FINANCIAL MECHANISMS for Electric Bus Adoption

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Published by:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

CHANGING TRANSPORT
Facilitating climate actions in mobility

On behalf of:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

1. Introduction

Bus fleet modernization, irrespective of the technology considered, goes in hand with considerable funding needs and is usually linked to several financing instruments and stakeholders. In most cases, diesel and CNG buses are currently funded through a combination of equity and loans. Whereas for the electrification of bus fleets, conventional financing schemes may be insufficient both in developing and industrialized countries due to the high upfront costs, mainly due to the battery, requiring thus innovative instruments, a more effective distribution of risks, and coordination between key stakeholders.

Beyond pilot projects, full in-house funding of electric buses is not suitable for operators, given the high upfront cost incremental compared to fossil technologies, the often times loss-making public transport and the concentration of risks in the hands of the operators. Especially the inability and/or reluctance to assume the high upfront costs of electric buses, lack of access to finance (due to insufficient commercial revenue, unsustainable business models, low recovery ratios, among others), and the predominance of CapEx considerations rather than lower operating costs of electric buses in relation to conventional bus technologies hamper their deployment. Scalability problems, inexistent support infrastructure (such as charging and maintenance facilities) and limited knowledge about the benefits and operation of electric buses are additional deterrents for fleet electrification.

Local public authorities can compel or incentivize fleet operators to electrify their fleets through several means, such as introducing such requirements in their service contracts (e.g. minimum quotas of electric vehicles), enacting specific policies aimed at the electrification of public transport, through the provision of financial support and benefits, among others. National governments can, in turn, support and/or require local governments to electrify their public transport fleets through the enactment of national laws and regulations (e.g. fuel efficiency standards) and financial support.

- In Colombia, Law No. 1964 of 2019 introduced an increasing quota of electric and low emission vehicles of all vehicles procured for public transport operations. This target applies to the municipalities with more than 250.000 inhabitants, starts with 10% in 2025 and grows to 100% in 2035. For this purpose, the new National Development Plan allows a cofinancing of rolling stock for these technologies of up to 70% with federal funds.
- The Senate of the city of Hamburg, Germany, passed a resolution in 2017 requiring public transport operators to purchase only zero-emission (i.e. fuel cell and electric) buses from 2020, with the ultimate goal of full electrification by 2030.
- In London, UK, the Ultra Low Emission Zone provided an additional incentive for the public transport operators to accelerate the electrification of their bus fleets.

A study by the World Resources Institute, however, argues that "many cities have difficulty acquiring e-buses using conventional procurement models since current contracting models do not consider the unique cost structure of e-buses (…) [C]ontracting models need to find ways to meet the high capital investment and maintenance responsibilities and overcome the risks associated with their adoption" (Sclar et al. 2019, 46). This also hints to the fact that goal setting at the local and national level is not sufficient to promote market uptake if not backed with additional financial instruments and incentives.

The aim of this document is thus to shed light on those financial mechanisms found in Table 1 that can be made available to operators in order to facilitate the electrification of their fleets.

Table 1: Overview of financial mechanisms

Category	Examples

Non-reimbursable funds	▪ Grants
	  ▪ Capital expenditure grants
	  ▪ Operational expenditure grants
	  ▪ Research and development grants
	▪ Public transportation budgets
	▪ Farebox revenue
	▪ Advertising revenue
	▪ Bus scrappage payments
	▪ Tax breaks
	  ▪ Value added tax
	  ▪ Import duties
	  ▪ Payroll tax
	  ▪ Environmental impact tax

Investment capital	▪ Loans
	  ▪ Market loans
	  ▪ Concessional loans
	▪ Green bonds

Legal arrangements	▪ Leasing (Bus, batteries)
	  ▪ Lease purchase contracts
	  ▪ Pay-as-you-save (PAYS)
	▪ Concessions
	▪ Public procurement contracts
	▪ Advertising contracts
	▪ Risk cover instruments, guarantees
	  ▪ Financial guarantees
	  ▪ Operational guarantees

Source: Li et al. (2018)

