the historical data is based on the data collection of 37 bus routes from other bus operator, Smart Bus Co.ltd. This approach complied with AMS.III-C section 5.4.4 option (4) b.
8. Emission factor of the passenger travelled by vehicle type ($EF_{PKM,x}$)	Emission factor of the passenger travelled with vehicle 'x'	Annually	Project Activity Operator or CME to update reference value acknowledged by TGO	Default value as per T-VER-METH-TM-06 ver.03

Other monitoring parameters

List	- Source	Measurement Interval	Person In Charge (Position)
9. Number of ICE buses in the public transport system of Bangkok and metropolitan area	- Record of number of registered vehicles in Bangkok metropolitan areas via transport statistics group of Department of Land Transport (https://web.dlt.go.th/statistics/)	Annually	- Bus Operation Manager or Assigned person
10. Validity of passenger transport licence	- Passenger transport license approved by DLT	Annually	- Bus Operation Manager or Assigned person
11. Technical improvement factor	- Technology improvement factor can be calculated based on country specific data, if available. - The default value from CDM-Tool 18 of the factor of 0.99 can be used in case of no available data from country specific data.	Annually	- Project Activity Operator or CME to provide research/study as reference acknowledged by TGO

12. SDG 8 – number of staff	- Record of number of employees of Thai Smile bus, and affiliated company that is involved in the program (e.g. staff member at charging station).	- Annually	- Bus Operation Manager or Assigned person
13. SDG 11 – ambient annual PM level in Bangkok Metropolitan	- Record of ambient annual means PM level in Bangkok Metropolitan from Air Quality and Noise Management Division Bangkok.	- Annually	- Project Activity Operator or CME
14. SDG 13 – quantity of emission reduction	- Amount of overall emission reduction quantified	- Annually	- Project Activity Operator or CME

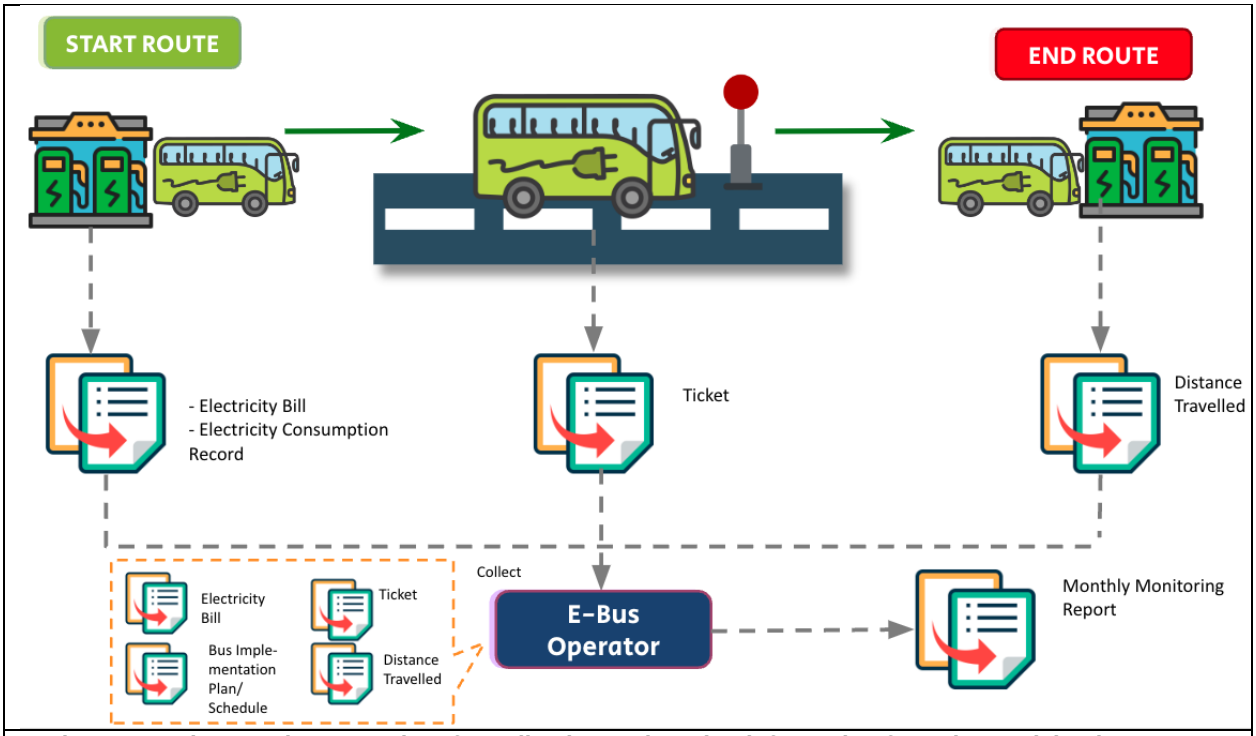


Figure A8: Chart stating procedure for collecting and storing information from the participating E-Bus Operators

Necessary information for monitoring CPA is as stated.

