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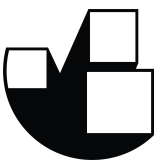
Business Model and Financial Analysis for Transjakarta Electric Bus Deployment

Supporting Jakarta's Transition to E-mobility

March 2021



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1. Executive Summary

The business model for electric buses would have significant differences compared to conventional buses. Transjakarta should adjust the model accordingly so they would not face any major problems relating to the costs, including capital cost, operational cost, maintenance cost, etc.

In Transjakarta's current business model, the GoJ has an essential role in delivering bus services to the public. The government would provide a subsidy called Public Service Obligation (PSO) as a financing support for Transjakarta. In return, the GoJ would receive a periodic report from Transjakarta consisting of the level of service achievement, financial, and management aspects of bus services.

The new model should give more flexibility to Transjakarta and share responsibilities to other parties. In this document, the list of business model options are defined as follow:

1. Battery Leasing Model
2. Bus Leasing Model
3. Financial Lease Arrangement
4. Utility Ownership of Charging Infrastructure
5. Energy/Transportation as a service
6. Outright Purchase with Existing Funds or Grants
7. Outright Purchase with Market or Concessional Loans

2. Introduction

Electric buses have local environmental benefit, which has incentivized cities to transition their fleets from diesel to electric. However, the issue of high upfront cost of electric buses delays this implementation process. Therefore, having a contracting and financing mechanism which address the high upfront issues could help accelerate the electric bus adoption.

Therefore creating a proper business model for electric bus operation of Transjakarta is important to provide a smooth transition to electric buses from conventional buses. Business model would include certain responsibilities for each stakeholder involved. The financial flow is also part of the business model to understand the role of each stakeholder providing services and payment.

3. Business Model

2.1 Current Business Model for Conventional Bus

The existing business model of Transjakarta consists of several stakeholders involved in the system. These stakeholders are the Government of Jakarta (GoJ), bus manufacturers, bus operators, passengers, and Transjakarta itself. Each stakeholder would have a role both in the service flow and the cash flow based on their responsibilities.

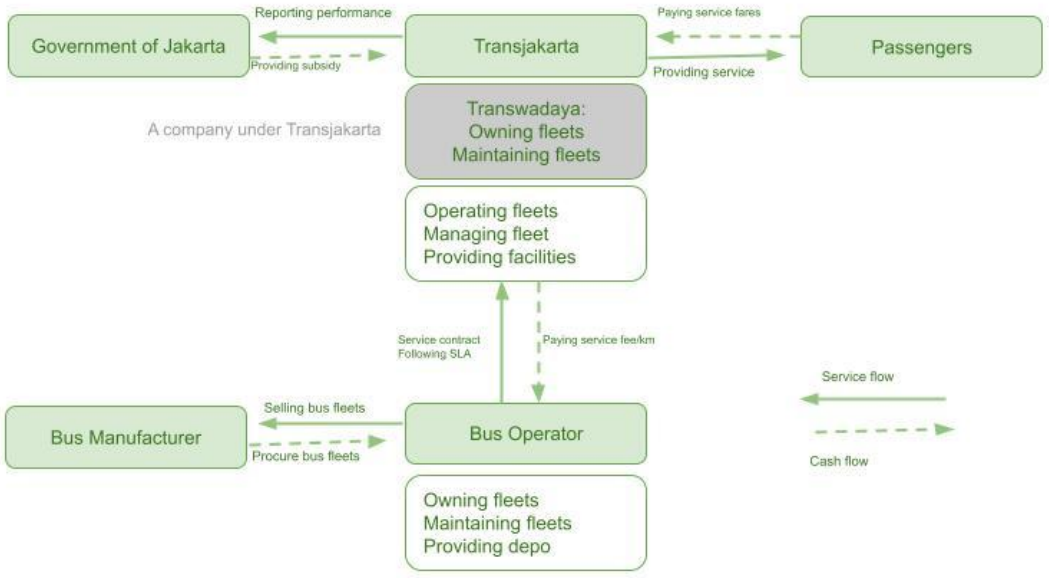

Figure 1: Current Transjakarta's Business Model

In the current business model, the GoJ has an essential role in delivering bus services to the public. The government would provide a subsidy called Public Service Obligation (PSO) as a financing support for Transjakarta. In return, the GoJ would receive a periodic report from Transjakarta consisting of the level of service achievement, financial, and management aspects of bus services.

