Towards Electric Vehicles in Indonesia

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ADB support to 2019 government policy on accelerating the deployment of EVs and has focused on identifying viable e-mobility options and projects.

- Despite the high grid factor (0.8 kgCO2/kWh), EVs can reduce GHG emissions by 20-40% compared to fossil-powered vehicles, significantly reduce local pollutants, and reduce fossil fuel imports.
- A high grid factor, high electricity tariffs, low fuel costs, and local content requirements are hampering the transition to electric mobility.

- Jakarta contributes 11% of Indonesia's total GHG emissions in the transport sector and has the worst air pollution in SE Asia. Vehicle emissions are responsible for 32%–57% of Jakarta's air pollution.
- By 2030 6 million EVs could circulate in Jakarta, consuming 2% of the 2018 national electricity production, reducing GHG and local pollutant emissions by 9% and 18% relative to BAU emissions.

ADB identified viable e-bus transport options for Jakarta, has launched an electric boat pilot in Batam, and finalized an electric 2-wheeler and 4-wheeler charging study. The TA was supported by the governments of Australia and Korea.

Technical Assistance

E-Mobility Reports

- E-Mobility studies Jakarta & Makassar (2019)
- Electrification of TransJakarta and BRT Lines Pre-FS (2019)
- Electrification of DAMRI BRT and Airport Routes (2019)

Charging Roadmaps

- Charging infrastructure roadmap for Electric Two Wheelers (2022)
- Charging infrastructure roadmap for Electric Four Wheelers (2021)

Knowledge Sharing

Workshops

- Potential of EV in Indonesia, 2019
- ADB x ITDP: In-Search of Better EV Policies, 2020
- Development Partner Meeting: ADB's EVs Activities, 2021

Loan / Grant Pipelines

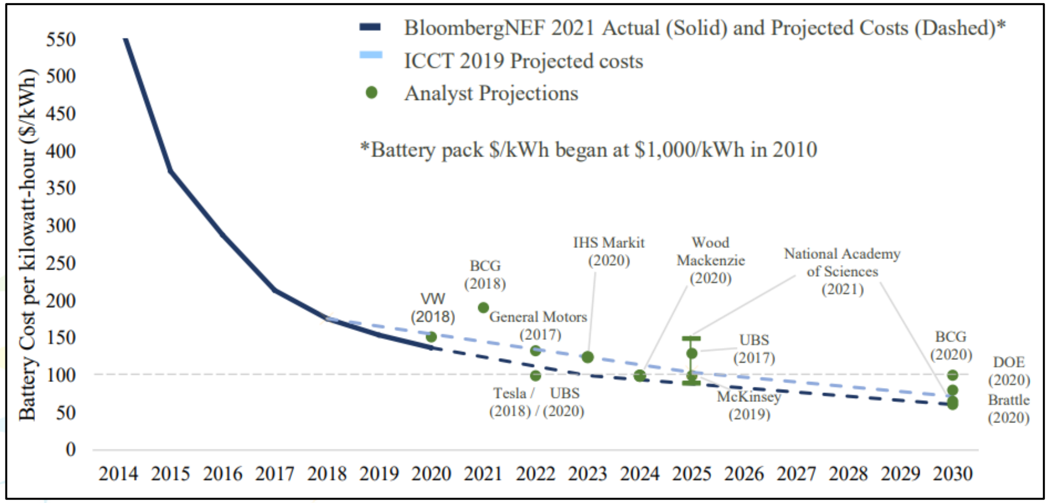
E-boat Pilot Project

Deployment of 4 e-boats in Batam.

