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JomCount: A Case Study of Tariff-Based Electric Vehicle Charging Cost and Time Calculations

[1]Raja Nurizzah 'Atirah Raja Idris, [2]Natasha Bungan Anthony & [3]*Nur Syazwani Ghazali

[1,2,3]Centre of Mathematical Sciences, Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia

[1]rajanurizzah24@gmail.com

[2]natashabungan@gmail.com

[3]*syazwanighazali@uitm.edu.my

*Corresponding author

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ABSTRACT

JomCount is a Java-based calculation tool developed to help residential electric vehicle (EV) users estimate charging cost and duration. The calculation uses battery capacity, initial state of charge, charger power and existing monthly household electricity consumption as inputs. The innovation applies household electricity tariff bands to the extra energy required for a charging session, allowing the charging-specific increment to be distinguished from the total electricity bill. Using a 75 kWh battery charged from 20% to 100%, the model requires 60 kWh. Charging duration is then estimated by dividing the required energy by charger power, assuming a constant charging rate. At historical household baselines of 197, 700 and 854 kWh, the estimated incremental costs are RM19.69, RM32.76 and RM33.11, respectively. A comparison using the 2025–2027 Domestic General variable base components gives RM26.66 for the same energy increment. The study illustrates JomCount's calculation workflow, tariff-boundary effects and charging-time estimates as a practical application of piecewise mathematics to everyday EV planning.

Keywords: Electric vehicle, JomCount, household electricity tariff, incremental charging cost charging time.

INTRODUCTION

Electric vehicles are increasingly relevant to sustainable transport, but daily charging decisions still depend on understandable estimates of energy, expenditure and time (Chan, 2002; Sanguesa et al., 2021; International Energy Agency, 2022; El Halim et al., 2022). EV research has considered charging-station planning, vehicle routing, battery testing and power-system interaction (Ahn & Yeo, 2015; Cataldo-Díaz et al., 2022; Camacho & Mihet-Popa, 2016; Srikakulapu et al., 2023). Digital driver-support tools likewise show the value of presenting technical charging information in an accessible form (Bedogni et al., 2014; Ferreira et al., 2011).

For home charging, a simple multiplication of battery capacity by a unit electricity price may be misleading when the applicable tariff has consumption blocks. JomCount addresses this practical calculation problem by incorporating the vehicle's battery condition, existing household use and charging power into a tariff-based estimate. This paper presents the calculation procedure, the Java interface and selected numerical cases, with a compact comparison to contemporary tariff components.

Inputs and calculation modes

The usage-based mode takes the EV model, battery capacity B (kWh), initial battery state of charge s_0 (%), target state s_t (%), household consumption before charging U (kWh) and charging power P (kW). It then calculates the energy requirement, duration and difference between household charges before and after the session. JomCount also provides a rapid approximate mode that combines the vehicle capacity with a rate selected from a household-bill band, following the simplified costing approach described by CARPUT (2022). Vehicle capacities are illustrative and can differ by model variant; relevant examples are discussed in EV and charging guides (Fulton & Roache, 2023; Stafford, 2021; Moloughney, 2022; Noyes, 2023; Porsche, n.d.).

Charging energy, time and tariff cost

The energy stored in the battery, E_β(kWh), is calculated from its nominal capacity and the required state-of-charge change. With charging efficiency η, the estimated grid electricity E_g (kWh) and idealised constant-power charging time t (hours) follow:

$$E_\beta = \mathrm{B}(s_t - s_0)/100, \qquad E_g = E_\beta/\eta \tag{1}$$

$$t = E_g/P, \qquad 0 < \eta \leq 1 \tag{2}$$

The implementation examples take s_t = 100%, η = 1 and P = 7.68 kW. The five-block household tariff used in the JomCount calculations is shown in Table 1. With u_i denoting consumption assigned to the ith block and r_i its unit rate, C(U) is the cumulative charge and CEV is the additional cost of charging:

$$C(U) = \sum_{i=1}^{5} r_i u_i, \qquad CEV = C\left(U + E_g\right) - C(U) \tag{3}$$

For example, the 75 kWh Tesla Model 3 case at 20% initial charge requires $E_\beta = 75(1 - 0.20) = 60$ kWh and t = 60/7.68 = 7.81 hours. In its approximate mode, JomCount instead uses $E_\beta = \beta \times$ r, where r is the selected household bill band rate.

Table 1

Five-block tariff applied in the JomCount examples

Monthly use (kWh)	Rate (RM/kWh)
0–200	0.218
201–300	0.334
301–600	0.516
601–900	0.546
Above 900	0.571

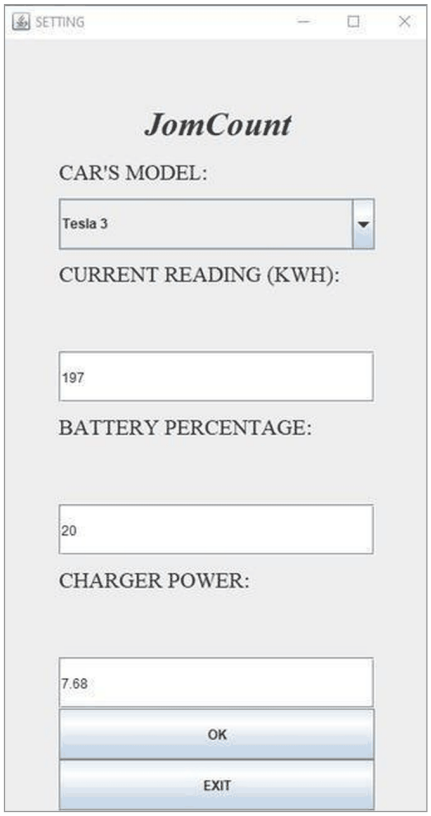
JomCount Java Interface

Figure 1 presents the usage-based input screen and a corresponding results screen. The user selects the vehicle, enters household electricity use, remaining battery percentage and charging power, and receives the charging-cost and time estimates. This creates a direct path from mathematical inputs to a readable charging summary.