On the other hand, Transjakarta has a multiple role in delivering services with numerous responsibilities. In general, Transjakarta would have a managing role in fleet operational and management across bus services. Transjakarta ensures that the passengers will be provided with high quality service of the public transportation system.

Other than operating and managing the fleets, Transjakarta also owns the fleet and provides operational services to the passengers via self-operation named Transwadaya. Transjakarta also maintains the buses operated by itself using their own resources, such as maintenance depot and maintenance team. In addition to fleet management and operations, Transjakarta has a provision in bus facilities, such as depot area, maintenance area, and bus parking area.

However, Transjakarta as the autonomous statutory agency to plan, manage, and control the delivery of bus services across the Jakarta bus rapid transit (BRT) network has the service contract agreement with the bus operators, through fees/km payment. The contract between Transjakarta and the operator is a performance-based contract, which requires operators to provide service according to Transjakarta standard. During a transition period, however, negotiated contracts will be awarded on the basis of negotiation with the existing operator. All of the ticket revenue is collected by Transjakarta.

2.2 Business Model for the Implementation of 100 Electric Buses

To start the deployment of electric buses, Transjakarta plans to deploy 100 e-buses this year as a pilot basis. In the business model of this pilot e-buses, similar to conventional diesel buses, the operator is responsible to procure and maintain electric buses. The operator also needs to provide charging infrastructure and depot. Bus operators should follow the service level agreement (SLA) set by Transjakarta and get the payment in form of service fee per kilometer travelled in return.

Besides the high upfront cost of its electric buses, the fee/km of electric buses is higher compared to diesel buses because based on Transjakarta own estimate price, the electric buses fee/km calculation is also included the cost of investment of electrical network installation in depo and additional land required for charging installation.

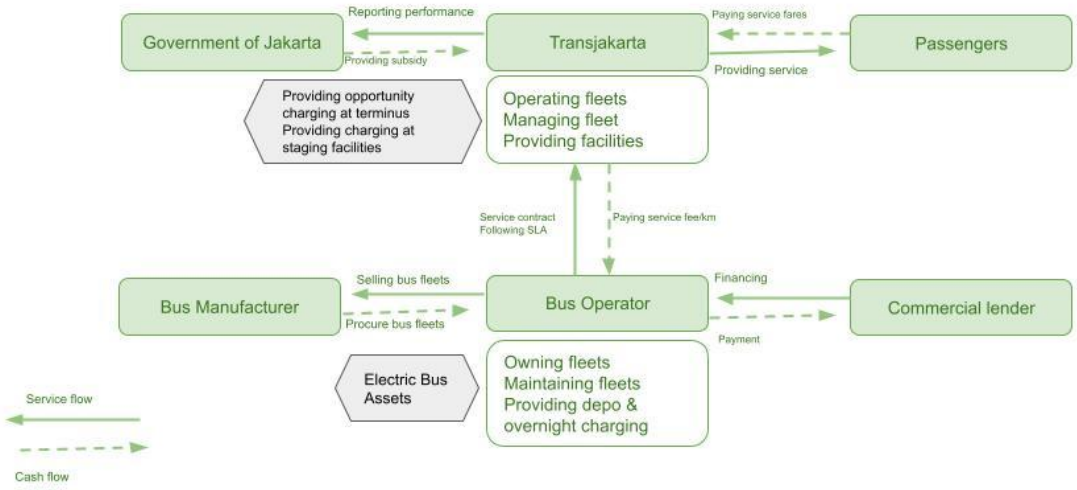

Figure 2: Business Model for Transjakarta's E-Bus Pilot Project

2.3 Benchmarking of Business Model for Electric Bus Adoption around The World

As transit agencies around the world are transitioning to electric buses, they have adjusted their business models to accommodate. Highlighting examples from other electric bus deployments can give inputs for the business model Transjakarta adopts. Any transit agency business model has several different components and involves several different entities. To keep the discussion on business models straightforward, we have grouped business models into four categories focused on the acquisition of e-buses and related infrastructure. Each of the transit agencies featured have unique business models, so diagrams of the full ecosystem of entities involved and their relationships to each other have been included where available. A table with high-level pros and cons of each business model follows the examples, and here again it should be noted that the pros and cons will be more detailed and nuanced based on an understanding of all components of the business model being implemented.

