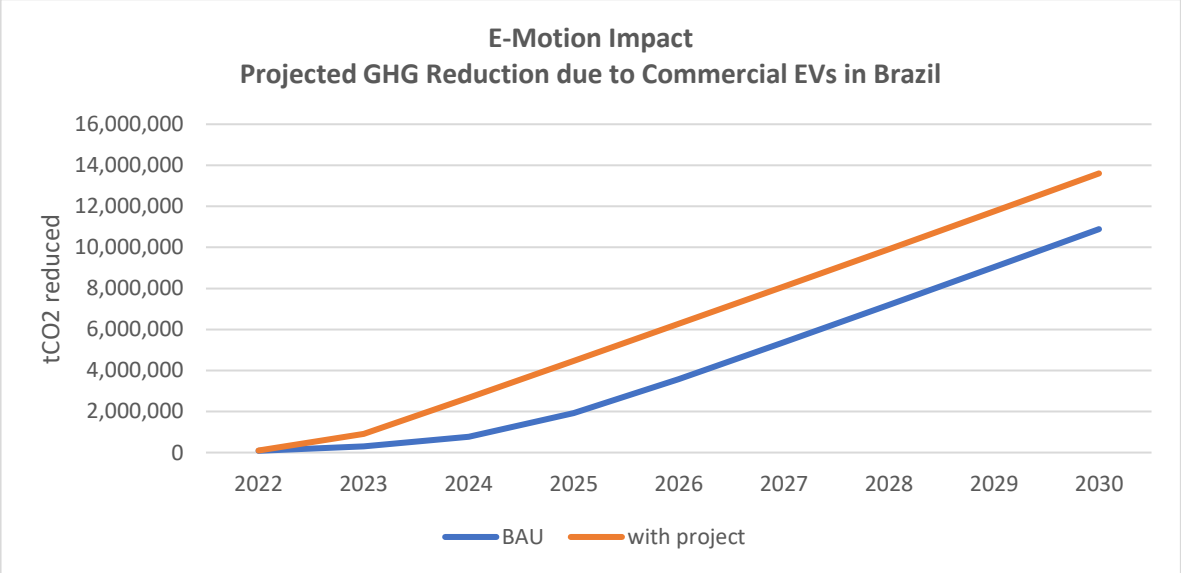
grütter consulting

E-Motion Summary Brazil



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

Overview

1. Brazil has an area of 8,512,000 km^2 and 210 million inhabitants. In 2019, the GDP per capita was 8,700 USD. The Brazilian automotive industry is among the ten most important in the world.

Climate and Energy Policies

2. Brazil's total GHG emissions in 2014 were 1,357 $MtCO_{2e}$. In 2019, emissions from transportation were 197 $MtCO_{2e}$. Trucks and automobiles are the two main sources of emissions in transportation, responsible for 40% and 31%, respectively, of the GHGs emitted in this sector in 2019 (SEEG, 2020).

3. In its NDC (Nationally Determined Contribution, 2015) Brazil commits to reduce GHG emissions by 2030 by 37%, reaching lower levels than 2005. The transportation measures identified in the NDC focus on biofuels, efficiency measures and improved public transportation infrastructure in urban areas.

4. Electricity is produced to 82% with renewables and to 18% with fossil sources (2019). The carbon grid factor is 0.119 $kgCO_2/kWh$.

Transport Sector

5. 2020 some 98 million vehicles were operating in Brazil. Road transport emission costs are close to 18 billion USD for 2019 with around 20% of costs due to local pollutants. Road transport GHG emissions of Brazil in 2019 are estimated at 290 million tCO_{2e}[1]. Commercial vehicles including taxis, buses and LCVs are responsible for around 40% of GHG emissions and 60-80% of pollutants ($PM_{2.5}$ and NO_x). GHG emission from the transport sector are expected to grow under a BAU scenario by 16% reaching 336 million tCO_2 by 2030.

