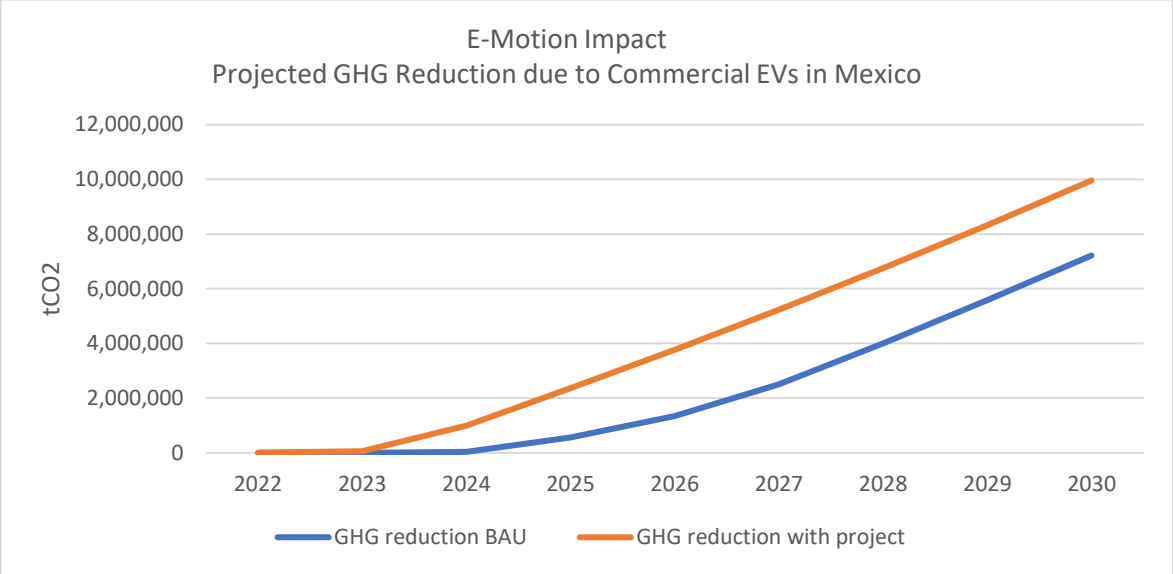
grütter consulting

E-Motion Summary Mexico



Client	AFD
Version	02
Date	03/04/2021
Authors	Jürg Grütter
Revision	Andres Chaves and Daniel Wunderlin
Contact	Rte. des Esserts 92, 1854 Leysin, Switzerland jgruetter@transport-ghg.com, www.transport-ghg.com

Overview

1. Mexico has an area of 5,144,295 km^2 and 126 million inhabitants. In 2019, the GDP per capita was 9,900 USD. The automotive industry has a 3% share of the national GDP generating 1.8% of the total employment in the country. Although no electric buses are currently produced in Mexico, various manufacturers have stated their intentions to produce such units in the next few years in the country. The Mexican Institute for Competitiveness (IMCO) generated in 2013 a study that evaluated in 34 Mexican cities the costs associated with health damages from air pollution such as premature deaths, hospitalizations and consultations and losses in productivity based on PM_{10} concentrations. On a national level the cost of air pollution was estimated at 323 MUSD in 2010.

Climate and Energy Policies

2. Mexico's Greenhouse Gas (GHG) emissions for 2017 are estimated at 734 $MtCO_{2e}$. The baseline scenario for 2030 projects GHG emissions of 991 $MtCO_{2e}$ of which 250 $MtCO_{2e}$ from the transport sector (Government of Mexico, 2020).

3. The Government of Mexico committed in its NDC to reduce its emissions by 22% by 2030. For the transport sector the target is set at 18%, reaching 218 $MtCO_{2e}$ by 2030. The *Climate Change Strategy to 2050* published in 2016 established that within 10 years the use of electric vehicles in public transport shall be common and within 40 years in all types of transport (SEMARNAT-INECC, 2016).

