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Electric Vehicle Charging Station Incentive Design for Low Utilization, Fast and Ultra-Fast Chargers in Indonesia

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ABSTRACT

This study addresses the financial feasibility challenges of deploying fast and ultra-fast electric vehicle charging station incentive design for low utilization, fast and ultra-fast chargers in Indonesia (EVCS) in Indonesia, where low utilization rates (<30%) create significant economic barriers. It evaluates the impact of government incentive schemes on investment viability using Discounted Cash Flow (DCF) simulations. Schemes analyzed include baseline (no incentive), CAPEX incentive, tariff incentive, and performance-based incentive (PBI), with key indicators: Net Present Value (NPV), IRR, and Payback Period. Simulations reflect utilization below 30%, typical outside major urban centres. Without incentives, projects show negative NPV and sub-threshold IRR. CAPEX incentives reduce upfront costs, improving feasibility; tariff incentives boost cash flow. PBIs, which provide fiscal support per kWh sold or utilization level, enhance sustainability by tying aid to usage. Sensitivity analysis confirms IRR sensitivity to utilization and CAPEX. The study concludes that combining capital and output-based incentives is essential to bridge the viability gap, especially in low-demand regions. This will accelerate EVCS deployment, bolster investor confidence, and advance national electrification goals via inclusive infrastructure.

KEYWORDS *Electric Vehicle Charging Station, Incentive Design, Discounted Cash Flow, Capital Expenditure (CAPEX), Internal Rate of Return (IRR), Net Present Value (NPV), Performance-Based Incentive*

INTRODUCTION

Electric Vehicle Charging Station (EVCS) infrastructure, especially fast and ultra-fast chargers are critical to accelerate Indonesia's transition towards sustainable transportation (Fitriana et al., 2024; Hardono et al., 2025; Kristiana et al., 2024; Liangliang et al., 2025). The urgency of developing robust EVCS infrastructure extends beyond transportation modernization—it directly impacts Indonesia's environmental commitments, economic competitiveness, and energy security. As a signatory to the Paris Agreement, Indonesia has committed to reducing greenhouse gas emissions by 29% unconditionally and up to 41% with international support by 2030 (Government of Indonesia, 2016). The transportation sector, which accounts for approximately 26% of national energy consumption and contributes significantly to urban air pollution, represents a critical intervention point for achieving these climate targets. Furthermore, the economic implications are substantial: delayed EVCS deployment risks Indonesia falling behind regional competitors in the electric vehicle value chain, potentially missing opportunities for manufacturing, technology transfer, and green job creation that could contribute billions of dollars to GDP growth.

To support this transition, the Ministry of Energy and Mineral Resources has issued MEMR Decree Number 24K of 2025 that stated the EVCS target in Indonesia from 2023 to 2030. The target can be seen in Table 1 below.

Table 1. EVCS Target and realization in Indonesia

Region	2023	2024	2025	2026	2027	2028	2029	2030
Sumatera	61	459	658	928	1,273	2,144	3,315	4,826
Java	434	1,933	4,093	7,233	11,072	20,779	33,797	50,620
Bali and Nusa Tenggara	305	314	432	611	831	1,391	2,156	3,142
Borneo	17	186	272	383	521	874	1,346	1,957
Moluccas and Papua	5	73	81	92	117	179	270	385
Indonesia	**854**	**3,163**	**5,810**	**9,633**	**14,339**	**26,251**	**42,251**	**62,918**

(Source: Ministry of EMR, 2025)

Yet, investment in fast and ultrafast EVCS remains low due to high Capital Expenditure (CAPEX), understandably low utilization rates (<30%), and Internal Rate of Return (IRR) values that mostly fail to meet the 11% threshold, especially in early stages (Gupta et al., 2023). Although MEMR Regulation No. 1 of 2023 provides several incentives (bulk electricity tariffs, subscription fee exemptions, and OSS-licensing facilitation), they are insufficient to eliminate economic barriers in low EV-populated areas (Hanun et al. 2023).

