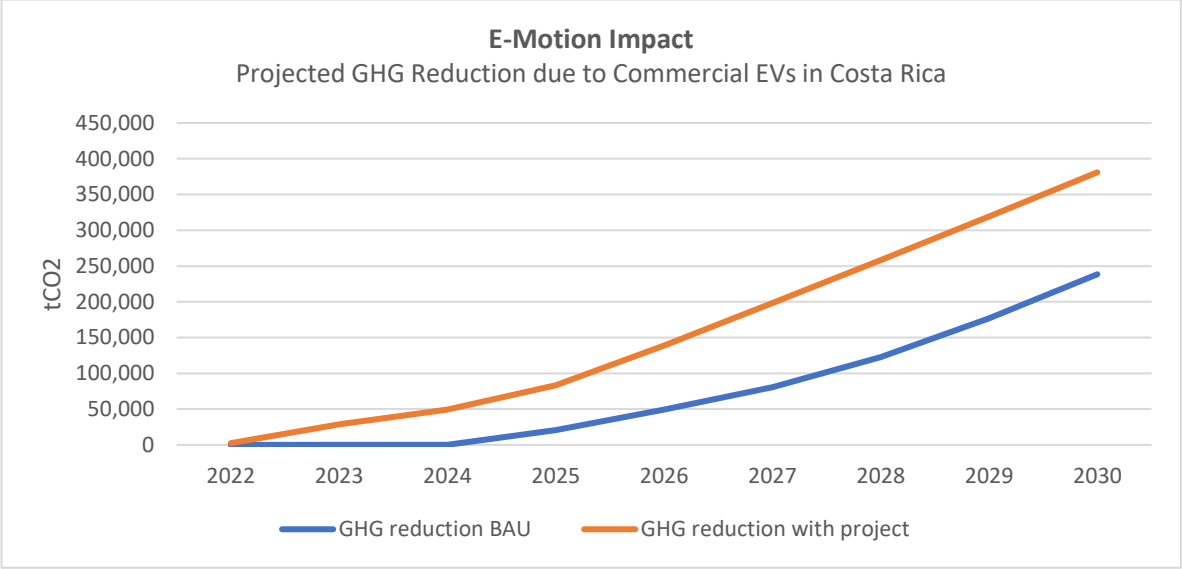
grütter consulting

E-Motion Summary Costa Rica



Client	AFD
Version	01
Date	28/02/2021
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. Costa Rica has an area of 51,100 km^2 and 5.1 million inhabitants. In 2019, the GDP per capita was 12,200 USD. The metropolitan area of San José concentrates half of the population. Costa Rica has no vehicle manufacturing or assembly industry.

Climate and Energy Policies

2. Costa Rica has a long tradition in being on the forefront of combating climate change. In its Nationally Determined Contribution (NDC), Costa Rica reaffirmed its aspiration of becoming a Carbon Neutral economy and aims for a decarbonized economy with net-zero emissions in 2050. Total GHG emissions of the country are estimated at 10.9 million tCO_{2e} in 2019 with land transport being responsible for more than 50% of total GHG emissions. Emissions under a Business as Usual (BAU) scenario are expected to increase by 45% by 2050. The updated NDC of Costa Rica includes as targets net emissions of 9.1 $MtCO_{2e}$ by 2030. Greening the transportation sector is key to achieving these targets. Electrifying mobility is considered as essential and a national priority.

3. The updated NDC has concrete 2030 e-mobility targets for public transport, passenger cars and fleets (8% of the vehicle stock). For other vehicle areas e.g. motorcycles targets and measures shall be developed to migrate towards EVs. Costa Rica has also developed a national plan for electric transport which includes concrete steps towards electrification of vehicles and has approved 2018 the law on incentives and promotion of electric transportation which includes targets for EV penetration, the establishment of a public charging infrastructure as well as important tax incentives for private EVs.

4. Electricity is produced nationally with renewables, whilst 100% of fossil fuels need to be imported. Projections estimate that the share of renewables will remain constant at this level also in the future, with an annual increase of production by 2%. Electricity generation is sufficient to cover 100% of national demand year-round. The average projected carbon grid factor to 2030 is 0.015 $kgCO_2$/kWh.