1. Electricity Consumption Record (kWh)
The bus operation manager or assigned person from the participating bus operators shall collect the record from two sources: a charging meter on a daily basis for each e-bus and an electricity bill from Metropolitan Electricity Authority, Provincial Electricity Authority where the charging station has been located or when charging station operator is in operation, the bill from the charging station operator can be used. In the situation where the charging station installs renewable energy, for instance solar cells, it shall be informed to Energy Absolute Public Company Limited and the project developer. Meters that are being used to record the electricity consumption from the charging station that will be used to calculate GHG emission reduction shall be verified and calibrated in the first year, and every 3 years during the project timeline

In the case that renewable energy source is installed at the charging station. The $EC_{RE,PJ,i,y}$ parameter is reflected upon the electricity meter at the charging station and the emission factor from renewable energy source shall equal to zero in the ex-post calculation. This is in accordance with CDM-ACM0002 "Grid-connected electricity generation from renewable sources" paragraph 31, states that most renewable energy power generation in project activities, PE_y = 0, except for biomass, geothermal power plant and from water reservoirs of hydro power plant. For implementing the energy consumption from renewable sources into the program, only renewable energy sources that are known to have 0 emission factor can be included. Supporting evidence regarding renewable energy consumption shall be provided during the monitoring period e.g. renewable energy certificates, virtual power purchase agreement or peer to peer power purchase agreement.

2. Amount of e-bus in each day sorted by their routes and battery size (recorded for each bus)
The bus operation manager or assigned person from the participating bus operators shall collect data of the actual bus plan schedule in a daily, weekly and monthly basis and compare with the planned schedule in the respective month, including the bus implementation plan if there are any changes. It will be used for the purpose of additional CPA inclusion in this PoA.

3. Bus Trips and Distance (km)
The bus operation manager or assigned person from the participating bus operators shall collect data of the number of trips and distanced from the e-bus mileage, and also distance detected through GPS in each

day for each e-bus as a summary in a daily, weekly and monthly basis sorted by the bus routes, where the e-bus routes must be indicated clearly.

4. Number of passengers traveling with e-bus (person-km/year)
The bus operation manager or assigned person from the participating bus operators records the distance and number of passengers through the e-bus ticket machine, or electronic card reader to report detailed information on a monthly basis. In the situation where a paper ticket is used, the paper ticket shall be collected each day and sorted by the price of each ticket and to be summarised on monthly basis. It will be used for calculating the amount of passenger travel in addition to the e-bus ticket information.

5. Portion of Passenger shifting towards e-bus from different modes of transportation
The bus operation manager or assigned person from the participating bus operators shall conduct research survey and create a report stating the information of the passenger who uses the e-bus annually via mechanical or digital survey. The basic goal of the survey is to identify the mode of transport used in absence of the project, as well as the kilometre travelled for each surveyed passenger. The survey design and questionnaire will follow appendix 4 and appendix 5 of CDM-ACM0031. The survey will also take into account of passengers who shifted from other mode of transportation and also passengers who shifted from non-motorised mode.

6. Emission factor from transmission and distribution line for electricity users (tCO_2/MWh)
Project Activity Operator or CME shall monitor the update of emission factors from the announcement in Thailand Greenhouse Gas Management (https://ghgreduction.tgo.or.th/th/). Grid emission factor in this programme refers to the Thailand Grid emission factor published by TGO on 24/01/2022 (the latest version available at the time of writing). Nonetheless, the latest update on the grid emission factor by TGO shall be considered for each monitoring period.

7. Specific fuel consumption ($SFC_{i,y}$) of ICE buses ($unit_{i,y}/km$)
The specific fuel consumption ($SFC_{i,y}$) in the ex-ante calculation derived from the average historical data is based on the data collection of 37 bus routes from other bus operator, Smart Bus Co., Ltd. The determination of $SFC_{i,y}$ parameter complied with specific fuel consumption determination according with the CDM-AMS-III.C version 16 paragraph 37 and 38. For each monitoring period, $SFC_{i,y}$ shall be monitored through the records data of the fuel consumption quantity of the ICE buses in Bangkok metropolitan area in each monitoring period divided by the overall monitored distance travelled of the ICE buses. For conservativeness, the NGV buses will be used to represent the monitored buses, as they contribute to lower emission reduction overall, and is considered common practice in Thailand. Moreover, the specific fuel consumption ($SFC_{i,y}$) could be determined using one of the options that mentioned in the CDM-AMS-III.C version 16, paragraph 32 to 39. This parameter will be used to multiply with the annual distance travelled of the baseline buses to calculate for the quantity of fuel consumption parameter, $FC_{BL,i,x}$ in formula 3 section 2.5.1 for ex-post calculation.

