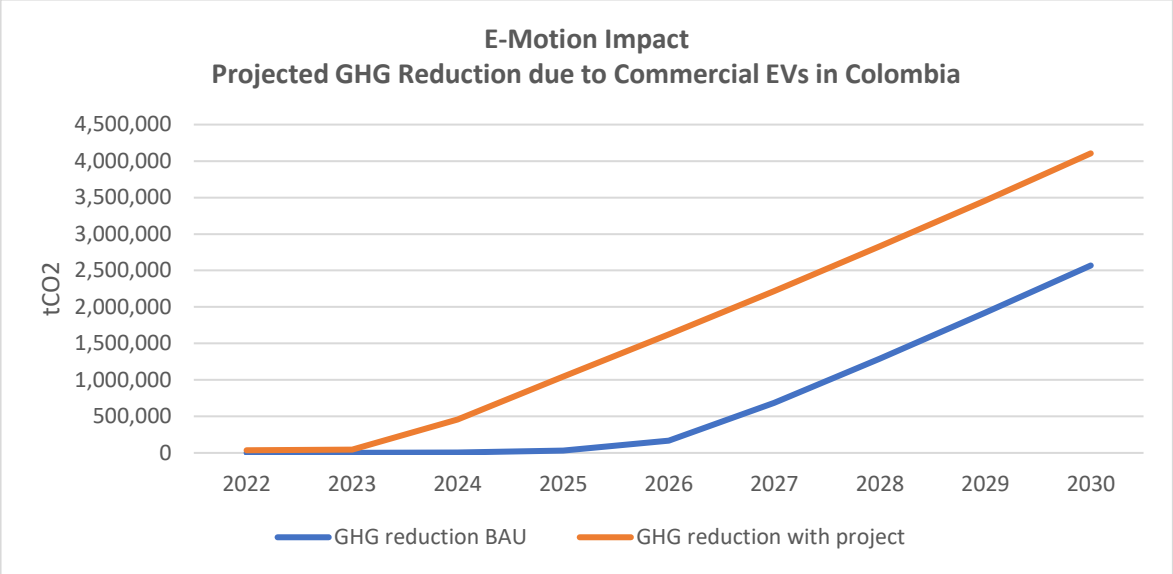
grütter consulting

E-Motion Summary Colombia



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Overview

1. Colombia has an area of 1,141,748 km^2 and 50 million inhabitants. In 2019, the GDP per capita was 7,800 USD. Colombia has an automotive industry dedicated mainly to vehicle assembly, auto parts production and motorcycle assembly. 76% of the municipalities with monitoring of the air quality in Colombia register PM_{10} levels which surpass the annual norm of 50 µgm. Emission inventories of large cities show that around 80% of particle emissions are due to transport and 20% due to industry. Depending on the methodology chosen the cost of air pollution is estimated at the equivalent of 0.2 to 1.5% of the GDP of Colombia.

Climate and Energy Policies

2. Colombia's Greenhouse Gas (GHG) emissions for 2014 are estimated at 237 $MtCO_{2e}$. Transportation emissions are estimated at 29 $MtCO_{2e}$ (31% of total emissions) with a growth of 20% since 2010. Land transport contributes the most emissions with an average of 92%. Colombia's Nationally Determined Contribution (NDC) Update estimates that under a reference scenario GHG emissions will reach 346 $MtCO_{2eq.}$ in 2030. Colombia commits with the NDC to emit a maximum of 169 $MtCO_{2e}$ in 2030 (equivalent to a 51% reduction of emissions).

3. The NDC contemplates for the transportation sector amongst others to achieve 600,000 registered electric taxis, buses, light commercial vehicles including small trucks and official vehicles. The 2019 enacted Electric Mobility Law of Colombia includes measures such as a quota of 30% of EVs. As a complement to the Law, the National Government has developed the National Strategy for Electric Mobility (ENME), which aims to promote the electrification of the transportation sector.

4. The public transportation system in Bogota has already contracted the purchase of nearly 1,500 12m electric buses and also Medellin and Cali have started to operate pilot fleets of e-buses. Colombia and Chile are thus clearly spearheading EV deployment in Latin America.