While existing literature has examined EVCS deployment in mature markets such as the United States (Bernal et al., 2024), Europe (Szumska, 2023), and China (Gan et al., 2020), significant research gaps remain regarding emerging markets with unique challenges. Specifically, Indonesia's context differs fundamentally in three critical dimensions: (1) archipelagic geography creating fragmented demand patterns and high infrastructure costs, (2) lower per-capita income limiting consumer willingness-to-pay for premium charging services, and (3) regulatory frameworks that cap electricity selling prices, constraining revenue potential. Previous studies on EVCS economics have predominantly focused on single-incentive mechanisms (Schroeder & Traber, 2012; Greene et al., 2020) or high-utilization urban scenarios (Wesseh & Lin, 2022), leaving a critical knowledge gap regarding multi-incentive designs for low-utilization contexts typical of developing economies. This research addresses these gaps by: (1) systematically comparing multiple incentive architectures under consistent low-utilization assumptions (<30%) representative of Indonesia's current market reality, (2) providing empirical evidence on incentive effectiveness thresholds specific to Southeast Asian regulatory and market conditions, and (3) developing an integrated incentive framework that balances fiscal sustainability with infrastructure deployment urgency—a contribution particularly relevant for other developing nations facing similar EV transition challenges.

In this paper, financial simulation based on Discounted Cash Flow (DCF) investigates the influence of different incentive options (Perrelli et al., 2023; Pless et al., 2016). A no-incentive scheme serves as the baseline for comparison with CAPEX incentives, tariff incentives, and Performance-Based Incentives (PBI) on the investment feasibility of fast and ultrafast EVCS projects. The study employs Net Present Value (NPV), IRR, and payback periods as key variables in the analysis. The simulation assumes low utilization (master-servant usage below 30%), which is typical in many low-density areas outside large cities (Lee et al., 2020; Perrelli et al., 2023; Samis et al., 2007).

Without incentives, fast and ultrafast EVCS projects demonstrate severe financial unviability, with negative NPV and IRR substantially below the acceptable investment threshold of 11%. This underscores the critical need for government intervention through structured incentive mechanisms. CAPEX stimuli, such as capital contributions, increase project viability by lowering cash outflows. Tariff incentives, on the other hand, merely boost cash inflows but are capped by regulation. Meanwhile, Performance-Based Incentives (PBI) that offer financial support for each kWh sold or used are more effective in enhancing project viability by linking additional economic rewards to utilization, thereby fairly improving both IRR and payback periods.

Sensitivity tests reveal that IRR is highly sensitive to factors such as utilization rate and CAPEX, emphasizing the need for appropriate subsidies in low-demand situations. The findings indicate that the financing viability gap should be bridged by a blend of capital top-ups and output-based incentives, particularly in non-commercial or less-densely populated locations. This will create a powerful platform to drive the rollout of Electric Vehicle Charging Stations (EVCS) and contribute to building investor confidence in meeting national electrification goals through sustainable, inclusive, and financially viable infrastructure.

The remainder of this paper is structured as follows: The Research Method section details the DCF modeling framework, scenario design, and analytical approach. The Results and Discussion section presents financial outcomes across four incentive scenarios with sensitivity analyses, comparing findings with international best practices. The Conclusion synthesizes key findings and provides policy recommendations for scalable EVCS deployment in Indonesia.

RESEARCH METHOD

This study employed a quantitative, scenario-based method. The approach was based on the development and testing of financial incentive instruments to stimulate investment in Electric Vehicle Charging Stations (EVCS). It used a discounted cash flow (DCF) model-based simulation to assess the impact of different incentive schemes. The use of this model was motivated by its common application in investment decision-making, where it efficiently accounted for the time value of money and calculated key workability indices that indicated an EVCS project's attractiveness to investors.