8. Emission factor of the passenger travelled by vehicle type ($EF_{PKM,x}$)
The emission factor of the passenger travelled by vehicle type update by TGO via the latest T-VER-METH-TM-06 shall be monitored by the Project Activity Operator or CME while constructing a monitoring report or ex-post calculation of emission reduction. The emission factor of the passenger travelled by vehicle type in the MADD refers to the default factor determined by TGO in T-VER-METH-TM-06 ver.03. Nonetheless, the latest update on the emission factor of the passenger travelled by vehicle type by TGO shall be considered for each monitoring period.

Other data parameters

9. Number of future buses to be included in the public transportation system in Thailand, Bangkok Metropolitan Region.
Refer to Annex 1 Part 1 Table A2 item 11 that requires participating bus operator to prove additionality on the CPA inclusion of the PoA1 and PoA2, the bus operation manager or assigned person from the participating bus operators shall monitor the total number of public buses in the public transport system.
The number of NGV buses in the public transportation system of Thailand, Bangkok Metropolitan Region to be used as a reference that it is still a common practice. This information infers that the number of electric buses has increased by more than the minimum number of vehicles under the license and would replace the ICE-buses that are expected to operate in that bus routes according to common practice analysis. This

information will be described in the additional part of each CPA according to the criteria for CPA inclusion, and in the annual monitoring report.

10. Validity of passenger transport licence

The validity of the passenger transport license shall be monitored by the bus operation manager via their data base platform. The license is valid for 7 years, and the approval/expiry date are varied for different routes. Therefore, the bus operation manager shall keep records of the validity of license every year. If there are any changes to the license permitted by DLT (e.g. restriction on type of public buses in Bangkok metropolitan areas, and/or changes in ticket price), the changes shall be notified in the monitoring report of the monitoring period where changes occur.

11. Technical improvement factor

The technology improvement factor for baseline vehicle is applied every year in both baseline emission calculation from fuel switch and modal shift activities which is mentioned in footnote 11 in formula 3 and footnote 16 in formula 6 in section 2.5.1.

Technology improvement factor can be calculated based on country specific data. If not available, the default value of the technology improvement factor for all baseline vehicle categories could be used 0.99, which complies with CDM-AMS-III.C and CDM-Tool 18.

12. SDG 8 number of staff

The number of staff operating the Bangkok e-bus Program by gender and wages for staff (e.g. bus driver and bus assistant) will be monitored by the Bus Operation Manager or Assigned person on a monthly basis. This is to illustrate the contribution to SDG target 8.5 where this program achieves productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.

13. SDG 11 – ambient annual PM level in Bangkok Metropolitan

The ambient of annual means level of PM in Bangkok Metropolitan area is monitored by Bus Operation Manager or Assigned person. The monitoring of air quality in the cities area is to illustrate the contribution to SDG target 11.6 where the program reduces the adverse per capita environmental impact of cities.

14. SDG 13 – quantity of emission reduction

The quantity of emission reduction is illustrated and monitor via monitoring report of the program by the Project Activity Operator or CME. The annual emission reduction of greenhouse gas is the contribution to SDG target 13.2 where the program integrates climate change measures in line with the national policies, strategies and planning.

Annex 2 – Authorisation of International Transfer Process

The process for the authorisation of international transfers is implemented in accordance with the procedures defined in the Bilateral Agreement as well as the relevant national regulation by ONEP and FOEN. This process needs to be integrated with the origination of mitigation outcomes under the T-VER standard. The integrated, two-track process is shown in the flowchart below. Figures and tables below show the complete process over the different phases and life-time of the mitigation activity as well as the detailed Authorisation Requirements of the Transferor and Acquirer.

Key points

- The Entity Authorised to Transfer (EA) appoints a validator that is mutually agreeable to ONEP, FOEN and TGO to validate - at the same time - the validation of the mitigation activity under the T-VER standard and the International Transfer Authorisation procedure.
- The Entity Authorised to Transfer (EA) appoints a verifier that is mutually agreeable to ONEP, FOEN and TGO to verify - at the same time - the origination of mitigation outcomes by the mitigation activity under the T-VER standard and the Authorisation Statement.
- The Thai international transfer authorisation requirements comprise a list of criteria that partially exceed the criteria formulated in the MADD. They are listed in the table below together with an explanation of how these requirements are met by the mitigation activity (more detail to be added as needed).