5. Costa Rica has established special electricity tariffs for e-buses and for public chargers.

Transport Sector

6. The vehicle fleet of Costa Rica has grown on average annually by 6% between 1980 and 2019 whilst the population has only grown by 2%. In 2019 more than 1.5 million vehicles were operating in the country. Road transportation emission costs are close to 500 MUSD for 2019 with around 30% of costs due to local pollutants. Road transport GHG emissions of Costa Rica in 2019 are estimated at 6.4 million tCO_{2e}[1]. Commercial vehicles including taxis, buses and LCVs are responsible for around 1/3rd of GHG emissions and 50% of pollutants ($PM_{2.5}$ and NO_x). GHG emission from the transport sector are expected to grow under a BAU scenario by around 30% reaching 8.1 million tCO_2 by 2030.

Barriers and Enabling Factors

7. Enabling Factors and Barriers to Commercial EVs in Costa Rica

Enabling factors	• E-mobility is a topic since many years in Costa Rica. The Government has issued important laws and regulations as well as national development plans containing EV targets, incentives and support structures. This has also resulted in some 3,000 EVs operating by 2020 including also a pilot of e-buses (3 units) and some LCVs and taxis. • Public charging infrastructure (primarily for passenger cars) is being established and electricity prices for public charging as well as e-buses have been fixed. • Costa Rica produces close to 100% of electricity based on renewables and has sufficient additional production capacity.

[1] Tank-to-wheel approach; well-to-wheel approach including Black Carbon: 8.4 $MtCO_{2e}$

Barriers	• Lack of experience and know-how on creating an enabling surrounding including regulations (e.g. concession contracts), business models and financial support policies. • Commercial EVs are perceived to lack profitability and have much higher upfront costs. • For taxi and LCV deployment an urban public fast charging infrastructure is required. • Lack of financial support for the purchase or operations of commercial EVs.

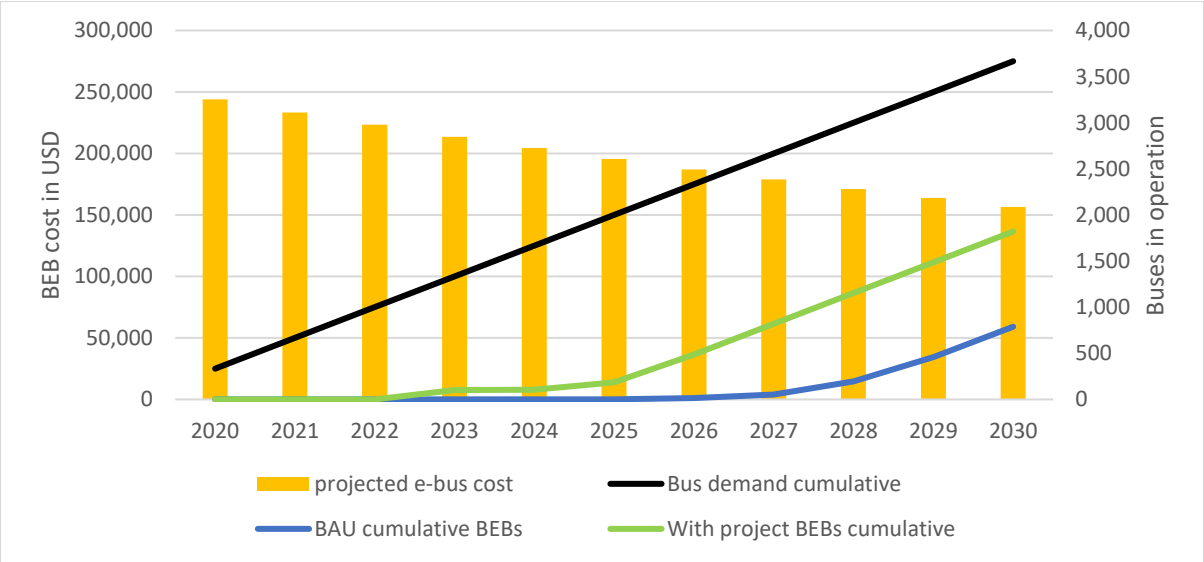
Market Analysis

8. 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 Costa Rica.