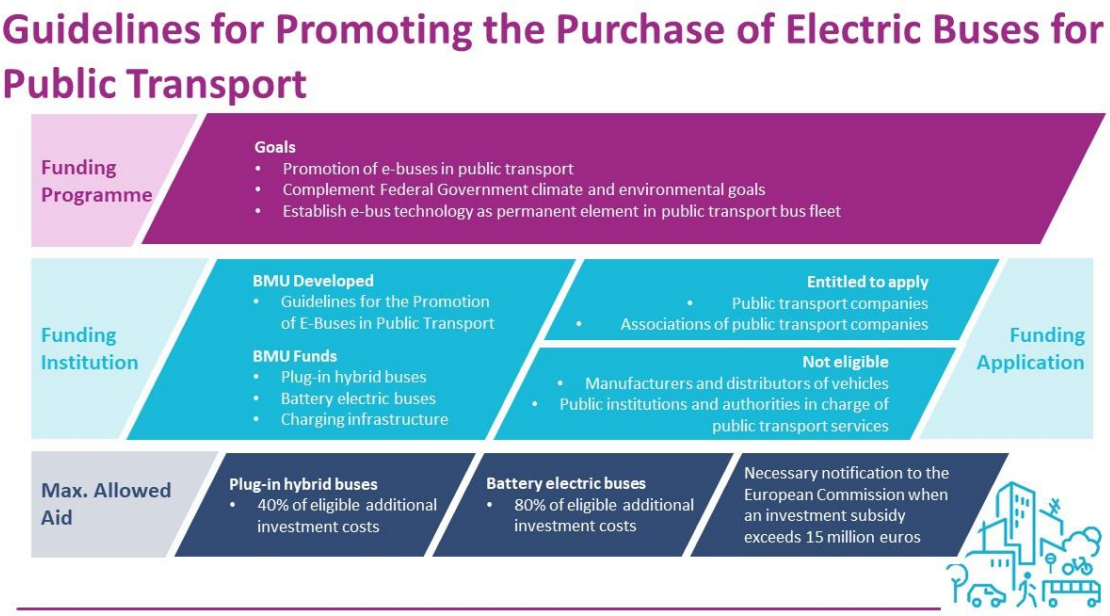
2. Grants

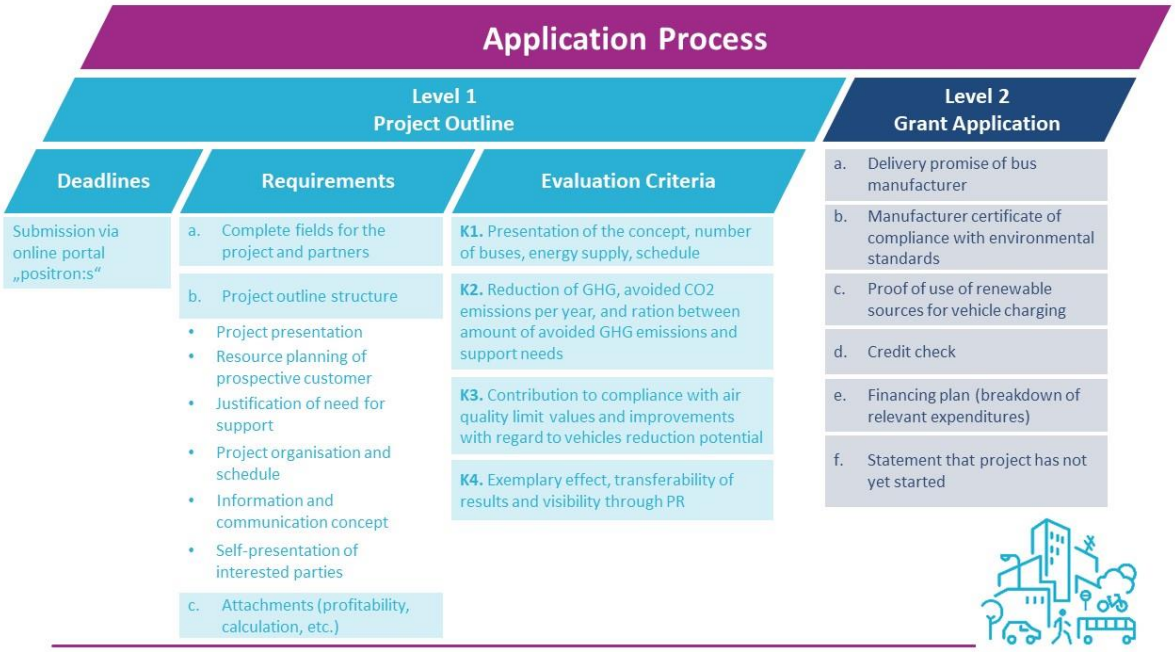
Currently, international organizations and national and local governments provide support to operators through grants as a complementary mechanism to loan funding. Grants are non-reimbursable funds or subsidies that are made available either through government budget allocations and/or by international financial institutions/donor funds. Grants may target different issues and thus take different forms.

