Investing in electric bus deployment in Latin America

Overview of opportunity and market readiness

July 2020

ZEBRA
ZERO EMISSION BUS
RAPID-DEPLOYMENT ACCELERATOR

Funder & Facilitator: P4G Partnering for Green Growth and the Global Goals 2030

Implementing Partners: icct THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION; C40 CITIES

Supporting Partners: Centro Mario Molina Investigación & desarrollo; World Resources Institute; GGGI; Clean Energy WORKS

Prepared By: Dalberg

Abstract & Authors

ABSTRACT

This report was developed by Dalberg, with guidance from the Zero Emission Bus Rapid-Deployment Accelerator (ZEBRA) Partnership teams at C40 Cities and the ICCT and support from P4G. The report aims to assist the ZEBRA Partnership with its goal of accelerating the transition to zero emission buses across Latin American cities, by highlighting the business case for e-buses, the current state of the market and its potential for growth, with investment synopses for five key cities: Bogotá, Santiago, Mexico City, São Paulo and Medellín. The report draws from consultations with financiers, investors, manufacturers, operators, city authorities and experts in the region. The authors greatly acknowledge and thank all those that have helped the conception of this report.

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Implementing Partners

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The ZEBRA partnership is accelerating e-bus scale-up

FUNDER & FACILITATOR

P4G Partnering for Green Growth and the Global Goals 2030

Provides a global network of innovators, investors, and others seeking breakthroughs in green economic growth, supported national platforms that secure political commitment to local projects. **Funds and facilitates ZEBRA to accomplish its mission**.

IMPLEMENTING PARTNERS

icct THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Has ~15 years of experience and technical expertise focused on improving the environmental and energy performance of the transportation sector, including public transport. **Leads the technical aspects of ZEBRA**.

C40 CITIES

Has long-standing relationships and support from 96 cities committed to tackling climate change—and helped spark the current transition towards e-buses in Latin America. **Leads the finance and Political aspects of ZEBRA**.

SUPPORTING PARTNERS

WORLD RESOURCES INSTITUTE

Has ~40 years of in viable climate solutions, including recent electric bus projects across Latin American cities. Will **support to channel investments from development financiers under a project-based approach**.

GGGI

Brings finance expertise to supports sustainable investment in its member countries. Will **support the design of a streamlined process for project preparation advisory services and the mobilisation of GCF finance**.

Centro Mario Molina Investigación & desarrollo

Works to develop local capacities in Latin America to address air pollution and climate change and provides technical support to countries, such as Chile. **Supports the work in Santiago, Chile and brings technical expertise to other cities**.

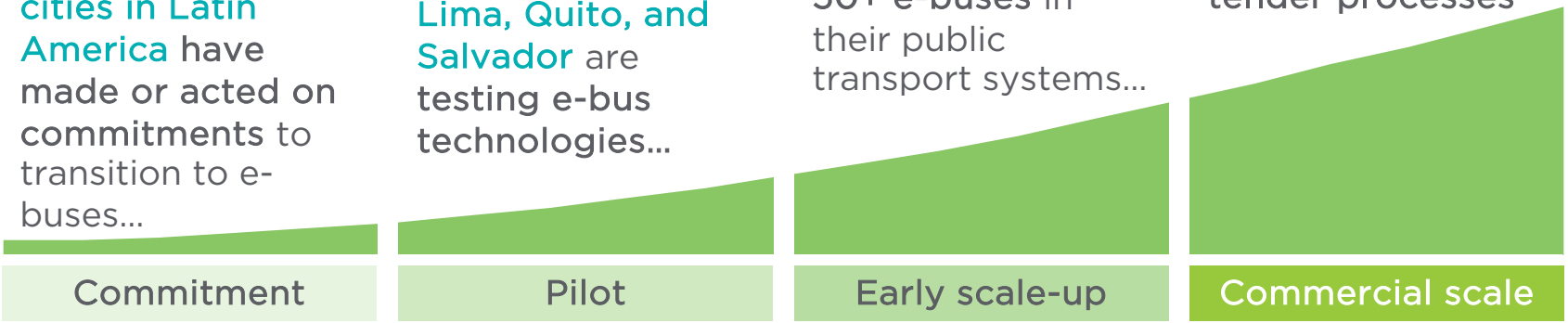
Clean Energy WORKS

Accelerates investments in cost-effective distributed energy solutions to open the clean energy economy. Will **support engagement of utilities through the development of alternative financing under a pay-as-you-save (PAYS) model**.

SUMMARY

A market transition is underway in Latin America

Scale-up of electric buses across Latin America[1]
Illustration of progress



Electric buses are in early phase of scale-up and poised for future growth

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Notes: 1. "Electric bus" includes battery-electric buses and trolley buses.

Environmental, health, and economic factors are driving change

Diesel buses account for 25% of black carbon emitted in cities, which has a **warming impact 900 to 3,200 times that of carbon dioxide**[1]

E-buses can help address the global air pollution crisis: nine out of ten people today breathe air considered unhealthy by the World Health Organization (WHO)[2]

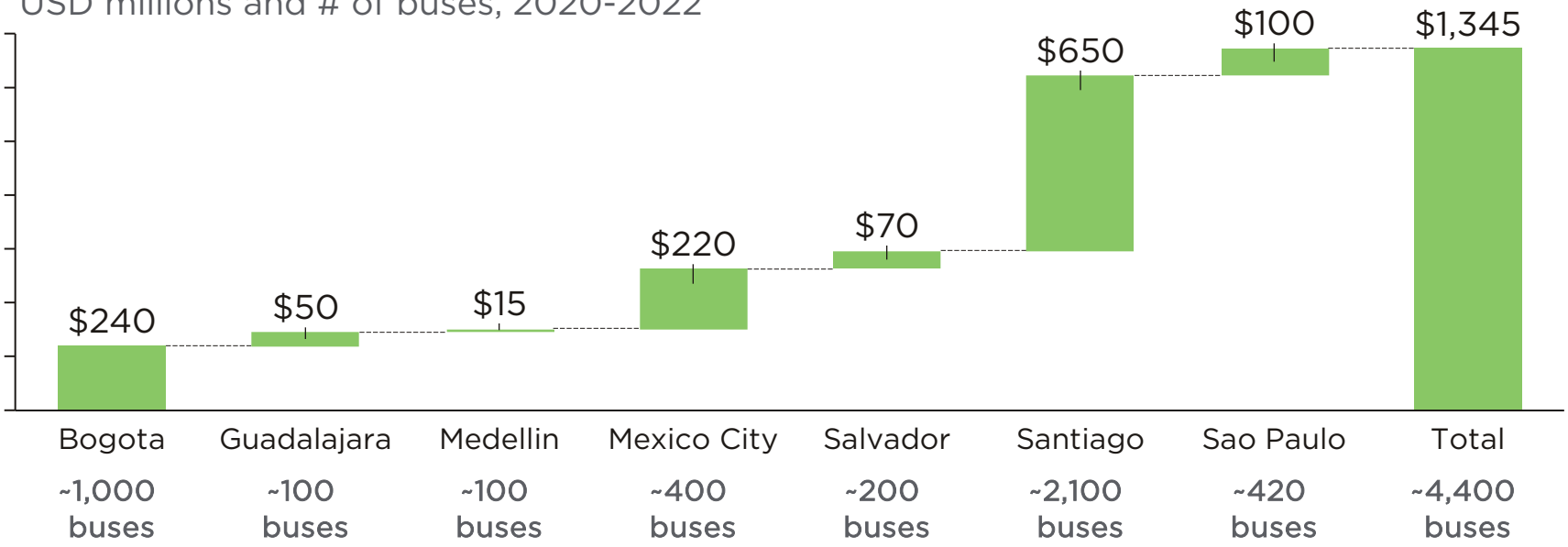
The total cost of ownership (TCO) of an e-bus can be **equal or less than that of a diesel bus**, given ongoing savings in fuel and maintenance[3]

Notes: 1. ICCT, "Financing the Transition to Soot-Free Urban Bus Fleets in 20 Megacities," 2017. 2. WHO, "How air pollution is destroying our health," accessed 2019. 3. ZEBRA, "Accelerating a market transition in Latin America: New business models for electric bus deployment," 2020

For 2020-2022, the Latin America e-bus market exceeds USD 1 billion

Market potential for select cities in Latin America[1]

USD millions and # of buses, 2020-2022



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Notes: 1. Analysis is based on ZEBRA knowledge of upcoming new contracts (e.g., tender processes) and city and operator plans to transition to e-buses within existing contracts. ***The analysis considers different sizes, models, and prices of buses across cities.***

ZEBRA is working to mobilize USD 1 billion through new financing models

Lever

Asset ownership

- **New players (e.g., capital funds, electric utility companies) come into the bus sector** to buy e-bus assets and lease them to traditional operators to use
- Allows for **sharing of costs** (i.e., the operator not cover all upfront costs) and the **sharing of risk** (e.g., traditional asset owners take on less technology and financial risk)

Sources and terms of financing

- Development finance institutions (DFIs) provide **attractive financing terms** to enable purchase of e-buses:
  - Lower interest rates
  - Extended payment periods (e.g., 10+ years)
  - Grace periods (e.g., two years)
- **DFIs can show proof-of-concept to replicate and scale**

These two levers can be used to create a range of viable financing models

E-bus projects offer a strong business case

TYPE OF BUS	PROJECT-LEVEL IRRS[1]
ELECTRIC BUS	• **9-18%,** depending on the market • **Some cities are structuring contracts with a set IRR for investors,** for example: – Bogotá aims to deliver 12% – Santiago is considering 9% • For other cities, project-level IRRs are **highly sensitive to bus cost and fleet provision payments**
DIESEL BUS	• **<10%, depending on the market**

- These IRRs are consistent with the **level of risk of e-bus projects**
- These IRRs are based on existing tariffs and subsidies; **there is no impact for passengers**
- For many operators, **e-buses are competitive with diesel**
- However, financial estimates **vary considerably** based on inputs and assumptions (e.g., fleet provision costs)

ZEBRA has developed a dynamic tool to estimate financials for specific projects[2]

ZEBRA ZERO EMISSION BUS

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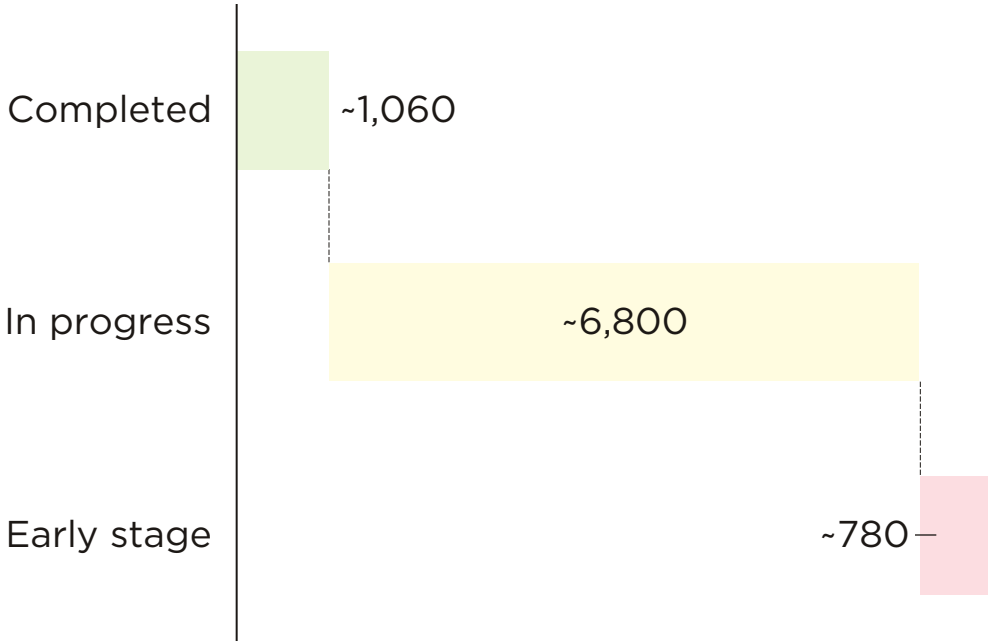
Notes: 1. These estimates are based on conversations with investors and the current financial model. The model is being constantly updated to reflect the rapidly-changing environment; as such, the estimates are likely to fluctuate with time. 2. To use this tool, please contact ZEBRA at zebra@c40.org.

And there is growing demand for financing at city level

Summary of completed transactions and pipeline
of buses, 2015-present



- **Santiago** – 410 buses
- **Bogota** – 483 buses
- **Medellin** – 68 buses
- **Mexico City** – 63 trolley buses
- **Sao Paulo** – 16 buses
- **Montevideo** – 20 buses

- **Santiago** – up to ~4,300 buses, 365
- **Bogota** – at least 631, up to ~2,000
- **Mexico City** – ~130 trolley buses
- **Panama City** – 35 buses

- **Sao Paulo** – up to 100 buses
- **Salvador** – up to 206 buses
- **Cali** – up to 106 buses
- **Mexico City** – up to 300 trolley buses
- **Quito** – up to 70 buses
- **Medellin** – TBC

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Notes: 1. This summarizes key transactions with over 15 buses but is not exhaustive.

