Introduction

On October 11-12, 2017, representatives from 9 municipal and state governments in Mexico attended a workshop on how to prepare and deliver electric bus projects, organised by the C40 Cities Finance Facility (CFF) in partnership with the World Resources Institute (WRI). Key topics of discussion included the choice of technology, risks and challenges, financing options, and the availability of electric buses in Mexico. The workshop was held along the side-lines of the 13th International Congress on Cities and Transport.

The workshop’s objectives were:

- Introduce the essential features of an electric bus project, and outline options with respect to technology, business model, financing, etc.;
- Share experiences between city and state officials of the challenges and opportunities in implementing public transport projects;
- Share Mexico City’s ground-breaking experience with the Eje 8 Sur project.

This report illustrates how these objectives were addressed through the workshop sessions and summarises next steps for the organisers and the attendees. It has been compiled based on the workshop discussions and the post-workshop surveys. Copies of all presentations and photos from the workshop are available upon request to amoro@c40.org.
### Attendees

City and state delegates included:

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<tr>
<th>City/state</th>
<th>First name</th>
<th>Last name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Aguascalientes</td>
<td>Diana Alejandra</td>
<td>López de la Torre</td>
<td>Dirección de Movilidad</td>
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<td>Chihuahua</td>
<td>Guillermo</td>
<td>Hernández Rodríguez</td>
<td>Director de Transporte</td>
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<td>Colima</td>
<td>Miriam</td>
<td>Monterrubio</td>
<td>Dirección General del Sistema Integrado de Movilidad</td>
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<tr>
<td>Mérida</td>
<td>César</td>
<td>Rovel Basteris</td>
<td>IMPLAN Mérida</td>
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<td>Mexico City</td>
<td>Erika</td>
<td>Kulpa</td>
<td>SEMOVI</td>
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<td>Mexico City</td>
<td>Rubí</td>
<td>Sanchez</td>
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<td>Mexico City</td>
<td>Casandra</td>
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<td>Mexico City</td>
<td>Candi</td>
<td>Dominguez</td>
<td>SEDEMA</td>
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<tr>
<td>Mexico City</td>
<td>Julio Iván</td>
<td>Martínez Cortijo</td>
<td>Metrobus</td>
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<td>Morelos</td>
<td>David</td>
<td>Martínez</td>
<td>Secretario de Movilidad de Morelos</td>
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<td>Nuevo Léon</td>
<td>Alfonso</td>
<td>Martínez Muñoz</td>
<td>Subsecretario de Protección al Medio Ambiente y Recursos Naturales</td>
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<tr>
<td>Sinaloa</td>
<td>Jorge Said</td>
<td>Osuna Félix</td>
<td>Dirección de Sinaloa, Red Plus</td>
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<tr>
<td>Tijuana</td>
<td>Nora</td>
<td>Márquez</td>
<td>Comisión Técnica del Eje de Movilidad</td>
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<tr>
<td>Madrid</td>
<td>Marta</td>
<td>Serrano</td>
<td>Directora de Comunicación y Consultoría</td>
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<td>Madrid</td>
<td>Ana</td>
<td>Pérez</td>
<td>Dirección de Comunicación y Consultoría</td>
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<tr>
<td>Santiago</td>
<td>Julio</td>
<td>Briones</td>
<td>Director de Finanzas, Transantiago</td>
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A number of CFF partners also attended the workshop, including representatives of the Chilean Ministry of Transportation and Communications, KfW, the German Embassy in Mexico, USAID, BANOBRAS, ITDP, and Carbon Trust.
## Agenda

### Workshop agenda overview

<table>
<thead>
<tr>
<th>Day</th>
<th>Session</th>
<th>Format</th>
<th>Subject Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Morning</td>
<td>Presentations</td>
<td>Introduction to electric buses</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Business models and financing options</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interactive discussion</td>
<td>Status quo and challenges</td>
</tr>
<tr>
<td></td>
<td>Afternoon</td>
<td>Presentation</td>
<td>E-buses available in Mexico</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interactive discussion</td>
<td>How to address challenges</td>
</tr>
<tr>
<td>2</td>
<td>Morning</td>
<td>Presentations</td>
<td>Experience in London and Warsaw</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Mexico City Eje 8 Sur project</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Technical assistance options</td>
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<td></td>
<td>Afternoon</td>
<td>Interactive discussion</td>
<td>Action plans</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Site visit</td>
<td>Eje Central trolleybus and Zocalo e-taxis</td>
</tr>
</tbody>
</table>
Workshop sessions

Laura Ballesteros (Sub-Secretary of Planning, SEMOVI) officially opened the workshop, restating the city’s strong support for the Eje 8 Sur project and encouraging attendees to incorporate resilience in their transport planning, based on Mexico City’s experience with the September 2017 earthquake.