The most common grant mechanism seeks to cover, either partially or completely (depending on the case), the incremental costs of electric vehicles in relation to conventional technologies, especially diesel buses. Examples of this are common (notice that almost all grant programmes also offer subsidies for the construction of relevant infrastructure).

- United Kingdom: Through the Ultra-Low Emission Bus Scheme, UK's Department for Transport offers grants covering up to 75 percent of the incremental costs between the zero emission bus (i.e. not only limited to electric vehicles but also includes also other technologies, such as fuel cell) and the conventional diesel bus.
- Germany: The national government's Electric Bus Programme has currently a budget of 300 mio. EUR until 2022 and provides grant coverage of up to 80 and 40 percent of incremental costs of electric and PHEV buses, respectively. The programme has already shown positive results: Berlin's public transport operator announced in March 2019 the purchase of 225 electric buses, which are to be jointly funded by the federal state of Berlin, the Federal Ministry of Transport and Digital Infrastructure (BMVI) and the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU). The guidelines for the purchase of electric buses and the application process can be found in Figures 1 and 2.

Figures 1 and 2: Germany's E-Bus Programme. Source: MobiliseYourCity





- USA: The Low- or No-Emission Grant program of the federal Transit Administration will support 38 different projects in 38 states for the purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of required supporting facilities.

Concessional loans and grants for the purchase of buses and/or infrastructure can be made available by a variety of actors, including governments, national and international development banks and international environmental funds (such as the Green Climate Fund and the Global Environmental Facility).

In addition to grants targeting the acquisition of vehicles and supporting infrastructure, these financial instruments can also have other purposes. Subsidies can also be provided for operational costs. This is common, as farebox and other sources of revenue are unable to cover operational and maintenance costs in many cities. In this respect, electric vehicles can help diminish this financial burden by reducing, especially, fuel and maintenance costs.

Other non-reimbursable instruments that have been used for financing electric vehicles are in-kind grants. Public and private stakeholders can provide them in the form of trainings, research and development, land, maintenance and infrastructure.

3. Tax breaks and other non-reimbursable revenue streams

Tax breaks and related instruments are valuable incentives and especially useful in cases when direct grants for the purchase of electric vehicles are not easily available (due to financial or political constraints, for example).

Tax breaks

Tax breaks include reduction or exemption from the Value Added Tax (VAT) or registration tax, reduction or exemption from import duties for OEMs, reduction in insurance costs, among others. In very specific cases, corporate tax reductions can even promote the establishment of bus manufacturing facilities. The provision of tax breaks is, however, a political process that must involve both local and national authorities, depending on the fiscal competences of the public stakeholders involved.