4. Mexico published the *National Electric Mobility Strategy Vision 2030*[1], which sets a goal of having 10 urban areas with electric mobility in their public transportation by 2030, as well as a 5% share of total sales of new electric or hybrid vehicles by 2030, 50% by 2040 and 100% by 2050 (SEMARNAT, 2018). In addition to the national instruments, the federal states incorporate within their programs strategies to incorporate electric mobility. Mexico City published the *Strategy for Electromobility of Mexico City 2018 - 2030,* in which it proposes to promote electric public transportation with incentives and support for both public and private operators, with the goal that 20% of the fleet will be electric in 2030 and 80% of the cabs will be hybrid or electric for the same year.

5. In 2019 the share of renewables in total electricity generated was 17%. The carbon grid factor of Mexico is 0.529 $kgCO_2/kWh$.

Transport Sector

6. 2019 more than 50 million vehicles were operating in the country. Road transport GHG emissions of Mexico are estimated at 141 million tCO_{2e} for 2019[2]. Commercial vehicles including taxis, buses and LCVs are responsible for around 30-40% of emissions. GHG emission from the transport sector are expected to grow under a BAU scenario by around 40% reaching 195 million tCO_2 by 2030.

[1] The final version of this strategy is not published, these goals were released as a preliminary. The document is currently under legal review and is expected to be published soon.
[2] Tank-to-wheel approach; well-to-wheel approach including Black Carbon: 172 $MtCO_{2e}$

Barriers and Enabling Factors

7. Enabling Factors and Barriers to Commercial EVs in Mexico

Enabling factors	• Experience in the automotive industry, which allows it to develop a local production that strengthens the reliability in the this new technology. At the same time local manufacturing sites are often a barrier for new technologies as they are not eager to change their production methods and fear new entrants. • Existence of structured transport systems. • Tax benefits for EVs.
Barriers	• Prevalence of unstructured and semi-structured systems: public transportation in Mexico is predominantly individually owned units in both buses and taxis. This makes the process of fleet renewal difficult. • Cost-benefit evaluation conditions: the federal government has developed guidelines for carrying out cost-benefit analyses that do not consider the social and environmental benefits of electric buses, which is why the initial cost of the vehicles takes on a significant weight compared to other technologies. • Lack of national policies and commitment to electric mobility.