DAMRI Sustainable E-Bus Project

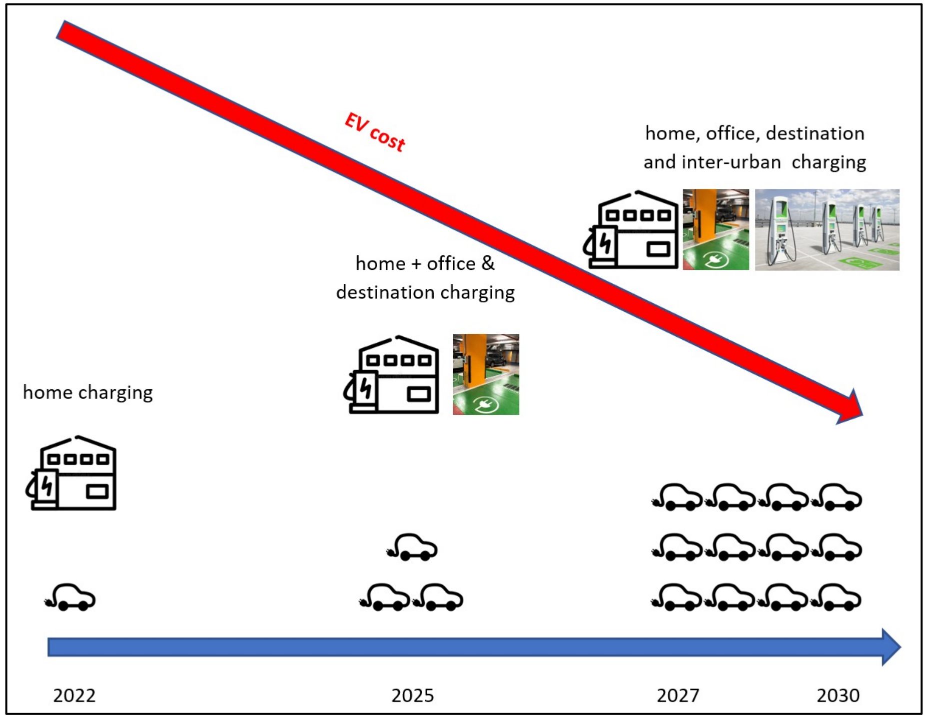
Deployment of 50 e-buses and 39 fast-chargers in Greater Jakarta.

EVs will come, however, speed might be slower in Indonesia than in Europe due to less incentives, longer stock turnover times, and bigger low-cost vehicle market

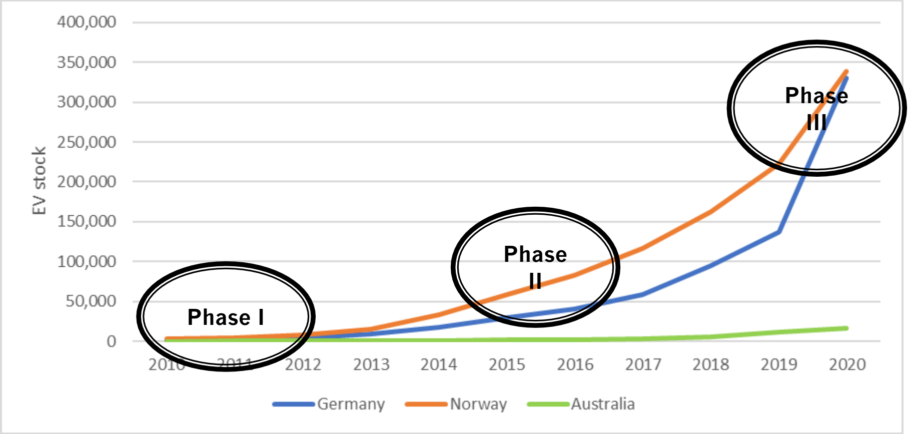


- Most EVs target upper- and middle-class vehicles in Indonesia

EV Deployment and Chargers



EV Deployment Phases



- Phase I early adopters
- Phase II market uptake
- Phase III EVs become common

e-BUS

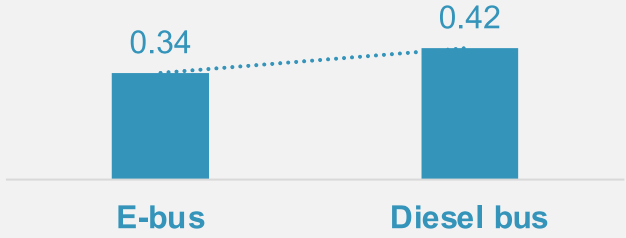
The electrification of buses is the lowest-hanging fruit and has huge environment impact.

Why E-bus?

E-buses are the EVs with the lowest incremental costs, lower TCO* than diesel buses and no need for large charging infrastructure.	Each e-bus has the same emission impact as 40 e-passenger car, 110 e-motorcycle, and 10 e-taxi.
Indonesia has subsidized fuel price and relatively higher electricity tariff. Therefore, it can be difficult to recover high EV CAPEX with the lower OPEX.	Buses account for 0.1% of total fleet but are responsible for 20-30% of total pollutants and 5% of GHG transport emissions (WTW incl. BC).

(*) Insights on TCO of E-bus

- E-bus has lower total cost of ownership (TCO) per km than diesel buses (using non-subsidized fuel).