Although the DCF model provided quantifications of scenario feasibility, interpretations were made in connection with broader environmental considerations. In this area, the PESTEL framework was used. This strategic analysis tool enabled systematic consideration of external factors that potentially impacted EVCS projects and incentive deployment. PESTEL was not applied directly to quantify or calculate but provided a framework as part of the methodology for discussing credible risks, barriers, and drivers that supported EVCS feasibility beyond the spreadsheet model.

RESULT AND DISCUSSION

The evaluation is conducted under four distinct policy intervention scenarios: (1) a baseline scenario without any government incentives; (2) a capital expenditure (CAPEX) incentive scenario, in which a portion of the initial investment is subsidized; (3) a tariff incentive scenario, where operators are permitted to apply a more favorable electricity selling price; and (4) a performance-based incentive (PBI) scenario, which provides fiscal support linked to the actual energy dispensed (measured in kWh) or station utilization levels. The input variables including equipment specifications, installation costs, electricity tariffs, and operational parameters are detailed in Appendices 1 through 3, ensuring transparency and replicability of the financial simulations.

Three investment metrics: NPV (to measure the present value of estimated cash flows), IRR (profitability compared with cost of capital) and payback period (the time within which cumulative cash inflows recover cost) are utilized for financial evaluation. The simulations are carried out in a low-utilization scenario where we have an average charger usage of less than 30%, which is very much consistent with the demand for charging that can be found today at many locations all over Indonesia. This analytical model can be used to determine the best policy measures to mitigate the viability gap and stimulate financially viable EVCS considering real world operational conditions.

Baseline scenario

Under the baseline scenario all EVCS projects are still uneconomic. Even more concerning is that not a single fund has achieved at least half its 11% target IRR. The IRR of Fast Charging equals 0.36 to 4.80% and for Ultra-Fast EVCS projects, even more discouraging results are reported: −5.26 to 0%. The Payback Period was also significantly expanded between 11 and 23 years, with no scenario showing a positive Net Present Value (NPV). These results show that with an current selling price of Rp2,467/kWh and no intervention from the government on tariffs then investments in EVCS still experience a high viability gap, especially at low levels of use. The simulation result can be seen in Table 2.

Table 2. DCF Simulation Result for Baseline Scenario

Scenario	IRR (%)	NPV	PBP (Years)	Tariff (IDR/kWh)
Fast Charging 1	0.36%	-IDR 393,785,604	14	2,467
Fast Charging 2	3.41%	-IDR 208,904,077	12	2,467
Fast Charging 3	4.80%	-IDR 157,091,894	11	2,467
Ultrafast Charging 1	-5.26%	-IDR 1,079,404,010	23	2,467
Ultrafast Charging 2	-2.55%	-IDR 634,462,946	18	2,467
Ultrafast Charging 3	0.09%	-IDR 412,833,209	15	2,467

(Source: Author, 2025)

30% CAPEX Incentive

In this scenario, it is assumed that government gives investment incentive by 30% of the total CAPEX for every EVCS project. The reduction of CAPEX will provide relief for EVCS developers, and will help to increase the IRR, but not enough to yield positive NPV in all scenarios.

In the Fast-Charging scenario, the IRR is increased to 2.69 % to 7.26% compared to the Baseline scenario, but it is still below the acceptable target of 11%. The Payback Period is also better, ranging from 10 to 12 years, while in the ultrafast charging scenario, 30% CAPEX incentive fail to increase EVCS projects' financial feasibility, with maximum IRR of only 2.25%. The simulation result can be seen in Table 3.

