

Adopting electric vehicles in Nepal: Foreign reserve and government revenue perspective.

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Abstract

This paper examines the impact of adopting electric vehicles (EVs) on Nepal's foreign reserves and government revenue. The adoption of electric vehicles saves foreign reserves by displacing imported fuel with electricity that is produced in Nepal. On the other side, the price of electric vehicles is higher than that of gasoline counterparts and has a greater import price which reduces the foreign reserves. We should consider the loss of government revenue due to the adoption of electric vehicles. This paper aims to provide a clear picture of the scenario to assist in effective policy formulation regarding the issue. The analysis is done using a comparable set of electric and gasoline cars. The paper concludes that the foreign reserve depletion and the loss of government revenue are significantly large in proportion and recommends adopting electric cars in Nepal after price parity with gasoline cars.

Introduction and Problem Statement

Electric mobility is considered the flagbearer of sustainable transportation and thus, huge investments are being made in the development of efficient, and higher-range electric vehicles. Several developed countries have set a target for the percentage of electric vehicles on the road in the future years. Norway is leading the race with 56 percent of vehicles on the road being electric (Global EV Outlook, 2020). Nepal's revised NDC targets a 25% market share for private electric passenger vehicles (including two-wheelers) and 20% for public four-wheeler electric vehicles by 2025. The goals escalate to 90% and 60% respectively by 2030.

Electric vehicles, though evolving and becoming more affordable, currently have higher market prices than gasoline-powered counterparts. Governments need to provide subsidies to meet targets. However, in developing countries with limited reserves and constrained budgets, the dilemma arises: stick with gasoline cars or embrace costlier electric alternatives for sustainability, impacting foreign reserves and budgets.

The impacts on macroeconomic factors in the USA with the adoption of electric vehicles along with the forecasted numbers to 2030 were examined by Becker & Sidhu (2009). The authors posit the benefit of embracing electric cars in the USA is the potential reduction of oil imports by 18-38 percent by 2030, improving the trade deficit. Therefore, heavy investment into the research and development of efficient battery technology is made by the USA. The significant opportunity for the nation's development lies in the potential to export battery technology and the net employment gains that come through establishing new businesses. Projected to be 1.1-1.5% of total business investment by 2030, investing in battery tech and charging infrastructure in the USA offers a compelling case with reduced oil imports and advanced technology exports, warranting government subsidies for electric vehicles.

Developing countries, with import-based economies and limited reserves, struggle to export technology. Although reduced fuel imports benefit trade, the higher upfront cost of electric cars compared to gasoline cars negatively impacts the balance of payments. It is prudent to delay the implementation of

electric four-wheelers in developing countries due to their initial higher prices (Rajper & Albrecht, 2020). The authors claim that the feasibility of electric mobility in developed countries is due to their high purchasing power unlike in developing countries. With higher initial costs associated with importing electric vehicles, the depletion of foreign reserves poses a significant financial burden to low and middle-income countries. For developing nations, foreign exchange reserves serve as a crucial instrument for sustained growth, acting as a final recourse to stimulate development even in the face of government inefficiencies (Polterovich & Popov, 2003). The authors also emphasize that imprudent decisions by a weak government to spend foreign exchange reserves on current consumption have adverse effects on the nation's long-term growth. The policy of providing subsidies to electric vehicles may result in long-term impacts on developing nations.

(Shrestha, 2016) developed a dynamic macroeconomic model and studied the relationship between economic growth, inflation, real exchange rate, and foreign reserve accumulation in South Asian countries. The model aligns with the findings of (Polterovich & Popov, 2003) and concludes that foreign reserve accumulation has positive effects on the economic growth of South Asian nations. The authors recommend developing countries to utilize their accumulated foreign reserves in importing capital goods to drive economic progress; spending these limited reserves in economically unproductive sectors can lead to economic difficulties within the nation.