To date, several institutions have committed financing

Ashmore

FINANCER LA TRANSITION ÉNERGÉTIQUE neot

CELSIA

ARC

enel X

ASCENDAL GROUP

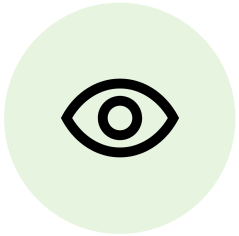
ENGIE

EXAMPLE: Celsia in Bogota

- Celsia is a Colombian energy company also active in Panama, Honduras, and Costa Rica
- In 2019, Celsia won a tender to provide 120 BYD buses to SITP in Bogota
- They invested USD ~30 million in equity, through a subsidiary company (Empresa de Energía del Pacífico S.A.)
- Celsia will now rent the buses to operators
- Celsia plans to expand to other markets

Through the signing of an "investor declaration," ZEBRA aims to secure more commitments from investors that provide a **critical market signal to cities, manufacturers, and operators**

ZEBRA offers dedicated support to these investor partners



Visibility

ZEBRA recognizes and directs positive attention to its investor partners at the municipal, national, regional levels

Partnerships

ZEBRA aims to connect investor partners to concrete opportunities and to facilitate dialogue with city officials, operators, manufacturers, and each other

Knowledge

ZEBRA actively shares updates related to city-level projects, tenders, and events as well as broader national and regional trends

SUMMARY

THE OPPORTUNITY

- CITY INVESTMENT SYNOPSES
  - Santiago
  - Bogota
  - Mexico City
  - Sao Paulo
  - Medellin

INVESTMENT PIPELINE

ADDITIONAL MATERIALS

MARKET OVERVIEW

Our analysis focused on five public transport systems in five cities

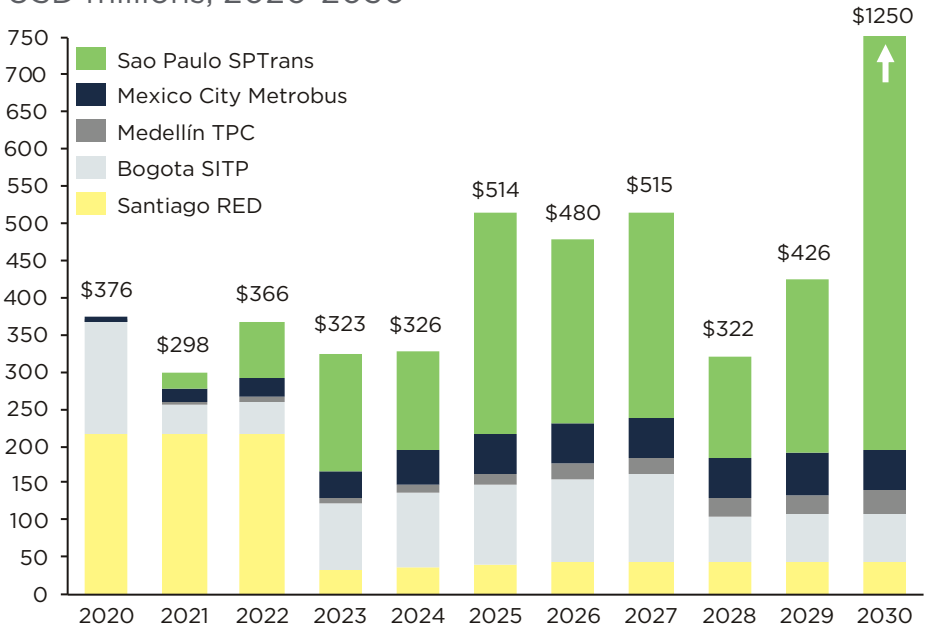
Santiago Red Metropolitana de Movilidad (RED)	~6,800 buses
Bogota Sistema Integrado de Transporte Público (SITP)	~8,000 buses
Sao Paulo SPTrans	~14,200 buses
Mexico City Metrobus	~700 buses
Medellin Transporte Público Colectivo (TPC)	~6,400 buses

MARKET POTENTIAL

The market size across these five systems will double to over USD 1200M by 2030

Market potential for electric buses[2]

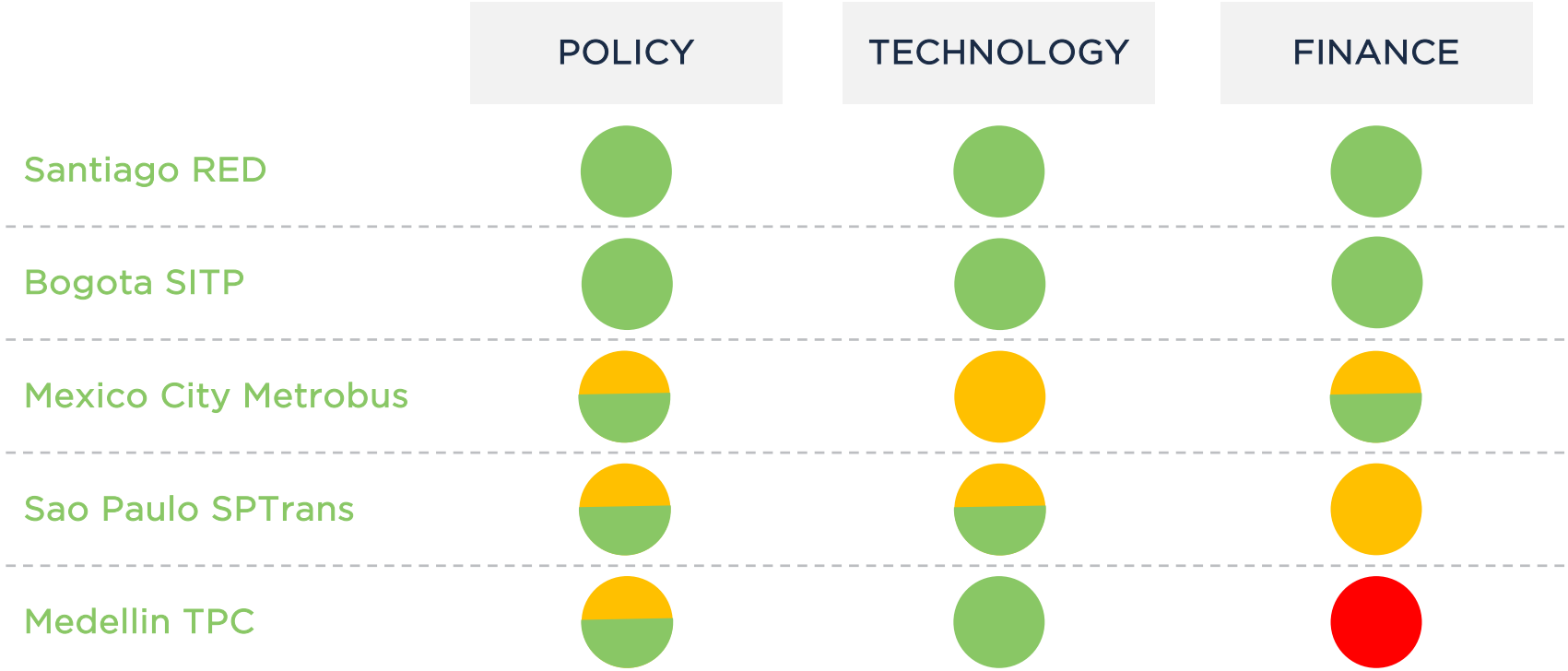
USD millions, 2020-2030



- **Santiago and Bogota** account for ~90% of the market for 2020-2022
- **Sao Paulo** will grow to dominate the market by 2030
- Opportunities in **Medellin Transporte Público Colectivo** and **Mexico City Metrobus** will increase steadily
- Key drivers of market size:
  - # of buses renovated per year
  - % of buses procured that are electric
  - Average price of assets

MARKET READINESS

Santiago and Bogota have the most mature markets



MARKET READINESS

Concession structure and electromobility policies/laws underpin readiness

	POLICY	
Santiago RED	• National Electric Mobility Strategy (2017), Electric Roadmap 2018-2022, Energy Efficiency Law in progress	★
Bogota SITP	• Strong support from new city government, National Law 1964, and 2020 tenders with incentives for e-buses	
Mexico City Metrobus	• City government is developing a 2020-2026 Climate Change Program	★
Sao Paulo SPTrans	• Sao Paulo has set pollution reduction targets via amendments to 2009 Climate Change Law	
Medellin TPC	• National Law 1964 mandates 10% vehicle electrification by 2025 and 100% by 2035	★

★ *Committed to procure only zero-emission buses after 2025 via C40 Green and Health Streets Declaration*

MARKET READINESS

Technologies have been tested and local supply is expanding in most markets

	TECHNOLOGY
Santiago RED	• **Supply is expanding:** three manufacturers have closed transactions, and two others are testing buses
Bogota SITP	• **BYD is market leader**, with >5 other suppliers exploring
Mexico City Metrobus	• **Yutong** leading with trolley buses, as Metrobus completes technology assessments for e-bus specifications
Sao Paulo SPTrans	• **BYD and Eletra factories in Sao Paulo state** for 12m and articulated e-buses
Medellin TPC	• **Zhongtong** has standardized 7.8m bus for Medellin • **BYD and Foton** have local representation

MARKET READINESS

Concession structure and public guarantees have driven investor interest in Bogota and Santiago

	FINANCE
Santiago RED	• 49 firms have bought the right to participate in the 2019/2020 tender, support by strong public guarantees
Bogota SITP	• Many third-party asset owners and DFIs interested in market; Ashmore and CELSIA won tenders
Mexico City Metrobus	• Several third parties, including private transport and energy companies, have expressed interest in asset ownership
Sao Paulo SPTrans	• BNDES has attractive e-bus financing, with local content requirements
Medellin TPC	• Lack of guaranteed cash flows in TPC currently impedes private investment

SUMMARY

THE OPPORTUNITY

CITY INVESTMENT SYNOPSES

- Santiago
- Bogota
- Mexico City
- Sao Paulo
- Medellin

INVESTMENT PIPELINE

ADDITIONAL MATERIALS

SUMMARY OF OPPORTUNITY

Investment requirements	SPV - equity	SPV - debt	Credit guarantee
Amount[1]	• 100-bus project (12m bus) – USD 30 million total investment • 200-bus project (12m bus) – USD 60 million total investment • 500-bus project (12m bus) – USD 150 million total investment		
Commercial model	Separation of all assets, through new contracts		
Instrument	Equity	Debt; various levels of seniority	• Partial credit guarantee (50%)
Time horizon	10 years; shorter with exit or re-financing	5-10 years; shorter with exit or re-financing	• 5-10 years, depending on loan duration
Expected returns	9% target IRR (TBC)	8% APR, depending on loan agreement	1% annual fee, depending on guarantee structure
Upcoming projects	• RED fleet renewal, ~4,300 buses over 2020-2023		

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Notes: 1. Project size could vary.

OVERVIEW

The Red Metropolitana de Movilidad (RED)[1] has >6,000 buses and is undergoing a transition

Market share of business models
# of units, out of ~6,756 total

RED is transitioning from a vertically-integrated model to divided responsibilities through new concessions. This process has started with ~400 e-buses introduced through existing contracts and will be formalized in the 2020-2020 tenders that will replace ~80 of the fleet.

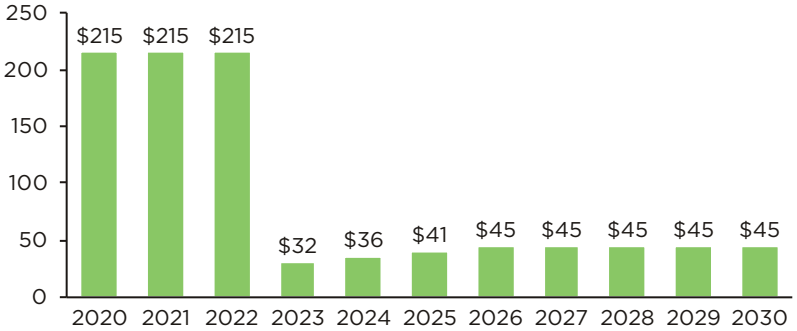
The following slides focus on all operators in RED (formerly known as Transantiago)

Notes: 1. *Transantiago was rebranded to RED.* 2. Over 400 e-buses have been introduced to the market with separated asset ownership (Engie, Enel X, NEoT own assets), within existing contracts. The entire RED system is now moving toward this divided responsibility model for all new tenders.

MARKET POTENTIAL

RED has >$600M e-bus investment opportunity during 2020-2022

Market share of business models
USD millions, 2020-2030



KEY DRIVERS:

- **Fleet renovation:** ~4,300 units during 2020-2022, followed by ~150 per year starting 2023[1]
- **% of buses procured that are electric**: ~50% for 2020-2022, increasing to 100% by 2026 per city target to have 100% zero emission fleet by 2035[2]
- **Bus cost**: ~300K, on average, for 12m e-bus

Overview of RED in Santiago - 2019

# OF BUSES	• 6,756+ buses in 380 routes • Most buses are Euro III diesel particulate filter (DPF) and V, with a growing percentage of Euro VI since 2018
# OF PASSENGERS	• ~3M average weekly transactions • Projected to increase, but Covid-19 has impacted ridership
CONCESSION AGREEMENTS	• Two separate tenders: one for fleet suppliers and one for operators[3]

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Notes: 1. 80% of the fleet will be replaced 2020-2020 2. While unknown, there are signs that over 50% of 2020-2022 tenders could be electric. Last diesel bus must be purchased in 2025 in order to have 100% zero emissions fleet by 2035, per city commitment. 3. Fleet supplier tenders last 10 years for internal combustion engines and 14 years for battery electric buses (but buses must be replaced after 10 years). Public transport operators (PTOs) lease buses via contracts for five years, which are extendable for up to an additional five years; If fleet is more than 50% electric, then PTOs can lease buses via contracts for seven years, which are extendable for up to an additional seven years.