Table 3. DCF Simulation Result for 30% CAPEX Incentive Scenario

Scenario	IRR (%)	NPV	PBP (Years)	Tariff (IDR/kWh)	Incentives (IDR)
Fast Charging 1	2.69%	-IDR 264,296,879	12	2,467	120,479,400
Fast Charging 2	5.60%	-IDR 118,760,337	10	2,467	103,230,000
Fast Charging 3	7.26	-IDR 69,856,016	10	2,467	99,900,000
Ultrafast Charging 1	-3.70%	-IDR 788,617,751	20	2,467	333,000,000
Ultrafast Charging 2	-0.60%	-IDR 436,728,290	15	2,467	226,440,000
Ultrafast Charging 3	2.25%	-IDR 267,440,079	13	2,467	166,500,000

(Source: Author, 2025)

Tariff incentive to reach IRR 11%

This scenario was designed to determine tariff per KWh of electricity for fast and ultrafast EVCS projects to cover 11% IRR of which is considered competitive for public infrastructure projects with moderate commercial and technical risks. To reach IRR of 11%, tariff between IDR 2,799 and IDR 3,240 per kWh. DCF simulation using this tariff level will return positive NPV ranging from IDR 34.33 million to 51.65 million with payback period of 8 years. However, for the ultrafast charging scenario, the required tariff is much higher, between 3,275 and 4,519 IDR/kWh. From DCF simulation, the NPV ranging from minimum IDR 53.02 million to IDR 103.84 million. The simulation result can be seen in the Table 4.

Table 4. DCF Simulation Result for Tariff Incentive Scenario

Scenario	IRR (%)	NPV	PBP (Years)	Tariff (IDR/kWh)	Incentives	Unit	Notes
Fast Charging 1	11%	IDR 51,654,015	8	3,240	772.57	IDR/kWh	Fixed target IRR, tariff to customer is capped at 2,467 IDR/kWh
Fast Charging 2		IDR 37,291,225	8	2,894	427.00		
Fast Charging 3		IDR 34,337,046	8	2,799	332.01		
Ultrafast Charging 1		IDR 103,841,616	8	4,519	2052.22		
Ultrafast Charging 2		IDR 68,992,930	8	3,687	1220.07		
Ultrafast Charging 3		IDR 53,021,169	8	3,275	807.98		

(Source: Author, 2025)

PBI

In this incentive scheme, the government provides incentive through a fraction the amount of kWh sold, which is simulated at 30% of PLN tariff for fast charging scenarios and 50% for ultrafast charging scenarios. This scheme is designed to directly support operational cash flow and encourages the EVCS operator to increase its efficiency and overall utilisation rate. Using this scheme, most fast charging scenarios will achieve financial feasibility, with IRR above 11% and positive NPV, while reducing the payback period to 7 to 9 years. In ultrafast charging scenario, only 1 of 3 scenario reach financial feasibility, with the IRR of 11,15% and NPV of IDR 61.26 million. The complete result can be seen in table 5 below.

Table 5. DCF Simulation Result for PBI Scenario

Scenario	IRR (%)	NPV	PBP (Years)	Tariff (IDR/kWh)	Incentives (IDR/kWh)
Fast Charging 1	7.75%	IDR -109,331,436	9	2,467	493.36
Fast Charging 2	12.28%	IDR 86,816,565	8	2,467	493.36
Fast Charging 3	13.44%	IDR 124,070,340	7	2,467	493.36
Ultrafast Charging 1	3.10%	IDR -605,313,730	12	2,467	822.26

Ultrafast Charging 2	7.51%	IDR - 160,372,667	9	2,467	822.26
Ultrafast Charging 3	11.15%	IDR 61,257,071	8	2,467	822.26

(Source: Author, 2025)

The results of CAPEX incentive and PBI are then subjected to sensitivity analysis for each incentive scheme (excluding the baseline, no incentive scenario).

• 30% CAPEX incentive has a positive impact on financial feasibility, primarily increasing the IRR and slightly improving the project's NPV. In particular, every 10% increase in the subsidy on investment expense would raise the IRR of Fast Charging scenarios by around 1 ‑ 2 percentage points and shorten the PBP by about 0.6 ‑ 0.7 year. For Ultra-Fast EVCS, the effect of CAPEX incentive is less significant. At 30% CAPEX incentive, the IRR for Ultra-fast scenario 1 only increases slightly from -5.3% to -3.7%, and from 0% to 2.25%, with payback period ranging from 13 to 20 years.