2.3.1 Battery Leasing Model

Many transit agencies seeking to transform their fleets to electric are purchasing buses upfront and leasing the batteries, particularly since battery technology is changing rapidly and batteries are likely to need to be replaced before the end of the bus's useful life. This model reduces upfront capital expenses and has the lessee maintain responsibility for battery performance. However, splitting ownership between the bus and the battery can add contracting complexity. Examples of this model include:

- **Park City Transit in Utah, United States**: In 2017, Park City Transit obtained grants from the federal government worth $4.4 million (across two years) to deploy Proterra electric buses. Park City Transit entered a battery lease agreement with Proterra, through which Park City Transit owns the electric buses, charging infrastructure, depot, and storage sites while Proterra owns and services the batteries on the bus. A pre-final lease agreement specified a term of 12 years and that Proterra guaranteed its batteries would operate at above 70% of their original nameplate capacities. It also specified that the bus batteries must be maintained between 20% and 90% state of charge at all times, with some exceptions.[1]
- **Tianjin and Qingdao, China**: Approximately 7000 electric buses in Tianjin and Qingdao operate using a battery leasing and swapping model. Under this model, operators lease battery packs from the Lishen Battery Company and pay the company an energy use fee. This fee is established by estimating the cost of operating an equivalent conventional bus.[2]

2.3.2 Bus Leasing Model

Leasing electric buses (in cases where grants are not easily available) can appeal to transit agencies given their higher upfront costs compared to diesel buses. Similar to the battery leasing model, this approach reduces technological and financial risk for the transit agency. Examples of this model include:

- **Metbus in Santiago, Chile**: Metbus is a private bus operator that operates and maintains buses as part of the public transport system in Santiago, known as RED (previously known as Transantiago). To acquire electric buses, Metbus partnered with Enel X (utility company) and BYD (bus manufacturer). Enel X owns the charging infrastructure and BYD buses, which are leased to Metbus under a 10 year leasing contract. Maintenance of the electric bus engines and batteries are coordinated between Metbus and BYD. The business model used in this case is shown in Figure 3.[3] In addition to the arrangement for leasing buses, the business model used in Santiago separates ownership of the buses from their operation and maintenance. Private fleet provider companies provide buses through a leasing contract to public transport operators, and the buses are paid for by the public transport authority. In addition,

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1 https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/18464/The%20U.S.%20Electric%20Bus%20Transition%20-%20An%20Analysis%20of%20Funding%20and%20Financing%20Mechanisms.pdf?sequence=1&isAllowed=y

2 https://www.sciencedirect.com/science/article/abs/pii/S0360544219304888

3 https://www.c40knowledgehub.org/s/article/Metbus-pioneering-e-bus-deployments-in-Santiago?language=en_US, https://www.c40knowledgehub.org/s/article/From-Pilots-to-Scale-Lessons-from-Electric-Bus-Deployments-in-Santiago-de-Chile?language=en_US

bids for the bus fleet provider tender are evaluated based on bus total cost of ownership, which can favor e-buses over diesel buses.[4]