Public transportation budgets

Transport authorities can make use of their budgets to support the procurement of e-buses. Investments can both be directed to the (partial or total) acquisition of electric buses or for support infrastructure (charging and maintenance). However, public transportation budgets cannot, in many cases, act as the main source of funding as these budgets are set up to meet a variety of functions, ranging from investments (infrastructure, rolling stock, ticketing systems, among others) to operations and maintenance. Thus, financing e-buses will necessarily compete with other tasks that need to be fulfilled by public authorities. In many cities, public budgets experience additional financial strain, as the costs of providing public transport are higher than the revenues generated. This deficit requires thus the provision of subsidies by public authorities, which further constrain their ability to use the public transport budget for additional investments. According to Sakamoto et al., "the funding of infrastructure often becomes financially unsustainable when shortfalls in revenue (…) is combined with excesses in expenditure (…) Investments require up-front funding but it is essential that over the longer term the revenue covers the financing, operating and maintenance costs" (2010, 8). Unsustainable public transport budgets will thus be limited in their capacity to financially support fleet modernization processes, which in turn increases the need to consider other (innovative) funding instruments. In any case, the role that the public budget will play in the electrification of the bus fleet will depend on the particular local context and role distribution / operational model.

Being the budget approval for public transport a political process that is usually being conducted on an annual basis, the necessary commitment by political decision makers can facilitate the allocation of additional funds for the procurement of electric buses.

Local authorities can also support this process by making use of other financial instruments presented in this document, such as leveraging loans and grants from national governments international organizations and development banks, issuing green bonds or freeing up additional revenue sources for operators (for example through the provision of tax breaks or advertising revenue).

Farebox revenue

Farebox revenue represents one of the main sources of commercial revenue available to operators to cover both operating costs and investments in rolling stock. Currently, operators purchase vehicles with a mixture of own capital and loan funding. As already mentioned, these sources are currently not sufficient for the acquisition of electric buses.

The extent to which commercial revenue (farebox and non-farebox) can be used for procuring electric buses depends on the systems financial performance. In contexts where operating expenditures are higher than revenues, operators will face greater difficulties in using this funding source for any kind of investment.

Advertising revenue

Another potential source of revenue that can be made available for bus operators in order to incentivize the electrification of their fleets is to allow the operators to collect revenue from the advertising space provided in and on the electric buses. This should be administered by the local transport authority if this instrument is to act as a positive incentive.

- The municipal government of Bogotá, Colombia, developed a financing scheme for the promotion of investments in electric vehicles. One component consisted in negotiations with Transmilenio, the public entity that coordinates Bogota's public transportation system, to allow owners of electric buses to collect revenue from bus advertising space (this is not the case for diesel buses). On the other hand, negotiations with the city's environmental department have been conducted to allow investors to postpone obligations for a number of particle filters for diesel buses in exchange for every electric bus acquired.

Bus scrappage schemes

National or local governments can make use of bus scrappage schemes to incentivize the uptake of electric buses. Through scrappage schemes public authorities will not only make the retirement of older buses compulsory (causing the operators to eventually replace these buses with newer ones), but they may provide additional financial support to operators undergoing such processes. A standard instrument within such programmes is to provide a fix amount of money for every bus scrapped (this value can also vary according to the specifications of the buses being scrapped), which in turn can be used by the operators to procure newer vehicles. To further incentivize the uptake of electric vehicles, higher compensation rates may be offered to those operators that replace their older buses with electric ones.

4. Loans

Loan funding alone, either through market or concessional loans, has had limited to no success regarding the purchase of electric vehicles. This is due to many factors already mentioned, such as predominance of CapEx over operating and maintenance costs in investment decisions, low knowledge of technology, poor financial conditions of operators, among others. Market maturity, reduced battery prices, increased knowledge and available charging and maintenance infrastructure will eventually make, in the medium- to long-term, loan-funding suitable for the purchase of electric buses.

5. Green bonds

A green bond can be issued by bus operators or local governments to finance the electrification of the public transport fleet. Although relatively uncommon in the transport sector, green bonds have been gaining popularity as an additional revenue source for the financing of environmental projects (e.g. clean water, renewable energy, energy efficiency, climate change mitigation, etc.). Green bonds operate under the same logic as normal bonds, in which issuers raise revenue by selling the bonds to investors at a fixed interest rate and for a defined period of time. The difference, besides the latter being earmarked for environmental projects, lies in tax incentives, such as tax exemptions and tax credits for green bonds, which make them attractive for a wider

range of investors as well as for the issuers, as green bonds reduce the borrowing costs and thus lower total expenditures.