- The calculation is based on differential costs.
- CAPEX includes bus plus infrastructures, battery replacement cost. OPEX includes energy cost, maintenance cost (of bus and infrastructure) and finance cost.

Source: ADB. 2020. *Detailed Project Report: E-buses for DAMRI*. Consultant's report. Manila (TA 9777-INO).

ADB supported two studies for DAMRI and Trans-Jakarta (TJ) assessing the viability of e-bus technologies and routes.

A

- Assessed electrification of (a) DAMRI's airport bus and (b) DAMRI's TJ routes with different charging options.
- Airport routes: (1) Use fast-charged buses; (2) Financial TCO slightly lower than diesel bus, but economic cost of emission is double for diesel. (3) Gambir, Rawamangun & Bekasi routes included in loan processing.

B

- TJ aims at replacing fossil buses with e-buses. ADB assessed a) BRT corridors, b) Non-BRT feeder units, c) minibus
- Recommendations: start electrifying BRT routes & standard 12m buses. Flash charging is the most viable option. Overnight charging is too costly.
- Electrify minibuses later due to high costs of e-buses and limited market availability
- TCO of e-bus is higher than diesel bus using subsidized diesel / 2500 ppm)

e-BUS

Poorly designed e-bus system can result in e-buses only used on short routes or cities/operators need more e-buses than before for the same passenger. The deployment of e-buses needs proper e-bus system design.

- DAMRI Airport bus routes
- Daily distance driven 350 – 470 km incl. dead-km
- Operations from 2AM to 9PM
- Stay at bus depot 3 hours

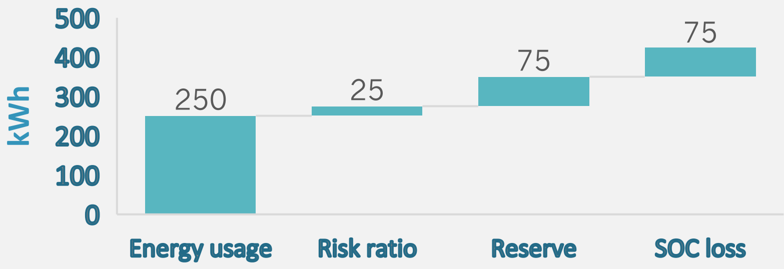
- Total project cost? $18.4 million
- 50 coach fast-charged battery electric buses 12m
- 39 fast-chargers at route end and bus depot
- 300 kW chargers
- 5-15 minutes charging at each end

Airport Bus Electrification Reduces Air Pollution, GHG Emission and Noise

Parameter	Unit	per annum
GHG reduction	tons	2.418
$PM_{2.5}$ reduction	tons	1,0
NO_x reduction	tons	52,6
SO_2 reduction	tons	10,2

Insights on Battery Size for Overnight Buses

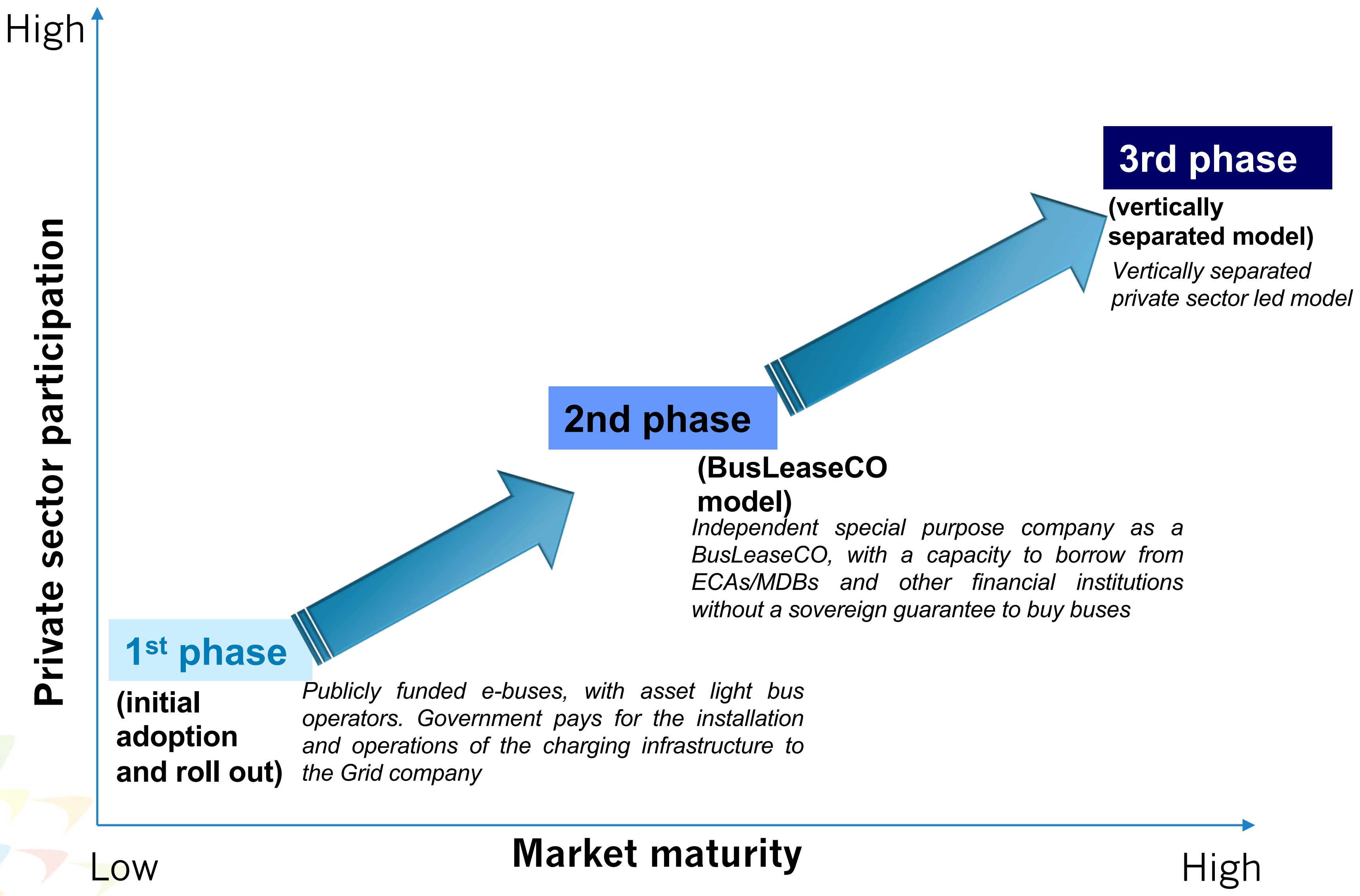
- Overnight charging is a risky strategy. Battery size needs to be calculated meticulously.
- E.g. for 230 km daily range, manufacturer may claim that a 300-kWh set of battery is sufficient. For safe, reliable and continuous operations, 450-kWh battery is recommended.



Recommended policies or approach for Jakarta to achieve greater e-buses deployment

Barrier	Potential Policies / Approach
High purchase cost	Subsidize the incremental cost of e-buses, reduce tax rates, lower financing cost, blended finance with grant, support entities which purchase large fleet of e-buses and lease it to bus operators
Insignificant OPEX savings	Lower electricity tariff for electric public transport as compensation for improved air quality, gradually phasing out low-grade fuel
Charging infrastructure investment	Grant or subsidize fast-charging infrastructure for public transport
Local content requirement	Exemption from local content requirement for new technology that are not available domestically
Lack of disincentive to use diesel buses	Demand that a specific share of new buses is electric and public tender of routes should favor e-buses, limit access to the city center for diesel buses

Financing Options for e-vehicles adoption and roll out



e-MOTORCYCLE

Background

- There are 6.5x as many motorbikes as there are cars. Estimated 135 million two-wheelers.
- Reportedly 41% of all domestic transport fuels (including water- and air-transport) consumed by 2-wheelers (IEO2019, year 2018 = 18 million bbl/year for 2-wheelers).
- → average of 3 litres per day gasoline. This suggests an average of 60-90km/day (i.e., across all 2-wheelers … seems high)
- 7-8 million 2-wheelers added to the fleet each year.
- Currently in-service e-2-wheeler emission 20% less than for gasoline (and expect small improvement for BAU forecast of RE 14%→27% by 2050. 20% based on emissions factor for electricity of 0.9 kg/kWh).
- Charging: a 400W home charge rate (and could be lower) not stressful on domestic electricity circuits. Many homes have this level of service available. Passenger car EV 5-20x higher charging rates.