MARKET READINESS

The government strongly supports e-buses and has a centralized system under DTPM

Policy – *e-bus commitment*

- **Government commitments are strong:** Santiago has committed to only procure zero-emission buses after 2025, via C40 Green and Healthy Streets Declaration, and the government aims to transition all public transit fleets in Chile to zero emissions by 2040
- **The Santiago government has led e-bus deployments** through policy action and motivating operators to use e-buses (e.g., providing guarantees, providing incentives for e-buses)
- Chile has a **National Electric Mobility Strategy (2017)**, the Ministry of Energy has an **Electric Roadmap 2018-2022**, and the government is developing an **Energy Efficiency Law**

Policy – *transport system organization*

- **DTPM**, the public transport authority, **manages central planning,** including selection of routes, contracts, and hiring of services (i.e., operations, terminals, payment systems) and **regulates and supervises the system** (e.g., monitoring quality, applying fines)
- Administrador Financiero de Transantiago (AFT) **functions like a city-level trust;** it receives subsidies, collects payments, and distributes payments to operators

★ Key learnings to date

- **Strong public commitment** has translated to nearly 400 electric buses in operation
- Currently, DTPM is modifying contracts and operations (i.e., limiting the fleet size of each operator, awarding smaller contracts, reducing responsibilities) **to reduce system risk and improve competition and efficiency**

MARKET READINESS

Enel-Metbus partnership is leading the shift towards e-buses in Santiago

Technology – *supply*

- **BYD currently leads the market with 285 buses**; BYD supports Enel X and Metbus, the operator, with maintenance, staff trainings, problem diagnosis and resolution, and work orders for bus repairs
- **Yutong** and **King Long** have also closed transactions
- **Supply is expanding:** Sunwin & Subus and BYD & Metbus have each piloted articulated bus; Alstom & Redbus have piloted one 12m bus
- Centro Mario Molina and ZEBRA undertook a **route-level modeling study** to identify the most suitable routes and define technical specifications for e-buses

Technology – *demand*[1]

- **Enel X, in partnership with Metbus,** invested ~USD $40 million in 102 12m BYD buses, 100 chargers, and in building an electro-terminal and recently procured an additional 183 buses from BYD to fully electrify Corredor Grecia (which became operational in October 2019)
- **Engie** invested in 100 Yutong ZK 6128 12m buses, in partnership with two operators: STP Santiago (25 buses) and Buses Vule (75 buses)
- **NEoT Capital,** a French investment platform specialized in distributed renewable energy and electric mobility, recently invested in 25 12m King Long e-buses, with RedBusUrbano

★ Key learnings to date

- **It is critical to have route-level planning for e-bus specifications** (battery size, battery range, energy consumption)—given the wide variation shown in technical studies
- Several charging systems are already being tested, **including fast chargers and pantographs**

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Notes: 1. Outside RED, the Las Condes municipality bought 10 Yutong E8 buses for local transport

MARKET READINESS

Strong public guarantees have helped private investors enter the market

Financing – *public*

- **Subsidy covers between 47-50% of all costs**, with remaining costs covered by fares
- **IDB** may finance projects by providing **loans to asset owners** with government guarantees
- **Banco Estado and CORFO** have not yet been involved directly, but could play a role
- **CORFO** is also planning to finance an electric mobility center

Financing – *private*

- **Energy companies Enel X and Engie have invested equity** in 485 buses (chassis, battery, and charging stations)
- **NEoT Green Mobility** has invested in 25 buses (chassis and battery)
- **Other private investors** (e.g., Mitsui/Sumitomo, Société Générale) are interested in asset provision

Financing – *guarantees*

- DTPM **guarantees leasing payments** between Metbus and Enel through AFT, as stipulated in service provision contract
- **Additional credit guarantees** could come from national financial institutions (e.g., Banco Estado, CORFO)

★ Key learnings to date

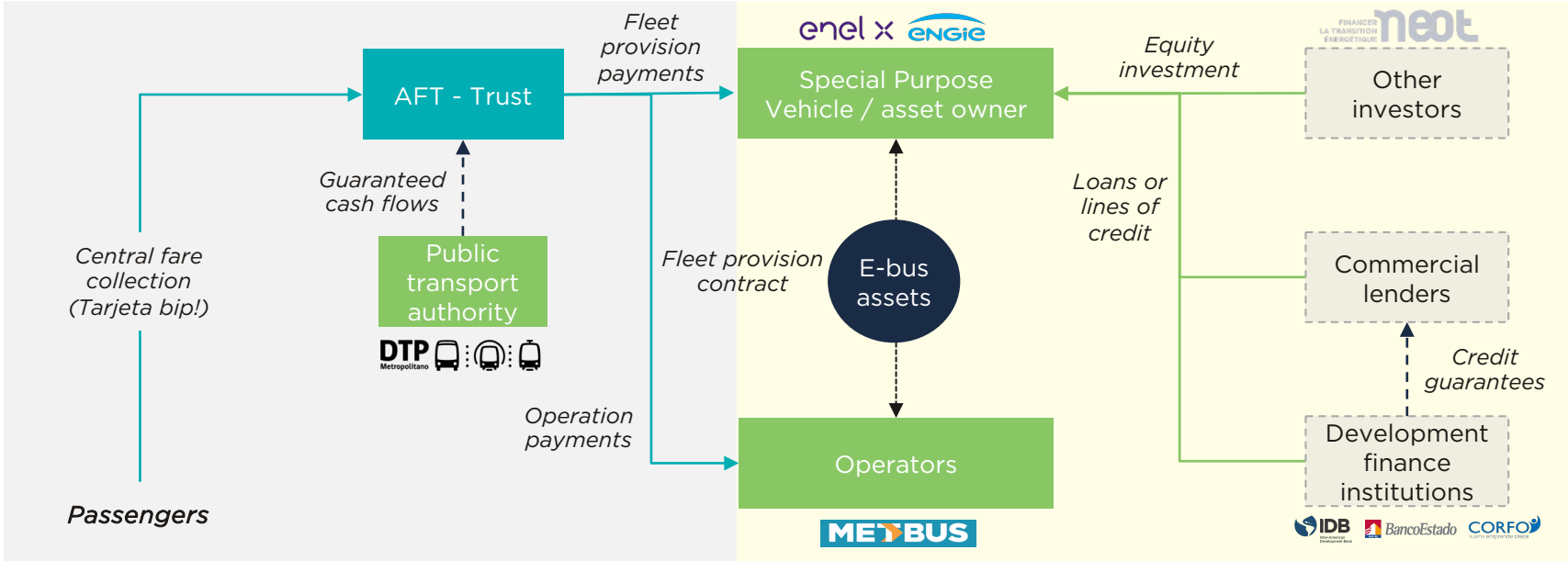
- There is **widespread international interest** to enter the market as asset owners: **49 firms have bought the right to participate in the 2019/2020 tender**[1]
- E-bus costs—both with depot and opportunity charging—**are consistently lower than those of Euro VI diesel buses**, although the total cost of ownership (TCO) varies

Notes: 1. RED, "Listado de Adquirentes," 2019

E-BUS MODEL

The current model brings in utility companies to own assets

FOCUS INVESTMENT OPPORTUNITY



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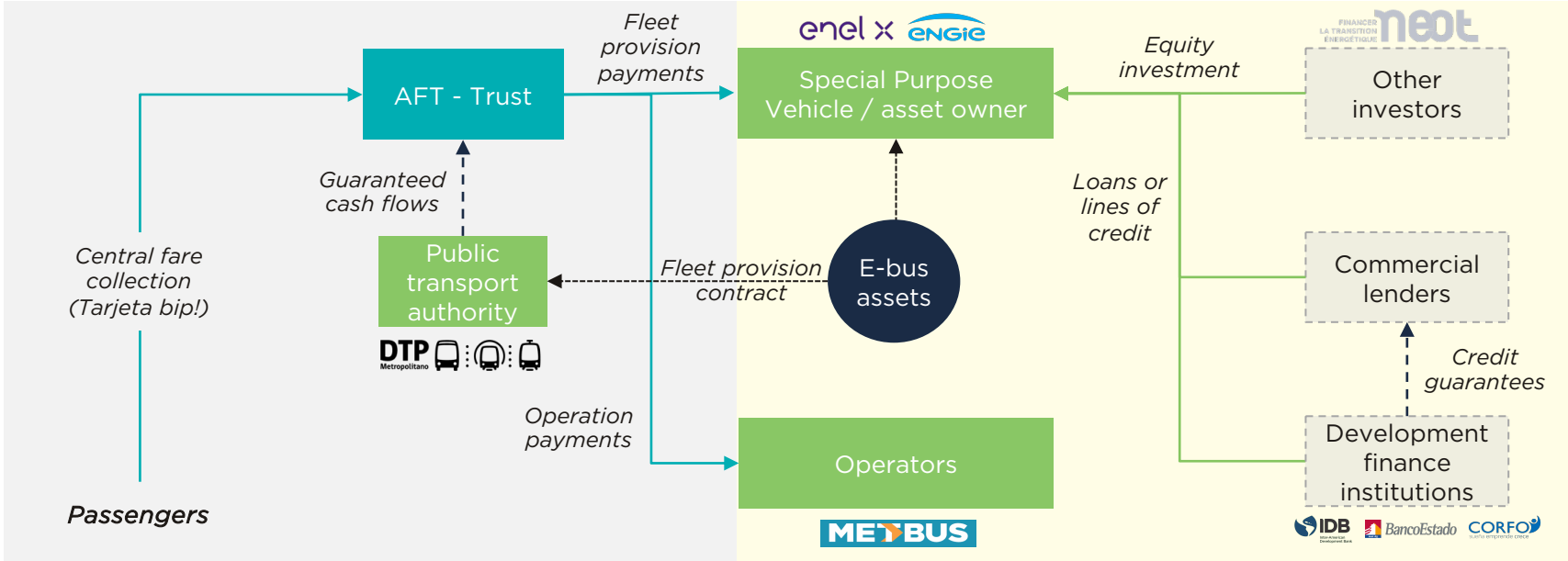
E-BUS MODEL

The future RED tenders fully separate fleet ownership from fleet operation

FOCUS INVESTMENT OPPORTUNITY



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SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (1/2)

Local Government

- Local government **does not play** a role in technology deployments in public transportation; however it does have its own bus fleet, which is quite small and usually operates free of cost
- **Transport and Telecommunications Ministry:** Mandates technology deployments in public transportation

Suppliers

- **BYD, Yutong, King Long:** Have closed e-bus transactions in Santiago
- **Sunwin and Alstom:** Have tested electric buses, but these are not yet approved
- **Foton:** Provided e-buses outside of Santiago
- **Zhongtong:** Has approved e-buses for the Chilean market, but is not operational yet

Operators

- **Metbus:** Currently leading the shift towards electromobility in partnership with BYD and Enel X; operates 59 routes in Santiago
- **Buses Vule and STP Santiago:** Operating Yutong buses
- **Redbus Urbano:** Piloted the Alstom bus in its C20 route, starting in May 2019; is operating 25 buses owned by NEoT
- **Subus:** Piloted one articulated bus

SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (2/2)

Financiers – Public

- *Only participation thus far is through the **subsidy** for public transportation*
- **Banco Estado:** Public bank focused on SMEs; has not yet been involved directly but could potentially play a role
- **CORFO:** Government agency that supports entrepreneurship, innovation, and competitiveness; could also potentially play a role, although not involved to date

Financiers - Private

- **NEoT:** Investment platform specializing in renewable energy and electromobility, has invested in 25 electric buses
- Approximately **50 companies** have bought tender rights; this includes both traditional financial actors and new actors (e.g., Hyundai, Volvo, Societe Generale, Sumitomo Corporation, Mitsui & Co, BKM Holding)

Utility Companies

- **Enel X:** Italian energy company active in Santiago, is currently leading Santiago's electromobility transition with investments in 285 e-buses
- **Engie:** French energy company active in Santiago that has invested in 100 e-buses
- **Sociedad Austral de Electricidad:** Chilean electricity company that is also involved in the sector

SUMMARY

SUMMARY OF OPPORTUNITY

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Amount[1]	• 100-bus project (12m bus) – USD 30 million total investment • 200-bus project (12m bus) – USD 60 million total investment • 500-bus project (12m bus) – USD 150 million total investment		
Commercial model	Separation of all assets, through new contracts		
Instrument	Equity	Debt; various levels of seniority	• Partial credit guarantee (50%)
Time horizon	10-15 years; shorter with exit or re-financing	5-10 years; shorter with exit or re-financing	• 5-10 years, depending on loan duration
Expected returns	12% target IRR	8% APR, depending on loan agreement	1% annual fee, depending on guarantee structure
Upcoming projects	• SITP zonal lines Phases 3, 4, 5 – 2,024 buses (Q2 2020) • SITP zonal renovation of Phase III buses reaching useful lifetime – 5,172 buses (2020-2031) • SITP trunk lines fleet increase – 150 (2023-2024) • SITP trunk lines renovation of Phase III buses reaching useful lifetime – 682 buses (2024-2028)		

Notes: 1. Project size could vary.

MARKET OVERVIEW

Bogota has consolidated most public transport operators within the SITP

Market share of business models[1]
# of units, out of ~12,484 total

BRT

ZONAL (SITP)

TEMPORARY SITP

The following slides focus on opportunities for the BRT and zonal systems

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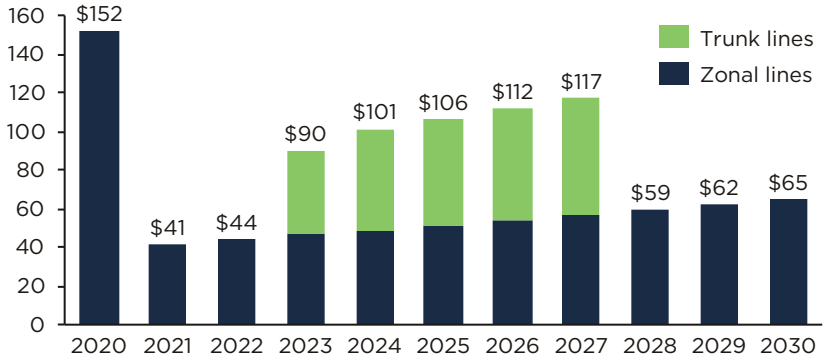
Notes: 1. Transmilenio presentation, May 2020. This excludes 163 cable car units within SITP.