1. Introduction to electric buses
   - Gustavo Jiménez, Senior Project Advisor in Mexico City, CFF

There are various electric bus technologies currently available around the world, such as opportunity charging, battery-powered buses and trolleybuses. These technologies are often compared with natural gas-powered and hybrid buses, currently more widely adopted technologies.

As part of the technical studies underpinning the Eje 8 project in Mexico City, the CFF has commissioned a wide-ranging study of electric bus technologies to provide the city with the information needed to make a decision around procurement. Technologies are being assessed according to technical specifications (e.g. range, terrain, climate), environmental performance (CO₂, methane, black carbon, PM2.5, NOₓ and noise), costs (capital expenditure, NPV, FIRR, total lifecycle cost), benefits (EIRR, environmental benefits), and risks (availability, years of experience).

Initial findings from this assessment were shared with the attendees, including recommendations for the best technology per type of transport system.

2. Electric buses: status quo and business models
   - Sebastian Castellanos, Energy and Climate Associate, WRI

Technological change and growing awareness of the impacts of poor air quality and greenhouse gas emissions are pushing the transport sector to innovate and increasingly move toward electrification. Electric vehicles are currently a small section of the market, but thanks to public and private investment and large cost reductions are expected to make 35% of all sales by 2040.

300 cities around the world have already purchased electric buses for their public transport fleets. However, the upfront cost of electric buses, uncertainty over the technology, inadequate business models, and resistance to change are barriers preventing widespread adoption.

When considering how to plan and implement an electric bus project, cities must consider, at minimum:
1) **the investment components**, including tangible assets (land acquisition, charging infrastructure, depots and ancillary infrastructure, buses and batteries), project development (technical studies, design, construction and installation, operation, training, maintenance), and intangible components (security, safety, reputation, affordability).

2) **the sources of revenue**, including income (user fees, land value capture, advertising, operational saving), incentives (subsidies, fiscal incentives) and other sources such as transfers, taxes, asset sales and scrapping;

3) **the financing options**, including equity (private and public investors), debt (bank loans, climate finance, green bonds) and risk reduction mechanisms (concessional finance, contingency funds);

4) **the implementation mechanisms**, including contracts (purchase agreements, leasing, concessions) legal structures (public, special purpose vehicles, mixed economy), enabling legislation (plans and objectives, regulations, enabling structures such as low-emission zones).

The presentation built on real-life examples from Shenzhen, London, Beijing, Gumi (South Korea), Bogotá, Gothenburg, Curitiba, Paris, and Seattle.

3. **Status quo and challenges**
   - Interactive workshop sessions facilitated by **Manuel Olivera**, Regional Director for Latin America, C40 Cities Climate Leadership Group
The attendees were then divided in small groups to discuss the morning presentations on the electric bus technologies and respective business models. They were asked to answer the following questions:

a. How is public transport structured in your city?
b. What would be required to develop an electric bus project in your city?
c. What challenges do you expect to face in developing and implementing an electric bus project in your city?

Despite differences across cities, the attendees identified similar challenges. These included lack of political leadership, fear of change and innovation, and operational barriers such as the strength of private transport operators. Delegates also highlighted the lack of data about users and costs, across all cities, while others mentioned fragmented governance as an issue, since states and cities often have competing priorities and differing regulations. Finally, there was agreement about the need to strengthen public transport to overcome the established model of ‘hombre-camiones’ and unions and to address the increase in private vehicular traffic.

