Transformative Urban Mobility Initiative

Picture: Pedro Bastos, C40 Cities

CASE STUDY

The Bogotá's business model for deploying electric buses

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E-Bus Mission

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The Bogotá's business model for deploying electric buses

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Sobre

This case study is part of a trilogy of analyses on the strategy taken by the city of Bogotá as a mentor city for the Transformative Urban Mobility Initiative (TUMI) in deploying electric buses in the following themes: technological advancement (with the detail of pilot tests and routes for electric buses); business models (the present document; raising the overall innovations enforced and governance established for making electric buses feasibly purchasing); recharge infrastructure (offering how to provide infrastructure and restore energy considering technical and regulatory issues)[1].

Content

1. Introduction

Bogotá has taken a significant step towards reducing urban emissions by introducing electric buses into its Bus Rapid Transit system. Since 2019, Bogotá has deployed 1,485 electric buses within the Integrated Public Transport System (SITP). This move is a commendable effort towards improving air quality in the city by decreasing PM10, CO2, and NOX emissions over the last decade.

It was a significant challenge to find a business model suitable for the operational and financial complexities required by the electric fleets. In other words, conventional business models typically

[1] Review and comments on this document by Samantha Pettigrew (ICCT), Gabriela de la Torre Ríos, and Rafael Muñoz (WRI) are gratefully acknowledged.

used for diesel-powered buses could be risky due to the higher upfront costs of electric buses, hence the need to develop a tailored strategy for battery-electric vehicles.

In the face of this context, the city of Bogotá has successfully executed the use of electric buses in its public transport system. Interestingly, they did so by segregating asset ownership, which led to positive externalities and acceptance between all the parties involved. This business model proved viable and successful results, making Bogotá a standout city in Latin America and a mentor city for the TUMI E-Bus Mission Initiative.

In this study case, we aim to delve into the experience of deploying electric buses in Bogotá, specifically within the SITP system. The SITP, managed by TransMilenio, is responsible for integrating various transportation services in the city, including zonal, special, cable car, and BRT. The city's BRT corridor, commonly referred to as TransMilenio, is a crucial component of the city's transportation network.

This case study is structured in four parts. The first part provides a contextualization of the city's business model. In the second part, we delve into the adaptation process that Bogotá underwent to acquire electric buses. The third part outlines some preliminary results, and the fourth and final parts present our conclusions and reflections.

2. Conceptualization

When designing a business model for electric buses, it's essential to consider all the investment components, resource funds, financial products, and delivery mechanisms necessary to make it financially achievable. By evaluating the technical feasibility of tangible and intangible assets, we can determine the best way to afford the components needed for implementation. Additionally, it's crucial to secure non-reimbursable resources to support the project, as well as third-party financial products that can help with amortization. Finally, contractual, legal, and commercial relationships must be established to distribute responsibility, manage risk, and align the interests of all involved parties. With a well-designed business model, implementing electric buses can be easier to make financially feasible and thus beneficial for all involved[2].

When structuring a business model, one of the key goals is to ensure that it creates, delivers, and captures value for society. This is especially true in the case of electric buses, where a well-planned business model can help shape positive externalities that contribute to improved air quality, reduced greenhouse gas emissions, green jobs, and greater ridership satisfaction. Moreover, these intangible assets can also be monetized, making it a win-win situation for all parties involved.

[2] "MODELO DE NEGÓCIOS PARA ADOÇÃO DE ÔNIBUS ELÉTRICOS," WRI Brasil, May 9, 2018, https://antigo.mdr.gov.br/images/stories/ArquivosSEMOB/ArquivosPDF/eficiencia/eletromobilidade/Modelodenegociosparaadocaodeonibuseletricos.pdf.

To overcome the financial barriers and uncertainties surrounding the operation of e-buses, it is advisable to create a competitive business model that involves all essential players. In Colombia, for instance, a regular electric bus cost between US $370,000 and $425,000 in 2019, three times higher than the purchase price of a diesel-powered bus. Even though electric buses can decrease the cost per kilometer by up to 31%, the exorbitant initial cost poses a challenge to their widespread use.[3].

To create a sustainable and profitable business model, it's crucial to carefully evaluate all expenses and factors involved in owning and operating vehicles. Put it, Bogotá has faced a significant hurdle in creating a successful model that makes sense for the city's unique context as they strive to ensure that the total ownership cost stands equal to or lower than that of diesel-powered vehicles.

3. The Bogotá's innovative model

Bogotá has been exploring various business models that could help them achieve the targets set out in the Nationally Determined Contributions (NDC) of the Paris Agreement and improve air quality[4]. Therefore, the city has focused on ensuring electric buses could be as competitive as diesel fleets in their TransMilenio system.