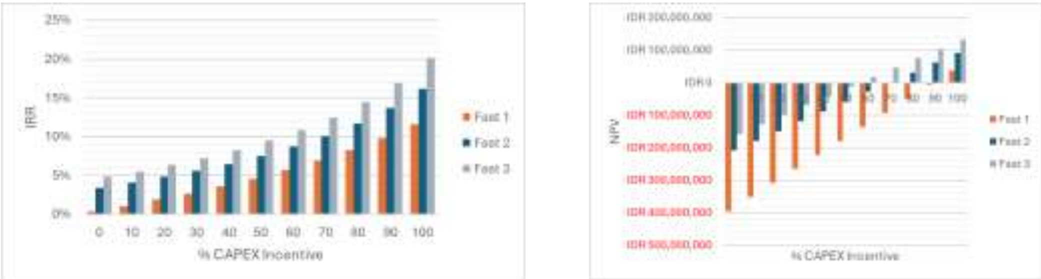

Figure 1. IRR and NPV to %CAPEX Incentive Sensitivity for Fast Charging EVCS Project's Scenario

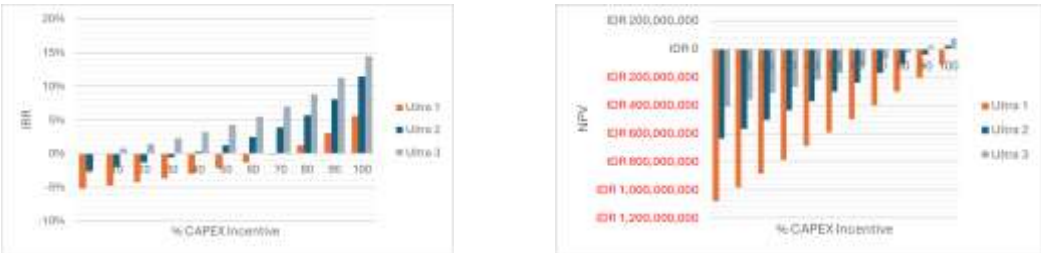

Figure 2. IRR and NPV to %CAPEX Incentive Sensitivity for Ultrafast Charging EVCS Project's Scenario

• Performance-Based Incentive demonstrated major impacts on the financial feasibility of the EVCS projects, particularly through increased IRR and lowered payback period, especially in high utilization situations. In fast charging scenarios, even at 20% incentive, IRR of 11% can be achieved, and at 50% PBI, all fast charging scenarios have reached financial feasibility with IRR above 11% and positive NPV. PBI also helped ultrafast EVCS to reach financial feasibility, albeit require much higher incentive, and in one scenario, is unable to reach required IRR even at 100% PBI.

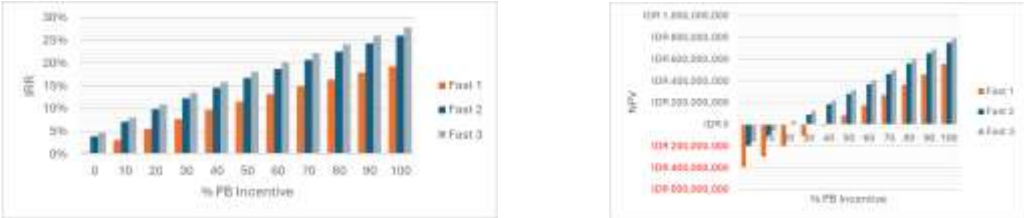

Figure 3. IRR and NPV to %PBI Sensitivity for Fast Charging EVCS Project's Scenario