9. Concessional loans help to resolve the liquidity issues and result in a marginal improvement of the investment profitability but investment risks remain high with an unsatisfactory payback time. It is clear that concessional loan conditions are not sufficient to tilt an investors decision with the current risk profile of BEBs in the country. An upfront grant of 20% on the total initial investment combined with concessional finance resolves to a large extent the profitability and risk issue.

10. Under a BAU scenario BEBs in Costa Rica start to get commercially viable around 2027 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 Costa Rica and Price Trend of E-Buses



11. Comparing the with and without project scenario we can state a doubling of the uptake speed (slope of the function). The e-bus fleet reaches by 2030 1,800 instead of 800 units resulting in additional 1.6 million tCO_{2e} reduced, and 46 $tPM_{2.5}$ as well as 5,400 tNO_x avoided. 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 profitable but with a considerable 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 (most public chargers available in Costa Rica are 7-14 kW chargers). 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 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 370,000 tCO_{2e} reduced, and 2 $tPM_{2.5}$ as well as 90 tNO_x avoided. The program has a decisive impact on accelerating e-taxi deployment in Costa Rica.

15. The investment in **e-LCVs** with current financial conditions and business models is profitable but with 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 Costa Rica. Under a BAU scenario electric LCVs start to get commercially viable around 2026. With initial financial assistance to deploy larger fleets of e-LCVs as well as technical assistance to ensure overcoming of current barriers related basically to performance risks of vehicles the deployment of mass-scale electric LCVs starts earlier and faster resulting in additional 120,000 tons of CO_2 reduced as well as the additional avoidance of 1 $tPM_{2.5}$ and 30 tNO_x.

Investment Projects

16. Proposed Investment Projects

ID	Project	Delivery model	Expected year	CAPEX
1	100 12m BEBs for the urban area of San Jose	Special Purpose Vehicle (SPV) either PPP or private led which owns buses and leases them to multiple operators	2023	28 MUSD
2	200 e-taxis + urban fast-charging network for the urban area of San Jose	Charging network through electric utility; taxis privately owned and managed; financed through national banks with special credit lines for e-taxis	2024	8 MUSD[2]
3	200 small e-LCVs	LCVs privately owned; financed through national banks with credit lines for e-LCVs	2023-2025	7 MUSD

Financial Assistance (FA)

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

[2] of which 1.5 MUSD charging infrastructure

18. Investment grant support worth 20% 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) assistance together with other partners (IDB, BCIE) in the re-structuring of public transport operations including route restructuring, fare management, legal arrangements, long-term financing structure (ii) Assistance in the structuring of appropriate concession contracts and concession conditions conducive to e-bus deployment (iii) Assistance in the structuring of business models which favour e-bus deployment (iv) advice on optimal e-bus technology and charging systems and (vii) Roadmap for e-bus deployment.

20. TA for e-taxis includes advice on optimal e-taxi technology and design of a fast-charging infrastructure, a roadmap for e-taxi deployment and assistance in developing a market structure with clear rules and regulations for ride-hailing services.

21. TA for e-LCVs includes advisory service in vehicle and technology, the establishment of a pilot e-LCV project with deployment and monitoring of at least 10 different types/sizes of electric LCVs, the development of a roadmap for e-LCV deployment including the design of policies to limit the use of fossil LCVs and incentivize electric units, e.g. low-emission-zones, access restrictions, etc.

22. 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

23. Financial Parameters

Parameter	Value
Total CAPEX excluding TA	43 MUSD
GCF Loan	13 MUSD
GCF Grant FA	6 MUSD
GCF Grant TA	3 MUSF
Total GCF	22 MUSD
Total CAPEX incl. TA	**46 MUSD**
Co-finance ratio	**51%**

24. Impact Parameters

Parameter	Direct Impact	Indirect Impact	Total Impact
GHG in tons lifetime asset	188,400 tons	1,859,768 tons	2,048,168 tons
$PM_{2.5}$ in tons lifetime asset	5 tons	43 tons	48 tons
NO_x in tons lifetime asset	530 tons	4,964 tons	5,493 tons
Energy saving in TJ lifetime asset	1,666 TJ	16,430 TJ	18,096 TJ
GCF cost per tCO_{2e} avoided	**118 USD/tCO_2**		**11 USD/tCO_2**
Total cost per tCO_{2e} avoided	**242 USD/tCO_2**		**22 USD/tCO_2**

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