Green bonds can be issued to purchase electric buses, batteries and/or charging and maintenance infrastructure. However, besides being an attractive instrument for local governments, green bonds may only be suitable for large operators, as green bonds carry the same credit rating as the issuers' other debt obligations and are backed by the issuer's balance sheet. Because green bonds are usually asset-backed, in the case of fleet modernization they need to be certified by a third party that evaluates eligibility of the assets to be financed with the green bonds.

6. Leasing

Leasing as an innovative business model relies on a basic principle: some, or all, components of the bus are not procured by the public transport operator, but by a third-party company, which then leases the purchased components to the operator. The leased components can be either the batteries or the whole bus. The operator then pays a fixed monthly sum to the lessor based on specific terms, which can pair the monthly payment sums to mileage conditions.

Vehicle leasing "removes the capital burden of the outright ownership model, allowing fleet operators to treat vehicle acquisition as an operational expense. Lessors that include maintenance and other services in the lease price can help reduce labour costs for large fleet operators, and lessors may also be able to secure significant volume purchasing discounts from vehicle OEMs, lowering costs for their lessees" (Electrification Coalition 2010, 83)

In the case of battery leasing, the lease agreement can provide for a performance warranty of the batteries and new batteries at mid-life to guarantee optimal operations. In order to safeguard the sustainability of the business model, the lessor of the batteries should also plan for secondary applications for the batteries at the end of their useful life in the vehicle.

Depending on the context, the third-party company (i.e. the lessor) will usually be the battery manufacturer or the OEM, but specialized financial companies can also assume this role. Charging facilities and maintenance services will, in most cases, also be assumed by the lessor, who in turn receives payments for the provision of these services.

The leasing model brings several benefits that facilitate the market uptake of electric vehicles. If the model relies only on the leasing of the batteries, the upfront costs of the electric bus will be drastically reduced to a price-level relative to a conventional diesel bus. This, in turn, will allow the operator to purchase the buses with little to no incremental costs, thus reducing the need for grants. On the other hand, by leasing the buses, the private sector will assume the ensuing costs, thus freeing up funding that the city and/or operator will be able to use for their lease payments. In any case, the transfer of operational and technology risks from the operator to the lessor will help mitigate some of the barriers to the electrification of the fleet, as risk distribution will be assumed by the stakeholders best suited to do so.

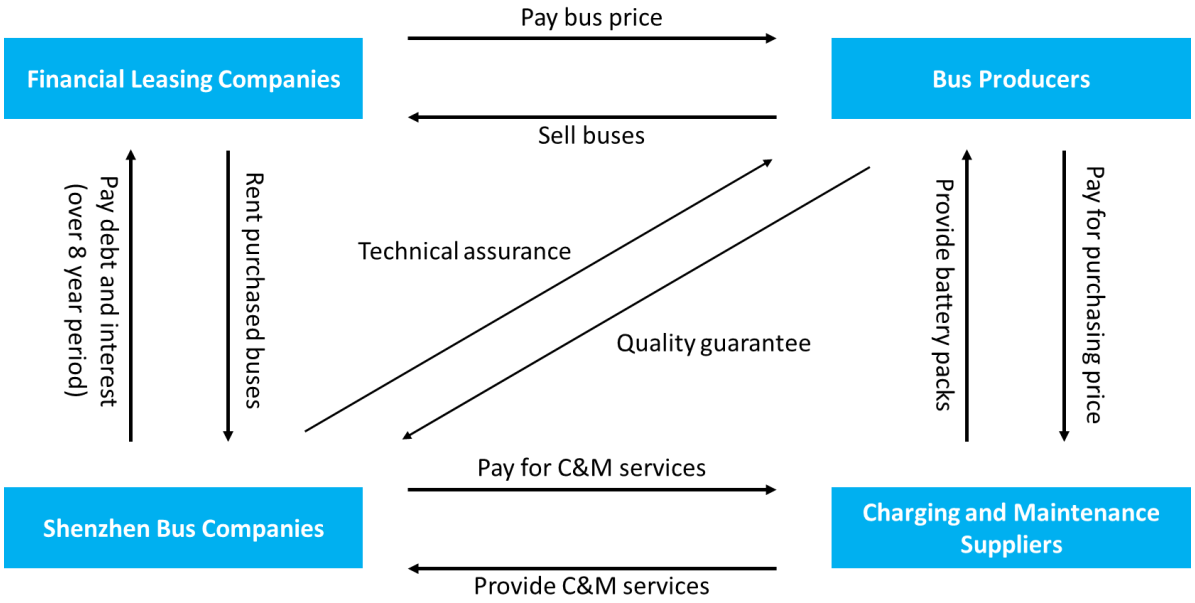
Leasing schemes do not act as the sole financial mechanism, but are implemented in combination with other instruments, including grants and loans. The amount of loans and/or grants required will depend on various factors, including the financial capabilities of the involved stakeholders and the costs involved. Also, leasing arrangements do not only include the operator and the lessor but are comprised by several public and private stakeholders depending on the context.