MARKET POTENTIAL

SITP has USD 150M potential for e-buses in 2020

Market potential for electric buses[2]

USD millions, 2020-2030



KEY DRIVERS:

- **Fleet renovation:** ~1,000 buses per year, following tender with 2,040 buses in 2020
- **% of buses procured that are electric**: At least 30% procured in 2020, followed by steady increases in line with Ley 1964 targets
- **Bus cost**: USD 250,000, on average

Overview of Transmilenio/SITP - 2019

General	• SITP is overarching transit system, which includes BRT and non-BRT
# of buses[1]	• 7,984 buses total • 2,007 buses in the BRT • 5,977 buses in zonal SITP
# of passengers	• 2.4M per day in the BRT • 1.5M per day in zonal SITP
Concession agreements	• Concessions last 10-25 years • Two concession modalities: – Fleet supplier and operator submit coupled proposal – Fleet supplier submits non-coupled proposal; Transmilenio designates the operator

Notes: 1. Transmilenio presentation, May 2020. This excludes 163 cable car units within SITP.

MARKET READINESS

The recently-elected city government strongly supports electromobility

Policy – *e-bus commitment*

- Bogota's city government in office since January 1, 2020 has **expressed strong commitment and support for electromobility**
- A **national law passed in 2019 (Ley 1964)** promotes vehicle electrification (e.g., through mandates and tax breaks) and sets annual targets, from 10% by 2025 to reach 100% by 2035
- **2020 tenders favor 100% electric buses**, with contracts that last for 15 years (rather than 10 years) and lower requirements for autonomy (260km instead of 300km)

Policy – *transport system organization*

- **Responsibilities are clearly stipulated:** the city develops routes and owns stops and terminals
- **Fleet providers own and help maintain assets for operator use**; both have contracts with the city

★ Key learnings to date

- Ley 1964 has elevated conversations on electric buses and has brought new attention to the issue
- There is an opportunity to advance e-bus adoption by getting more leaders on board with electromobility, as seen by the progress made in Bogota after the new mayor supported e-buses

Notes: 1. Transmilenio presentation, May 2020. Warranties for e-buses must last 5 years or 400K km, compared to 3 years and 200K km for CNG or diesel.

MARKET READINESS

Bogota has contracts for 483 e-buses and >30% of 2020 tender will be electric

Technology – *supply*

- Bogota will have a total of **483 electric buses in** 2020-2021
- **BYD is currently the market leader,** with contracts for 379 buses, which will be operational in September 2020[1]
- **Yutong** manufactured the first electric bus to arrive in the city
- Mitsui – Caetano, Siemens, Sunwin, Yinlong, Dongfeng, Sinotruck, Foton, and Zhongtong also participated in the bid
- In first round of e-bus tenders (483 e-buses), charging infrastructure was set to be provided by the city's distributor (Enel-Codensa). For new tenders, charging infrastructure is open for new providers.

Technology – *demand*

- **Celsia** is purchasing **126 e-buses** from BYD to join the SITP fleet, corresponding to USD $33 million
- **Ashmore (Estructura Plural Electribus Bogotá)** has purchased **253 buses** from BYD for TransMilenio UF2 and UF5, totaling USD $80 million
- **BYD** closed deals for an additional **104 buses** in UF Suba and Perdomo, **totaling 483**
- In 2020, the city is tendering **another 2,085 buses** (with 80, 50 and 40 passenger capacity); projects with zero emissions and extended guarantees will be prioritized; it is expected that at least **30% of tendered buses will be electric**

★ Key learnings to date

- Concession contracts mitigate technology risk via five-year or 400,000km factory guarantees and guaranteed battery autonomy for 15 years
- BYD has considerably scaled post-sale support as a part of 2019 contracts, including preventive maintenance for ~2 years, guaranteed spare parts for 15 years, trainings for technicians and drivers, and workshop support infrastructure
- Tendering charging infrastructure provision—which was set in the first round of e-bus tenders—can reduce leasing costs paid by Transmilenio; this is the model going forward

Notes: 1. BYD, "BYD to Help Colombia Create the Largest Electric Bus Fleet in the Americas", Nov. 2019.

MARKET READINESS

Private investors and energy companies are leading e-bus financing

Financing – *public*	• **Financiera de Desarrollo Nacional** is working with the government to develop a financing scheme for transactions over USD $30 million • **Bancoldex** is working to develop a line of credit to support electromobility
Financing – *private*	• Two third parties, **Ashmore and Celsia,** have won tenders to procure electric buses • Others are interested in joining as asset providers • **Commercial banks** are reluctant to increase their exposure to the transport sector
Financing – *guarantees*	• Bogota has a **trust fund** where fare collections are sent; the city provides additional resources when needed • The system trust fund **guarantees payment** to investors

★ Key learnings to date

- It is critical that contracts address termination risk and interface risk for asset owners[1]
- Bringing in third-party asset owners (like Ashmore, Celsia) has been a new way to finance e-buses given the hesitance of commercial banks

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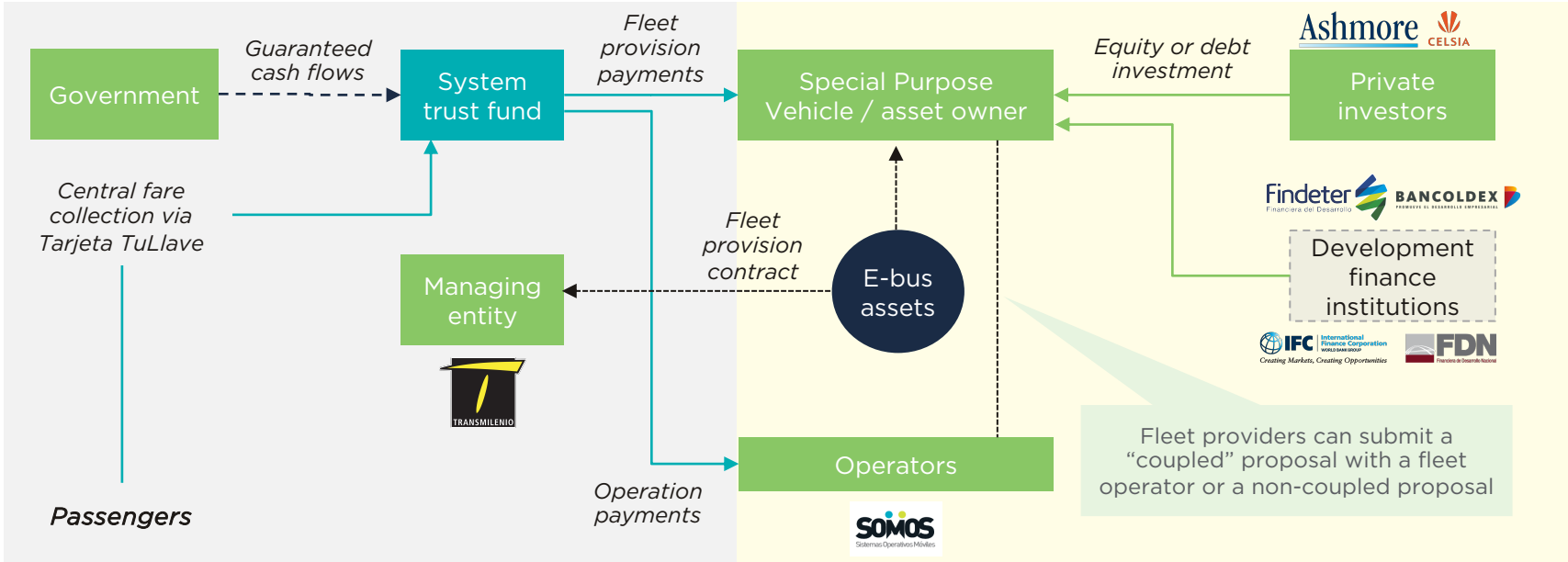
Notes: 1. For termination risk, contracts currently specify three options: i) government continues to pay asset owner, ii) government deploys assets to another operator, or iii) government buys asset. For interface risk, the government increased fleet reserve requirements and agreed to pay asset owners 80% of the monthly payment for 10 years after buses are delivered; the remaining 20% of the payment depends on bus availability.

E-BUS MODEL

SITP has already put in place a model to scale up electric buses

FOCUS INVESTMENT OPPORTUNITY



SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (1/2)

Local Government

- **Mayor's Office:** Defines bidding parameters to ensure e-buses are financially and fiscally viable for all stakeholders (i.e., operators and government)
- **Transmilenio:** Bus rapid transit system in Bogotá that awarded e-bus contracts to BYD
- **SITP:** City-wide transportation system under which e-buses will operate

Suppliers

- **BYD:** Bogotá's current and main supplier – it will provide 379 e-buses, which will begin operating in September 2020
- **Yutong:** Supplied the first electric bus in December 2019
- **Sunwin and Foton:** Participated in the bidding process and are currently exploring the market, but have not made any transactions yet

Operators

- **Sistemas Operativos Móviles and Empresa Operadora de Transportes Gran Américas S.A.S:** Will operate the day-to-day operations of e-buses, starting in the towns of Usme and Fontibon

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SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (2/2)

Financiers – Public

- **Bancóldex:** National development bank that created a line of credit for SITP operators/concessionaries to promote electromobility adoption
- **Financiera de Desarrollo Nacional:** National development bank that is working to develop a financing scheme for electric bus projects larger than USD 30 million
- **Fondo Nacional de Garantías:** Public institution that provides guarantees to increase credit to SMEs; could potentially guarantee e-bus projects in the future

Financiers - Private

- **Ashmore:** Investment manager that invested USD 80 million in 259 e-buses in Bogotá

Utility Companies

- **CELSIA:** Electric energy company that has invested in 120 e-buses

SUMMARY

THE OPPORTUNITY

CITY INVESTMENT SYNOPSES

- Santiago
- Bogota
- Mexico City
- Sao Paulo
- Medellin

INVESTMENT PIPELINE

ADDITIONAL MATERIALS

SUMMARY OF OPPORTUNITY

Investment requirements	SPV - equity	SPV - debt	Credit guarantee
Amount[1]	• 20-bus project (18m articulated) – USD 16 million total investment • 50-bus project (18m articulated) – USD 40 million total investment • 100-bus project (18m articulated) – USD 80 million total investment		
Commercial model	Separation of all assets, through existing contracts		
Instrument	Equity	Debt; various levels of seniority	• Partial credit guarantee (50%)
Time horizon	10-15 years; shorter with exit or re-financing	5-10 years; shorter with exit or re-financing	• 5-10 years, depending on loan duration
Expected returns	IRR should target IRR, depending on fleet provision payment amount (not yet set by Metrobus)	8% APR, depending on loan agreement	1% annual fee, depending on guarantee structure
Upcoming projects	• Metrobus Line 3 (2020-2021) • Annual fleet renovation		

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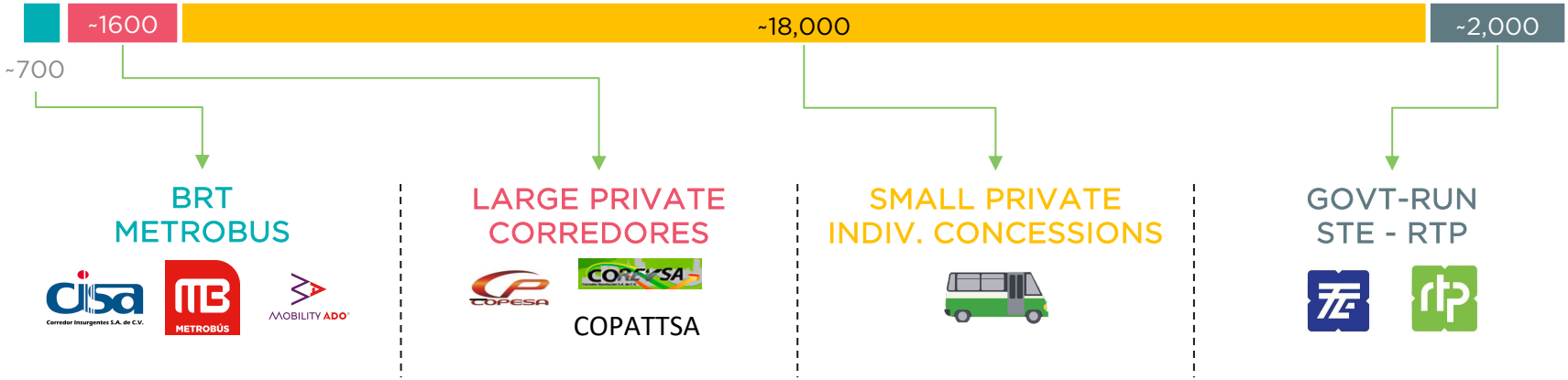
Notes: 1. Project size could vary.