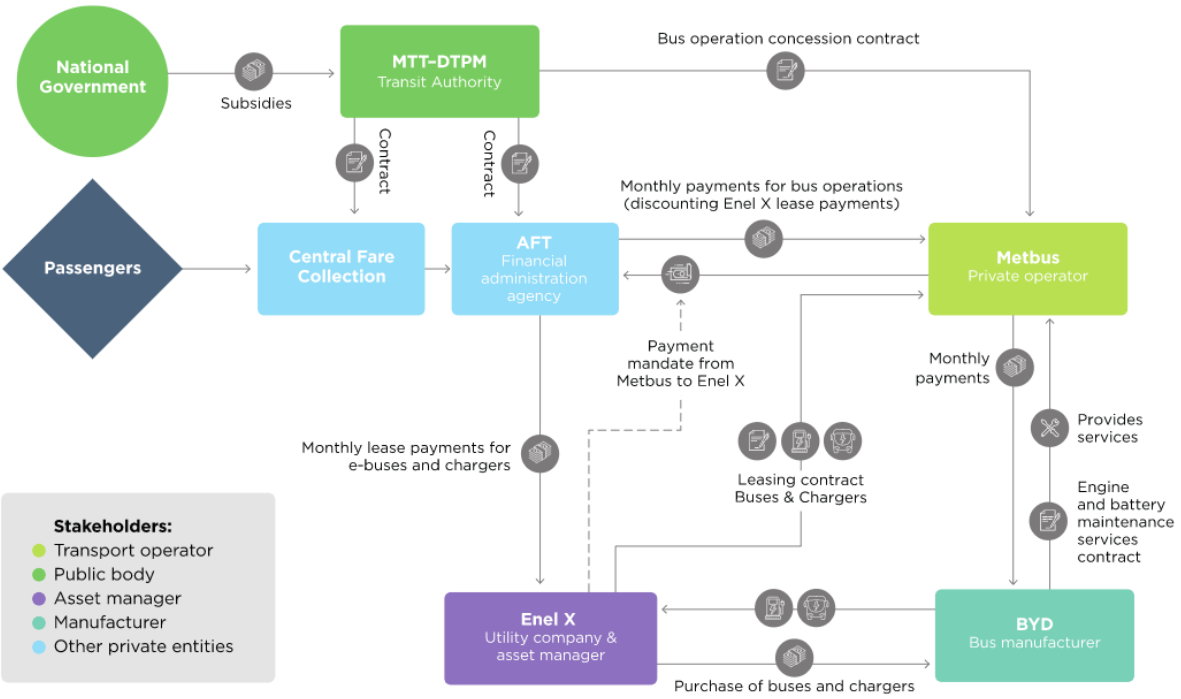

Figure 3: Metbus's Business Model (Santiago)

- **Bogotá, Colombia**: In Bogotá, electric bus fleet purchase is kept separate from fleet operation. In December 2020, BYD delivered more than 450 electric buses to Bogotá. The buses were purchased by Celsisa, Colombia's bus procurement company, are owned by a utility, and leased to a local bus operator. Construction and installation of the charging stations, as well as the electricity supply, are provided by the utility.[5] Another interesting innovation in Bogotá is that the manufacturer of the buses provided training to the bus operators' technicians and a longer-than-usual

4 https://www.c40knowledgehub.org/s/article/How-we-made-e-bus-a-reality-in-Santiago-Chile?language=en_US

5 https://blogs.iadb.org/sostenibilidad/en/bogota-is-a-pioneer-in-acquiring-electric-buses-by-tender/, https://www.businesswire.com/news/home/20201222005415/en/BYD-Delivers-Largest-Pure-Electric-Bus-Fleet-in-Colombia, https://www.sustainable-bus.com/electric-bus/bogota-enel-x-electric-buses-electroterminals/

maintenance contract (five years) with the expectation that the operator technicians will no longer need external training support after that time.

2.3.3. Financial lease arrangement.

There are multiple types of financial lease arrangements, including direct leasing, after-sales leasing, and entrusted leasing. This scheme is similar to a loan, and often involves multiple stakeholders in the arrangement. This differs from the bus or battery lease, as another stakeholder with capital for purchase leases to the operators in this arrangement. Often, the financial leasing company purchases only the buses (not batteries) and leases the fleet to the bus operator, who pays the lease for a set time. The bus operator pays both the initial cost and interest on the buses, while the financial leasing company is guaranteed interest over time

2.3.4 Utility Ownership of Charging Infrastructure

Some transit agencies may not want to be responsible for owning and operating charging infrastructure. Utility companies are a key stakeholder to engage for electric bus deployments given their expertise in electric infrastructure, and could have a vested interest in owning and operating charging infrastructure if they can charge consumers electricity tariffs to make up for the capital investment. This type of model allows entities to focus on their areas of expertise (utilities on electric infrastructure and transit agencies on bus service). However, directly having the utility manage all aspects of the charging infrastructure can result in objections from non-utility installers for reducing competition. since An example of this model is:

- **Tri-Met in Oregon, United States**: Tri-Met applied for a grant from the federal government to purchase electric buses but did not want to own and operate charging infrastructure. Tri-Met approached the local utility (PG&E) for financial assistance with the charging infrastructure. PG&E set forth a plan that was approved and included building, owning, and operating Tri-Met's bus depot charging infrastructure and an on-route charger. PG&E is allowed to rate-base its investments at a 9.5% return on equity.[6]

Short of utilities owning and installing charging infrastructure, there are examples of them assuming certain risks on behalf of the transit agency. In Gothenburg, Sweden for example, the utility company (Gothenburg Energy) paid for investments in electric infrastructure, including an electric substation adaptation and bus chargers. Another example of utility company involvement is Foothill Transit in California, United States, where the utility company (Southern

6 https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/18464/The%20U.S.%20Electric%20Bus%20Transition%20-%20An%20Analysis%20of%20Funding%20and%20Financing%20Mechanisms.pdf?sequence=1&isAllowed=y

California Edison) provided a demand surcharge waiver for buses that were being recharged at peak times, therefore taking the risk of changes in the cost of electricity.