Previously, the way buses worked was that operators had to acquire and run the vehicles under the watchful eye of TransMilenio. TransMilenio was responsible for boosting rapid transit infrastructure and completing the planning process. In addition, fare collection was essential to cover capital investments, operational expenses, and maintenance costs. There was just one legal entity responsible for providing and operating the fleet, and their remuneration relied on the variable costs incurred per kilometer traveled[5].

One of the strategies that Bogotá employed to mitigate initial financial risks and uncertainties was to segregate responsibilities through separate ownership. This approach enabled the city to leverage the expertise performance, and financial capacity of operators, bus manufacturers, and energy providers. Moreover, the asset ownership model ensured service quality was balanced with the city's fiscal feasibility and financial sustainability for operators. As a result, Bogotá overcame financial barriers by allowing more prominent investors with greater investment capacity to support the funding scheme without burdening the operators. Since 2019, Bogotá has enforced various

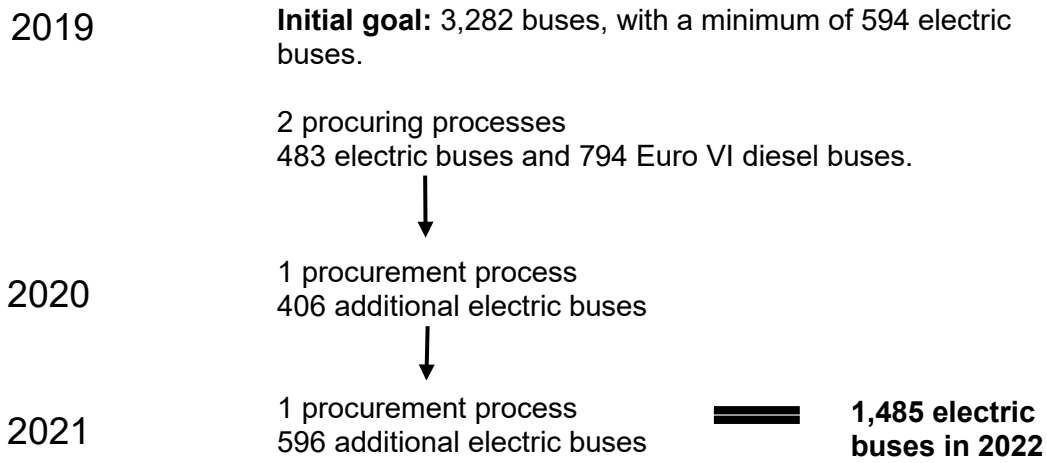
[3] Lefevre, Benoit, et al. "Bogotá Es Pionera En Adquirir Buses Eléctricos Por Licitación." Sostenibilidad, April 10, 2020. https://blogs.iadb.org/sostenibilidad/es/bogota-es-pionera-en-adquirir-buses-electricos-por-licitacion/.

[4] Política para el Mejoramiento de la Calidad del Aire (acto 3943, del Consejo Nacional de Política Económica y Social), entre otros.

[5] Sclar, Ryan, Emmert Werthmann, Jone Orbea, et al.. "THE FUTURE OF URBAN MOBILITY: THE CASE FOR ELECTRIC BUS DEPLOYMENT IN BOGOTÁ, COLOMBIA," 2018. https://urbantransitions.global/wp-content/uploads/2020/04/The_Future_of_Urban_Mobility_web_FINAL.pdf.

business models throughout different bidding phases to cater to each situation. These changes have been effective, and Figure 1 showcases how they unfolded.

Figure 1: Electric bus acquisition process in Bogotá.



Source: adapted from M. Fernanda Ortiz[6].

In 2019, Bogotá utilized the first model for kicking off electric buses, establishing three separate contracts. The first contract was for a direct lease, which included the supply of recharge infrastructure. The other two arrangements were for concession purposes, with one responsible for providing the e-buses and the other for operating them. These contracts resulted from extensive dialogue between all interested parties, including the electricity supplier.

The following models generated new contracts to negotiate electric buses in late 2019 and early 2020. First, the city opted to modify concession contracts enforced with operators instead of carrying out a tender, replacing diesel-powered buses with battery-electric ones. This choice led to introducing of a new player, the charging infrastructure provider, picking a lease model to make battery charging feasible. The model assumed a comprehensive concession contract with the operator, which now supplies and operates the electric fleet, and a direct lease contract with the electricity supply infrastructure provider.