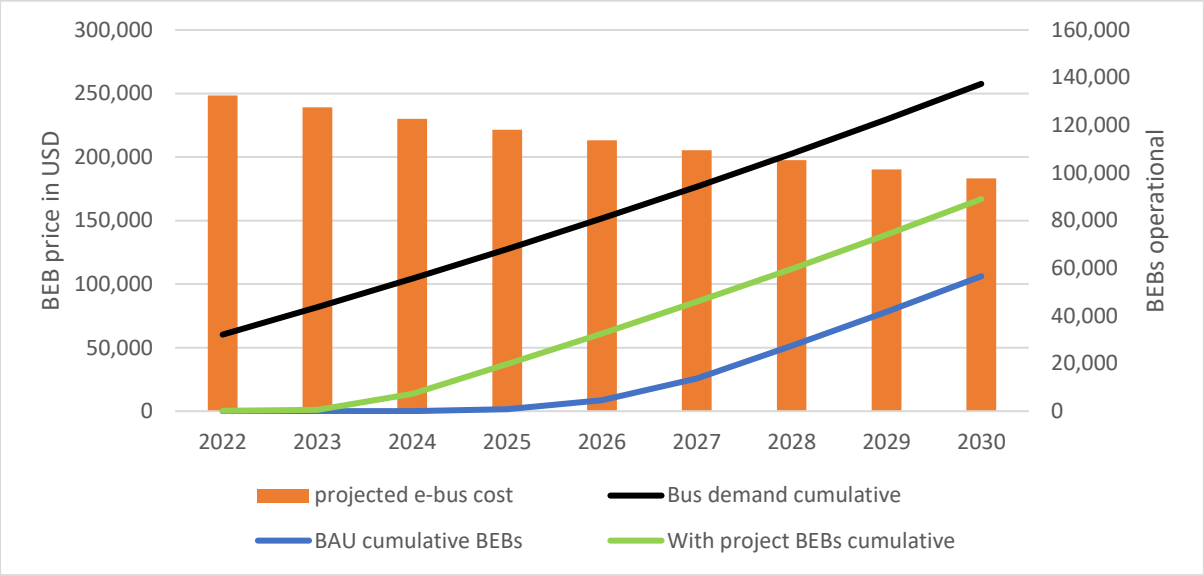
Market Analysis

8. The investment in **Battery Electric Buses (BEBs)** with the current financial conditions and business models is not profitable, a considerable risk, and requires a significant increase in owners capital. BEBs will require a different financial structuring and financial incentives to be a viable business proposal in Mexico.

9. Concessional loans helpsto resolve liquidity issues and result in an improvement of the investment profitability but investment risks remain high with an unsatisfactory payback time. It is clear that concessional loan conditions are an important feature but are not sufficient to tilt an investors decision with the current risk profile of BEBs in the country. A 20% upfront grant combined with a concessional loan resolves fully the profitability and risk issue.

10. Under a BAU scenario BEBs in Mexico start to get commercially viable around 2026 and then increase rapidly. The E-Motion program has as basic function to accelerate EV deployment. It uses financial assistance (FA) to deploy an initial at-scale fleet used to reduce the performance risk perception of future investors by having actual performance data of large-scale fleet application, by reducing risks and costs of new market entrants, by having appropriate maintenance facilities in place and by having new business models in place. Technical assistance (TA) is used to reduce entry barriers e.g. concession contract issues, asset turn-over contracts, or new business models. Capacity building and training reduce in parallel performance risks. The figure below shows the projected e-bus market deployment with and without project.

BAU and with-Project Projected E-Bus Uptake in Mexico and Price Trend of E-Buses



11. Comparing the with and without project scenario the Program can accelerate the commercial uptake of BEBs resulting in 23,000 additional units by 2030. This allows to reduce an additional 21 million tCO_{2e}, 1,060 tons of $PM_{2.5}$ as well as 127,000 tons of NO_x. Thus the program has a decisive impact on accelerating climate friendly technologies.

12. The investment in **e-taxis** with current financial conditions and business models is marginally profitable, has a high risk and high owner capital requirements. One of the major additional risks is that revenues will be lower when using an e-taxi. Taxis are often driven with 2 shifts especially during weekends (Friday to Sunday) or on special days. During such days the driving range of the e-taxi will be insufficient without re-charging. Home-charging takes 6-8 hours and is too slow. Also public chargers available are in general too slow. A fast-charging urban network of 100-150kW chargers is a necessity to ensure that e-taxi owners do not lose a significant part of their revenues. Therefore currently e-taxis cannot be considered a financially viable investment except for special cases such as luxury taxis or low-mileage units with very regular schedules.

13. The main impact of a concessional loan on e-taxis is a significant improvement of the liquidity position and of profitability thereby making the investment financially attractive. No grant finance is required. The core issue will remain however to establish a fast-charging network.

14. Under a BAU scenario electric taxis start to get commercially viable around 2025. This can be significantly accelerated by deploying an initial fleet and especially by establishing a fast-charging infrastructure targeted to taxis. This acceleration scenario results in additional 5.5 $MtCO_{2e}$ reduced, and 46 $tPM_{2.5}$ as well as 2,340 tNO_x avoided. The program has a decisive impact on accelerating e-taxi deployment in Mexico.

15. The investment in **e-LCVs** with current financial conditions and business models is not profitable, has a high risk and a very long payback time. The impact of the concessional loan is very limited. Grants would be required to make the investment commercially attractive. At least for this vehicle segment the commercial viability is still a few years off and it is therefore recommended that the Program does not enter this market in Mexico.