- China: the Chinese national government has been promoting the electrification of public transport fleets since 2009 through various policy instruments, including grants for the purchase of electric buses. The city of Shenzhen achieved full electrification of its public

transport fleet in 2017 with a total number of 16,359 e-buses. One of the central factors leading to this success lies on the combination of subsidies (cf. Figure 3) provided by the national government (in 2016, these were high enough to cover more than half of the upfront costs of an electric bus, although the subsidy rates have been gradually declining) and ambitious policy goals set by the city administration, which set a target of 100 percent electric buses by the end of 2017. The local government has also set up additional funding mechanisms, including concessional loans with low or negative interest rates and additional funds for research and recycling of batteries.

The success of Shenzhen, however, demonstrates the need for innovative financing schemes, as it also involves leasing companies, which purchase and lease the buses to the operators. Additionally, charging and maintenance functions and the purchase of batteries have been outsourced and assumed by specialized suppliers, thus distributing both financial and operational risks among several stakeholders.

Figure 3: Financial and operational model for e-buses in Shenzhen, China



Source: Adapted from C40 Cities (2016)

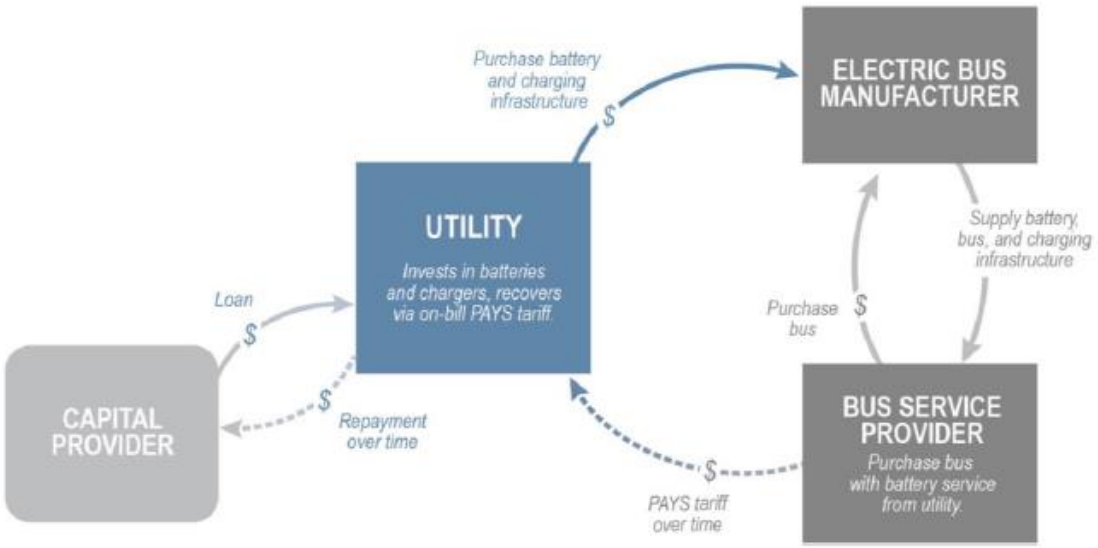
7. Pay-as-you-Save (PAYS) Model

The Pay-as-you-Save (PAYS) Model, developed by Clean Energy Works, a nonprofit organization, represents an innovative mechanism that bestows a central role on the energy service company. While new to the transport sector, this approach has already been implemented by utilities to increase investment of climate solutions, especially in the energy sector. Essentially, the PAYS model can be regarded as an elaborate institutional arrangement based primarily on the leasing of batteries and charging infrastructure.