Figure 1

JomCount Java interface: usage-based inputs and calculated results

(a) Usage-based calculation input



(b) Calculation results

Results

Parameter	Result
Car Model	Tesla 3
Battery Percentage left	20%
Charger Power	7.68 kW
Battery Capacity of the car	75.0 kWh
Battery percentage to Full	80.0 %
Current electricity power	197.0kWh
Battery capacity to full	60.0
Total monthly bill before charging	RM42.95
Total monthly bill after charging	RM62.64
Accurate cost of charging	RM19.69
Charging time	7hours 48 minute

NUMERICAL RESULTS

Incremental household charging cost

Table 2 illustrates the effect of existing household use on the cost of the same 60 kWh charging session. Under a block tariff, the additional charging cost is the difference between two cumulative charges, not the full post-charging bill. At U = 197 kWh, the increment spans two blocks: 3(0.218) + 57(0.334) = RM19.69. At U = 700 kWh, it is 60(0.546) = RM32.76; at U = 854 kWh, it is 46(0.546) + 14(0.571) = RM33.11.

Table 2

Usage-based cost example: 75 kWh battery, 20% initial charge, 60 kWh added

Initial use U (kWh)	After EV (kWh)	Bill before (RM)	Bill after (RM)	EV increment (RM)
197	257	42.95	62.64	19.69
700	760	286.40	319.16	32.76
854	914	370.48	403.59	33.11

The same pattern is visible around the 200, 300, 600 and 900 kWh tariff boundaries: as the baseline moves into a higher historical block, the cost of an additional 60 kWh increases or remains unchanged. Independent calculations using direct block-by-block allocation agree with the cumulative-bill difference for the illustrated threshold cases.

Approximate costs and charging duration

In the quicker full-capacity mode, three illustrations give Tesla Model Y: 81(0.334) = RM27.05; Porsche Taycan: 93.4(0.546) = RM51.00; and Tesla Model X: 100(0.571) = RM57.10. For duration, the constant-power approach at 7.68 kW gives the examples in Table 3. These calculations demonstrate two functions of JomCount: immediate approximate costing and more detailed usage-based costing.

Table 3

Illustrative charging-time calculations at 7.68 kW

EV model	Battery (kWh)	Initial SOC (%)	Energy required (kWh)	Time (h)
Mini Cooper E	36.6	40	21.96	2.86
Tesla Model X	100.0	70	30.00	3.91
BMW iX3	74.0	30	51.80	6.74

Contemporary tariff and efficiency illustration

For a short comparison, the Domestic General variable base components in Malaysia's 1 July 2025–31 December 2027 tariff schedule are 27.03 sen/kWh (energy), 4.55 sen/kWh (capacity) and 12.85 sen/kWh (network) for the applicable example range, giving RM0.4443/kWh (Energy Commission, 2025). A 60 kWh session therefore contributes 60(0.4443) = RM26.66 in these base components at any of the three household baselines in Table 2. The same input yields the efficiency illustrations in Table 4.

Table 4

Charging-efficiency sensitivity for a 60 kWh battery-energy requirement

Efficiency η	Grid energy (kWh)	Time (h)	Historical cost (RM), U = 700	RP4 base only (RM)
100%	60.00	7.81	32.76	26.66
90%	66.67	8.68	36.40	29.62
85%	70.59	9.19	38.54	31.36

DISCUSSION AND CONCLUSION

The principal contribution of JomCount is a straightforward calculation workflow that brings together battery energy, household consumption, charging power and an electricity tariff. The usage-based calculation explains why two homes charging the same vehicle can obtain different incremental electricity costs under a block tariff. The approximate mode offers a quicker estimate, while the worked examples make the mathematical procedure transparent. The contemporary tariff example also shows how an updated rate structure can be incorporated into the calculation approach.

The five-block tariff reflects the schedule used for JomCount calculations, and the RP4 comparison covers only published variable base components rather than a complete payable bill; incentives, Automatic Fuel Adjustment, retail charges, taxes and optional time-of-use pricing may change actual charges (Energy Commission, n.d.; Tenaga Nasional Berhad, 2026). Battery capacities, constant charging power and illustrative efficiencies are simplified inputs, and the newer tariff and efficiency cases are analytical examples rather than demonstrated functions of the existing Java interface. The numerical results have not been assessed against charging-meter measurements, actual electricity bills or formal software usability tests.

Overall, JomCount demonstrates a practical educational innovation: it turns tariff bands and charging equations into understandable household EV cost and time estimates. Future enhancement can concentrate on maintained tariff rates, more realistic charging-efficiency inputs and testing against observed charging sessions.

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