2.3.5 Energy/Transportation-as-a-Service

Energy/transportation-as-a-Service business models shift the administrative burden associated with infrastructure investments and charging away from the transit agency and offer a simple revenue model, such as cost per mile, cost per kilowatt hour, or tariffs on utility bills. This model would allow the transit agency to focus on its core duties while spreading the cost premium associated with electric buses over the bus lifetime. However, this model was established for energy efficiency upgrades for buildings and has not been proven in the transportation sector. Although not actively in use at any transit agencies, one example of this model is:

- **Pay As You Save (PAYS)**: Under the PAYS model, the transit agency purchases electric buses from a manufacturer, investing only the equivalent amount it would for diesel buses. Meanwhile, the utility finances the bus batteries and charging infrastructure, charging the transit agency a fixed monthly payment which is capped at a level below the estimated savings (relative to the cost of diesel fuel for a diesel bus). A depiction of this model is shown in Figure 4.[7] This model was assessed for the transit agency GoTriangle in North Carolina, United States and for bus electrification in Lima, Peru. The analysis conducted for Lima resulted in a revision of the model to include additional elements and stakeholders to be taken into account, as shown in Figure 5.

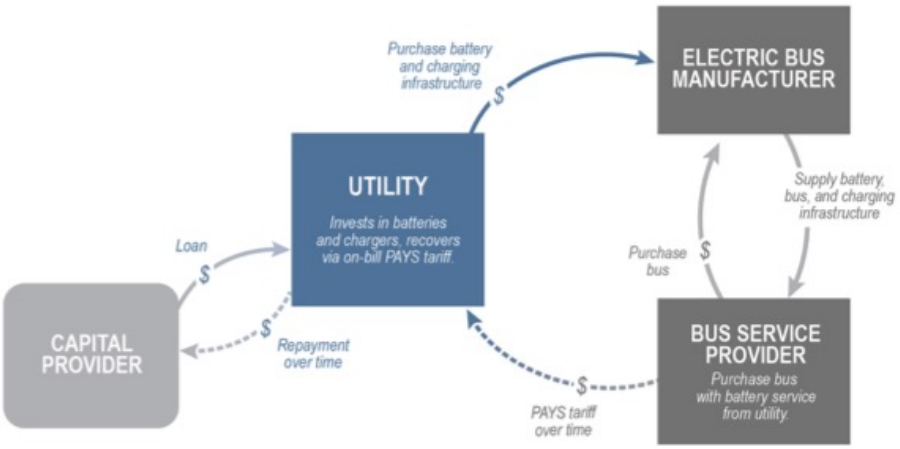

Figure 4: PAYS Model

[7] https://www.cleanenergyworks.org/clean-transit/

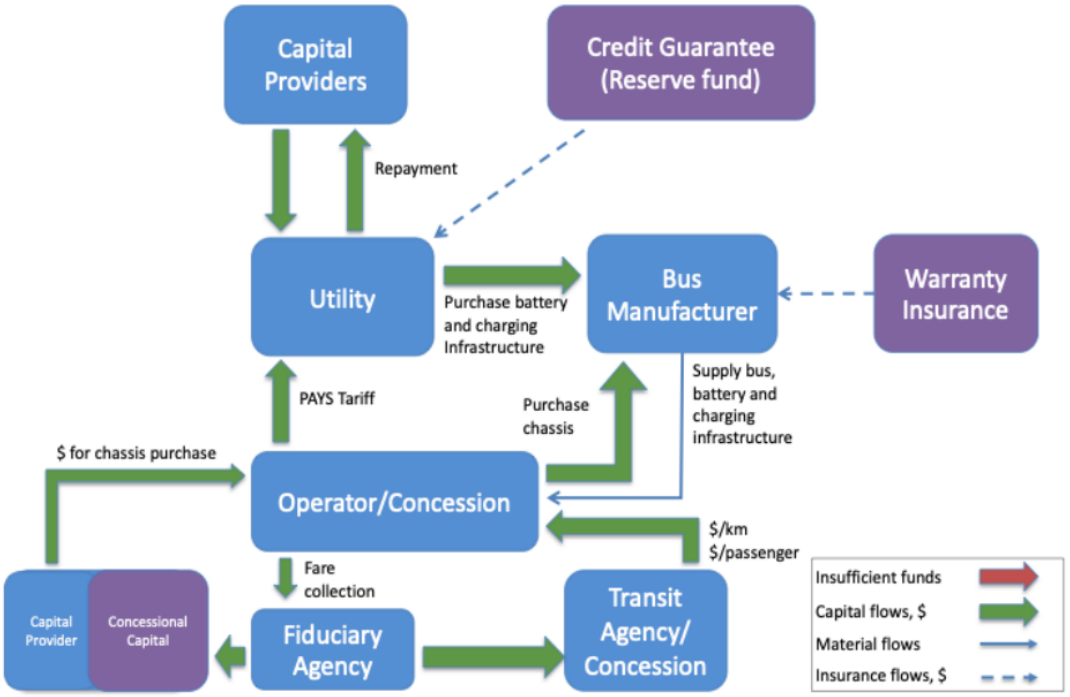

Figure 5: E-bus Business Model in Lima, Peru

2.3.6 Outright purchase with existing funds or grants.

In this scheme, the public transportation agency/operator takes on the entirety of financial costs, through direct budgets or with grants. Upfront purchases from public budgets are relatively common in Europe and the United States. However, in regions with limited funds, this option is often rendered infeasible.

2.3.7 Outright purchase with market or concessional loans.

In this scheme, the public transportation agency utilizes flexible loans for upfront and/or operational costs, repaying lender(s) over a given time period. Lenders may include development banks or international environment funds, such as the Green Climate Fund or the Global Environmental Facility, who are motivated to reach urban development and climate change goals

2.4 Business Model for Electric Bus

Table 1 below describes the pros and cons of the business models.

Table 1: Pros and cons of the business model

Business Model of E-buses	Pros	Cons