A study on the PAYS model as well as Figure 4 explain how it functions:

> "The utility and BSP [Bus Service Provider] initially agree to terms-of-service that allow the utility to pay for the primary components of the incremental upfront costs of electric buses - namely batteries and charging stations - and recover its costs over time through a tariffed, fixed charge on the BSP's regular monthly electric bill - the PAYS Program Services charge ("PAYS charge").
>
> The PAYS tariff is designed to ensure that (1) the operating costs of an electric bus will be less than the estimated operating costs of an equivalent diesel bus; and (2) the utility will fully recover its investment cost within the warrantied period of the battery and charging equipment, subject to the restriction in (1). The utility is protected from technology risk by the manufacturer's equipment warranty, and its investment is both cost-effective and secure, with the ability to disconnect service in the case of non-payment. The BSP is required only to ensure it pays its electricity bills, facing no additional liability.
>
> Once the tariff is in place, the utility can leverage external debt lent against its balance sheet to pay for the cost of electric bus batteries and charging infrastructure. This allows the BSP to obtain new electric buses from a manufacturer debt-free with an off-the books investment, paying roughly the same upfront costs as it would for equivalent diesel buses. If the upfront cost is still higher than diesel, the remaining fraction of the gap is met with grant funding from the concessional capital provider or utility incentives.
>
> The utility recovers its investment costs (including its cost of capital) from the BSP via the PAYS charge on its monthly electric bills, and once those costs are recovered, the BSP gains ownership of the battery and charger assets" (Abramskiehn and Clark 2018, 5).