Opportunity

- Battery a significant cost component of an EV (+30%):
  - Battery can be small for a 2-wheeler (related to both vehicle size and distance travelled).
- Potential for early purchase price parity with gasoline 2-wheeler.
  - But currently also contending with high cost of small-scale manufacture.
- Total cost of ownership would be lower now for e-motorcycle, inclusive of battery, if in mainstream manufacture.
- "Entry" price parity expected now if e-motorbike in mainstream manufacture and battery provided through rental/third party provider.
- Battery rental also has the advantage of de-risking unknown battery life to purchaser. However, battery model yet to be proven/provided commercially.
- Industry supplying 7-8 million motorbikes to domestic market every year.
  - Has potential to switch to supply of electric 2-wheelers.

e-MOTORCYCLE

Reality…

- Market highly dependent upon Japanese supply and manufacturing partners:
  - Currently little incentive to change;
  - But four majors working together in Japan on e-motorcycles and battery swapping.
- Currently no testing equipment to provide Type Approval for e-motorcycles

  → dependence on imported models (as CKDs) … and imported batteries.
- Apart from a battery safety standard, no "ultra low voltage" e-mobility standards or norms in place:
  - → risk a multitude of charging connectors, charger types, performance variations, quality concerns and unsafe practices that risk damaging the growth of the industry;
  - However, Japanese industry partners likely to adopt same battery-swap specification.
  - Could take 2-3 years to have supporting policy in place in a supporting govt. environment.
- Near-zero public awareness:
  - Could take several years of awareness and advertising for the market to be "e-Motorcycle Ready"
- Charging requires development:
  - Home-charging should not pose an issue.
  - Visible destination charging and/or access to battery swapping stations required to avoid range anxiety, reduce battery size, and attract commercial users (gojek/Grab).
  - Could take +2-3 years to develop business model and introduce battery swapping.
  - But experience from App-based e-scooters indicates change can be fast once the market is ready.
- → Many reasons to push early pilot/demonstration – to get market EV-Ready.

What might the future look like?

- Little market growth expected for 2-3 years.
- Suggest initial geographical focus – Jakarta for emissions, Bali for tourism.
- Uptake also highly dependent upon price to enter. Many examples where Indonesians buy on price ahead of all others. Provision of battery rental services expected to accelerate uptake therefore look to encourage.
- For 1% new e-motorcycles in 2024 and doubling e-uptake every year after:
  - e-motorcycles = 5% of the fleet by 2030
  - 50% of new motorbikes.
  - Feasible if cost effective to purchaser (Norway @+70% EVs).
- A do-nothing approach stands to delay the start of exponential growth (as still need supporting policy and others in place to support constructive growth) resulting in delayed gain of benefit to country.

e-TAXIS

Requires incentives (financial and non-financial), regulation, and charging infrastructure to be successful in the mass taxi market

- **Situation:**
  - High mileage
  - Often 2 drivers
  - Peak demand times 24 hours operation
- **Problem:** EVs do not have sufficient range and home charging takes too long as power too low; also typical destination chargers of up to 22kW are too slow
- **Result:** Electric taxis are not common except luxury cabs, special services etc.
- **Solutions** e.g. Amsterdam: only e-taxis from 2025: Regulations + incentives (subsidy, preferred parking sites) + fast charging infrastructure; similar London; California regulation 2030 for ride-hailing services 95% emission free.

- **Fast chargers**
  - required for topping up the taxi when its operating during the day
  - minimum 50kW but better 100-150kW to reduce the waiting time
  - located at strategic taxi spots such as the airport, bus/train stations, core downtown areas
- **Night charging**
  - home-charger
  - If home-charging is not feasible level 2 public chargers (3.3-6.6 kW AC) installed on different roads (off-street parking sites close to homes of taxi drivers) plus the fast-charging network could be used

Findings & recommendations to way forwards

General ADB Findings:

1

Strong financial incentives are needed for promotion of passenger EVs, e.g incentive to: reduce the EV price and wide installation of public fast-charging infra. Non-financial incentives such as EV parking area is also needed.

2

At initial stage, ADB's analysis suggest that Indonesia focuses point-to-point transport such as electric buses, 4 and 2 wheeler taxis, delivery vehicles, and corporate fleets.

3

Potential bottleneck for electric transport development in Indonesia:

- Local content requirement
- Electricity tariff
- EV and charging standardization

- Start with electric bus deployment
- Ensure to implement most viable and state of the art technology
- Enable private sector transition with regulation (taxi and two-wheeler transport)
- Refrain from pushing failed niche concepts such as retrofitting
- Provide public subsidies

Thank You