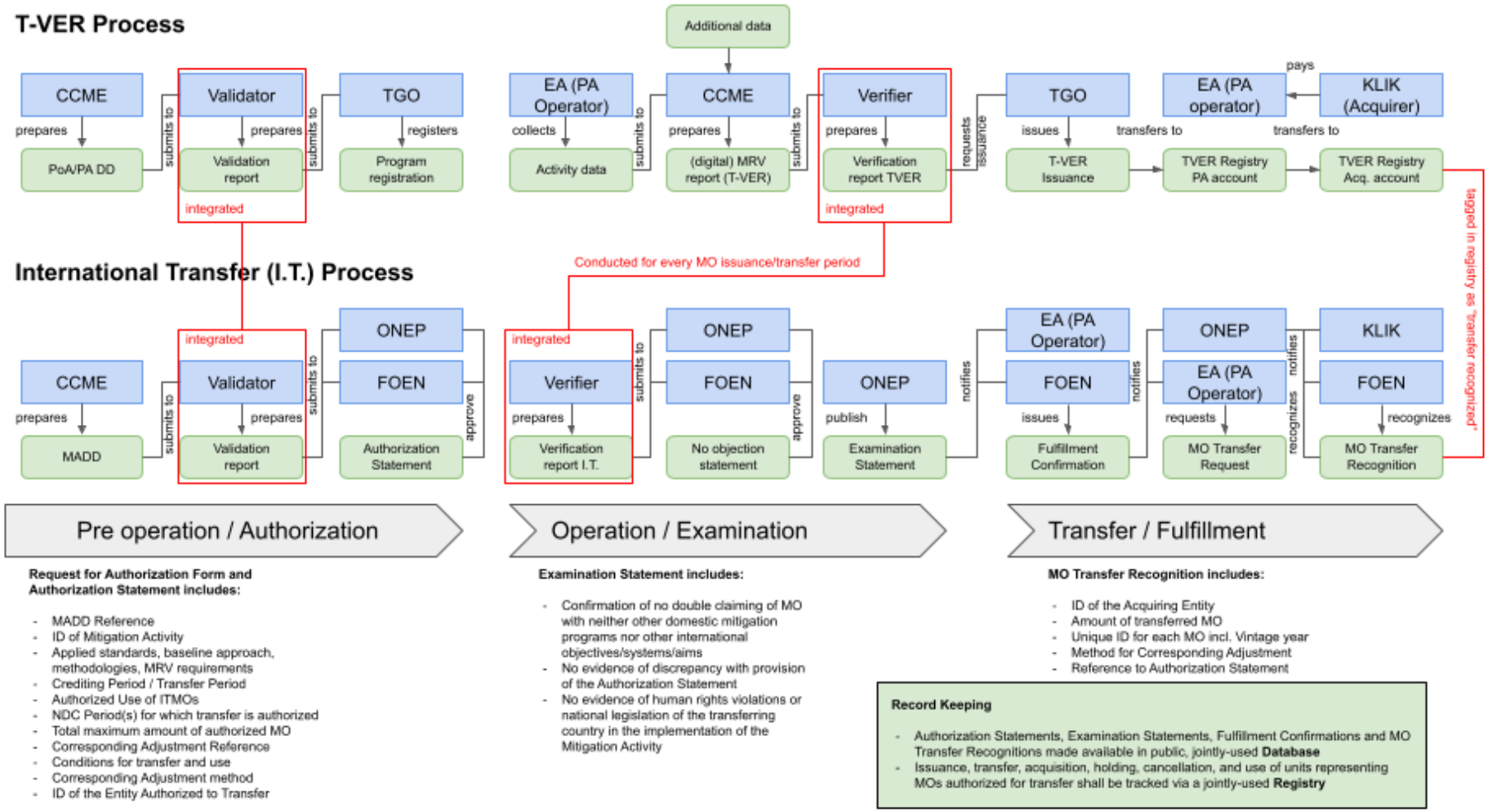


Figure A9: T-VER Issuance and Thailand - Switzerland Authorisation and Transfer Process

Table A17: Thailand Authorisation Criteria and their application to the project activity

(for future use as ONEP Authorisation Request Form)

Thailand Authorisation Criteria for International Transfers	How the Project Activity meets the authorisation criteria (either text of reference to MADD)
1. An identification of the Mitigation Activity from which the Mitigation Outcomes originate	Fully addressed in MADD section 1.2.1
2. A description of, inter alia, the applied standards, baseline approach, methodologies, and requirements for Monitoring and Verification Reports	Fully addressed in MADD section 2.5
3. The crediting period for the Mitigation Activity	● The crediting period needs to be separated from the MOPA contract and international transfer period under this MADD. ● The crediting period shall be established in accordance with TGO/T-VER rules (2 * 7 years). ● The contract & international transfer period shall be set in accordance with the NDC implementation period. ● The MOPA shall allow for an extension of the contract and transfer period if so decided when a subsequent NDC implementation period is agreed (but shall be limited by the crediting period of the project).
4. The authorised use of ITMOs	Further clarification regarding the corresponding adjustment with Switzerland is required; to be in line with the demonstration of compliance with Initial Report requirements of Article 6 Glasgow decision.
5. A description of the NDC implementation period(s) during which the ITMOs are authorised for transfer and use, as appropriate	The current NDC period ends on 31 Dec 2030. The purchase contract will only be for carbon credits generated before that date.
6. The total cumulative maximal amount, in absolute or relative terms, of Mitigation Outcomes for which transfer and use is authorised	This figure needs to be established in the MADD on the basis of the project roll out plan and subject to approval by the BA Parties.
7. A reference to the corresponding Authorisation of the other Party, where applicable	to be defined in a Template for Authorisation Request in accordance with ONEP regulation.
8. Any conditions or eligibility criteria for transfer and use of Mitigation Outcomes	to be defined in a Template for Authorisation Request in accordance with ONEP regulation.
9. The applicable method of corresponding adjustment	The transfer of these ITMO is then recognised via corresponding adjustment by the Parties in accordance with Art 6.2 Paris Agreement.