Investment Projects

16. Proposed Investment Projects

ID	Project	Delivery model	Expected year	CAPEX
1	150 18m and 26m BEBs for Metrobus, Mexico City financed by the Program[3]	Special Purpose Vehicle (SPV) which owns buses and leases them to operators	2023/24	115 MUSD
2	90 12m and 18m BEBs for STE, Mexico City financed by the Program[4]	Public sector led delivery	2022/23	47 MUSD
3	130 12m BEBs for Monterrey financed by the Program	Public or private sector led delivery with SPV/PPP	2023	41 MUSD
4	33 10m BEBs for Guadalajara financed by the Program	Public or private sector led delivery with SPV/PPP	2022	8 MUSD
5	51 12m BEBs for Hermosillo financed by the Program	Public or private sector led delivery with SPV/PPP	2025	16 MUSD
6	100 12m BEBs for Sinaloa financed by the Program[5]	Public or private sector led delivery with SPV/PPP	2022	32 MUSD
7	1,000 e-taxis + urban fast-charging network for Mexico City[6]	Charging network through electric utility; taxis privately owned & managed; financed through national development banks as already done with the current taxi financing schemes within the municipal taxi replacement program	2023	41 MUSD
8	urban fast-charging network for Sinaloa[7]	Charging network through electric utility	2023	5 MUSD[8]

Financial Assistance (FA)

17. FA includes concessional loans for electric buses and taxis. In the case of buses the project includes buses, charging infrastructure, grid connection and required bus depot upgrades. GCF participation in concessional loans is 20% for buses and 30% for taxis with an estimated interest rate of 0.75%.

18. Investment grant support worth 10% of the total e-bus investment and 50% of the charging infrastructure is provided with GCF funds. In absence of such support investments will not take place.

Technical Assistance (TA)

19. TA includes for e-buses (i) Support in the structuring of operation contracts that allow the inclusion of third parties in public transport systems; (ii) technical advisory services for e-bus options for bus-only routes. TA for e-taxis includes advice on optimal e-taxi technology and design of a fast-charging infrastructure, and a roadmap for e-taxi deployment; (iii) battery policies including battery re-usage, recycling and disposal; (iv) training and capacity building; (v) advice on concession and business model

[3] The program only finances 30% of the total bus demand estimated at around 510 units
[4] The program only finances 30% of the total bus demand estimated at around 300 units
[5] The program only finances 50% of the total bus demand estimated at around 200 units
[6] The program only finances a share of the total taxi demand estimated at around 5,200 units
[7] The program only finances the charging infrastructure as the size of a loan for 100 taxis is deemed to small i.e. the 100 taxis are financed by a third party
[8] Only charging infrastructure

for e-bus deployment; (vi) policy advice on sectoral roadmaps for electrification of public transport and of taxis; (vii) support for the structuring of the national electromobility committee and outreach and knowledge products. The forementioned TA is executed by GIZ. TA is also given for project preparation (full feasibility, due diligence) of individual investment projects. Latter TA is executed by AFD.

GCF Intervention at a Glance

20. Financial Parameters

Parameter	Value
Total CAPEX excluding TA	305 MUSD
GCF Loan	62 MUSD
GCF Grant FA	31 MUSD
GCF Grant TA	6 MUSD
Total GCF	**98 MUSD**
Co-finance ratio	**68%**

21. Impact Parameters

Parameter	Direct Impact	Indirect Impact	Total Impact
GHG in tons lifetime asset	447,000	25,642,000	26,089,000
$PM_{2.5}$ in tons lifetime asset	18	1,080	1,100
NO_x in tons lifetime asset	2,150	124,000	126,000
Energy saving in TJ lifetime asset	7,020	435,000	442,000
GCF cost per tCO_{2e} avoided	**220**		**4**
Total cost per tCO_{2e} avoided	**695**		**12**

Direct impact: due to investment projects
Indirect impact: Due to acceleration of EV deployment caused directly by the FA and the TA