MARKET OVERVIEW

Mexico City has four bus models, with varying levels of formalization and govt oversight

Market share of business models[1]
# of units, out of ~22,300 total



The following slides focus on Metrobus, the BRT system, which offers near-term opportunities to transition to e-buses

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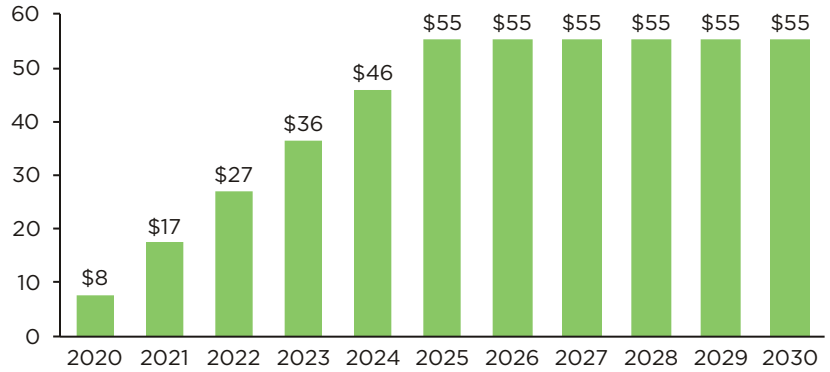
Notes: 1. Colors correspond to the five high-level bus operator business models that exist in Latin American cities today. For more information, see slide 74.

MARKET POTENTIAL

Metrobús has >$50M annual potential for e-buses by 2030

Market potential for electric buses[2]

USD millions, 2020-2030



KEY DRIVERS:

- **Fleet renovation:** ~70 buses per year
- **% of buses procured that are electric**: Gradual increase to 100% electric by 2025, given city commitment
- **Bus cost**: USD ~800K for 18am articulated bus

Overview of Metrobús in Mexico City - 2019

General	• Metrobus is the BRT system in Mexico City
# of buses	• ~700 buses in the BRT system across 10+ private operators • Buses are mostly articulated, biarticulated, and two-story • Recent efforts have renewed fleets to cleaner technologies1
# of passengers	• ~1 million per day
Concession agreements	• Most concessions last 10 years; concessions in Línea 7 are 20 years

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Notes: 1. Diesel Euro V and diesel particulate filter. 2. Annual market potential based on # of buses renovated per year (70, on average), % of buses procured that are electric (10 buses in 2020, growing to 100% of buses in 2025 per government commitment to C40 Green and Healthy Streets Declaration), and cost of e-bus (USD 790k, per latest estimate from Metrobus).

MARKET READINESS

The government has committed to e-buses and started to explore opportunities

Policy – *e-bus commitment*

- City government has **committed to only procure zero-emission buses after 2025,** via the C40 Green and Healthy Streets Declaration
- City is developing a 2020-2026 **Climate Change Program—*Programa para la Reducción de Emisiones del Transporte*—which includes a chapter on electromobility,** required by law

Policy – *transport system organization*

- Metrobus creates **clear central plans for routes, operations, and expansion,** which are accessible to all system stakeholders
- **Responsibilities are clearly defined**: operators supply buses, while Metrobus oversees stations, roads, and parking lots
- A central trust (fideicomiso) **guarantees payments to operators** (based on kms. in service), fleet renewal credits, and other payments—based on central fare collection system; for e-buses, Metrobus is exploring using its **trust to lease e-bus assets for operator use**
- Concession agreements have comprehensive terms that **clearly define the relationship between Metrobus and operators**
- Metrobus **monitors** that operating routes are met, bus maintenance is up to date, and operators are on schedule

★ Key learnings to date

- For the extension of Linea 5, Metrobus has put in place a pilot with two concessions that separate asset ownership from asset operation and maintenance
- Depending on results, this model could be further scaled throughout Metrobus—creating an opportunity for e-buses
- The Metrobús fideicomiso regulation was updated to allow for leasing of e-bus assets from a third party, for operator use

MARKET READINESS

Metrobus is preparing to test several e-buses in 2020

Technology – *supply*

- Metrobus has conducted technical assessment of Linea 3 to **develop/revise technology specifications for articulated buses**; also aims to develop **technology specifications for 12m buses in Linea 4**
- **Several Chinese manufacturers, Daimler, and Volvo are exploring the market;** BYD and Yutong have local representatives
- Although outside Metrobus, **Yutong has provided 63 fully-electric trolley-buses to the Sistema de Transporte Electrico (STE)**, now operational in the Eje Central and select other routes
- **Comisión Federal de Electricidad (CFE)** is public utility; Engie is also active in the market

Technology – *demand*

- **MIVSA/ADO, Engie, and Yutong have signed MOU and plan to procure and pilot one 18m e-bus from Yutong**, to arrive later in 2020
- Metrobús aims to place **10 articulated e-buses in Linea 3 by mid-2020** and is exploring opportunity to place **8 or 10m e-buses in feeder lines**
- **Several other operators within Metrobus have expressed interest in e-buses** and are exploring the opportunity, in partnership with ZEBRA
- STE aims to scale to ~**500 new trolleybuses**

★ Key learnings to date

- Secure performance guarantees from manufacturers to ensure that operators have a minimum number of buses available that meet key performance metrics (e.g., # of km per charge of battery)
- Identify lines and operators where close to 1:1 replacement is possible, based on routes and charging needs, and focus initial procurement on these lines
- Prioritize fast-charging systems, where possible

MARKET READINESS

Financiers have expressed interest but are waiting for concrete opportunities

Financing – *public*	• **Banobras and NAFIN are interested** in electric mobility but have not yet established concrete financing schemes for e-buses
Financing – *private*	• Several third parties, including private transport and energy companies, have **expressed interest in asset ownership**
Financing – *guarantees*	• The city **takes on demand risk by paying operators per kilometer**, as stipulated in concession agreements • Credit payments are executed via the **Metrobus fideicomiso**, providing a guarantee to investors

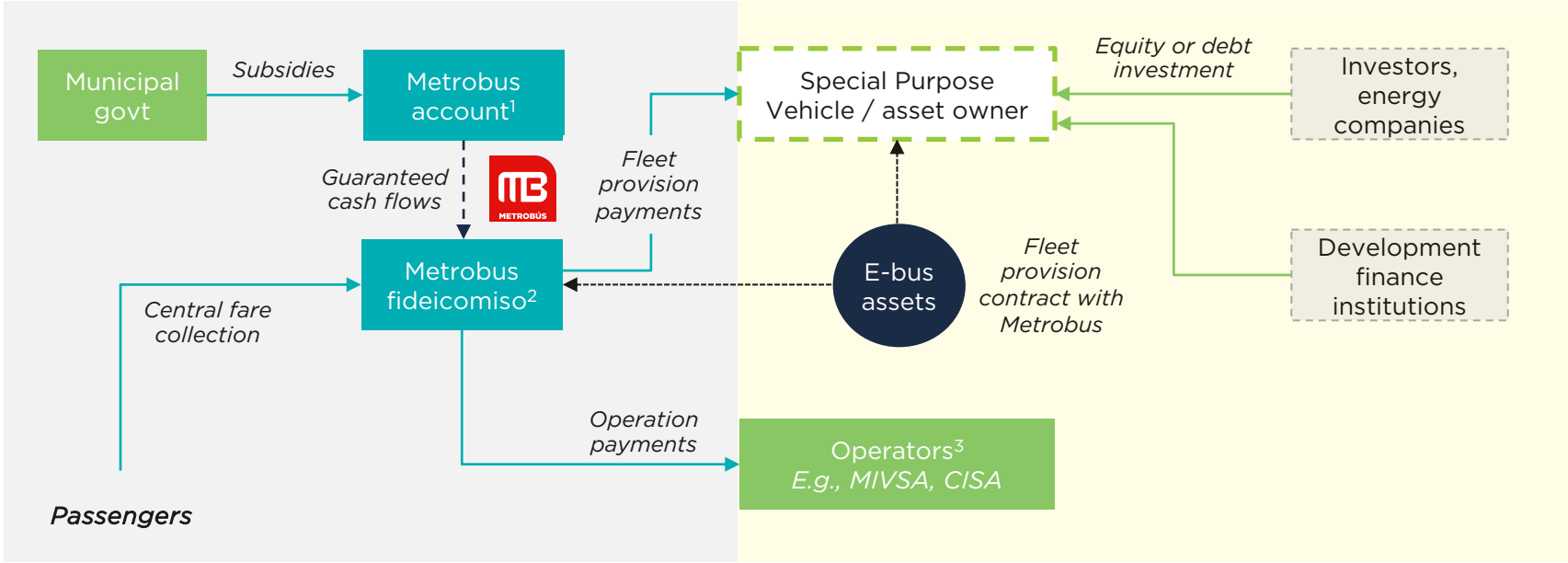
★ Key learnings to date

- Separation of asset ownership from operations in future concessions is seen as potential opportunity to finance the transition to e-buses
- Having a sub-sovereign guarantee is ideal; however, many city and state/regional governments have been hesitant to provide them—either due to lack of resources or political dynamics across parties

E-BUS MODEL

The Metrobus fideicomisco could secure leasing contracts with third party asset owners

FOCUS INVESTMENT OPPORTUNITY



Notes: 1. Receives and manages subsidies from the government and helps make operation payments to operators (by km). 2. Stabilizes demand, by guaranteeing a minimum level of revenues to operators and to SPV. 3. Operators could own the chassis (supported by concessional finance), if investor did not want to own this asset.

SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (1/2)

Local Government

- **Secretaría de Movilidad (SEMOVI)**: Sets policy and regulates public transport system in Mexico City
- **Secretaría del Medio Ambiente (SEDEMA)**: Sets policy and oversees environmental issues in Mexico City; is developing a 2020-2026 Climate Change Program for the city, required by law
- **Metrobus:** Oversees and regulates BRT system in Mexico City; is exploring how to place e-buses in Linea 3, Linea 4, and several feeder lines
- **Sistema de Transporte Eléctrico (STE)**: Oversees and regulates electric transport in Mexico City; this includes ~200 trolley buses

Suppliers

- **Yutong**: Largest manufacturer of e-buses globally; has representatives in Mexico City; to date, is the main trolley bus supplier for the city
- **BYD**: Second largest manufacturer of e-buses globally; has representatives in Mexico City

Operators

- MIVSA/ADO
- CISA: Association of operators created in 2005; has 1,300 buses in three lines of Metrobus (1, 4, 7) and outside of Metrobus in corridors
- RTP

SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (2/2)

Financiers – Public

- **Banobras**: National development bank that has a fund, PROTRAM, focused on infrastructure projects for BRT systems, which has invested over USD 1.2 billion to date
- **NAFIN**: National development bank that provides guarantees and loans to support private operator fleet renewal in corridors; for example, in 2017 NAFIN issued a credit line for USD ~25 million for fleet renewal at the federal level

Financiers - Private

- **Ascendal**: Transport company interested in acting as fleet provider in Mexico City; has signed Investor Declaration with ZEBRA
- **Banca Mifel**: Commerical bank that has supported bus financing projects alongside Banobras PROTRAM; for example, in Queretaro they established a line of credit to purchase 222 new BRT buses, backed by the trust of the BRT
- **Banco Multiva**: Commercial bank that has supported bus financing projects alongside Banobras PROTRAM
- **CitiBanamex**: Commercial bank that has supported bus financing projects alongside Banobras PROTRAM

Utility Companies

- **Comisión Federal de Electricidad (CFE)**
- **Engie**: Private energy company interested in acting as fleet provider in Mexico City

SUMMARY

THE OPPORTUNITY

- CITY INVESTMENT SYNOPSES
  - Santiago
  - Bogota
  - Mexico City
  - Sao Paulo
  - Medellin

INVESTMENT PIPELINE

ADDITIONAL MATERIALS

SUMMARY OF OPPORTUNITY

Investment requirements	SPV - equity	SPV - debt	Credit guarantee
Amount[1]	• 100-bus project (12m bus) – USD 10 million[2]		
Commercial model	Separation of electric assets, via existing contracts		
Instrument	Equity	Debt; various levels of seniority	• Partial credit guarantee (50%)
Time horizon	10 years; shorter with exit or re-financing	5-10 years; shorter with exit or re-financing	• 5-10 years, depending on loan duration
Expected returns	9% target IRR (TBC)	8% APR, depending on loan agreement	1% annual fee, depending on guarantee structure
Upcoming projects	• Distribution subsystem operator (2020-2021)		

Notes: 1. Project size could vary. 2. Only includes electric components, ~1/3 of bus price.

MARKET OVERVIEW

24 private operators participate in SPTrans, across three sub-systems

Market share of business models[1]
# of units, out of ~14,000 total

~4,350	~3,600	~6,100
STRUCTURAL SUBSYSTEM	REGIONAL ARTICULATION SUBSYSTEM	DISTRIBUTION SUBSYSTEM
Larger buses run by traditional operators	*Basic buses run by traditional operators*	*Smaller buses run by newer operators*
mobibrasil, Santa Brígida		TRANSWOLFF

The following slides focus on high-potential operators across the three sub-systems

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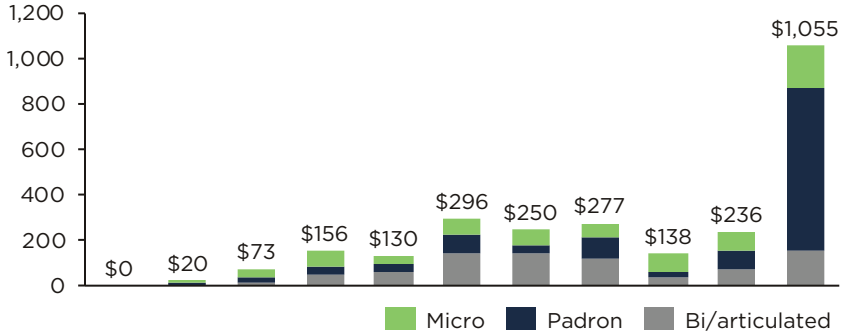
Notes: 1. The structural subsystem connects terminals, using corridors and serving the central region. The regional articulation subsystem connects smaller and busier neighborhoods within the same region. It also connects different regions, if neighborhoods share borders and do not cross the central region. The distribution subsystem connects remote neighborhoods to local bus corridors and terminals (CPTM trains and metro stations), not crossing the central region.