This study focuses on the net effect on the foreign reserves and government revenue in Nepal due to the adoption of electric vehicles. Notably, petroleum products have the greatest share of total imports in Nepal; the potential of hydroelectricity production is increasing, with many hydroelectric projects nearing completion (Poudyal, Loskot, Nepal, Khadka, & Parajuli, 2019); it seems logical to consider electric vehicles as a medium to reduce petroleum dependency and instead leverage domestically generated hydroelectric power. However, the government must not overlook the higher import price of electric cars during policy formulation and implementation. A comprehensive study is essential to form a well-informed perspective on this issue.

Being a developing nation, Nepal is in an economic dilemma regarding the adoption of electric cars, and the government has not been able to formulate long-term policies regarding the subsidies on electric vehicles. This policy uncertainty has led to frequent fluctuations¹ in import taxes on electric vehicles, creating confusion among consumers regarding the government's stance on electric vehicles. Before shaping national policies on electric vehicles, the government must consider the pace of battery technology development and the volatility of prices in the global market. The cost of battery packs decreases with technological advancements, and as the price of battery packs decreases, the price of electric vehicles will also decrease.

Nepal operates as an import-based economy, importing essential goods like agricultural products. A robust foreign reserve status is essential for maintaining a stable economy in Nepal. Also, the recurrent expenditure of the government is increasing year by year; 7.9 percent increase in 2020/2021 followed by a 13.6 percent increase in 2021/2022 (Nepal Rastra Bank, 2022). A detailed accounting regarding the national foreign exchange reserves and the governmental revenue seems indispensable before introducing subsidies on luxury items, such as electric cars, in the context of Nepal. Although the current subsidies might benefit by reducing the total cost of ownership for the consumers of electric cars, which also have lower fuel and maintenance costs, the scale of government investment seems substantial and primarily for a smaller number of populations with a high standard of living.

¹ The customs duty for electric cars with motor peak power exceeding 100 kW but not exceeding 200 kW was 15 percent in 2021/22, increased to 30 percent in 2022/23, and again decreased to 20 percent in 2023/24.

Methodology

This paper explores the effects on (i) foreign reserve depletion, and (ii) government revenue due to the adoption of electric cars in Nepal. To conduct this comparative study, Tata Nexon EV is chosen to represent electric vehicles, and Tata Nexon Petrol to represent gasoline vehicles. This comparative study focuses on two vehicles with similar body shapes, sizes, and manufacturers. The primary difference between them lies in their driving mechanisms — one is electric-powered, while the other is gasoline-powered. (Tata Motors, n.d.). Furthermore, both vehicles represent mid-range options from the consumer's perspective, allowing the study to reflect the average conditions in Nepal.

In this study, the net foreign reserve depletion and net loss in government revenue for a single unit import of electric and petrol cars were calculated. The values were then multiplied by the annual average number of cars imported, based on the import figures from the last five years in Nepal. To visualize various feasible conditions, three scenarios were considered based on the average daily commute of a car: 15 km, 20 km, and 30km of an average daily commute². For the macro level analysis, an average daily commute of 20km is used. Additionally, four different scenarios are produced regarding the import share of electric cars: annual imports of electric cars at 30 percent, 60 percent, 90 percent, and 100 percent of the total imports of cars (electric and petrol). The net effects on foreign reserve depletion and loss in government revenue are analyzed under these scenarios.

Foreign Reserve Depletion

When a car is imported, the amount equivalent to the import price in USD is decreased from Nepal's foreign reserve account. This amount differs between the import of comparable gasoline and electric cars due to variations in their import prices.

Opting for an electric vehicle leads to a greater depletion of foreign reserves due to higher initial import prices. However, over the operational service period, electric cars save foreign reserves by reducing the need for petrol imports and utilizing internally produced electricity as their energy source. Excluding the maintenance cost of the vehicle (offsetting the costs of replacing the battery once during its life in terms of EV to the costs of maintaining the petrol car's engine and transmission parts in foreign reserve), we calculated the total cost of importing an electric and a petrol car for Nepal in terms of foreign reserves. This included the import cost and the operation cost (in terms of fuel only) i.e., the import price in the electric car, and import price and annualized cash flows of fuel price for the service period (considered as 20 years in this study) for petrol car.

The annualized cash flows represent the costs of fuel in terms of petrol cars. These cash flows are discounted at time, $T=0$ to compare the effects of electric cars and petrol cars at the time of import. The discount rate is taken as the weighted average of the lending rate of the commercial banks in Nepal, while the fuel cost is taken as the import price of petrol according to Nepal Oil Corporation (NOC). The annualized cash flows are discounted at the time of import using Equation 1.

$$\Delta O|_{T=0} = \Delta O * \left(\frac{1}{r} - \frac{(1+r)^{-t}}{r} \right) \quad (1)$$

Where,

$\Delta O|_{T=0}$ is the value of annualized operational cash flows at the time of import

ΔO = annual operational costs in terms of fuel for petrol car

r = discount rate

t = service period of car

² A survey by (Gautam & Marsani, 2020) estimates the average travel distance for people commuting to work / business in Kathmandu as 15.47km.

Loss in Government Revenue

The cars imported in Nepal are subjected to customs duty, excise duty, VAT, and RDF. The tax rates for electric and petrol cars vary each other; the VAT is the same for both types of vehicles at 13 percent, but the customs duty, excise duty and RDF are lower for electric cars compared to petrol cars (Department of Customs, 2023). These tax subsidies result in a reduction in government revenue. The government’s revenue collected during the import of both types of cars is calculated by the corresponding value of import taxes. The difference between these values is referred to as the loss in government revenue resulting from the adoption of electric vehicles.

Petrol is subjected to various taxes such as customs duty, road maintenance tax, pollution tax, infrastructure development tax, value added tax, and price stabilization fund imposed by the government, which accounts for 71.94 percent of import value as total taxes (Nepal Oil Corporation, 2023). The annual loss of government revenue i.e., taxes subjected to petrol, over the service life of the car, is discounted to the time, $T=0$. The total revenue loss for the government attributed to the import of a single electric car is calculated as the sum of revenue loss due to the import duty subsidy on electric cars and the revenue loss in taxes due to the replacement of petrol as fuel, discounted to the import time.

Analysis and Results

In Nepal, the import price of Nexon EV is NPR 28,41,997 while that of Nexon Petrol is NPR 10,59,277 (Department of Customs, 2023). These amounts represent what is depleted from Nepal’s foreign reserves with the import of one unit of the respective car. The weighted average lending rate of the commercial banks, as of July 2023 was 12.3 percent (Nepal Rastra Bank, 2023). The mileage for Nexon Petrol is taken from the TATA official website (Tata Motors, n.d.) as 17.33 km per liter. According to (Nepal Oil Corporation, 2023)’s 15-day profit and loss account as of July 1, 2023, the import price of petrol, excluding taxes, stands at NPR 85.11 per liter and the total government taxes per liter amounts to NPR 61.23, which approximately is 71.94 percent of the import price.

Import of electric and petrol cars in Nepal

The import of cars in the last five years is taken from (Department of Customs, 2023). The number of petrol cars and electric cars imported in the last five years is plotted in Figure 1 whereas Figure 2 illustrates the percentage share of respective types of cars.

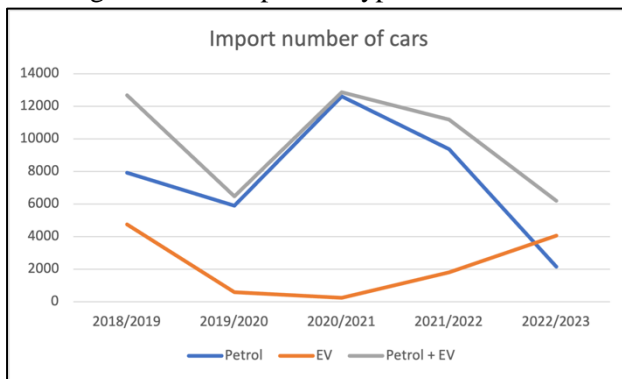


Figure 1: Number of imports of cars.

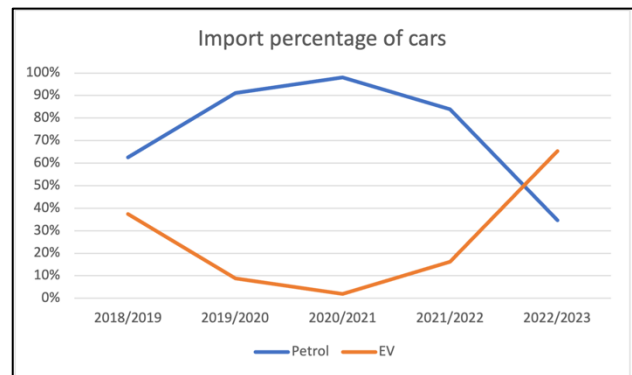


Figure 2: Import percentage of petrol and electric cars.

The total number of cars imported in the last five years varies from about 12,859 to 6,194. The variation is attributed to several external macroeconomic factors which is not the scope of this study. The average number of car imports in the last five years, about 9,175, is considered as the annual number of car imports in Nepal.

We can observe the massive jump in the share of electric vehicles in total car imports in Nepal, rising from 16 percent in 2021/2022 to 65 percent in 2022/2023. In terms of numbers, electric car imports increased from 1,807 to 4,050, while petrol car imports decreased from 9,370 to 2,144 during the years 2021/2022 and 2022/2023.

Analysis of foreign reserve depletion

Three scenarios are assumed for the study, varying the average daily commute distance: 15km, 20km, and 30km. The average daily commute is multiplied by 365 to calculate the average yearly commute distance. The annualized volume of petrol required is obtained by dividing the average annual commute distance by the car’s mileage. Then, the annualized cost in terms of foreign reserve depletion is obtained by multiplying the import price of petrol by the required volume of petrol for each scenario.

The annual operating cash flows are discounted to the time of car import, and the depletion of foreign reserves at the time of import is observed. The foreign reserve depletion due to the import of an EV car is NPR 28,41,997 for all three scenarios, as the primary operation cost i.e., fuel (electricity) is assumed to be fully generated within the nation. Regarding the petrol car, the foreign reserve depletion is calculated to be NPR 12,56,401 for a 15km daily average commute, NPR 13,22,109 for a 20km daily average commute, and NPR 14,53,525 for a 30km daily average commute, as shown in Figure 3.

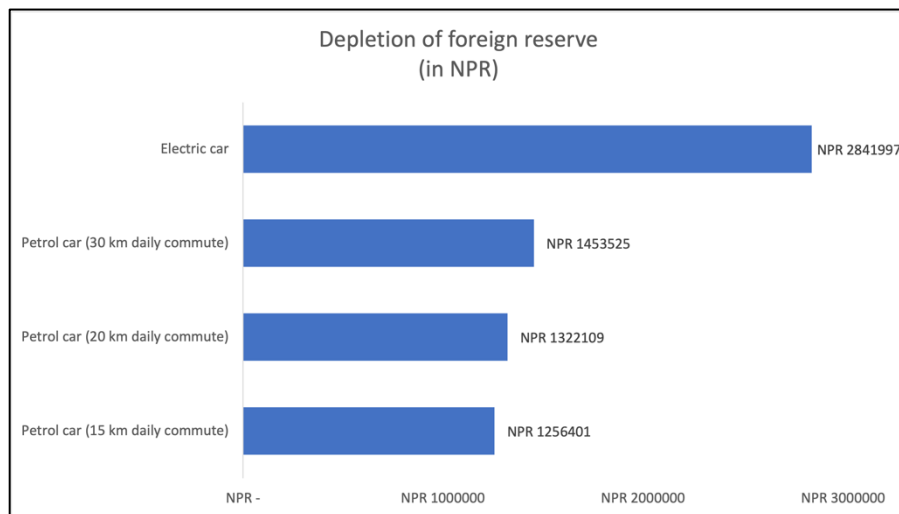


Figure 3: Depletion of foreign reserve discounting the fuel costs at the time of import.

We created four scenarios where the import share of electric cars is 30 percent, 60 percent, 90 percent, and 100 percent and observed their annual net effect on Nepal’s foreign reserve status. The net difference in foreign reserve, discounting the operational charges to the time of import, T=0, due to the import of one electric car is NPR 13,22,109 (assuming an average daily commute of 20km). With an average of 9,175 cars imported per year, the summary of the amount is shown in Table 1 (in Annex), and the plot is shown in Figure 4.

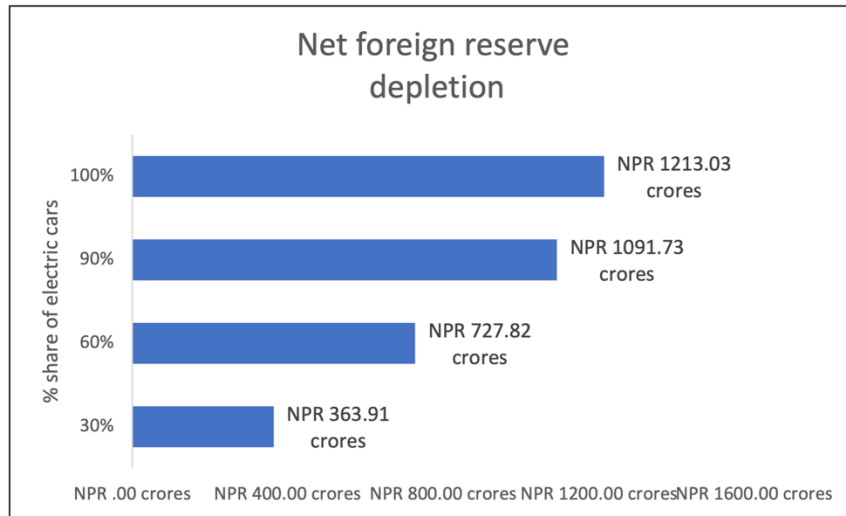


Figure 4: Net foreign reserve depletion with several percentage shares of electric cars.

Analysis of the loss in Government Revenue

The Nexon EV, which has a motor capacity of 95 kW, is subjected to 14.5 percent customs duty, 10 percent excise duty, 13 percent VAT, and 5 percent RDF during import. In contrast, the petrol variant, which has a 1.2L engine displacement capacity, is subjected to 77.6 percent customs duty, 65 percent excise duty, 13 percent VAT, and 8 percent RDF. Based on these values, the total import tax for the electric Nexon is 49.11 percent of the import price, while for the petrol variant, it is 257.63 percent of the import price. The total import tax for the electric Nexon is NPR 13,95,801 whereas for the petrol Nexon is NPR 27,28,973. Importing one electric car results in a loss of NPR 13,33,172 as government revenue during the import. There are variances in annual tax in the cars which are not considered in this study as the amount is not significant compared to the import tax. With an average commute of 20 km per day, the annual consumption of petrol is 421.23 liters, and the equivalent annual revenue loss is NPR 25,792. The discounted revenue loss at the time of import, considering the service period of the vehicle, is equivalent to NPR 1,89,087. With an average of 9,175 cars imported per year, the annual loss in government revenue for various scenarios of percentage of share of electric cars is shown in Table 2 (in Annex) and Figure 5.

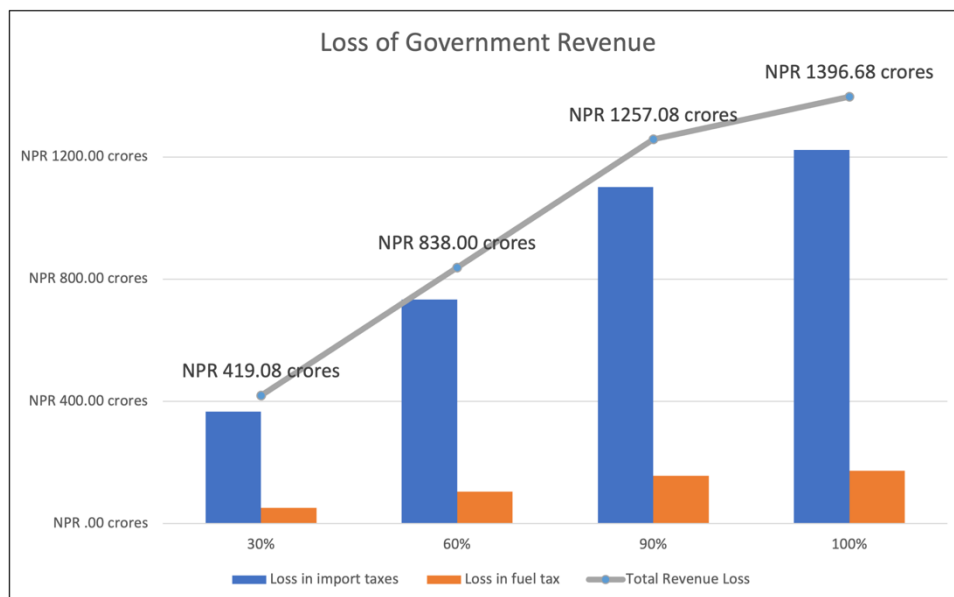


Figure 5: Loss of government revenue at several percentage shares of electric cars.

Conclusion

The current import of electric cars in Nepal entails an annual depletion of NPR 727.82 crore in foreign reserves and a loss of NPR 838.00 crore in government revenue. This constitutes a significant 15 percent of the total budget allocation for agriculture and livestock development. However, a forward-looking perspective is crucial. Despite the present losses and recognizing the positive environmental impact of electric cars, a prudent approach involves awaiting the imminent price parity with gasoline cars. As battery technology advances and economies of scale come into play, the near future promises economic benefits without requiring government subsidies. This approach safeguards national resources, offering a more economically beneficial, stable, and pragmatic stance for Nepal's electric car adoption.

Limitations of the study

The model is simple and does not consider several real-life scenarios. However, the scale of these aspects is quite small and is considered safe to neglect in this study. The limitation of the model in the study can be summarized as:

1. This study does not consider the environmental benefits of electric cars and the consumer's welfare opting for electric cars.
2. The operational costs do not include the cost of servicing, spare parts, etc. of a vehicle which is greater for internal combustion engine vehicles but the battery in the electric vehicle should be replaced after a certain number of years (at least once during the service period of twenty years) thus leading to comparable operational cost in terms of spare parts. These costs are not included in the study.
3. The salvage value of the vehicle after usage is not considered in the study.
4. The study does not consider the difference in the annual taxes on vehicles. It takes the taxes on imports and the taxes on petrol into consideration.

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ANNEX

| Percentage share of electric car | Number of electric cars | Total amount of net foreign reserve depletion (in crores) |
|----------------------------------|-------------------------|---|
| 30% | 2753 | NPR 363.91 crores |
| 60% | 5505 | NPR 727.82 crores |
| 90% | 8258 | NPR 1091.73 crores |
| 100% | 9175 | NPR 1213.03 crores |

Table 1: Net foreign reserve depletion at several percentage shares of electric cars.

| Percentage share of electric car | Number of electric cars | Loss of government revenue in import of cars (in crores) (A) | Loss of government revenue in fuel tax (in crores) (B) | Total amount of loss of government revenue (in crores) (A + B) |
|----------------------------------|-------------------------|--|--|--|
| 30% | 2753 | NPR 367.02 crores | NPR 52.06 crores | NPR 419.08 crores |
| 60% | 5505 | NPR 733.91 crores | NPR 104.09 crores | NPR 838.00 crores |
| 90% | 8258 | NPR 1100.93 crores | NPR 156.15 crores | NPR 1257.08 crores |
| 100% | 9175 | NPR 1223.19 crores | NPR 173.49 crores | NPR 1396.68 crores |

Table 2: Net loss of government revenue at several percentage shares of electric cars.