Barriers and Enabling Factors

6. Enabling Factors and Barriers to Commercial EVs in Brazil

Enabling factors	• The Government has passed some initial bills and regulations for EVs. • Brazil manufactures vehicles which can be a barrier or an enabling factor towards e-mobility (barrier if the industrial policy is backwards oriented and trying to preserve existing structures and an enabling factor if the industrial policy is geared towards fostering new technologies and future markets). • Brazil has realized various EV pilots and is thus gaining initial experience. • Brazil has a very low carbon grid factor.
Barriers	• Lack of experience and know-how on creating for commercials EVs an enabling surrounding including regulations, business models and financial support policies which enable their massive uptake. • Commercial EVs lack profitability and have much higher upfront costs. • For taxi and LCV deployment an urban public fast charging infrastructure is required. This is not yet available making operations of such vehicles problematic. • Lack of financial support for the purchase or operations of commercial EVs. • Brazil focuses its efforts on the promotion of biofuels. This presents a barrier towards a shift to a more sustainable transportation technology.

[1] Tank-to-wheel approach; taking into account biofuels and assuming that biofuels have no upstream emissions the GHG emissions from the transport sector are 253 Mt CO_{2e}; Using a well-to-wheel approach including Black Carbon emissions are 361 Mt CO_{2e}.

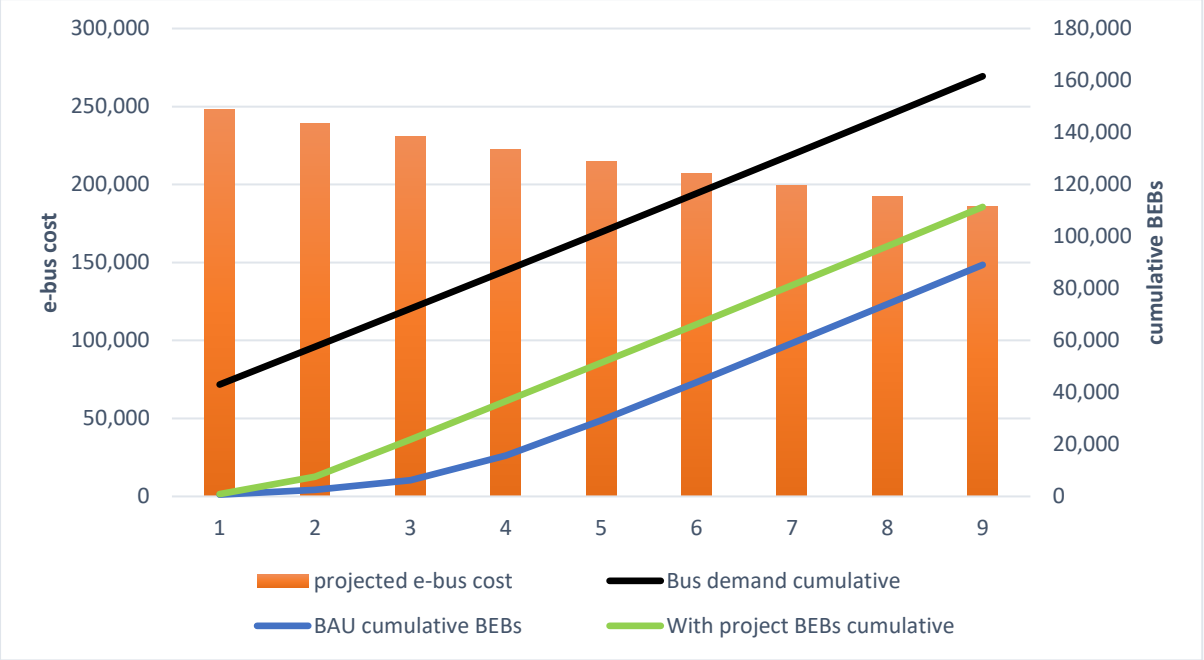
Market Analysis

7. The investment in **Battery Electric Buses (BEBs)** with the current financial conditions and business models is not profitable, a high risk, requires a significant increase in owners capital and results in potentially serious liquidity problems. The total cost of ownership (TCO) does give the indication that e-buses are potentially an interesting alternative. However, BEBs will require a different financial structuring and financial incentives to be a viable business proposal in Brazil.