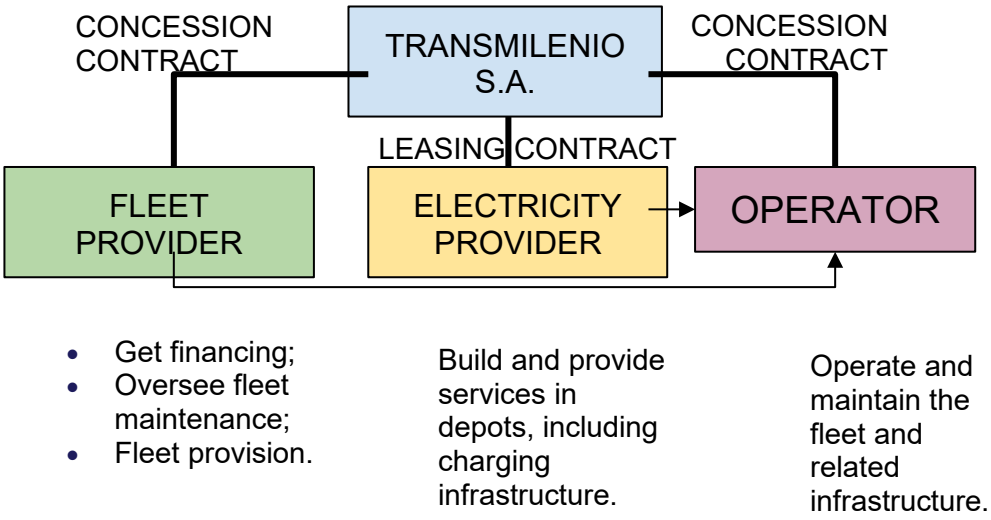
[6] Ortiz, Maria Fernanda. "E-Mobility - Bogotá's Case Study by María Fernanda Ortiz Carrascal," May 21, 25AD. https://www.slideshare.net/emmaline742/emobility-bogots-case-study-by-mara-fernanda-ortiz-carrascal.

Figure 2: View of the *La Rolita* depot with vertical-structured plug-in charging infrastructure for e-buses.

Source: Pedro Bastos, C40 Cities, Feb. 2023.

With the third model, Bogotá established two concession contracts in January 2021 to acquire electric buses. This innovative approach involved one agent providing all necessary assets (such as buses and charging infrastructure) while another handled operation and maintenance. Again, the city's goal was to streamline the process and promote a sustainable community transportation system.

Figure 3: The business model chosen by Bogotá for deploying electric buses.



Source: adapted from M. Fernanda Ortiz[7].

Therefore, private fleet providers own e-buses while TransMilenio pays for their use and the operator's services within the SITP. This model is flexible enough for TransMilenio to replace operators if they do not fulfil the requirements for excellent service. In addition, the model helps avoid bus disruption and unavailability, thus not affecting the operation demand.

By signing contracts directly with the managing public entity, TransMilenio, fleet providers carry lower financial risks. In other words, TransMilenio guarantees to pay off debts with the support of the city's fiscal support. TransMilenio also maintains separate accounts for remunerating each operator, allowing each player to carry out tasks only within their area of expertise. For instance, operators can continue to drive buses, while the charging infrastructure providers are usually electricity supply companies partnering with manufacturers.

This way, financial risks for the fleet provider are lower since the contract is signed directly with the managing public entity, TransMilenio, which guarantees to pay debts off with the support of the city's fiscal support. In addition, TransMilenio also maintains separate accounts for remunerating each operator. This way, the actors involved carry out tasks only within their area of expertise. In other words, an operator continues to drive buses, while the charging infrastructure providers are usually electricity supply companies partnering with manufacturers.

[7] Ortiz, Maria Fernanda. "E-Mobility - Bogotá's Case Study by María Fernanda Ortiz Carrascal," May 21, 25AD. https://www.slideshare.net/emmaline742/emobility-bogots-case-study-by-mara-fernanda-ortiz-carrascal

It's worth noting that the extension of concession contracts was another crucial factor in deploying electric buses. To ensure that the investment in battery-electric vehicles could be financially viable, the city changed the period contract terms from an average of over 20 years to 10 years for Euro VI and 15 years for battery-electric vehicles. Again, such a change reflects the initiative to tackle the higher upfront investment required for battery-electric vehicles, as previously mentioned.

By opting for a monthly payment plan for electricity, the high initial costs are spread out evenly over the contract term, resulting in a well-distributed total cost of ownership. This approach ensures that the system costs are manageable, making it possible to achieve electrification without increasing fares[8][9]. However, it is essential to note that while electric buses may not yet be as cost-competitive as their diesel counterparts, this approach still makes it feasible to implement electrification.

It's worth noting that the arrival of e-buses in TransMilenio coincided with the COVID-19 pandemic, which caused a decrease in ridership from 2.4 million people daily to 1 million on the TransMilenio system. Decreased ridership led to increased operation expenditures and public subsidies transferred to afford the system. Higher upfront costs of electric buses challenged the city's role in making electromobility manageable since the system needed broader financial support to run beyond a technological advancement. On the other hand, it did not prevent Bogotá from remaining to subsidize TransMilenio. Since 2012, Bogotá has funded 25% of the technical fare, making buses accessible for those who rely on public transport to get around. The city also changed the remuneration model. Previously, the model was associated with variable costs per km driven and fleet size. Therefore, with the contractual changes, remuneration became subject to the vehicle's availability to run and provide public transportation service.