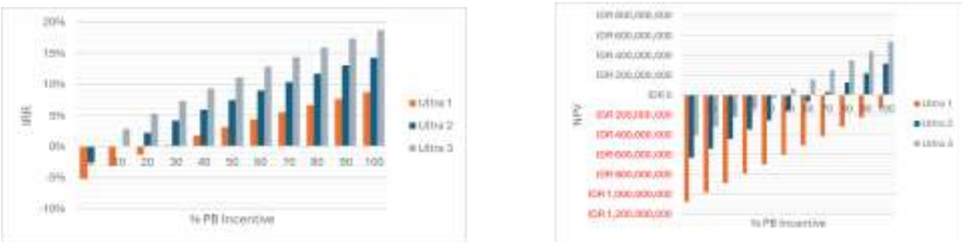

Figure 3. IRR and NPV to %PBI Sensitivity for ultrafast Charging EVCS Project's Scenario

Simulation result shows that without incentives, it's not financially viable to set up fast and ultra-fast EV charging stations in low-utilisation scenarios and that no single incentive type can fully address the viability gap in the specific conditions of the scenarios examined. It must be noted that in many cases, even with the provision of a 30% CAPEX subsidy or the maximum permissible tariff, the ultrafast charging scenarios remained below the expected 11% IRR, while PBI was found to impact the most by directly addressing the revenue shortfall.

Key incentive scenario outcomes:

1. Baseline (no incentive): low IRR (approximately 4–5%), a negative NPV, and a payback period exceeding 15 years, indicating poor feasibility without external support.
2. 30% CAPEX incentive: The reduction in upfront costs, yields small improvement of approximately 2-3 percentage points in the IRR, but still below ~11% IRR deemed acceptable. Despite the provision of a significant financial incentive, the IRR remains below the financial viability threshold, particularly given the limited EVCS utilisation.
3. Tariff incentive: Allowing higher revenue per kWh improves cash flow, but is not sufficient to reach the required IRR in the low-utilisation case. The selling price cap of 2,467 IDR/kWh limits how much tariff adjustments can boost profitability.
4. Performance-based incentive (PBI): An output-linked incentive can make a project more viable. A PBI of 30-50% of the consumer tariff can raise the IRR above 11% in the more cost-efficient scenarios, shortening the payback to around 7-8 years. This reflects the effectiveness of linking incentives to usage: as utilisation grows, the financial support increases, directly bolstering revenue and investor returns.

Another alternative to single incentive scheme is a combined incentive approach, that is using multiple incentive mechanisms together. For example, a CAPEX incentive of 20–30% combined with an PBI during the first years of operation can improve project cash flows. This approach shortens the payback period and brings higher Internal Rate of Return (IRR) to around 11% despite regulated user tariff. The logic goes like this: Providing an initial CAPEX incentive gives the prospective customer a cost break as they adopt your technology and market, with additional revenue realized when utilization grows. Other than fiscal incentives, non-fiscal incentives can also increase financial viability in an indirect way. Facilitating the licensing process and making land or space available for charging stations at a reduced price can both contribute to cutting down development as well as operational costs. These measures would maximise the impact of financial incentives. The combination of these facilitating policies with the direct incentives would then create a more conducive environment for investing in EVCS.

In conclusion, policymakers should adopt a variety of incentives to encourage investment in EV charging infrastructure. There is empirical support of a mix and match approach to infrastructure incentives for Indonesia in addressing the viability gap. To meet national targets, the incentive programme will need to be broad in scale and find an effective combination of financial support with driving access. This will incentivize investment in underused areas on a financially responsible basis.

CONCLUSION

This study shows that deploying fast and ultra-fast EV charging stations (EVCS) in Indonesia's low-utilization areas is financially unviable without government intervention, as baseline simulations yield negative net present values and sub-threshold internal rates of return. A hybrid incentive combining capital expenditure (CAPEX) subsidies with performance-based incentives (PBI) tied to kWh sold proves most effective, mitigating upfront costs, boosting revenue in early operations, elevating IRR above viability thresholds, and shortening payback periods to enhance investor confidence in underserved regions. For future research, studies should dynamically optimize these hybrid structures amid rising EV adoption and falling technology costs, integrate non-fiscal measures like streamlined permitting and demand management into comprehensive models, assess socio-economic/environmental impacts and government fiscal sustainability, and apply the framework comparatively to other emerging economies.

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