Transjakarta E-Bus Pilot Business Model	• Shift responsibility of depo charging infrastructure and e-fleet investment from Transjakarta • Transjakarta does not have responsibility for equipment-end-of-life	• It would have been very difficult or expensive for the operator to finance the purchase of the fleet and infrastructure • High upfront capital cost for electric buses procured by the bus operator could lead monopoly of the operator because the barrier of entry would be very high • Adds to operational budget and increase subsidy for Transjakarta
Battery Leasing Model	• Reduces upfront capital expenses • Lessee maintains responsibility for battery performance • Lessee responsible for equipment end-of-life	• Splitting ownership between the bus and battery can add contracting complexity • Adds to operational budget
Bus Leasing Model	• Reduces upfront capital expenses • Lessee maintains responsibility for bus performance • Lessee responsible for equipment end-of-life	• Adds to operational budget
Utility Ownership of Charging Infrastructure	• Shifts responsibility of charging investment and infrastructure away from transit agency • Reduces upfront capital expenses • Specialization of companies involved	• May result in criticism for reducing competition
Energy/Transportation-as-a-Service	• Shifts responsibility of charging investment and infrastructure away from transit agency • Spreads e-bus cost premium over bus lifecycle	• Model has not been implemented in the transportation sector • Could add contractual complexity
Outright Purchase with Existing Funds or Grants	• Easy to be implemented • Simple business and	• All of the risks taken from the government side

	contracting mechanism	• Not feasible for local government with low fiscal capacity
Outright Purchase with Market or Concessional Loans	• Funding options for local government with low fiscal capacity • Having a comprehensive plan for project deliverable as usually requested by lender	• All of the risks taken from the government side

Despite the pros and cons of the business model presented above; the acquisition of buses and also charging infrastructure will be a major factor in delivering the electric buses since it may need a huge investment. Currently, for the pilot phase to share the investment risk, Transhajarta bus operators own the fleet and charging infrastructure at the depo while the government will provide the charging infrastructure needed during the operational hours. That being said, for the larger deployment, Transjakarta should be aware of the financial capacity of operators to procure the bus since operators may find it difficult to prepare massive capital investments. Therefore, the government should prepare more incentive packages for operators to reduce the capital expenditure of operators, such as tax reduction and administrative fee exemptions. While it may not lower the cost in a significant way, it is a good starting point to invite more operators to invest in electric buses.