In a follow-up session in the afternoon, delegates were asked to debate potential solutions to the barriers identified in the morning. Attendees suggested prioritising the creation of legal and institutional structures conducive to cities being able to propose and invest in public transport projects, especially electric mobility. A majority of the cities are currently developing Sustainable Urban Mobility Plans and establishing Integrated Transport Systems, but these achievements must be built upon. Delegates also recommended strengthening relationship with civil society and academia to educate citizens about the benefits of sustainable mobility to increase political pressure on governments to act. Finally, with respect to financing, the establishment of national fiscal incentives would spur investment in electric mobility.
4. Electric buses available in Mexico

- Jorge Suarez, Volvo
- Tobias Zhao, BYD
- Ediltron Gomes, Sunwin
- Abraham Hernández, DINA

Different manufacturers presented their current portfolio of electric buses available in Mexico, and laid out their expectations of the country’s transition to electric mobility.

5. Experience in Madrid, London and Warsaw

- Ana Perez and Marta Serrano, Dirección de Comunicación y Consultoría, Empresa Municipal de Transportes (EMT) de Madrid
- Marcin Wroblewski, Infrastructure Department, Warsaw City Hall
- Mike Weston, former Director of Buses, Transport for London

City officials from three different European cities shared their experience in procuring electric buses, both in person and remotely.

In Madrid, initial tests with 8m electric buses and hydrogen were undertaken in 2000, but the city has primarily acquired hybrid buses, both diesel-electric and GNC-electric, with mixed results. Currently, the EMT is operating 18 e-buses (from several manufacturers, e.g. BYD, Irizar, Solaris), a number expected to quadruple to 73 by the end of 2019. The city is scoping out opportunity-charging technology, but barriers such as uncertainty, and the feasibility, cost and visual impact of charging infrastructure remain to be fully addressed. The EMT is also retrofitting an existing, 40,000 m² bus depot (La Elipa Operations Centre) into a net zero energy building.

Marcin Wróblewski from Warsaw outlined the city’s actions to modernise its public transport services, which include the purchase of 30 electric buses since 2014. Warsaw, a signatory to the C40 Clean Bus Declaration, found that its fleet of battery-powered electric buses have significantly lower operating costs and greenhouse gas emissions, justifying the higher upfront cost. The city is now procuring 130 electric buses with support from the national government, and has established incentives for private operators to include environmental criteria when choosing the type of technology to adopt.

Finally, in London, public concern over poor air quality and regulations to limit circulation of polluting vehicles (e.g. Ultra-Low Emission Zone) underpinned the development of London’s Zero Emissions Map, which mandates that by 2037 all single- and double-deck buses must be electric or hydrogen-powered. Currently, the city operates 73 pure electric buses, all battery-powered, out of a fleet of 8,500. London is also trialling electric double-deckers, the city’s iconic bus type, which constitute the majority of all buses and for which there is limited experience globally.
6. **Experience in Mexico City – The Eje 8 Sur project**  
- **Gustavo Jiménez**, Senior Project Advisor in Mexico City, CFF  
- **Eduardo Venadero**, Director General, STE

The C40 Cities Finance Facility is supporting Mexico City by developing the necessary feasibility studies for a new bus corridor project, which will include a fleet of electric buses and bicycle lanes alongside it. The new bus corridor on Eje 8 Sur will be 22km long and serve an estimated 160,000 daily trips, providing connections with five Metro lines and one Metrobus Bus Rapid Transit line. The corridor will improve connections between low- and middle-income neighbourhoods and promote urban development across the area. This project has the potential to pave the way for other cities to shift their buses to low or zero emission technologies, particularly in Latin America.

**Eduardo Venadero** highlighted the importance of the Eje 8 project for Mexico City and STE. The agency is committed to promote new-generation, clean and efficient technologies, and to strengthen its role as the provider of electric transport options in the city. The Eje 8 project, supported by international organisations, is a key component of this objective.