MARKET POTENTIAL

SPTrans will reach $1B annual potential for e-buses by 2030

Market potential for electric buses
USD millions, 2020-2030



KEY DRIVERS:

- **Fleet renovation:** Varies by year, depending on how many buses entered the system each year, 2009-19
- **% of buses procured that are electric**: Working toward 100% by 2028, in line with Climate Change Law
- **Bus cost**: USD 150K for micro (<12m), USD 270K for padron (~12m), USD 515K for articulated

Overview of SPTrans - 2019

# of buses	• ~14,000 buses across 24 private operators • 70% of buses are Euro V • 26% of buses are 12m[1]
# of passengers	• 6.5M per day, on average • 2.6B passengers in 2019 • Covid-19 is affecting ridership
Concession agreements	• Concessions are regulated by SPTrans and last 15 years • The most recent contracts were signed in Sep 2019[2] • Private concessionaires own and operate fleet

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Notes: 1. 19.1% are Mini (~35 pax), 18.4% are Midi (~55 pax), 17.4% are Basic (~75 pax), 10.2% are Articulated 23m (~171 pax), 6.2% are Articulated 18m (~120 pax), 1.4% are trolley buses (padron sizes. 12-15m, ~96-101 pax), 0.9% are Padron 15m (~99 pax), and 0.7% are Biarticulated (~198 pax). 2. No buses were renovated at this time; renovation plans are presented six months after contract renewal.

MARKET READINESS

Based on Climate Law, public transport must be zero emission by 2038

Policy – *e-bus commitment*

- **In January 2018, São Paulo set pollution reduction targets for all buses,** including 100% reduction in CO2 within 20 years and 95% for particulate matter and nitrous oxide,[1] based on amendments to the 2009 Climate Change Law
- **Contracts signed** with bus operators **set annual emission reduction targets**, which provide another tool to reinforce emission reduction targets within public transport

Policy – *transport system organization*

- The Secretary of Mobility and Transportation (SMT) is responsible for **regulating and making concessions** in the system
- SPTrans is the public transport authority and is responsible for **supervising contracts, planning routes, managing payment systems, monitoring quality, and applying fines**
- Operators are chosen through a bidding process—they **own, operate and maintain** their fleets
- The last bidding process was finalized in March 2019 and the winning operators signed 15-year contracts in September 2019

★ Key learnings to date

- **Implementation follow-up is critical to make sure target emissions reductions are achieved;** the previous Climate Law did not meet its goals, in part due to lack of penalty for not meeting targets
- Contracts stipulate penalties if operators do not comply with emission reduction targets and can be suspended if not followed within a six-month window
- Maintenance and diesel costs need to be revised for new procurements, as costs stipulated for 16 e-buses pilot were higher than diesel

Notes: 1. Specific targets are: CO2 to be reduced 50% in 10 years and 100% in 20 years, particulate matter to be reduced 90% in 10 years and 95% in 20 years, and nitrous oxide to be reduced 80% in 10 years and 95% in 20 years.

MARKET READINESS

São Paulo has local e-bus production, due to high cost of importation

Technology – *supply*

- **BYD** has a factory in Campinas (São Paulo State) that **produces chassis and battery** for 720 vehicles/year and will produce articulated buses in 2020; BYD is also installing a **battery assembly plant** in Manaus
- **Eletra** has a factory in São Bernardo do Campo (São Paulo) and **produces e-buses and trolleybuses**
- **Higer** has representation and offers ultracapacitor and opportunity charging buses, but none have been procured yet
- **Body builders Caio and Marcopolo** are interested in supplying e-buses; Caio is **liaising with CaetanoBus** for the drivetrain supply

Technology – *demand*

- **Transwolff**, a bus operator in São Paulo, procured **16 electric buses** from BYD in 2019, as well as charging infrastructure and a credit agreement for electricity with Enel X
- **Eletra** has provided **~200 trolleybuses** to the city of São Paulo; the last purchase was made in 2013

★ Key learnings to date

- **Local manufacturing is critical** given high cost of importing, due to national policies
- **Local supply of articulated buses and micro buses is needed;** BYD plans to launch both models
- **Competition is needed** to offer the best products to operators (e.g., lower maintenance costs, reliable)
- **Drop-in biodiesel technologies (HVO)** are supported by the national government, the biodiesel sector and diesel bus manufacturers and operators; however, supply is not readily available and could be more expensive than e-buses
- SPTrans and operators prefer to purchase chassis but lease batteries and charging infrastructure

MARKET READINESS

National DFIs have attractive financing schemes, with strict national content rules

Financing – *public*	• **BNDES** has an attractive finance scheme for e-buses, **FINEM Meio Ambiente,** with credits that cover 80-100% of bus cost, last the entire lifetime of the asset (up to 34 years), and have a 9-11% interest rate • BNDES has **strict rules for national content**, which stipulate that a certain percentage of the product must be produced inside Brazil[1] • **CAIXA and other regional development banks,** such as Banco do Nordeste, also offer favorable conditions for e-buses
Financing – *private*	• **Enel X has expressed interest in asset ownership** • **Engie, Siemens Financial Services,** and other private investors are also participating in discussions • **Commercial banks have long-standing relationships with operators** (i.e., Luso, Guanabara, Caruana Financeira) and provide credit and contract loans, but do not offer specific conditions for e-buses
Financing – *guarantees*	• **The farebox trust fund**, managed by SPTrans, can be used as a **guarantee** for private operators to cover up to 30% of their monthly payment • **SPTrans consent on the concession contract terms** (i.e., 15 years, with established payments and ROI) has also been used as a guarantee

★ Key learnings to date

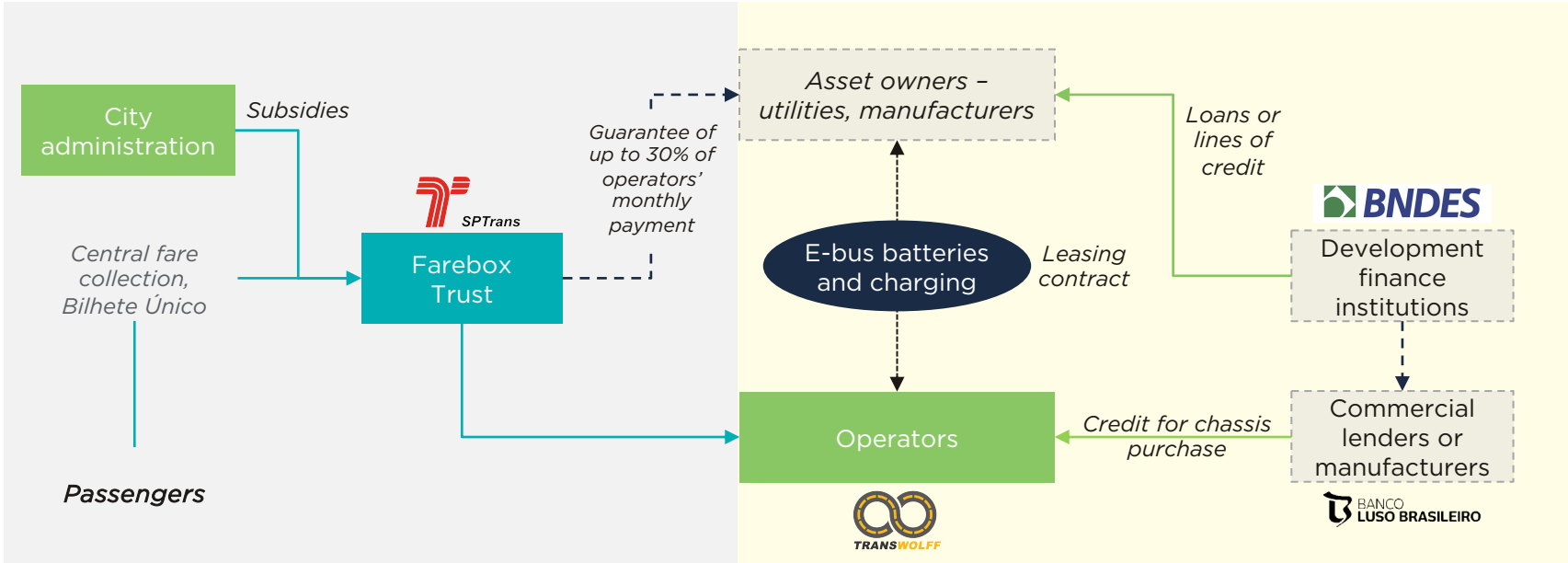
- **Attractive public financing options exist**, contingent on national content regulations
- Public and private financiers are still reluctant to accept existing guarantees given they do not cover all risks (e.g., fares are politically set)
- Financing options are needed for operators and third parties—given operators prefer to purchase chassis but lease batteries and charging infrastructure

Notes: 1. BNDES has recently decreased the national content minimum requirement for e-buses to 20% until the end of 2021, 30% from 2022 to 2026, and 50% from 2026 on.

E-BUS MODEL

Bringing in new asset owners helps separate and mitigate risks

FOCUS INVESTMENT OPPORTUNITY



SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (1/2)

Local Government

- **SPTrans:** Municipal local government authority that manages public transportation and is responsible for supervising contracts, planning routes, managing payments, monitoring quality, and applying fines
- **Secretary of Mobility and Transportation (SMT):** Municipal authority responsible for regulating and making concessions
- **SMT:** i) formulates, proposes, manages, and evaluates public policies for the development of urban mobility; and ii) studies, plans, manages, integrates, inspects and controls the individual and collective transport of the city
- **COMFROTA (Steering Committee of the Fleet Replacement with Cleaner Alternatives Monitoring Program):** Program that supports the implementation of recommendations and guidelines established by Climate Laws n° 14,933/2009 and n° 16,802/2018

Suppliers

- **BYD:** Leader in the market, manufactured the 16 electric buses that are currently operating in the city; BYD has a factory in Campinas
- **Eletra:** Manufactures the trolleybuses that operate in the city of São Paulo (engine: WEG); Eletra has a factory in São Bernardo do Campo

SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (2/2)

Financiers – Public

- **BNDES Finame:** Provides financing for chassis and batteries (financing 80% of the amount in 10 years)
- **Caixa:** Offers better conditions for e-buses; other regional national development banks such as Banco do Nordeste do so as well

Financiers - Private

- **Siemens:** Participating in discussions to provide financing, but there have been no concrete actions to date
- **Commercial banks:** Have long-standing relationships with operators and provide credit and contract loans, but do not offer specific conditions for e-buses

Operators

- **Transwolff:** Currently leading the shift towards electromobility; it operates 16 electric buses on one route
- **Ambiental Transportes Urbanos:** Operates the trolleybus system (~200 vehicles)
- **Santa Brígida:** Tested e-buses in tests deployed in the city prior to 2019

Utility Companies

- **Enel X:** Italian energy company that has expressed interest in financing e-buses through leasing deals, buses, batteries, infrastructure, and supporting operators with deployment

SUMMARY

SUMMARY OF OPPORTUNITY

Investment requirements	SPV - equity	SPV - debt	Credit guarantee
Amount[1]	• 40-bus project (8m bus) – USD 6 million • 80-bus project (8m bus) – USD 12 million • 100-bus project (8m bus) – USD 15 million		
Commercial model	Separation of assets, via permits that local public transport authorities guarantee for 15 years		
Instrument	Equity	Debt; various levels of seniority	• Partial credit guarantee (50%)
Time horizon	10-15 years; shorter with exit or re-financing	5-10 years; shorter with exit or re-financing	• 5-10 years, depending on loan duration
Expected returns	IRR should target 9-18%, depending on fleet provision payment amount (not yet set)	8% APR, depending on loan agreement	1% annual fee, depending on guarantee structure
Upcoming projects	• 2-3 TPC operators		

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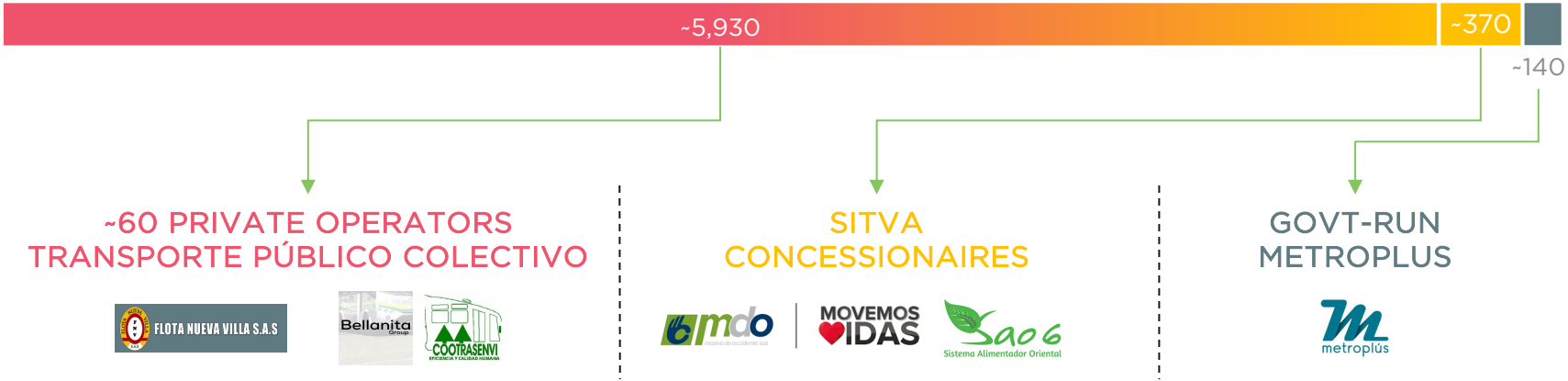
Notes: 1. Project size could vary.