Table A18: Thailand Authorisation Process[32] (as per draft guidance)

Process & Requirement	Justification
1. The project activity shall result the GHG emission reduction from its source or increase the GHG sequestration which shall be additional from NDC roadmap of the country	The project is GHG reduction in public transportation which is operated by a private company in Bangkok is not in the work scope of OTP. Fully addressed in MADD section 2.1.2
2. The project activity shall promote the achievement of country NDC and Thailand's long-term low greenhouse gas emission development strategy: Thailand LTS	The project enhances the energy efficiency in the transportation sector and also promotes the achievement of NDC and LTS of the country. Fully addressed in MADD section 2.1.2
3. The project activity shall determine "fair share" by considering from the investment ratio or international regulation / conventional framework or other relevant regulations	The fair share of carbon credits generated by the project would be determined in line with investment ratio in which can be covered the financing gap between TCO of e-bus and the conventional bus. The additional financial support from the mitigation outcome purchase agreement shall be used to close the TOC gap, in which the value per each MO is identified in the contract agreement.
4. The project activity shall specify the crediting period of carbon credit no longer than the NDC implementation period	The crediting period covers the time frame of the first NDC which is not beyond 2030. Fully addressed in MADD section 2.2
5. The project activity shall contribute to the development innovation and high technology with high investment, and is involved with resources of carbon finance in reduction GHG emission from the project source or increase GHG sequestration	Section 2.4.8 of MADD mentioned that the project will enhance the technology transfer of public e-mobility.
6. The emission reduction from project shall be used for international purposes and shall be issued in the unit of tCO_2e	This is described in section 2.5 of MADD and refers to the T-VER methodology TM-05 ver.03 and TM-06 ver.03 which the outcome of emission reduction will be presented as the unit of ton carbon dioxide equivalent.
7. The project activity shall demonstrate the Environmental Integrity as below points. 7.1 The lower baseline scenario compared with the business as usual (BAU) 7.2 The GHG leakage emission 7.3 Risk reduction of non-permanent mitigation outcome 7.4 Transparency and Auditability	 7.1 The baseline scenario is determined lower than the BAU according to T-VER Methodology's requirements. This is fully addressed in MADD section 2.1.3 7.2 This is in line with the TM05 and TM06. Fully addressed in MADD section 2.5.2 7.3 Full addressed in MADD section 1.2.8. 7.4 This is indicated in section 2.5 of MADD - Determination, monitoring, and reporting of mitigation outcome
8. The project activity shall demonstrate the sustainable development 8.1 The project activity enhances SDG promotion	 8.1 Fully addressed in MADD section 2.4.2

[32] This is aligned with the coming regulation on the guidance and management mechanism of carbon credits in Thailand.

Process & Requirement	Justification
8.2 The project activity shall demonstrate mitigation measures for environment, economic and social aspects. This may include air quality, biodiversity and sustainable management of natural resources as well as social inequality, gender equality and discrimination to specific group of people in the basis of gender, nationality, or age if relevant	8.2 Fully addressed in MADD section 2.4.4 and 2.4.5
8.3 The project activity shall be conducted in line with the local regulation and requirements of national environmental legislation and any related international rule.	8.3 Fully addressed in MADD section 2.4.4 and 2.4.6
9. Other aspects (Ref: the application criteria of the international financial support on climate change). The project shall demonstrate as below	
9.1 Enhance the capacity of the economic system, society and environment of the country in order to ensure the climate resilience and to protect the system performance which can be restored to its original state immediately.	9.1 Fully addressed in MADD section 2.4.7
9.2 Scaling-up	9.2 This is not included in the MADD yet. The expansion of bus routes shall be eligible if received approval and permit for the passenger transport licence from DLT.
9.3 Investment promotion in the related activity and technology in the country	9.3 Fully addressed in MADD section 2.4.8
9.4 Enhance the capacity building in climate change area to relevant stakeholders until the end of the project	9.4 Full addressed in MADD Annex A Part A3, where capacity is enhanced through cooperation implementing the monitoring plan.

Annex 3 - Environmental and Social Management Framework (ESMF) assessment forms

Table A19: Assessment Form E-1: Initial assessment of project location sensitivity