5. In 2020 the share of renewables in total electricity generated was slightly above 70%. Colombia still has a considerable non-exploited renewable energy capacity in terms of hydroelectric, solar and wind power. The carbon grid factor of Colombia is 0.178 $kgCO_2/kWh$.

Transport Sector

6. 2018 around 14 million vehicles were officially listed in the statistics of the Ministry of Transport - however, based on an analysis of vehicle insurance and annual registration the actual number of operating vehicles is estimated at around 8.5 million units. Road transport GHG emissions of Colombia in 2018 are estimated at 33 million tCO_{2e}[1]. Commercial vehicles including taxis, buses and LCVs are responsible for around 50% of emissions. GHG emission from the transport sector are expected to grow under a BAU scenario by around 40% reaching 46 million tCO_2 by 2030. With this growth the NDC target will be difficult to achieve.

[1] Tank-to-wheel approach; well-to-wheel approach including Black Carbon: 43 $MtCO_{2e}$

Barriers and Enabling Factors

7. Enabling Factors and Barriers to Commercial EVs in Colombia

Enabling factors	**EVs are a political priority:** the National Government has enacted policies that seek to promote electromobility; major cities such as Bogota, Medellin and Cali have started incorporating EV fleets. **Conducive business models:** Public transport systems such as Transmilenio are establishing new business models which cater better to EVs. **Structured entities in the transportation sector:** Since Transmilenio started operating in Bogotá, Colombia initiated a process of change that has allowed for a radical change in the business structure of the public transportation sector. The BRT systems model has allowed to move from a scheme of atomized ownership to a formally structured sector.
Barriers	**High initial investment costs:** this is the major hurdle for most public transport services. **Lack of knowledge of the technology:** Experience to the moment is limited to buses operating under mixed traffic conditions – the knowledge on effective EV system approaches for larger (18-26m) buses on trunk routes is not well known. **Financial conditions of transport systems:** in general, transport systems do not have financial solvency, which increases the investment risk for traditional financiers, who, considering the payment history of previous loans, prefer not to participate in these schemes. **Recharging infrastructure:** fast chargers lack for taxis and the establishment of charging infrastructure is expensive and also requires grid upgrades for large systems at bus depots. **Coordination with local and regional authorities:** although the law 1964 of 2019 establishes a roadmap with the percentage of electric buses that must be included at the time of fleet replacement or fleet addition, this is a national policy that needs to be adapted to the local context. In addition, each municipality must establish a roadmap, allocate resources for this type of projects and have instruments for their implementation.