MARKET OVERVIEW

Medellín has govt-run BRT and private operators that vary by scale and level of formalization

Market share of business models[1]
# of buses, out of ~6,440 total



The following slides focus on Transporte Público Colectivo (TPC), given TPC represents >90% of the market in the city

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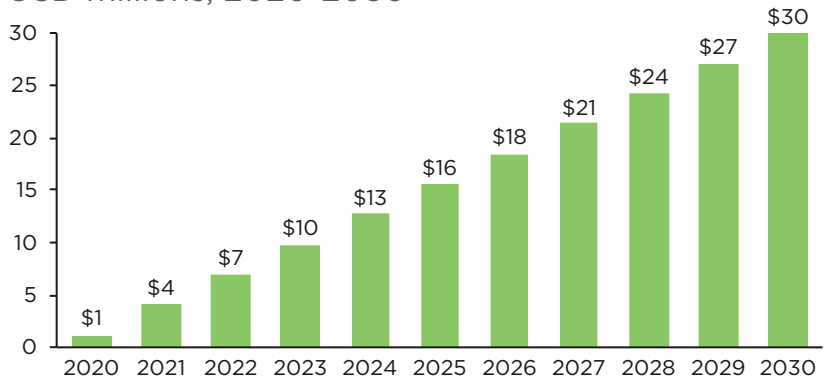
Notes: 1. Colors correspond to the five high-level bus operator business models that exist in Latin American cities today. For more information, see slide 74.

MARKET POTENTIAL

TPC will reach ~$30M annual potential for e-buses by 2030

Market potential for electric buses[2]

USD millions, 2020-2030



KEY DRIVERS:

- **Fleet renovation:** ~450 buses per year
- **% of buses procured that are electric**: 2-3 operators currently ready to transition, with growth each year to meet Ley 1964 targets
- **Bus cost**: USD 150K for 7.8m bus

Overview of Transporte Público Colectivo (TPC) - 2019

General	• TPC spans across the Valle de Aburrá, the metropolitan area • Medellin is one city within the metropolitan area
# buses	• ~6,000 buses across ~60 private operators[1] • Many buses are Euro IV, V • Most buses are micro, ~8m
# passengers	• 879,000 per day
Concession agreements	• Operators have permits with no end date • Both the Medellin (Secretary of Mobility) and Valle de Aburrá (AMVA) local authorities oversee the system

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Notes: 1. There are 6,000 buses in the Valle de Aburrá, ~3,600 buses in the city of Medellin. 2. Annual market potential based on # of buses renovated per year (400, on average), % of buses procured that are electric (based on Ley 1964 targets), and cost of e-bus (USD 150k).

MARKET READINESS

The government publicly supports e-buses and is working to consolidate the TPC system

Policy – *e-bus commitment*

- City government has committed to **electrifying 100% of the city's bus fleet by 2030**, with the goal of becoming the "capital of electromobility" in Latin America
- City government has **committed to only procure zero-emission buses after 2025,** via C40 Green and Healthy Streets Declaration
- A **national law passed in 2019 (Ley 1964)** promotes vehicle electrification (e.g., through tax breaks) and sets annual targets, from 10% by 2025 to reach 100% by 2035

Policy – *transport system organization*

- The Secretary of Mobility in Medellin (SMM) and AMVA carry out **central planning—including recent efforts to consolidate and integrate the TPC system**—to guide operator activities
- **Responsibilities are clearly stipulated**: operators own, operate, and maintain buses; the city handles road infrastructure and permits[1]
- **There is not currently a city-level trust to back operations;** central fare collection exists (Tarjeta Civica), but most TPC operators are not yet integrated and therefore collect fare revenues in cash

★ Key learnings to date

- Continue to support the organization and consolidation of traditional TPC operators into consortiums, which creates opportunity to transition to e-buses
- Create juridic stability of contracts for operators that transition to buy e-buses, to ensure services and revenues continue for the lifespan of vehicles
- Create centralized fare collection system to separate fare collection and payment to operators, without impacting the tariff
- Launch early planning efforts to find space for patios and chargers

Notes: 1. For the BRT and SITVA, SITVA handles central fare collection.

MARKET READINESS

E-buses have been tested in the city and several suppliers have executed transactions

Technology – *supply*

- **Zhongtong has established a warehouse in Medellin** with spare parts and a technical team; they have standardized their **7.8m e-bus model for Medellin and have sold 12 of these buses to Masivo de Occidente (MDO)**
- **BYD** has established a store in Medellin with **post-sale support; their smallest e-bus model is 9.3m,** but are considering 8m bus
- Electricity can be purchased in **non-regulated market with minimum of 0.1MW demand**
- **Foton also has representation in Medellin**

Technology – *demand*

- Metroplús, the Bus Rapid Transit (BRT) public body, purchased **64 12m e-buses from BYD**, following a successful pilot since 2017; **all 64 buses are operating in groups of ~17-22**; Metroplús is developing charging stations and infrastructure
- MDO, a private operator and concessionaire of SITVA feeder lines, purchased **four 7.8m e-buses to begin operations in 2020**; they have ordered eight more to arrive in June 2020
- **Several TPC operators have expressed interest in e-buses** and are exploring the opportunity, in partnership with ZEBRA

★ Key learnings to date

- Secure warranty and maintenance agreement with manufacturers, especially for batteries
- Ensure maintenance happens through OEM-approved programs
- Use purchasing terms to ensure strong post-sale support (e.g., Metroplús purchase was contingent on BYD opening a store in Medellin)
- Structure performance-based contracts, where manufacturers compensate operators if buses are not available for operations
- Engage formal, creditworthy operators to structure viable deals within TPC

MARKET READINESS

Government is leading efforts to develop financing schemes for electric mobility

Financing – *public*

- AMVA, EPM, Findeter, and others are structuring **a line of credit to provide financing to operators for electric vehicle renovation**, including some e-buses; the credits can cover up to 70% of the vehicle price, last up to 10 years, and have interest rates ranging from ~8-12%[1]
- **Bancoldex** is working to develop a line of credit to support electromobility

Financing – *private*

- Masivo de Occidente accessed **financing from Leasing Bancolombia**—supported by line of credit from Findeter—to purchase 12 e-buses
- **Bancolombia has *Linea Sostenible de Bancolombia***, a line of credit for sustainable transactions with an interest rate that is one percentage point lower than the standard rate; the scope includes e-buses
- Several third parties, including manufacturers and asset management funds, have **expressed interest in asset ownership**

Financing – *guarantees*

- City does not currently guarantee TPC operator revenues, but **central fare collection** could help guarantee payment to investors
- Credit guarantees could be provided by **Fondo Nacional de Garantías (FNG)** or development banks
- FNG guarantees credits for small and medium-size businesses (SME), based on their level of revenue, and charges an **annual commission** based on the remaining balance of the debt

★ Key learnings to date

- Many investors have minimum investment size above USD 30 million—which highlights the importance of structuring larger projects rather than pilots only
- Centralized payment system with guaranteed cash flows is critical to investors

Notes: 1. This financing scheme focuses on vehicle electrification more broadly and e-buses are not the primary target. The financing scheme has not yet been used for e-bus renovation, but this is one part of the plan. *2. The maximum value to be guaranteed for a preferred medium-sized company is 7.130M COP, covering up to 50% of the loan. The cost of the guarantee is 6.58% each year.*

SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (1/2)

Local Government

- **Secretaría de Movilidad de Medellín**: Sets policy and regulates public transport system in Medellin
- **Secretaría de Medio Ambiente de Medellín**: Sets policy and oversees environmental issues in Medellin
- **Área Metropolitana del Valle de Aburrá** (AMVA): As the transport authority, sets policy and regulates public transport system in Valle de Aburrá, including Medellin

Suppliers

- **Zhongtong**: Chinese manufacturer of e-buses; provided four 7.8m e-buses to Masivo de Occidente in 2019 and will provide eight more e-buses in 2020; has a warehouse with spare parts in Medellin
- **BYD**: Second largest manufacturer of e-buses globally; provided 64 e-buses to Metroplús (BRT system) and has set up physical presence/store in Medellin
- **Foton**: Has representation in Medellin and is exploring the market
- **Other**: Sunwin, Yutong exploring other markets in Colombia

Operators

- **Flota Nueva Villa**: Association of operators created in 1971; has 72 buses in 4 routes arranged directly with the municipality; is currently renovating 4 buses per year with their own resources
- **Sotrames**: Association of operators created in 1964; has 402 buses in 27 routes arranged directly with the municipality and with Cuenca 5
- **Santra**: Association of operators with 320 buses (380 upper limit) in 17 routes arranged with the directly with the municipality and Cuenca 5

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SUMMARY OF KEY PARTNERS

Success requires collaboration between public and private sectors (2/2)

Financiers – Public

- **Findeter**: National development bank working with AMVA and EPM to develop a financing scheme to renovate electric vehicles
- **Bancoldex**: National development bank structuring a line of credit for e-mobility
- **Financiera de Desarrollo Nacional (FDN)**: National development bank working to develop financing scheme for electric bus projects larger than USD 30 million
- **Fondo Nacional de Garantías (FNG):** Public institution that provides guarantees to increase access to credit for SMEs; could potentially guarantee e-bus projects in the future

Financiers - Private

- **Ashmore**: Exploring the market; has invested in 253 buses in Bogota
- **Bancolombia**: Bancolombia Leasing financed 12 e-buses purchased by Masivo de Occidente
- **MGM Innova Group**: Exploring the market for e-buses in Medellín

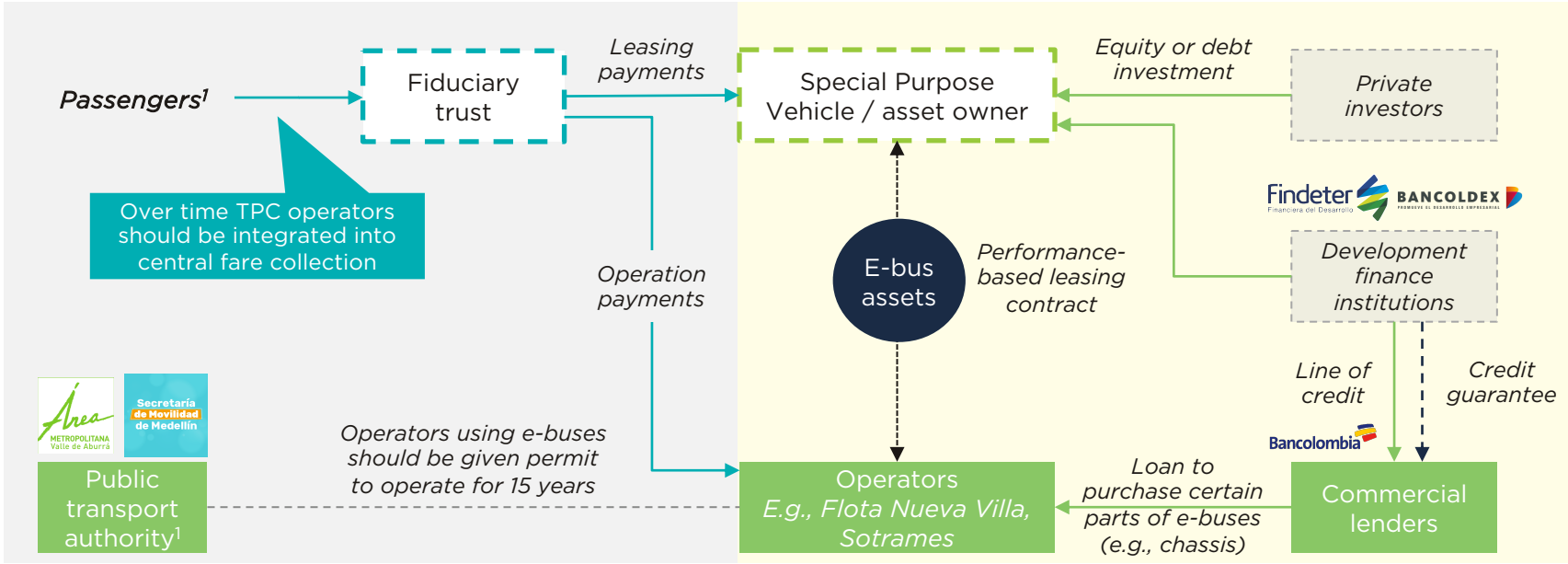
Utility Companies

- **Empresas Públicas de Medellín (EPM)**: Public utility company serving Medellin and other areas of Colombia; working with AMVA and Findeter to develop a financing scheme to renovate electric vehicles
- **Celsia:** Colombian energy company investing in e-buses in Bogota, but not yet active in Medellin

E-BUS MODEL

Bringing in new asset owners could help separate and mitigate risks

FOCUS INVESTMENT OPPORTUNITY



Notes: 1. Ideally, PTA would also guarantee cash flows to the fiduciary trust, but this is not the case today.