Topic	Yes	No	Additional comments
Disaster Risk Location In the locations or adjacent areas that are at risk with disaster (flood, earthquake, landslide, broken dam, wildfire, chemical leakage).		X	Thailand has a peak monsoon season where rainfall can reach up to 500 mm/month.[33] The chance for flooding events cannot be excluded. However, flooding of project assets will not be harmful to the environment or users. Charging stations will have an automatic power cut-off in case of high water.
Valuable historic, archaeological and tourist site In the locations or adjacent areas that are valuable for religion, history, archaeology, or tourist and aesthetic; community location valuable to its ethnic group.		X	Charging stations will be located at strategic locations near parking lots and commercial/industrial areas. No negative aesthetic effects are expected to impact valuable historic or cultural sites.
Wildlife habitat and forest In the locations or nearby areas to a wildlife sanctuary, community forest, conservation area or important natural habitation area, migratory routes of birds and wildlife, etc.		X	The Bangkok e-bus Program focuses primarily on urban areas and will be far removed from wildlife habitat and forests.
Water source In a location of or nearby to water source (i.e., for consumption and agricultural purpose).		X	Bangkok e-bus Program activities are not related to water sources.
Impact sensitivity location In a location or nearby where there is an environmental impact sensitivity, i.e., temple, hospital, dense housing, etc.		X	EV's will operate instead of existing ICE vehicles. No additional negative impact on the environment is expected from the operation of Bangkok e-bus Program.

(Source: Environmental and Social Management Framework of Greenhouse Gas Mitigation Project, TGO, 2020)

Following the Assessment form E1, under Environmental and Social Impact Screening, no negative impact to the project location is identified.
The Bangkok e-bus Program shall adhere to the following laws[34]:

- Fuel Control Act, B.E. 1999 (2542) - Department of Energy Business, Ministry of Energy.
  - Electricity used as a transport fuel.[35]
- ERC Code of Practice: Solar for electricity - Energy Regulatory Commission (ERC).[36]
  - Solar-charged battery charging stations.
- Waste Management Law - Pollution Control Department, Ministry of Industrial works.[37]
  - Battery disposal.

[33] Source: https://journals.sagepub.com/doi/pdf/10.1177/0975425317748532

[34] Derived from Environmental and Social Management Framework of Greenhouse Gas Mitigation Project, TGO, 2020

[35] Source: http://elaw.doeb.go.th/document_doeb/EN/627_0001.pdf (Thai) / http://elaw.doeb.go.th/document_doeb/EN/627_0001.pdf (English)

[36] Source: http://www.erc.or.th/ERCWeb2/Front/StaticPage/StaticPage.aspx?p=295&Tag=%E0%B8%9B%E0%B8%A3%E0%B8%B0%E0%B8%A1%E0%B8%A7%E0%B8%A5&muid=24&prid=199

[37] Source: http://www.ratchakitcha.soc.go.th/DATA/PDF/2562/A/056/T_0231.PDF

Table A20-: Assessment Form E-2: Initial Environmental Impact Likelihood and Severity

Impact occurrence probability	Impact severity level				Additional remarks
	No impact	Less impact	Medium impact	High impact	
Physical resources					
Water pollution occurrence	**X**				
Soil pollution occurrence	**X**				
Air pollution occurrence	**X**				
Noise pollution occurrence	**X**				No negative additional impact. EV technology provides noise reduction compared to baseline alternative.
Odour pollution occurrence	**X**				
Soil erosion, coastal/river bank erosion occurrence	**X**				
Waste					
Increase of general waste	**X**				
Increase of toxic waste, i.e., contaminated waste from oil, chemicals, electronics and used oil, etc.			**X**		End-of-life batteries are considered chemical waste. Increased electric vehicle use, will eventually increase the number of disposed batteries. Proper battery disposal facilities and waste management practices are essential.
Increase of infectious waste	**X**				

Increase of electronics waste		**X**			A disposed electric vehicle is not considered electronic waste, but certain electronic parts will need to be disposed in a specific disposal facility.
Bio-resources					
Forest area/land use change	**X**				
Land and wildlife ecosystem loss	**X**				
Water and aquatic animal ecosystem loss	**X**				
Human utilisation					
Flood, drainage obstruction or waterway change	**X**				
Change in water utilisation	**X**				
Land occupation change	**X**				No significant land occupation changes from charge station infrastructure. Charging stations are small and additional to existing parking space or commercial land use.
Quality of life					
Cause damage to the value of religion, antique, ancient monument and tourism	**X**				
Others	**X**				

(Source: Environmental and Social Management Framework of Greenhouse Gas Mitigation Project, TGO, 2020)

Table A21: Assessment Form E-3: Initial Social Impact Likelihood and Severity

Impact occurrence probability	Impact severity level				Additional remarks
	No impact	Less impact	Medium impact	High impact	
Public safety	X				
Health impact	X				No negative impact. Positive co-benefits are high (see form E-6).
Immigration or temporary/permanent land loss	X				
Income/occupation loss		X			Loss to ICE bus repair and maintenance services. Minimal impact from Bangkok e-bus Program activities, as the EV buses also require a certain level of servicing.
Impact on public utility, i.e., electricity, telephone				X	Increased electricity demand from battery charging.
Traffic impact				X	The activity has a high POSITIVE impact on the existing traffic flow. The project will facilitate better integration with other forms of mass transit, such as electric boats, MRT and BTS.
Community conflict impact	X				
Employment and workforce impact		X			The activity provides co-benefits in terms of new employment opportunities (see form E-6).
Race, religion and ethnic group impact	X				

(Source: Environmental and Social Management Framework of Greenhouse Gas Mitigation Project, TGO, 2020)

Table A22: Assessment Form E-4: Selection of Environmental and Social Impact Mitigation Management Tools

Project impact level	Criteria, procedures/practices
• Projects with no impact.	• Immediate action.
• Projects with less/medium impact. • Projects that may affect environmental/social sensitivity areas as stated in Assessment form E-1.	• Implementation in accordance with measures related to Environmental Codes of Practices (ECOP).
• Projects that are in the scope of Initial Environmental Evaluation Report (IEE).	• IEE reporting.
• Project with high impact that needs an EIA report by law.	• EIA reporting.
• Projects with severe impact where the measures for safeguard, reduction and appropriate compensation cannot be determined. • Project being contrary to law and government procedures	• Not considered for embedding in a greenhouse gas abatement plan.

Note: An ECOP is a standard not enforced by law but rather used as a general practical guideline commonly acceptable and in line with the law.

(Source: Environmental and Social Management Framework of Greenhouse Gas Mitigation Project, TGO, 2020)

Bangkok e-bus Program activities are expected to drive up market demand for a publicly accepted transport mode and will operate under the existing transport and energy laws of Thailand. No negative environmental impacts are expected and therefore immediate action is possible.

Table A23: Assessment Form E-5: Co-benefits checklist form

Indicator	Co-benefit list	Supportive view
Criteria 1 - Waste management		
1.1 Campaign on waste reduction, separation and usage	❑ Having co-benefits ❑ Waste disposal system. ❑ Others (if any) ❑ No co-benefits	Batteries from EV's (1) have a second life potential for different use cases and (2) can be refurbished into new batteries. At the same time, lower maintenance from EV compared to ICE reduces the waste from (engine) oils and rotating vehicle parts.
1.2 Greenhouse gas emission reduction from usage of organic waste product	❑ Having co-benefits ❑ Encouragement of waste processing and usage. ❑ Others (if any) ❑ No co-benefits	

Criteria 2 - Wastewater management		
2.1 Water quality analysis	❑ Having co-benefits ❑ Water quality testing from water sources at least once every three months. ❑ Others (if any) ❑ No co-benefit	
2.2 Water quality control and conservation	❑ Having co-benefits ❑ Reduce contamination flow into water sources, compared to the base year/before the project, such as: ❑ Heavy metal ❑ Pesticides ❑ Other toxins ❑ Nitrate ❑ Others (if any) ❑ No co-benefits	
Criteria 3 - Entire environmental quality enhancement of community/environmental pollution mitigation		
3.1 Increase aesthetic value to the community	❑ Having co-benefits ❑ Promote tree plantation in natural areas, crops should be planted and be compatible with the former ecosystem of the area(s). ❑ Others (if any) ❑ No co-benefits	
3.2 Air pollution mitigation	❑ Having co-benefits ❑ No air (local) pollution occurrence compared to the base year.	Removal of local tailpipe emissions will improve local air quality and reduce dangerous PM2.5 particles in the air. Reducing ICE vehicle will reduce the contribution of combustion engines

	❑ Help mitigate air pollution compared to the base year ❑ () SO2 ❑ () NOx as NO2 ❑ () TSP ❑ () CO ❑ Others: reduction of the urban heat island effect. ❑ No co-benefits	to the urban heat island effect by almost 3ºC and make cities in tropical Thailand more liveable.
3.3 Disturbed ordour mitigation	❑ Having co-benefits ❑ Help mitigate disturbed order, compared to the base year. ❑ Others (if any) ❑ No co-benefits	
3.4 Water pollution mitigation	❑ Having co-benefits ❑ Do not discharge nor reduce effluent discharge of the project, compared to the base year/prior to the project. ❑ Wastewater passing the effluents standard can be used outside the project compounds. ❑ Others (if any) ❑ No co-benefits	
3.5 Soil contamination and pollution reduction	❑ Having co-benefits ❑ Help reduce toxic chemicals contamination into soil as compared to the base year/prior to the project. ❑ Heavy metal ❑ Pesticides	

	❑ Other toxins ❑ Others (if any) ❑ No co-benefits	

(Source: Environmental and Social Management Framework of Greenhouse Gas Mitigation Project, TGO, 2020)