**Gustavo Jiménez** presented the Eje 8 project, from its inception to its current status. A redevelopment of the Eje 8 Corridor was first proposed in 2004, and the need to provide a modern public transport option along the route has grown since. Currently, the estimated 160,000 daily trips along the corridor are served by 14 different lines. The project not only includes technical and financial studies of the electric bus corridor, but also complete street and transit-oriented development elements and extensive stakeholder consultation.
7. Options for technical assistance

- **Manuel Olivera**, Regional Director for Latin America, C40 Cities Climate Leadership Group
- **Mathias Merforth**, Transport Policy Advisor, GIZ
- **Francisco Quiñones**, Gerente del Programa de Apoyo Federal al Transporte Masivo (PROTRAM)

This session covered a few of the existing options available to cities to explore and develop electro-mobility and public transport projects.

**Manuel Olivera** presented the objectives and activities of the C40 Cities Finance Facility (CFF). The CFF facilitates access to finance for climate change mitigation and resilience projects in urban areas by providing technical assistance to develop cities’ sustainability priorities into bankable investment proposals. The CFF aims to deliver project preparation and capacity development, and to widely share knowledge and establish partnerships between cities and financiers. Funded by the German Federal Ministry for Economic Cooperation and Development, the Government of the United Kingdom and the United States Agency for International Development, the initiative is implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH together with the C40 Cities Climate Leadership Group. Bogotá, Mexico City and Durban are the cities currently receiving technical assistance from the CFF. A new round of applications will take place in 2018.

**Mathias Merforth** presented GIZ’s initiatives on sustainable urban development. These include CiCliM (Protección del Clima en la Política Urbana de México), helping local governments in Mexico to integrate climate change measures in their overall development strategies, by focusing on climate-proof urban development, ecosystem protection, and sustainable urban mobility (e.g. e-mobility). International programmes include TRANSFER, the Transforming Urban Mobility Initiative and MobiliseYourCity.

**Francisco Quiñones** presented the Programa de Apoyo Federal al Transporte Masivo (PROTRAM). The programme provides financing and capacity development for public transport projects, and is already operational in more than a dozen cities in Mexico (e.g. Tijuana, Puebla, Monterrey, Pachuca, Léon).
Site visit

The workshop ended with a site visit organised by the Electric Transport Service (STE) in a BYD pilot electric bus specially designed for the 2016 C40 Mayors’ Summit. Attendees were taken along Paseo de la Reforma to Eje Central, where one of few trolleybus lines remains in operation and is currently managed by STE. Trolley-buses have operated on Eje Central since the 1970s, but limited investment since has caused a deterioration in their conditions and the bus fleet has not been upgraded since the early 1990s.

Delegates were then brought to the Zócalo, Mexico City’s main square, where the city-owned electric taxi fleet is stationed. STE officials explained the current operating model for e-taxis, the fleet’s characteristics and the main issues and opportunities.
Feedback from participants

- César Rovel Basteris, Mérida: ‘The combination of speakers and presenters allowed attendees to have a clear view of the process of how to develop an electric bus project’.
- Miriam Monterrubio, Colima: ‘The global mapping of factors to consider in the development of a business model for an electric bus project was very useful’.
- Diana Alejandro López de la Torre, Aguascalientes: ‘It was an excellent workshop. Thank you for the opportunity to attend!’

Next steps

The CFF is continuing its work in Mexico City to support the development of the necessary feasibility studies for the Eje 8 Sur project. Several studies, including the completion of the vehicle technology assessment, a mobility study, and financial analyses will be delivered in 2018, and will be shared with other cities in Mexico and beyond. A detailed case study about the CFF’s work in Mexico City will also be completed and disseminated with interested stakeholders in 2018.

With the support of partners such as WRI, the CFF will continue its work to encourage other cities and states in Mexico and the federal government to support electric mobility projects in the country. The CFF’s work has contributed significantly to the national conversation on electric mobility, now reflected in growing awareness among policy-makers about the benefits of such a transition. It is hoped that these discussions will continue throughout 2018 and beyond to ensure Mexican governments, at the federal, state and municipal level, are at the forefront of this momentous shift to sustainable mobility.

Further reading

- What’s Holding Back Latin American Cities’ Clean Bus Transition? – Blogpost by WRI, March 2017
- Low Carbon Technologies can Transform Latin America’s Bus Fleets (IADB, 2013)
- Financing the Transition to Soot-Free Urban Bus Fleets in 20 Megacities (ICCT, 2017)
- ZeEUS eBus Report – An overview of electric buses in Europe