Figure 4: PAYS financial model

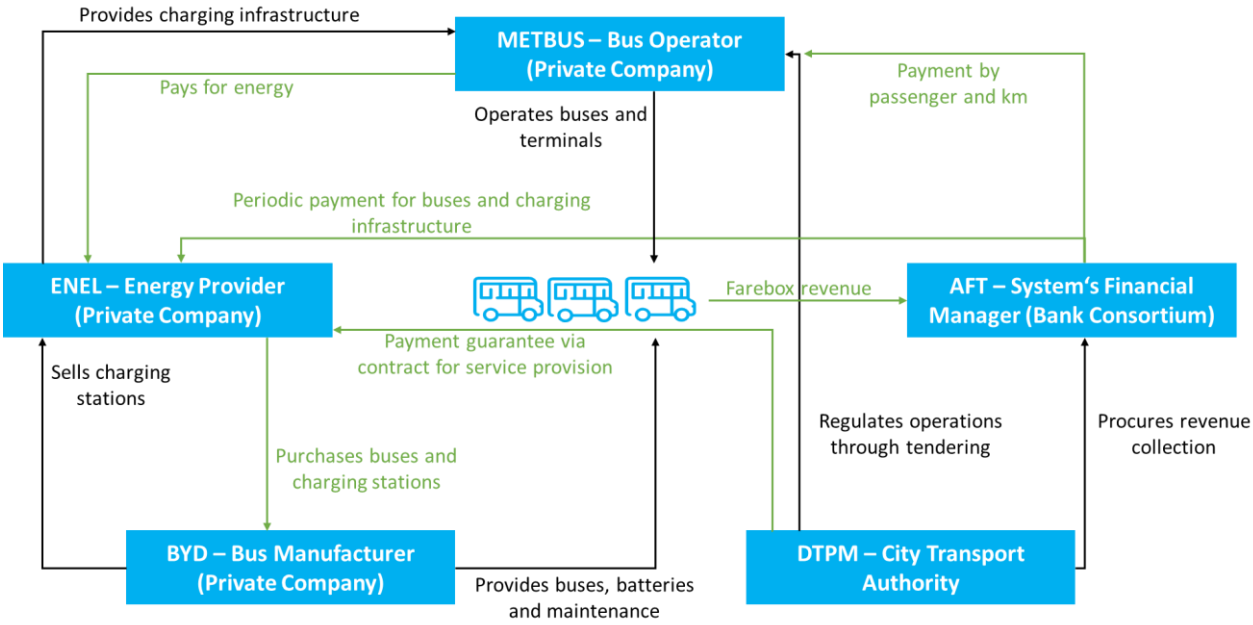


Source: Abramskiehn and Clark (2018)

- Chile: The country's capital, Santiago, became in 2019 the city with the largest electric bus fleet in Latin America through the procurement of 183 electric vehicles via an innovative financial and operational model that involves several public and private stakeholders and a highly specialized institutional arrangement. Additionally, the financial and operational models are graphically presented in Figure 5 found below:
  - BYD (bus manufacturer) - sells the buses and charging infrastructure and provides maintenance service.

- Enel (private energy service company) - purchases the buses and charging infrastructure and provides for charging services.
- AFT (private enterprise procured by the city's transport authority to manage the system's finances) - collects the system's revenue (including farebox) and distributes it among the utility (payment for buses and charging infrastructure on set periods) and the bus operator (payment by passenger and mileage).
- METBUS (the bus operator), operates the buses and terminals, receives payment by the financial entity and in turn pays the utility for energy provision and BYD for maintenance service.
- DTPM (the city's transport authority) - regulates the terms of operations via contracting or tendering. Additionally, the authority provides the utility with a payment guarantee.

Figure 5: Financial and operational model for e-buses in Santiago, Chile



Source: Translated and adapted from BYD (n.d.)

8. Financing infrastructure

As a general rule, all financial mechanisms mentioned above can be utilized to fund public transport infrastructure required to support the electrification of the transport fleet. This type of support infrastructure relates mainly to charging and maintenance. Some arrangements, however, must be considered separately, as they are particularly suited for financing infrastructure.

The high environmental and economic benefits generated by a clean public transport fleet can justify investment by governmental authorities. Some of the instruments outlined above pinpoint the current importance of government involvement in the financing of electric buses (in the form of grants, tax breaks, as guarantor, etc.). This is also the case for infrastructure. Currently, government support represents the most common source of funding for charging facilities. Financial support is mainly provided through grants intended to cover some or all costs of the

charging infrastructure. The stakeholders eligible for these grants vary depending on the context, but energy service companies (ESCOs) have played a central role in the provision of these services in many cases.

ESCOs can also assume the investment costs of charging infrastructure (either through loan-funding, own capital or with the support of grants) and recuperate their investment by charging the users (i.e. fleet operators) for service provision. ESCO funding is especially beneficial because these companies usually have the financial power and stability to assume the whole costs and risks for investing in this type of infrastructure. The ESCO can further improve their business case through shared usage, for example with other heavy-duty vehicles. Additionally, the government may act as a payment guarantor via contract for service provision, thus helping mitigate some risks.

In cases where public transport operators and the electricity utility company are under public ownership, investment in infrastructure can be collectively assumed. This is the case in Germany, where the public transport operator and the utilities are under one holding and jointly invest in the infrastructure.

9. Further Readings

Comparative studies and general overview on electric bus adoption

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Pay-as-you-Save Model

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Published by:

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

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Programme/project description:

TRANSfer

Author/Responsible/Editor, etc.:

Mateo Gomez Jattin, GIZ, Eschborn

Design/layout, etc.:

Niklas Hutz, GIZ, Bonn

URL links:

www.changing-transport.org

Photo credits/source: Ant Rozetsky on Unsplash

GIZ is responsible for the content of this publication.

On behalf of

The Federal Ministry for Environment, Nature Protection and Nuclear Safety of the Federal Republic of Germany

Eschborn 2019