8. Concessional loans together with a limited grant resolve the liquidity and profitability issues and are sufficient to tilt an investors decision with the current risk profile of BEBs in the country.

9. Under a BAU scenario BEBs in Brazil start to get commercially viable around 2024/25 due to decreasing vehicle purchase costs. 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 Brazil and Price Trend of E-Buses



10. Comparing the with and without project scenario we can state an earlier uptake of BEBs. The e-bus fleet reaches by 2030 20,000 additional units resulting in additional 44 million tCO_{2e} reduced, and 1,090 $tPM_{2.5}$ as well as 128,000 tNO_x avoided. Thus the program has a decisive impact on accelerating climate friendly technologies.

11. The investment in **e-taxis** with current financial conditions and business models is not profitable, has a high risk and higher owner capital requirements. One of the major 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.

12. Concessional loans plus a 20% grant do not resolve the lack of commercial viability of e-taxis. This is due to the very low cost of locally manufactured gasoline units and the limited market and high price of EVs. Without national production of cost competitive EVs this will remain a market without large potential. A decreasing e-taxi price trend can only be expected if national manufacturers start producing low-cost EVs. The conclusion for e-taxis is that it is not feasible, even with significant financial incentives, to achieve in the medium run a sustainable EV market in this segment. Therefore the recommendation for the Program is to not enter with e-taxis in Brazil.

13. 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. Also electric LCVs are not common in the market and are not offered by vehicle suppliers in Brazil. A concessional loan improves the liquidity situation and the profitability without however being sufficient to make an investment feasible. The interest of public entities in entering this area with EVs is limited. Therefore the recommendation for the Program is to not enter with e-LCVs in Brazil.

Investment Projects

14. Proposed Investment Projects

ID	Project	Delivery model	Expected year	CAPEX
1	70 26m BEBs for Curitiba	The delivery channel could be with a public sovereign loan for all projects which is passed-on to the municipalities. Transport operations could be with a private or public-led model.	2024	67 MUSD
2	30 12m and 50 18m BEBs for Curitiba		2024	46 MUSD
3	20 12m BEBs for Teresina		2023	6 MUSD
4	140 12m and 18m BEBs for Florianopolis		2024	52 MUSD
5	100 12m BEBs for Niteroi		2023	32 MUSD
6	150 8m, 12m and 18m BEBs for Belo Horizonte		2025	56 MUSD

Financial Assistance (FA)

15. FA includes concessional loans for electric buses including charging infrastructure, grid connection and required bus depot upgrades. GCF participation in concessional loans is 30% with an estimated interest rate of 0.75%. FA also includes a grant of 5% for the total CAPEX of e-bus systems.

Technical Assistance (TA)

16. TA includes for e-buses support on new business models (separation of asset ownership and operations), financial models and sector re-structuring for the bus sector, integration of other players with stronger financial background in the public bus sector, and adaptation of bus concession contracts and bus tariff structures. TA also includes the development of a roadmap for electrification of public transport services and support in battery policies (re-usage, recycling and disposal policies). Support in training and capacity building for e-bus deployment is also realized. The general TA is executed by GIZ. TA is also given for project preparation (full feasibility, due diligence) of individual investment projects which is executed by AFD.

GCF Intervention at a Glance

17. Financial Parameters

Parameter	Value
Total CAPEX excluding TA	260 MUSD
GCF Loan	78 MUSD
GCF grant FA	13 MUSD
GCF Grant TA	4 MUSD
Total GCF	**95 MUSD**
Co-finance ratio	**64%**

18. Impact Parameters

Parameter	Direct Impact	Indirect Impact	Total Impact
GHG in tons lifetime asset	1,232,000	42,235,000	43,467,000
$PM_{2.5}$ in tons lifetime asset	28	1,060	1,080
NO_x in tons lifetime asset	3,200	124,000	127,000
Energy saving in TJ lifetime asset	10,100	400,000	410,000
GCF cost per tCO_{2e} avoided	**77**		**2**
Total cost per tCO_{2e} avoided	**214**		**6**

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