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SUMMARY

Summary of transactions (not exhaustive)

Summary of completed transactions 2015-present

Project	City	Amount	# of buses	Investors	Model	Status
Transantiago, Corredor Grecia (part I)	Santiago	USD ~30M	102 (12m)	Enel X	Separation of assets, new contract, with utility	Complete
Transantiago, Vule y STP	Santiago	*Unknown*	100 (12m)	Engie	Separation of assets, new contract, with utility	Complete
Transantiago, Corredor Grecia (part II)	Santiago	*Unknown*	183 (12m)	Enel X	Separation of assets, new contract, with utility	Complete
Metroplús	Medellin	*Unknown*	64 (12m)	City government	Upfront purchase	Complete
Sistema de Transporte Eléctrico	Mexico City	*Unknown*	63 (trolley buses)	City government	Upfront purchase	Complete
Sistema de Transporte Masivo	Cali	*Unknown*	26 (8m)	Celsia, Transfondo	Separation of assets, existing contract, with utility	Complete
SITP, UF4 & UF5	Bogota	USD ~80M	259 (12m, <12m)	Estructura Plural Electribus Bogotá (Ashmore)	Separation of assets, new contract, with investor	Complete
SITP, UF2	Bogota	USD ~30M	120 (12m, <12m)	Empresa de Energía del Pacífico S.A. E.S.P (Celsia)	Separation of assets, new contract, with utility	Complete
SITP, UF3 Perdomo	Bogota	*Unknown*	13	Este Es Mi Bus S.A.S.	Provision and operation, new contract	Complete
SITP, UF1 Suba	Bogota	*Unknown*	91	ETIB S.A.S.	Provision and operation, new contract	Complete

Summary of transactions (not exhaustive)

Summary of pipeline 2015-present

Project	City	Amount	# of buses	Investors	Model	Status
Transwollf	Sao Paulo	*Unknown*	16 (12m)	Transwollf, BYD	Separation of batteries, existing contract, with manufacturer	Complete
Redbus, NEoT, ABB (25)	Santiago	*Unknown*	25 (12m)	NEoT, ABB	*Unknown*	Complete
Sistema de Transporte Metropolitano (STM)	Montevideo	*Unknown*	20 (12m)	*Unknown*	*Unknown*	Complete
Masivo de Occidente	Medellin	*Unknown*	12 (8m)	Leasing Bancolombia	Direct finance to operator	In progress (4 procured)
RED	Santiago	Up to USD 1.B	Up to ~4,300	*TBD*	Separation of assets, new contract	In progress
Sistema Integrado de Transporte, Fase V, Etapa III y IV	Bogota	Up to USD 670M	At least 631, up to 2,040	*TBD*	Separation of assets, new contract	In progress
MiBus	Panama City	*Unknown*	35 (8m)	*Unknown*	*Unknown*	In progress
Sistema de Transporte Eléctrico	Mexico City	*Unknown*	50 (18m, articulated)	STE	*Unknown*	In progress
Sistema de Transporte Eléctrico	Mexico City	*Unknown*	80 (12m)	STE	*Unknown*	In progress

Summary of transactions (not exhaustive)

Summary of pipeline 2015-present

Project	City	Amount[1]	# of buses[2]	Investors	Model	Status
SPTRANS operator	Sao Paulo	*TBC*	Up to 100	*TBD*	*TBD*	Early stage
New BRT system	Salvador	Up to USD 75 million	Up to 206	*TBD*	*TBD*	Early stage
Sistema de Transporte Masivo	Cali	Up to USD 35 million	Up to 106	*TBD*	*TBD*	Early stage
Sistema de Transporte Eléctrico	Mexico City	Up to USD 140 million	Up to 300	*TBD*	*TBD*	Early stage
Ecovia	Quito	Up to USD 45 million	Up to 70	*TBD*	*TBD*	Early stage
Transporte Público Colectivo	Medellin	*TBD*	*TBD*	*TBD*	*TBD*	Early stage

Notes: 1. These are early estimates based on number of buses and average cost of type of bus. 2. Not confirmed, based on current discussions.

SUMMARY

ZEBRA Vision & Goals

ZEBRA
ZERO EMISSION BUS RAPID-DEPLOYMENT ACCELERATOR

Shift all new bus procurements in leading Latin American cities to zero emission technologies

Cities

- Guarantee political commitment and develop fleet-wide deployment strategies in leading Latin American cities (Medellín, Mexico City, Santiago, São Paulo)
- Establish a procurement pipeline of over 3,600 e-buses in the region

Industry

- Increase market competition and product availability
- Establish ZEBRA industry guidelines
- Engage utility sector to ensure grid capacity

Financiers

- Secure public commitments from leading financiers
- Establish financial mechanisms for $1bi USD zero emission bus finance
- Secure streamlined funds for advisory services

Knowledge Sharing

- Host annual showcase event
- Facilitate knowledge transfer across cities
- Deliver training on best practices to utilities and financiers
- Disseminate real world performance data

BUS OPERATOR BUSINESS MODELS

We identified five types of bus operator business models across Latin American cities

A Vertically-integrated, private operator in BRT
One private operator owns, operates, & maintains via concession

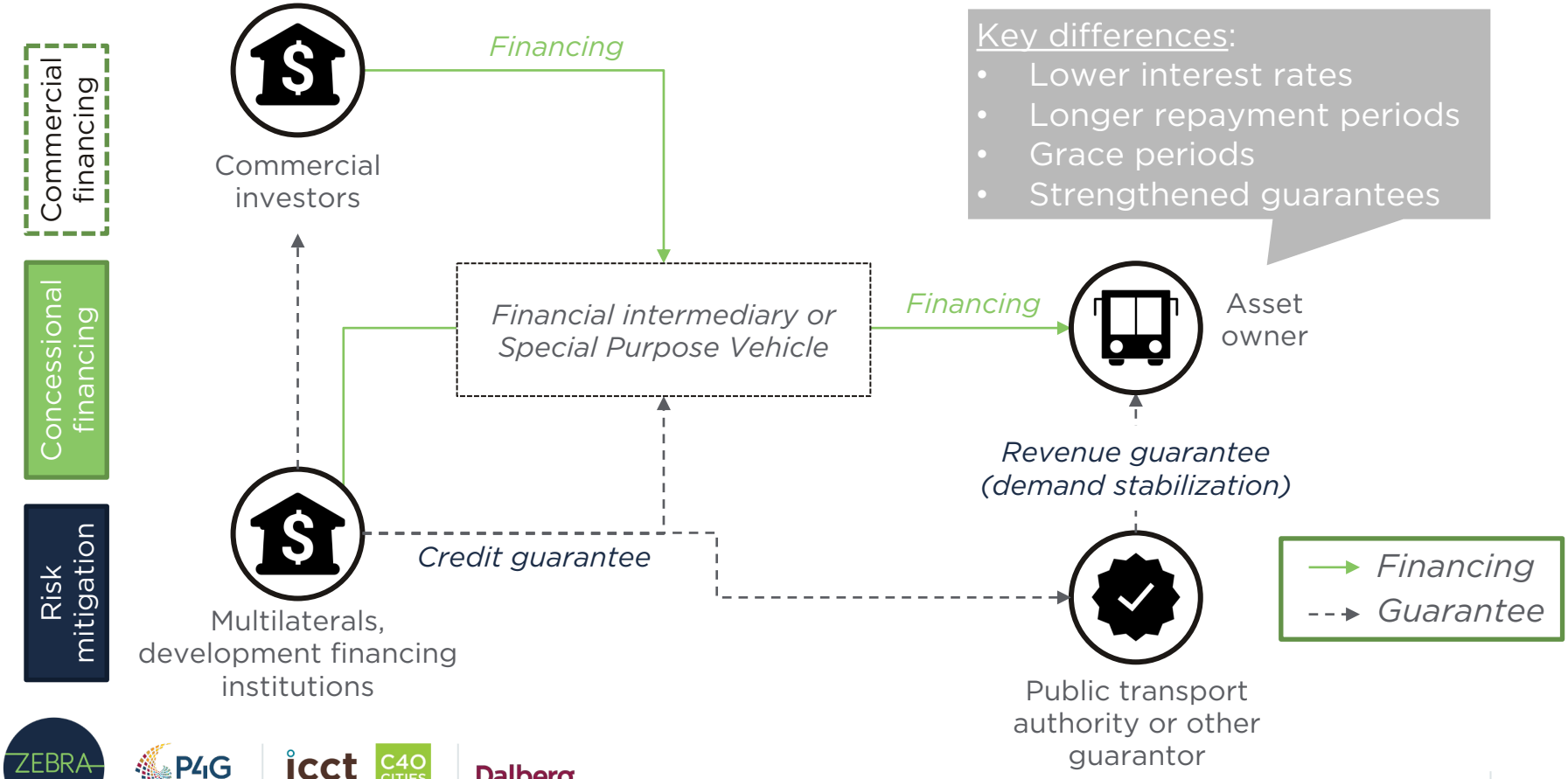
B Divided responsibilities in BRT
One entity owns assets; another operates & maintains via concession

C Large, more formal, private operator in traditional service
One private operator owns, operates, & maintains via permit

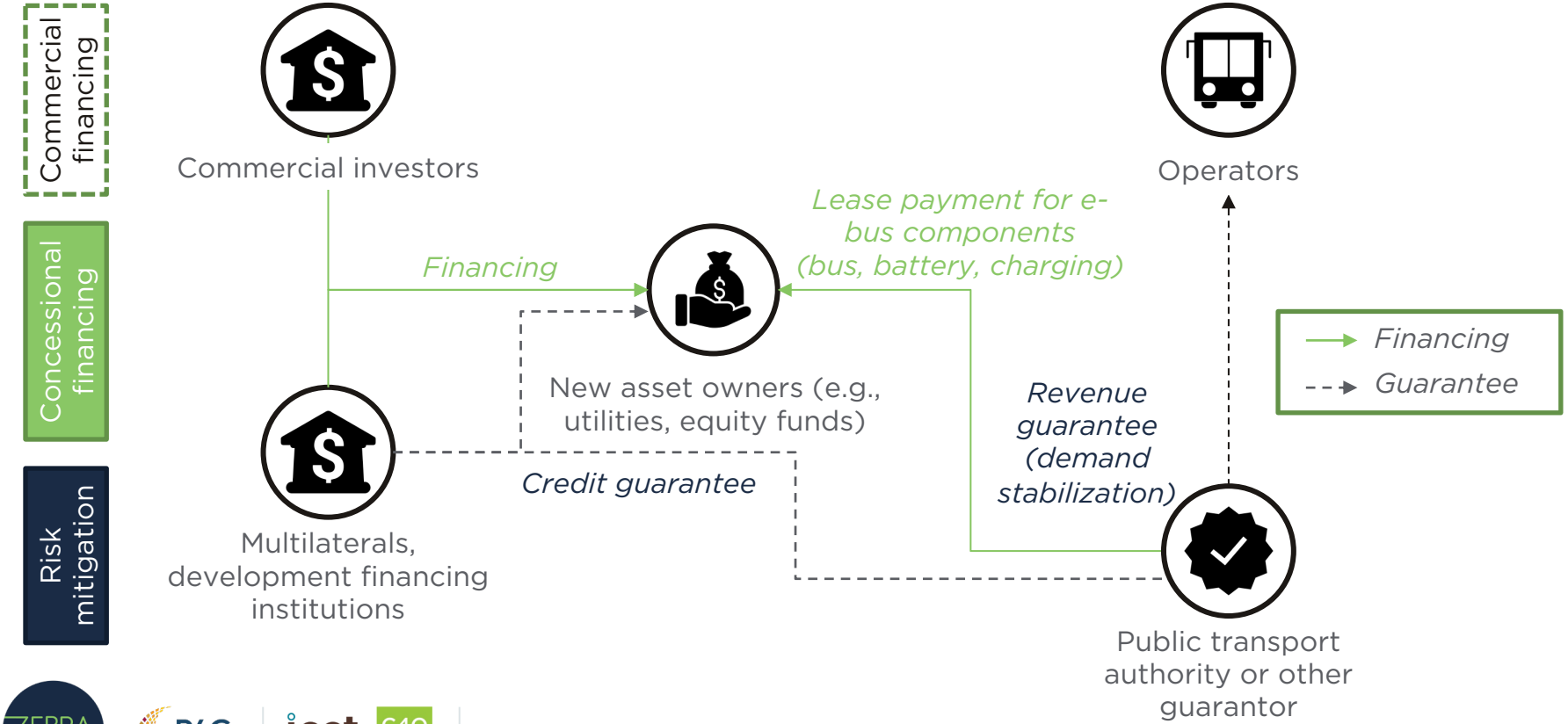
D Small, informal, private operator in traditional service
Individual owns, operates, & maintains via permit

E Government-run system
Public entity owns, operates, & maintains

How would concessional/blended finance work?



How would separation of asset ownership work?



ROLES OF KEY ACTORS IN E-BUS MODELS (1/2)

SPV / asset owner	• Receives and manages resources from investors • Purchases e-bus assets (batteries, charging stations, and/or chassis) • Provides/leases e-bus assets to operators, via performance-based contracts • Oversees fleet provision
Fiduciary trust	• Collects revenues from passenger fares, either through centralized fare collection system (Tarjeta Civica) or agreements with operators • Provides revenues to SPV, to make fleet provision and operation payments
Public transport authority	• Stabilizes demand, by guaranteeing a minimum level of revenues to the trust (e.g., per month)
Operators	• Access preferential financing from financial institutions to purchase certain e-bus assets (e.g., chassis) • Lease other e-bus assets from SPV, via performance-based contracts • Operate and maintain e-bus assets in public transport system

ROLES OF KEY ACTORS IN E-BUS MODELS (2/2)

Commercial lenders	• Provide loans to operators, with appropriate conditions (i.e., interest rate, duration, grace period), to purchase certain e-bus assets
DFIs	• Provide lines of credit or guarantees to financial institutions, with explicit conditions for e-bus lending • Invest in SPV, possibly through blended structure to catalyze private investment
Private investors	• Invest in SPV / asset owners, through equity or debt
Energy companies	• In some cases – invest in assets, either directly or through SPV (via combination of equity, debt) • Provide charging infrastructure and electricity

Investing in electric bus deployment in Latin America

Overview of opportunity and market readiness

July 2020

ZEBRA
ZERO EMISSION BUS
RAPID-DEPLOYMENT ACCELERATOR

Funder & Facilitator: P4G Partnering for Green Growth and the Global Goals 2030

Implementing Partners: icct THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION; C40 CITIES

Supporting Partners: Centro Mario Molina Investigación & desarrollo; World Resources Institute; GGGI; Clean Energy WORKS

Prepared By: Dalberg