Table A24: Assessment Form E-6: Social co-benefits checklist form

Indicator	Co-benefit list	Supportive view
Criteria 4 - Enhancement of health and safety of urban community		
4.1 Project management regarding community health promotion	❑ Having co-benefits ❑ Enhancement of green space and big tree conservation in the area(s). ❑ Others (if any) ❑ No co-benefits	Improvement of community health through better air quality and reduced urban heat stress. Presence of EV's increases awareness of a clean alternative to the combustion engine vehicles.
4.2 Enhancement of community sanitation in the projects and surrounding areas	❑ Having co-benefits ❑ Enhancement of community sanitation in the project area. ❑ Others (if any) ❑ No co-benefits	
Criteria 5 - Job creation and poverty alleviation		
5.1 Encouragement of urban income in the project areas	❑ Having co-benefits ❑ New or part-time job creation. ❑ Others: increased income for low-income households. ❑ No co-benefits	Increased income generation for bus operators, due to lower fuel and maintenance costs of EV compared to ICE vehicle. Creation of new jobs in vehicle assembly, charging station installation, solar installation and the operating and maintenance of vehicles, infrastructure and charging services.
5.2 Technological development and its access	❑ Having co-benefits ❑ Technology development and	Bangkok e-bus Program will be a stimulus for EV charging infrastructure development and local EV assembly in Thailand. This will

	its access with plans/activities for the development access. ❑ Others (if any) ❑ No co-benefits	stimulate knowledge development on EV manufacturing, infrastructure planning and electric grid stabilisation/smart charging.
Criteria 6 - Community participation		
6.1 Participation process of people in communities	❑ Having co-benefits ❑ Communities get access to information through various channels and participate in sharing comments on the start-to-end project implementation. ❑ Information disclosure/receipt of and response to complaints from the public in a systematic way. ❑ Others (if any) ❑ No co-benefits	Passengers are reached via fleet operators. Fleet operators will actively communicate with the passenger community during the Bangkok e-bus Program and will set-up feedback sessions via the mobile application that passengers can use to plan their routes and track the bus location in real-time.
6.2 Enhancement of community grouping/inter-community networking	❑ Having co-benefits ❑ Community grouping or networking occurred from the project. ❑ Others (if any) ❑ No co-benefits	Bangkok e-bus Program actively brings together a network of fleet aggregators/fleet operators, charge point operators, vehicle manufacturers, financing facilities and government institutions to set up project activities.
Criteria 7 - Enhancement of knowledge and understanding of climate change		
7.1 Creation/enhancement of potential in responding to climate change	❑ Having co-benefits ❑ Activities to enhance the potential for climate change response. ❑ Others (if any) ❑ No co-benefits	The Bangkok e-bus Program will speed up the transition from ICE vehicles to EV's, in turn causing lower fossil fuel consumption, lower GHG emissions and lower heat emissions in urban areas. The switch to battery charging as a transport fuel also allows for better integration of renewable energy sources in the electricity grid.

Criteria 8 - Women, children and disabled organisation potential development		
8.1 Potential development of women/children and disabled people in the urban area, including migrant workers	❑ Having co-benefits ❑ Enhancement of women organisation potential. ❑ Others (if any) ❑ No co-benefits	
8.2 Development of quality of life of people with disabilities	❑ Having co-benefits ❑ Plan to support expenditure to empower people who are in poverty and with disabilities. ❑ Others (if any) ❑ No co-benefits	
Criteria 9 - Support for social and cultural development, and sufficient economy philosophy		
9.1 Support activities for social and cultural development, and sufficiency economy philosophy	❑ Having co-benefits ❑ Sufficiency economy philosophy in accordance with its definition and CSR standard. ❑ Others (if any) ❑ No co-benefits	
Criteria 10 - Enhancement of energy security		
10.1 Energy conservation promotion	❑ Having co-benefits ❑ Energy consumption reduction by replacing with energy efficient equipment and electric appliances. ❑ Bio-diesel production from waste cooking oil in urban workplaces. ❑ Others (if any) ❑ No co-benefits	Batteries charged with renewable energy will be eligible for additional carbon finance, because the energy source also reduces emissions compared to the baseline energy source (grid power). This will incentivise the charge point operators to partner with clean energy providers. Also, electric vehicles are more energy efficient than combustion engine vehicles, as no energy is wasted on heat generation and less energy is spent on the transportation of fuels.

(Source: Environmental and Social Management Framework of Greenhouse Gas Mitigation Project, TGO, 2020)

Table of abbreviations

BA	Bilateral Agreement
BAU	business-as-usual
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
ECOP	Environmental Codes of Practices
EIA	Environmental Impact Assessment Report
ESMF	Environmental and Social Management Framework
EVs	Electric Vehicles
FOEN	Federal Office for the Environment
GHG	greenhouse gas
ICE	internal combustion engine
IEE	Initial Environmental Evaluation Report
ITMOs	International Transferred Mitigation Outcomes
MADD	Mitigation Activity Design Document
MO	Mitigation Outcome
MOPA	Mitigation Outcome Purchase Agreement
NCCC	National Climate Change Committee
NDC	Nationally determined contributions
NGV	Natural Gas Vehicle
ONEP	The Office of Natural Resources and Environmental Policy and Planning (Thailand)
OTP	The Office of Transport and Traffic Policy and Planning (Thailand)
PoA	Programme of Activities
SEC	The Securities and Exchange Commission
T-VER	Thailand Voluntary Emission Reduction Program
TVERs	Carbon credit certified by TGO under the scheme called Thailand Voluntary Emission Reduction, or T-VER.
TCO	total cost of ownership
TGO	Thailand Greenhouse Gas Management Organisation
TS	Term Sheet