4. Findings

In 2022, Bogotá could finally operate 1,485 electric buses thanks to the undertaking of various models in recent years. The main achievements that have been documented include:[10]:

- Service continuity: With the asset ownership model in place, service continuity is ensured even during contingencies. This is because the model allows for a seamless transition between operators without disrupting the fleet's operations. Should the need arise, another operator can quickly take over the driving duties without the need for renegotiating contracts for vehicle provision. This ensures the fleet keeps running smoothly, without hiccups or delays.

[8] Lefevre, Benoit, et al. "Bogotá Es Pionera En Adquirir Buses Eléctricos Por Licitación." Sostenibilidad, April 10, 2020. https://blogs.iadb.org/sostenibilidad/es/bogota-es-pionera-en-adquirir-buses-electricos-por-licitacion/.
[9] Olivera, Manuel, "How E-Buses Took off in Latin America to Save Lives, CO2 and Money," IGI Global, 2022, https://www.igi-global.com/gateway/chapter/296231.
[10] Idem.

- Bankability: the division of risks by breaking up operation and provision contract makes obtaining loans to renew the fleet easier. Financial institutions can be valuable partners for businesses looking to invest in their operations.
- Efficiency: Thanks to the separation of responsibilities and the role of public policies and regulatory frameworks in prioritizing public transport, Bogotá achieved greater efficiency in its operations. This has helped them reduce the city's environmental impact and provided a better experience for Bogotan users.

When creating a successful business model, one of the most important factors to consider is how it can contribute to society. For example, according to data from TransMilenio[11], implementing a certain number of buses in circulation can greatly impact CO2 emissions. In fact, by doing so, it's possible to avoid up to 94.3 thousand tons of CO2 emissions each year, equivalent to the emissions produced by 42,000 private cars over the same period.

Figure 4: Melissa Díaz, La Rolita's driver.

Source: Pedro Bastos, C40 Cities, Feb. 2023.

[11] TransMilenio. "Para finales de este año, Bogotá tendrá la flota eléctrica más grande del mundo, superada solo por China," February 14, 2022. https://www.transmilenio.gov.co/publicaciones/152658/para-finales-de-este-ano-bogota-tendra-la-flota-electrica-mas-grande-del-mundo-superada-solo-por-china/.

Not only does implementing this type of model positively impact the environment, but it can also create new job opportunities. For example, the entry into the operation of 172 electric buses in February 2022 has led to the creation of 502 green jobs directly through the operation's concessionaire. So, not only is this type of business model beneficial for society as a whole, but it can also help to create a more sustainable and prosperous economy.

Therefore, electric buses promote the Colombian national industry and create job opportunities through contractors and suppliers. For instance, 172 buses' bodies were assembled locally, employing more than 1,400 individuals, including 165 females. Furthermore, users have expressed their positive opinion due to the high quality of zero-emission buses. This has encouraged the city to continue its efforts to transition to zero emissions in public transport completely[12].

It's also noteworthy that Bogotá focuses on gender equality through the Eco-Driving program, a joint initiative of the District Mobility Secretariat and the Women District Secretariat (Secretaria Distrital de la Mujer). Thanks to the financing of international cooperating companies, such as TUMI E-bus Mission and C40 Cities, a group of women have been selected to learn how to drive electric buses run by the District Transport Operator/La Rolita - the first public operator of the SITP. Over half of the workforce in La Rolita comprises women in 2023. This is such an important achievement for social inclusion, especially considering how male-dominated this sector has been in Latin America.

5. Conclusions

The article showed how Bogotá has been able to successfully implement and maintain electric buses in its TransMilenio system. One of the key factors behind this achievement was the city's access to political and institutional support. As a result, Bogotá has become a leading example in Latin America and the world for its commitment to transitioning to a large-scale zero-emission fleet, which aligns with international climate mitigation commitments.

It's worth noting that this success can be attributed to a combination of factors, including the city's innovative business model, which has allowed for structural changes towards new zero-emission technologies. Despite higher initial costs, the long-term positive results and impacts of this approach have been evident.

Moreover, the contractual separation of responsibilities has provided valuable information for other governments and entities seeking to enable electric buses on a larger scale.

On the other hand, cities willing to learn from the Colombian experience should bear in mind that Bogotá's business model is not unique and depends on specific context factors such as public sector fiscal capacity, technology players/suppliers availability, regulations, and previous policies.

[12] Idem.

Therefore, these factors must be considered when structuring a new business model for electromobility projects in public transport.

Thank you from our TUMI E-Bus Mission Partners: