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Economic And Investment Feasibility Comparison Between Electric And Conventional Delivery Vehicles: Case Study Of Pt Pos Indonesia, Karawang Branch

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Abstract

Purpose: *This study aims to compare the economic and financial feasibility of electric vehicles (EVs) and conventional vehicles (CVs) in tertiary distribution operations at PT Pos Indonesia, focusing on two operational units: KCU Karawang and KCU Cirebon.* ***Methods***: *A quantitative comparative approach was applied using Total Cost of Ownership (TCO) and investment appraisal indicators, including Net Present Value (NPV), Internal Rate of Return (IRR), Benefit–Cost Ratio (BCR), and Payback Period (PP). Operational data such as fuel consumption, maintenance, insurance, tax, and depreciation were analyzed under a five-year economic life cycle.* ***Results***: *The findings show that EVs consistently outperform CVs across all major financial indicators. EVs reduce annual energy costs by up to 80%, significantly lower maintenance and tax expenses, and generate positive NPV values in both locations. IRR for EVs exceeds the 5% discount rate—9.35% in Karawang and 11.2% in Cirebon—while BCR values remain above 1. Payback periods for EVs are 4.4 years in Karawang and 4.3 years in Cirebon. Conversely, CVs show negative NPV, BCR < 1, and no recoverable payback period.* ***Implications***: *The results highlight the strong financial viability of adopting EVs within Indonesia's logistics sector, supporting strategic fleet electrification for long-term cost efficiency. The findings also reinforce national sustainability policies promoting low-carbon transportation and provide evidence-based insights for future investment decisions in logistics operations.*

INTRODUCTION

The logistics sector plays a fundamental role in ensuring the availability of goods at the right time, location, and quantity, thereby supporting the overall effectiveness of supply chain operations. As one of its core components, transportation facilitates the movement of goods across production, distribution, and consumption points, making it central to both operational performance and economic growth (Speranza, 2018). Increasing competition in global transportation markets has driven the need for continuous technological advancement and service innovation (Nechaev et al., 2021). However, transportation remains a major contributor to environmental degradation, accounting for approximately 23% of global greenhouse gas emissions and serving as a significant source of carbon dioxide (de Abreu et al., 2022; Rigogiannis et al., 2023). These challenges have intensified global efforts toward sustainable mobility systems,

including the promotion of green transportation technologies (Gudmundsson et al., 2016; Shah et al., 2021).

Among various sustainable transport solutions, electric vehicles (EVs) have gained increasing attention due to their potential to reduce fossil fuel dependency, lower operating costs, and diminish environmental impacts. Global EV adoption has risen significantly, with more than two million battery electric and plug-in hybrid vehicles already in use as early as 2016. In Indonesia, EV adoption has expanded primarily in the private vehicle segment, driven by concerns over air pollution and reliance on imported fuels (Gunawan et al., 2022). As of November 2024, national registrations recorded more than 195,000 battery electric vehicles, dominated by motorcycles and passenger cars, although the penetration of EVs in logistics operations remains minimal. Most delivery fleets, particularly in the courier sector, continue to rely on gasoline and diesel vehicles.

The logistics industry itself is rapidly expanding and is projected to contribute up to IDR 1.623 trillion to Indonesia's GDP by 2025, with an annual growth rate of 12.53% (Iskandar & Arifin, 2023). This growth, however, is accompanied by rising carbon emissions, underscoring the need to evaluate cleaner and more cost-efficient transport technologies. PT Pos Indonesia, the country's largest and oldest postal and logistics service provider, offers a relevant case for such an evaluation. With an extensive distribution network spanning regional hubs and local delivery offices, PT Pos Indonesia operates a diverse fleet for primary, secondary, and tertiary distribution. Among these, tertiary routes—typically operated using Grandmax vans with fixed daily service patterns—present the most technically feasible segment for the deployment of electric vehicles. Conversely, secondary and primary routes remain unsuitable due to the limited commercial availability of electric trucks in Indonesia.

Existing studies have examined EV adoption from technological, behavioral, and environmental perspectives, including electric bus transitions (Sunitiyoso et al., 2022), national EV policy development (Utami et al., 2024), technology readiness (Maghfiroh et al., 2021), and charging infrastructure influence (Haryadi et al., 2023). Despite these contributions, research assessing the economic and financial feasibility of EV adoption within Indonesia's logistics sector remains limited. In particular, empirical evaluations comparing EVs and conventional vehicles within operational delivery contexts are still scarce.

To address this gap, this study analyzes the financial feasibility of adopting electric vehicles for tertiary distribution operations at PT Pos Indonesia's Karawang and Cirebon regional hubs. The analysis applies a Total Cost of Ownership (TCO) framework integrated with investment appraisal indicators including Net Present Value (NPV), Internal Rate of Return (IRR), Benefit–Cost Ratio (BCR), and Payback Period (PP). By combining operational cost assessment with

investment evaluation, the study aims to provide a comprehensive understanding of cost efficiency, economic viability, and long-term benefits associated with EV deployment in postal logistics. The findings are expected to inform strategic decision-making for sustainable fleet transformation and contribute to Indonesia's broader transition toward environmentally responsible and economically sound logistics systems.

METHODS

This study employs a quantitative research approach, which focuses on the use of numerical data and statistical analysis to assess the financial feasibility of electric vehicles compared to conventional vehicles. Quantitative research, grounded in positivist philosophy, relies on structured data collection, measurable variables, and objective analysis to test predetermined hypotheses (Sugiyono, 2019). A comparative method is used to evaluate differences in economic and financial feasibility between the two vehicle types across two operational locations: KCU Karawang and KCU Cirebon. Comparative research examines one or more variables across distinct samples to identify variations or performance gaps (Sugiyono, 2019). This approach enables a systematic assessment of Total Cost of Ownership (TCO) and investment indicators such as NPV, IRR, BCR, and Payback Period for both electric and conventional vehicles in each regional hub.

1. Total Cost Ownership

The previous literature review session used TCO to compare conventional and electric vehicles. It adopts the following TCO formulas from Bubeck et al. (2016):

$$TCO = ANF_r^n \cdot \sum_{t=j=0}^{n} \frac{I_t + F_t + M_t + S_t + T_t}{(1+r)^{t-j}}$$

$$ANF_r^n = \frac{r(1+r)^n}{((1+r)^n - 1) \cdot (1+r)}$$

Description:

ANF : Annuity factors
I_t : Investment cost
F_t : Fuel cost
M_t : Service cost
S_t : Assurance cost
T_t : Vehicel tax
t : Year
j : Investment year = 0
n : Last year of vehicle life (year 5)
r : Discount rate (%)

2. Net Present Value

The Net Present Value (NPV) is calculated using the following formula:

$$NPV = \sum_{t=0}^{n} \frac{C_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{Co_t}{(1+i)^t}$$

Description :

(C)t : Cash inflow in year t
(Co)t : Cash outflow or payment in year t
n : Lifespan of the unit/business
i : Discount rate
t : Year

3. Internal Rate of Return

According to Kasmir and Jakfar (2017:105), the Internal Rate of Return (IRR) is a technique used to calculate the specific rate of return generated by a project's cash flows over its investment period. This method provides an indication of investment profitability expressed as a percentage. IRR is also useful when there is uncertainty or difficulty in determining the appropriate discount rate. The formula for calculating IRR is as follows:

$$IRR = i_1 + \frac{NPV}{NPV1 - NPV2} \; x \; (i_2 - i_1)$$

Description :

i_1 = Discount rate 1
i_2 = Discount rate 2
$NPV1$ = Net present value 1
$NPV2$ = Net present value 2

4. Benefit Cost Ratio

Benefit–Cost Ratio (BCR), also known as the Profitability Index (PI), is a ratio that compares the present value of future net cash inflows with the initial investment cost (Kasmir and Jakfar, 2017). Unlike the Net Present Value (NPV) method, which evaluates investment feasibility in absolute terms, the Profitability Index provides a relative measure indicating how much benefit is generated per unit of capital invested. The BCR/PI formula is:

$$BCR = 1 + \frac{NPV}{\sum PV_{cost}}$$

Description :

NPV = *net present value*
PV_{cost} = Present value of all costs incurred over the project's economic life

5. Payback Period

To calculate the investment payback period for electric vehicles, where cash inflows are not constant, the Payback Period formula by Sutrisno (2012) is used:

$$PP = n + \frac{A - B}{C - B}$$

Descreption :

A = Initial investment (Rp)

B = Cumulative cash inflow at the end of year *n*

C = Cumulative cash inflow at the end of year *(n + 1)*

n = Last year in which cumulative cash inflow has not yet covered the investment

Assumption

1. Investment costs are calculated as initial capital for vehicle purchases, which is IDR 179,100,000 for conventional vehicles and IDR 350,000,000 for electric vehicles (Gelora E). Meanwhile, energy costs for electric vehicles (Gelora E) are IDR 200/km (Gooto.com, 2023).
2. The monthly maintenance cost for conventional vehicles is IDR 400,000/month, while for electric vehicles it is IDR 3,912,000/5 years or IDR 55,886/month (Gridoto, 2022).Biaya asuransi dihitung dengan estimasi 2,8% untuk kendaraan konvensional dan 1,3% untuk kendaraan listrik dari harga awal beli kendaraan (OJK, 2017).
3. Based on survey results, the annual vehicle tax for conventional vehicles used by PT Pos Indonesia is IDR 2,100,000. In comparison, according to Ministry of Home Affairs Regulation No. 1 of 2021, the vehicle tax for electric vehicles such as the Gelora E is set at 10% of the normal tax rate, which is 2%. Therefore, the tax is calculated as 2% × IDR 350,000,000 = IDR 7,000,000, and 10% of that amount is IDR 700,000.
4. Depreciation cost is calculated as 50% of the initial purchase price (Bubeck et al., 2016).
5. A discount rate of 5% is applied (Bubeck et al., 2016; Wu et al., 2016).

RESULTS AND DISCUSSION

This study evaluates the financial feasibility of electric vehicles (EVs) compared with conventional internal combustion engine (ICE) vehicles for tertiary distribution operations at PT Pos Indonesia's Karawang and Cirebon regional hubs. The analysis integrates operational cost components, energy consumption, and investment appraisal indicators (TCO, NPV, IRR, BCR, and Payback Period).

Table 1 below shows the route data and distance traveled for tersier goods shipments at KCU Karawang-per day.

Table 1. Distribution Routes and Distances (KCU Karawang)

Route	Distance (KM)
(TERSIER PAGI 07:20) HUB JOHAR - MAJALAYA - RAWAMERTA - TELAGASARI - TEMPURAN - CIMALAYA - BANYUSARI - LEMAHABANG WADAS (PP)	120
(TERSIER PAGI 07:20) HUB JOHAR - RENGASDENGKLOK - BATUJAYA - BELENDUNG- KUTAWALUYA- PEDES (PP)	70
(TERSIER PAGI 07:20) HUB JOHAR - KLARI - CIKAMPEK - TIRTAMULYA - JATISARI (PP)	45
(TERSIER PAGI 07:20) HUB JOHAR - TELUKJAMBE - WANASARI - PANGKALAN (PP)	26
(TERSIER SIANG 13:30) HUB JOHAR - KLARI - CIKAMPEK - TIRTAMULYA - JATISARI (PP)	45
(TERSIER SIANG 13:30) HUB JOHAR - MAJALAYA - RAWAMERTA - TELAGASARI - LEMAH ABANG WADAS - BANYUSARI - CILAMAYA - TEMPURAN (PP)	120
(TERSIER SIANG 13:30) HUB JOHAR - RENGASDENGKLOK - BATUJAYA - BELENDUNG - KUTAWALUYA - PEDES (PP)	70
(TERSIER SIANG 13:30) HUB JOHAR - WANASARI - PANGKALAN - WANASARI - AGEN CIHERANG - TELUK JAMBE PP	30
Total	**526**

Source : PT Pos KCU Karawang, 2025.

Then table 2 shows the route data and distance traveled for tersier goods shimpment at KCU Cirebon per-day.

Table 2. Distribution Routes and Distances (KCU Cirebon)

Rute	Jarak (KM)
KCU Cirebon 45100 - KCP CNSL - KCP CNKB - KCP SBE - KCP DKP - KCP BEB	160
KCU Cirebon 45100 - KCP MUD - KCP AJP- KCP SDU- KCP KRB - KCP GBA - KCP LOS - KCP PAB - KCP CLD - KCP WLD - KCP BBK	221
KCU Cirebon 45100 - KCP CNKG - KCP CNKD - KCP KAK - KCP KRD - KCP PGA - KCP AWN - KPC GGS - KCP KLW	163
KCU Cirebon 45100 - KCP CNKN - KCP DWN - KCP PLE - KCP PLB - KCP KNE - KCP PIM - KCP CWN - KCP SSK	187
Total	**731**

Source : PT Pos KCU Cirebon, 2025.

Comparison of Fuel Consumption and Energy Consumption

The comparison between fuel consumption of conventional vehicles (Grandmax) and energy consumption of electric vehicles (Gelora E).

Table 3. Comparison of Fuel and Energy Consumption (KCU Karawang)

Distance (round trip in km)	Conventional Fuel Costs	Electric Vehicle Costs IDR200/km
120	IDR120.000	IDR24.000
70	IDR70.000	IDR14.000
45	IDR45.000	IDR9.000
26	IDR26.000	IDR5.200
45	IDR45.000	IDR9.000
120	IDR120.000	IDR24.000
70	IDR70.000	IDR14.000
30	IDR30.000	IDR6.000
526/day	**IDR526.000**	**IDR105.200**
15780/month	**IDR15.780.000**	**IDR3.156.000**
189360/year	**IDR189.360.000**	**IDR37.872.000**

Source: Author's analysis, 2025.

Table 4. Comparison of Fuel and Energy Consumption (KCU Cirebon)

Distance (round trip in km)	Conventional Fuel Costs	Electric Vehicle Costs IDR200/km
160	IDR160.000	IDR32.000
221	IDR221.000	IDR44.200
163	IDR163.000	IDR32.600
187	IDR187.000	IDR37.400
731/day	**IDR731.000**	**IDR146.200**
21930/month	**IDR21.930.000**	**IDR4.386.000**
263160/year	**IDR263.160.000**	**IDR52.632.000**

Source: Author's analysis, 2025.

Table 3, shows at KCU Karawang, the operational fleet travels approximately 526 km per day, equivalent to 189,360 km per year. Annual fuel expenditure for conventional vehicles reaches IDR189,360,000, whereas electric vehicles require only IDR37,872,000 per year. This results in an annual energy cost saving of IDR151,488,000, driven by the higher energy conversion efficiency of electric drivetrains compared with internal combustion engines.

Then table 4, shows that KCU Cirebon, daily tertiary distribution covers a longer distance of 731 km, or 263,160 km annually. Daily fuel costs for conventional vehicles amount to IDR731,000, while electric vehicles require only IDR146,200 per day (at an energy rate of IDR200/km). On a yearly basis, conventional vehicles incur IDR263,160,000 in fuel costs, compared with IDR52,632,000 for electric vehicles. This reflects an 80.1% reduction in energy-related operating expenses with the use of electric vehicles.

Comparison of Maintenance Costs

The following is a comparison of maintenance costs for conventional and electric vehicles:

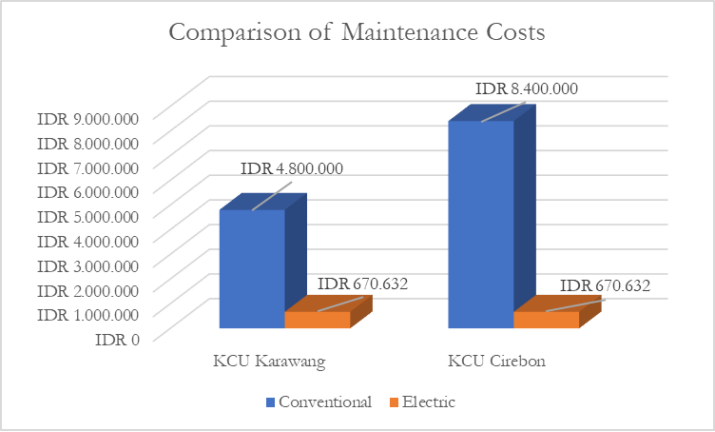

Figure 1. Comparison of Maintenance Costs
Source : Author's Analysis, 2025.

Figure 1 above, illustrate that the maintenance costs of electric vehicles are significantly lower than those of conventional vehicles, where at KCU Karawang, conventional vehicles require an average maintenance cost of IDR400,000 per month (IDR4,800,000 per year). In contrast, electric vehicles incur only IDR55,886 per month (IDR670,632 per year), resulting in an annual savings of IDR4,129,368 per vehicle. This indicates that electric vehicles reduce maintenance expenses by more than 85% compared with conventional vehicles. Similarly, at KCU Cirebon, conventional vehicles incur IDR700,000 per month (IDR8,400,000 per year) in maintenance costs, while electric vehicles require the same amount as in Karawang IDR55,886 per month or IDR670,632 per year. This means that EV maintenance costs represent only 7% of those of conventional vehicles, providing a cost reduction of approximately 93%.

Comparison of Insurance Costs

This section compares the insurance costs between conventional vehicles and electric vehicles.

Table 5. Comparison of Insurance Costs

	KCU Karawang	KCU Cirebon
Conventional	IDR 5.014.800	IDR 5.070.800
Electric	IDR 4.550.000	IDR 4.550.000

Source: Author's analysis, 2025.

Table 5 above, show that the annual insurance cost at KCU Karawang for conventional vehicles is IDR5,014,800, while electric vehicles require IDR4,550,000 per year. This results in an annual savings of IDR464,800, indicating an additional cost efficiency advantage for electric vehicles. Meanwhile, KCU Cirebon, a similar pattern is observed. Conventional vehicle insurance costs reach IDR5,070,800 per year, whereas electric vehicles maintain a lower cost of IDR4,550,000 annually. Although the difference is relatively small, it can be influenced by factors such as the vehicle purchase year, market value at the time of insurance assessment, and operational risk profiles in each region. Newer vehicles tend to have higher insurance premiums due to increased market value and inflationary adjustments.

Comparison of Tax Costs

This section highlights the differences in annual vehicle tax costs between conventional vehicles and electric vehicles in KCU Karawang and KCU Cirebon. Government policies in Indonesia have introduced tax incentives to encourage the adoption of electric vehicles, resulting in significantly lower tax rates for EVs. The comparison is illustrated as follows:

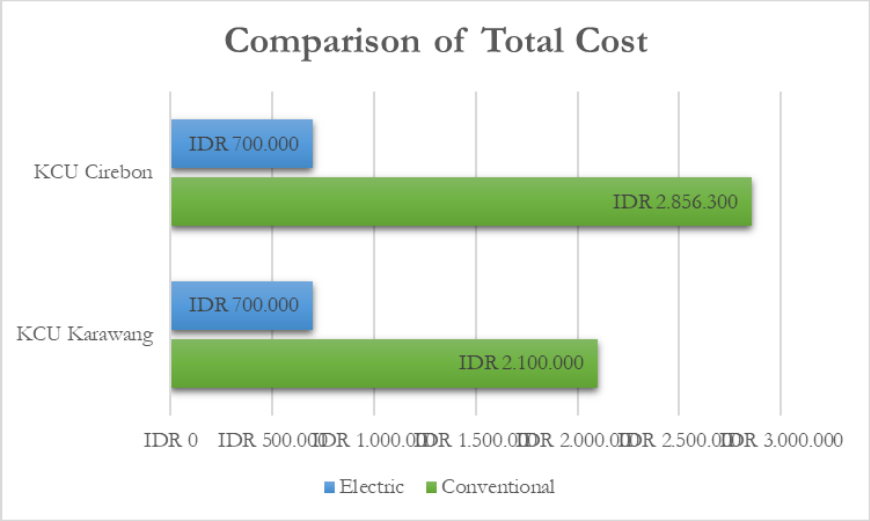

Figure 2. Comparison of Tax Costs

Source: Author's analysis, 2025.

The annual tax cost for electric vehicles is lower—only IDR 700,000 compared to IDR 2,100,000 for conventional vehicles at KCU Karawang, and IDR 2,856,300 at KCU Cirebon. This aligns with government policy to provide tax incentives for electric vehicle transactions, such as the value-added tax borne by the government (VAT-DTP) under the Ministry of Finance Regulation No. 12 of 2025. This policy aims to encourage the adoption of environmentally friendly vehicles.

Calculation and Comparison of Total Costs

After calculating each of the cost components above, a comprehensive comparison of the total costs is presented in Table 6 below:

Table 6. Comparison of Total Costs/Year

	KCU Karawang		KCU Cirebon	
Component	**Conventional**	**Electric**	**Conventional**	**Electric**
Investment Cost	IDR 179.100.000	IDR 350.000.000	IDR 181.100.000	IDR 350.000.000
Fule/Energy Cost	IDR 189.360.000	IDR 37.872.000	IDR 263.160.000	IDR 52.632.000
Maintenance Cost	IDR 4.800.000	IDR 670.632	IDR 8.400.000	IDR 670.632
Assurance Cost	IDR 5.014.800	IDR 4.550.000	IDR 5.070.800	IDR 4.550.000
Tax Cost	IDR 2.700.000	IDR 700.000	IDR 2.856.300	IDR 700.000
Depreciation (50%)	IDR 89.550.000	IDR 175.000.000	IDR 90.550.000	IDR 175.000.000
Total	**IDR 291.424.800**	**IDR 218.792.632**	**IDR 370.037.100**	**IDR 233.552.632**

Source: Author's analysis, 2025.

The comparison of total costs is illustrated as follows:

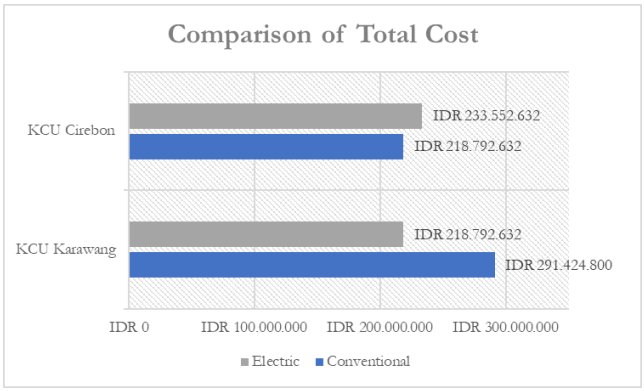

Figure 3. Total Cost Comparison

Source: Author's analysis, 2025.

The figure 3 above presents a comparison of the total cost components between conventional and electric vehicles in KCU Karawang and KCU Cirebon. In both Karawang and Cirebon, electric vehicles (EVs) require a higher initial investment than conventional vehicles. However, this is offset by substantially lower operating costs. EVs incur significantly reduced annual expenses for energy, maintenance, insurance, and taxes, while also retaining a higher resale value. At KCU Karawang, the total annual cost of an EV is IDR218,792,632, lower than the IDR 291,424,800 for a conventional vehicle. Then KCU Cirebon, EVs also show strong financial advantages, with a total annual cost of IDR233,552,632, compared with IDR370,037,100 for conventional vehicles. Overall, EVs offer lower total cost of ownership, driven by major savings in operational expenses despite higher upfront costs. These results demonstrate the long-term economic benefits and financial sustainability of adopting electric vehicles for PT Pos Indonesia's distribution operations.

Comparison of Total Cost of Ownership (TCO) KCU Karawang

The TCO calculations for both conventional and electric vehicles are as follows:

$$ANF_r^n = \frac{r(1+r)^n}{((1+r)^n - 1) \cdot (1+r)}$$

$$ANF_r^n = \frac{5\%(1+5\%)^5}{((1+5\%)^5-1)\cdot(1+5\%)} = \mathbf{0,2}$$

Conventional's TCO

$$TCO = ANF_r^n \cdot \sum_{t=j=0}^{n} \frac{I_t + F_t + M_t + S_t + T_t}{(1+r)^{t-j}}$$

$$= 0,2\ x\ \frac{IDR\ 179.000.000 + IDR\ 189.360.000 + IDR\ 4.800.000 + IDR\ 5.014.800 + IDR\ 2.700.000}{(1+5\%)^{1-0}}$$

= IDR72.566.628

Electric's TCO

$$TCO = ANF_r^n \cdot \sum_{t=j=0}^{n} \frac{I_t + F_t + M_t + S_t + T_t}{(1+r)^{t-j}}$$

$$= 0{,}2\ x\ \frac{IDR\ 350.000.000 + IDR\ 37.872.000 + IDR\ 670.632 + IDR\ 4.550.000 + IDR\ 700.000}{(1+5\%)^{1-0}}$$

= IDR75.008.120

Comparison of Total Cost of Ownership (TCO) KCU Cirebon

Conventional's TCO

$$TCO = ANF_r^n \cdot \sum_{t=j=0}^{n} \frac{I_t + F_t + M_t + S_t + T_t}{(1+r)^{t-j}}$$

$$= 0{,}2\ x\ \frac{Rp\ 181.100.000 + Rp\ 263.160.000 + Rp\ 8.400.000 + Rp\ 5.014.800 + Rp\ 2.856.300}{(1+5\%)^{1-0}}$$

= IDR87.730.876

Electric's TCO

$$TCO = ANF_r^n \cdot \sum_{t=j=0}^{n} \frac{I_t + F_t + M_t + S_t + T_t}{(1+r)^{t-j}}$$

$$=0{,}2\ x\ \frac{Rp\ 350.000.000 + Rp\ 52.632.000 + Rp\ 670.632 + Rp\ 4.550.000 + Rp\ 700.000}{(1+5\%)^{1-0}}$$

= IDR77.819.549

The TCO value for electric vehicles is higher than that of conventional vehicles, and it is illustrated as follows:

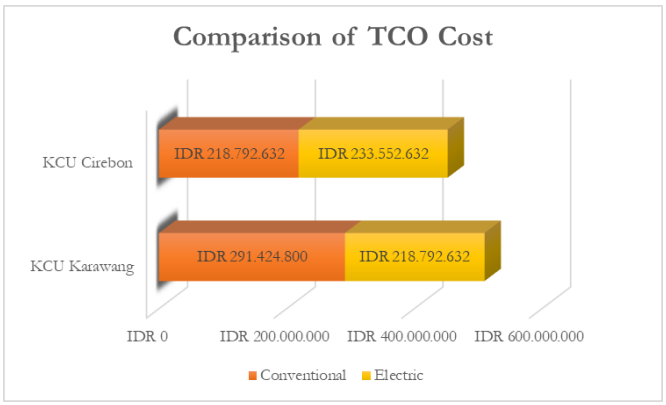

Figure 4. TCO Comparison

Source: Author's analysis, 2025.

Based on the TCO calculations shown in Figures 4 above, the results indicate different outcomes for each location. Total Cost of Ownership (TCO) in KCU Karawang for electric vehicles is slightly higher than that of conventional vehicles, with a difference of IDR2,441,491.81. In contrast, at KCU Cirebon, electric vehicles show a financial advantage, with a TCO that is IDR9,911,327 lower compared with conventional vehicles.

Comparison Net Present Value (NPV)

The NPV analysis of KCU Karawang, show that conventional vehicles generate a

negative NPV of –IDR526,672,080, indicating that the investment is not financially viable. In contrast, electric vehicles produce a positive NPV of IDR53,832,465, demonstrating that they are economically feasible and capable of providing financial value over the analysis period. Meanwhile, in KCU Cirebon, the results follow the same pattern but with an even wider gap. Conventional vehicles yield a negative NPV of –IDR773,049,330, while electric vehicles achieve a positive NPV of IDR80,750,079. This highlights that conventional vehicles result in long-term financial losses, whereas electric vehicles produce net economic gains.

The NPV performance of electric vehicles in both locations is driven by significantly lower energy, maintenance, and tax costs. In regions like Cirebon, where operational distances are longer and delivery frequency is higher, the financial advantages of electric vehicles become even more pronounced, supporting their role in advancing sustainable transportation. Overall, the NPV comparison between conventional and electric vehicles at each KCU is as follows:

Table 7. Comparison of NPV Cost

	KCU Karawang	**KCU Cirebon**
Konvensional	-Rp526.672.080	-Rp773.049.330
Listrik	Rp53.832.465	Rp80.750.079

Source : Author's Analysis, 2025.

Comparison of Internal Rate of Return (IRR)

The IRR analysis at KCU Karawang and KCU Cirebon shows that conventional vehicles are not financially feasible at either location. In both cases, the cumulative net cash flows remain negative throughout the analysis period, resulting in negative NPV values and the absence of an NPV intersection with zero. Consequently, the IRR for conventional vehicles cannot be calculated, indicating that these investments are unable to recover their costs or generate financial returns over their operational lifespan.

In contrast, electric vehicles demonstrate clear financial viability at both locations. Using NPV_1 calculated at a 5% discount rate and NPV_2 at a 10% discount rate, the resulting IRR at KCU Karawang is 9.35%, while at KCU Cirebon it reaches 11.2%. Both values exceed the applied 5% discount rate, confirming that electric vehicle investments generate positive long-term returns. These results reflect the strong operational efficiency of electric vehicles, particularly lower energy, maintenance, and tax costs which contribute to positive NPVs and make electric vehicles a superior investment alternative compared with conventional vehicles.

Comparison of Benefit Cost Ratio (BCR)

The BCR analysis compares the present value of benefits and costs to determine the financial feasibility of each vehicle type. A BCR greater than 1 indicates that an investment is

financially feasible, while a value below 1 indicates the opposite.

Table 8. Comparison of BCR Cost

	KCU Karawang	KCU Cirebon	Description	Feasible/Not
Conventional	0,6	0,3	< 1	Not Feasible
Electric	1,2	1,3	> 1	Feasible

Source : Author's Analysis, 2025.

The BCR results of table 8 show that conventional vehicles have values of 0.6 at KCU Karawang and 0.3 at KCU Cirebon, both of which are below 1. In contrast, electric vehicles record BCR values of 1.2 in Karawang and 1.3 in Cirebon, both exceeding the threshold of 1. Overall, the BCR comparison clearly indicates that conventional vehicles are financially infeasible at both locations, while electric vehicles meet the feasibility criteria, offering greater economic benefits relative to their costs.

Comparison of Payback Period (PP)

The Payback Period (PP) analysis evaluates how long it takes for an investment to recover its initial cost through the net cash inflows generated annually. For conventional vehicles at both KCU Karawang and KCU Cirebon, the PP cannot be calculated because the annual net cash flows remain negative throughout the analysis period. This indicates that conventional vehicles never reach a break-even point, meaning their investment costs are not recoverable.

In contrast, electric vehicles show clear investment recovery potential at both locations. At KCU Karawang, cumulative cash flow indicates that the investment is recovered in the fourth year, and the calculated PP is 4.4 years with the , meaning the initial investment is fully returned after approximately 4 years and 4 months. At KCU Cirebon, the recovery pattern is similar, with a PP of 4.3 years, equivalent to 4 years and 3 months. These results demonstrate that electric vehicles provide a feasible payback period and are financially beneficial compared with conventional vehicles, which do not achieve investment recovery at all.

DISCUSSION

The findings indicate that electric vehicles consistently outperform conventional vehicles across all financial parameters in both KCU Karawang and KCU Cirebon. Electric vehicles generate substantial operational savings—up to 80% in Karawang and even higher in Cirebon—mainly due to lower and more stable energy costs, simpler drivetrain systems, and reduced maintenance needs. Additional financial advantages also come from lower taxes and insurance costs supported by government incentives.

The Total Cost of Ownership (TCO) analysis shows location-specific differences. In Karawang, electric vehicles have a slightly higher TCO, while in Cirebon they offer notable cost

savings. This highlights that financial viability depends heavily on operational patterns, particularly distance and usage intensity. In areas with longer routes and higher delivery frequency, electric vehicles provide greater economic benefit.

Investment feasibility analysis further strengthens these conclusions. Electric vehicles show positive NPV, IRR values above the discount rate, BCR > 1, and payback periods of approximately 4.3–4.4 years, indicating strong financial viability. Conversely, conventional vehicles exhibit negative cash flows, resulting in negative NPV and an undefined IRR, making them financially unfeasible.

Implications and Alignment with Previous Studies

This study provides direct implications for logistics operations and sustainable transport policy in Indonesia. The finding that electric vehicles are financially more viable than conventional vehicles offers a strong basis for logistics companies—such as PT Pos Indonesia—to consider transitioning to electric fleets for long-term cost efficiency. The results also support government efforts to design subsidies and clean-energy transition strategies in the transport sector. With higher energy efficiency and lower operating costs, electric vehicles represent a practical and sustainable solution for urban delivery operations.

These findings are consistent with previous studies by Liu et al. (2021), which show that electric vehicles become more economical than fossil-fuel vehicles over medium to long-term use. This research also reinforces theories suggesting that adopting low-carbon technologies, such as electric vehicles, can yield substantial long-term cost savings (Pereirinha et al., 2018; Bubeck et al., 2016).

CONCLUSION

The results of this study demonstrate that electric vehicles are financially more feasible than conventional vehicles for PT Pos Indonesia's operations in both KCU Karawang and KCU Cirebon. Conventional vehicles incur substantially higher annual operating costs—particularly for fuel and maintenance—resulting in overall expenses exceeding Rp180 million per year. In contrast, electric vehicles show strong financial performance across all feasibility indicators, including positive NPV values, BCR ratios greater than 1, and payback periods of 4.4 years in Karawang and 4.3 years in Cirebon, indicating that the initial investment can be recovered before the end of the 5-year economic life.

Conventional vehicles, however, show negative NPV, BCR values below 1, and no calculable payback period due to consistently negative net cash flows. These findings confirm that electric vehicles provide significant cost savings and long-term financial benefits, making them

particularly suitable for high-intensity distribution areas such as Cirebon, while their adoption in lower-intensity areas like Karawang may require phased implementation or additional support due to higher upfront investment costs. Overall, the study reinforces the economic viability of transitioning to electric vehicles and highlights their potential to enhance operational efficiency and contribute to sustainable transport practices within PT Pos Indonesia.

For future research, this study can be expanded by extending the analysis period beyond five years to obtain a more accurate, of the long-term efficiency of electric vehicles. In addition, incorporating sensitivity analysis on key cost components is recommended to assess how sensitive the financial feasibility results are to changes in major variables.

REFERENCE

Bubeck, S., Tomaschek, J., & Fahl, U. (2016). Perspectives of electric mobility: Total cost of ownership of electric vehicles in Germany. Transport Policy, 50, 63-77. https://doi.org/10.1016/j.tranpol.2016.05.012

de Abreu, V. H. S., Santos, A. S., & Monteiro, T. G. M. (2022). Climate change impacts on the road transport infrastructure: A systematic review on adaptation measures. Sustainability, 14(14), 8864. https://doi.org/10.3390/su14148864

Gudmundsson, H., Hall, R. P., Marsden, G., & Zietsman, J. (2016). Sustainable transportation. Heidelberg, Ger. Frederiksberg, Denmark, Spreinger-Verlag Samf. https://doi.org/10.1007/978-3-662-46924-8

Gunawan, I., Redi, A. A. N. P., Santosa, A. A., Maghfiroh, M. F. N., Pandyaswargo, A. H., & Kurniawan, A. C. (2022). Determinants of customer intentions to use electric vehicle in Indonesia: An integrated model analysis. Sustainability, 14(4), 1972. https://doi.org/10.3390/su14041972

Haryadi, F. N., Simaremare, A. A., Ajija, S. R., Hakam, D. F., & Mangunkusumo, K. G. H. (2023). Investigating the impact of key factors on electric/electric-vehicle charging station adoption in Indonesia. *International Journal of Energy Economics and Policy*, *13*(3), 434-442.

Iskandar, T., & Arifin, R. (2023). Navigating Indonesia's logistics and supply chain challenges: A data-driven analysis of logistics performance index. Jurnal BPPK: Badan Pendidikan dan Pelatihan Keuangan, 16(1), 110-123. https://doi.org/10.48108/jurnalbppk.v16i1.820

Kasmir, & Jakfar. (2017). *Studi Kelayakan Bisnis*. Edisi Revisi. Jakarta: Kencana Prenadamedia Group.

Liu, Z., Song, J., Kubal, J., Susarla, N., Knehr, K. W., Islam, E., ... & Ahmed, S. (2021). Comparing total cost of ownership of battery electric vehicles and internal combustion engine vehicles. Energy Policy, 158, 112564. https://doi.org/10.1016/j.enpol.2021.112564

Maghfiroh, M. F. N., Pandyaswargo, A. H., & Onoda, H. (2021). Current readiness status of electric vehicles in indonesia: Multistakeholder perceptions. *Sustainability*, *13*(23), 13177.

Nechaev, Andrey, Yulia Skorobogatova, and Maria Nechaeva. "Toolkit for the transportation and logistics infrastructure." *Transportation Research Procedia* 54 (2021): 637-644.

Pereirinha, P. G., González, M., Carrilero, I., Anseán, D., Alonso, J., & Viera, J. C. (2018). Main trends and challenges in road transportation electrification. Transportation research procedia, 33, 235-242. https://doi.org/10.1016/j.trpro.2018.10.096

Rigogiannis, N., Bogatsis, I., Pechlivanis, C., Kyritsis, A., & Papanikolaou, N. (2023). Moving towards greener road transportation: A review. Clean Technologies, 5(2), 766-790. https://doi.org/10.3390/cleantechnol5020038

Shah, K. J., Pan, S. Y., Lee, I., Kim, H., You, Z., Zheng, J. M., & Chiang, P. C. (2021). Green transportation for sustainability: Review of current barriers, strategies, and innovative technologies. Journal of Cleaner Production, 326, 129392. https://doi.org/10.1016/j.jclepro.2021.129392

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Sunitiyoso, Y., Belgiawan, P. F., & Rizki, M. (2022). Public acceptance and the environmental impact of electric bus services. Transportation Research Part D: Transport and Environment, 109, 103358. https://doi.org/10.1016/j.trd.2022.103358

Sutrisno. (2012). *Manajemen Keuangan: Teori, Konsep, dan Aplikasi*. Yogyakarta: Ekonisia.

Utami, M. W. D., Yuniaristanto, Y., & Sutopo, W. (2020). Adoption intention model of electric vehicle in Indonesia. Jurnal Optimasi Sistem Industri, 19(1), 70-81. https://doi.org/10.25077/josi.v19.n1.p70-81.2020