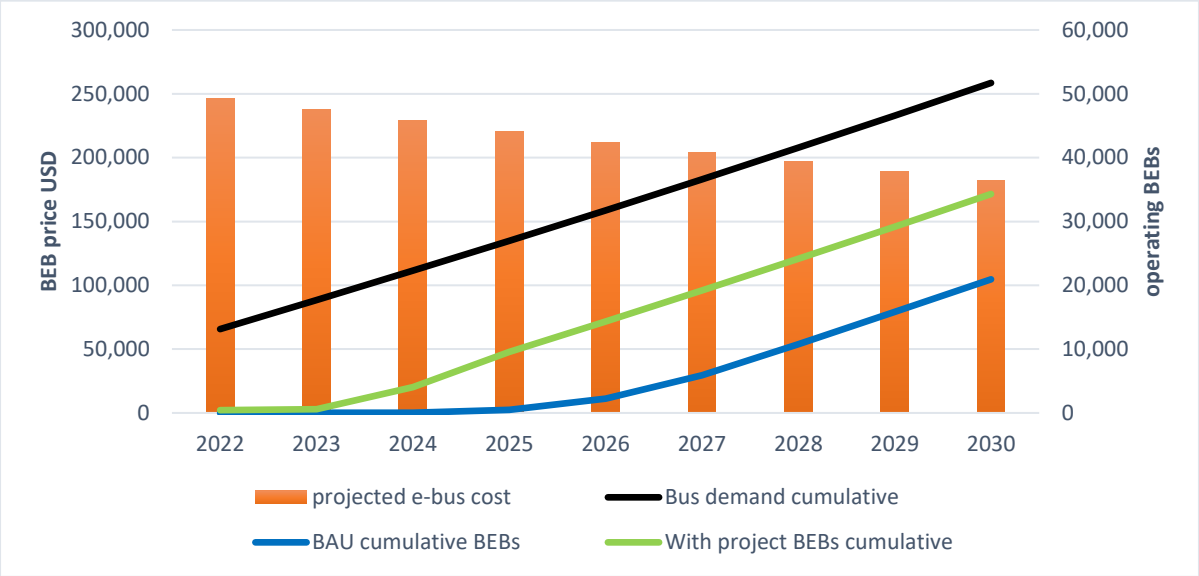
Market Analysis

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. This is also reflected in the initial e-bus purchases in Colombia which received subsidies from the municipalities. 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 Colombia.

9. Concessional loans together with an upfront grant resolve the problems of profitability, liquidity and payback time. Concessional loans alone without subsidy are insufficient to tilt the decision.

10. Under a BAU scenario BEBs in Colombia start to get commercially viable around 2026 and then increase rapidly. With the BAU scenario the Colombian target of 34,000 e-buses by 2030 cannot be achieved. 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 Colombia and Price Trend of E-Buses



11. Comparing the with and without project scenario we can a faster commercial uptake of BEBs resulting in 7,000 additional units by 2030. This allows to reduce an additional 7.7 million tCO_{2e}, 280 tons of $PM_{2.5}$ as well as 33,000 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 not 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 for taxis is that the payback time is reduced and that the Cash Flow would be positive from year 1. Whilst this is interesting from a liquidity perspective the core issue will remain to realize a fast-charging network.

14. Under a BAU scenario electric taxis start to get commercially viable around 2027. 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 5.1 $MtCO_{2e}$ reduced, and 30 $tPM_{2.5}$ as well as 1,660 tNO_x avoided. The program has a decisive impact on accelerating e-taxi deployment in Colombia.

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. Even a 20% upfront grant will not 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 Colombia.

Investment Projects

16. Proposed Investment Projects

ID	Project	Delivery model	Expected year	CAPEX
1	Program with 14 cities with 330 BEBs of different size financed by the Program[2]	Special Purpose Vehicle (SPV) either PPP or private led which owns buses and leases them to multiple operators	2022	87 MUSD
3	200 18-26m BEBs for bus-only lanes of Transmilenio, Bogota[3]	Special Purpose Vehicle (SPV) either PPP or private led which owns buses and leases them to multiple operators	2025	142 MUSD
3	1,000 e-taxis + urban fast-charging network for Bogota[4]	Charging network through electric utility; taxis privately owned & managed; financed through Findeter / national banks with special credit lines for e-taxis	2023	39 MUSD
3	urban fast-charging network for Medellin[5]	Charging network through electric utility	2023	6 MUSD[6]

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. TA is also realized in the areas of battery policies including battery re-usage, recycling and disposal. 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	274 MUSD
GCF Loan	55 MUSD
GCF Grant FA	27 MUSD
GCF Grant TA	7 MUSF
Total GCF	**90 MUSD**
Co-finance ratio	**68%**

[2] The program only finances a share of the total bus demand estimated at around 1,100 units
[3] The program only finances a share of the total bus demand estimated at around 1,000 units
[4] The program only finances a share of the total taxi demand estimated at around 17,000 units
[5] The program only finances the charging infrastructure; the 150 taxis are financed by a third party
[6] Only charging infrastructure

21. Impact Parameters

Parameter	Direct Impact	Indirect Impact	Total Impact
GHG in tons lifetime asset	720,000	18,904,000	19,624,000
$PM_{2.5}$ in tons lifetime asset	22	530	560
NO_x in tons lifetime asset	2,600	60,670	63,270
Energy saving in TJ lifetime asset	6,480	174,800	181,300
GCF cost per tCO_{2e} avoided	**125**		5
Total cost per tCO_{2e} avoided	**391**		**14**

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