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Institute for Essential Services Reform

Electric Vehicle in Decarbonizing Indonesia's Road Transport Sector

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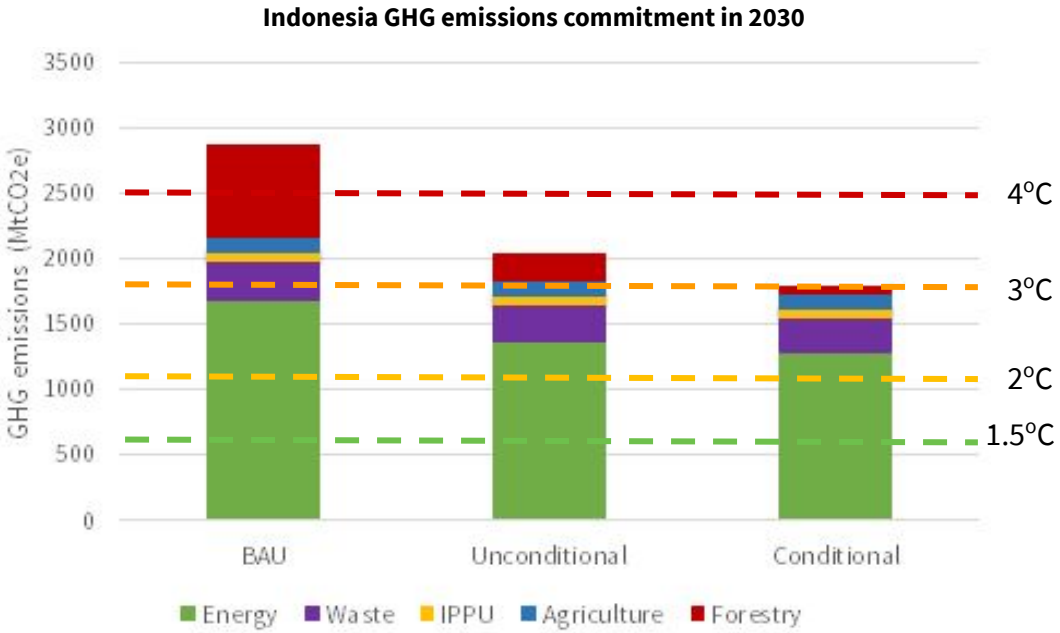
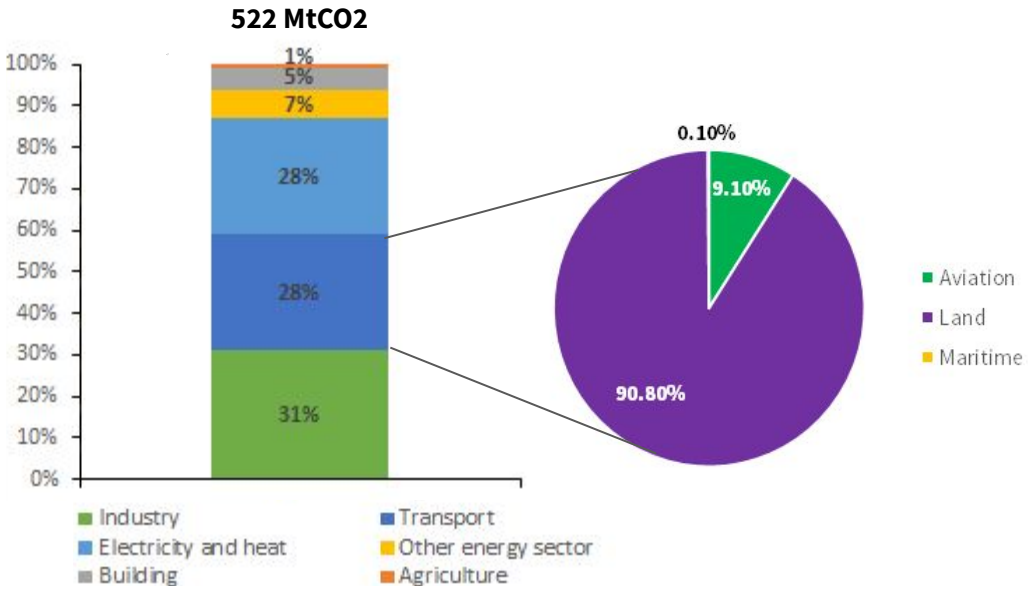
Indonesia sets an NDC target, yet inadequate to achieve 1.5°C target



- In 2030, Indonesia's emission is expected to double from 2010 level under BAU scenario.
- Energy sector contributes 34% of GHG emission in 2010 and is expected to increase to 58% in 2030.
- Indonesia pledges to reduce GHG emissions by 29% in 2030 unconditionally or 41% with international support.
- The reduction is mainly obtained by forestry (17.2%) and energy (11%) sectors.
- This target is higher than the maximum emissions of 622 $MtCO_2$/year (excluding LULUCF) required to meet the 1.5°C pathway according to Climate Action Tracker.

Transport sector continues to be a main driver of CO2 emissions

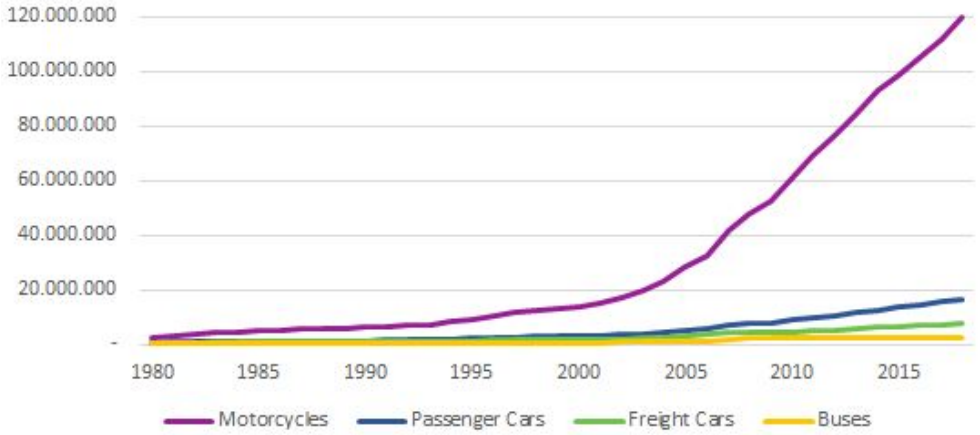
Share of energy-related CO2 emissions (2017)



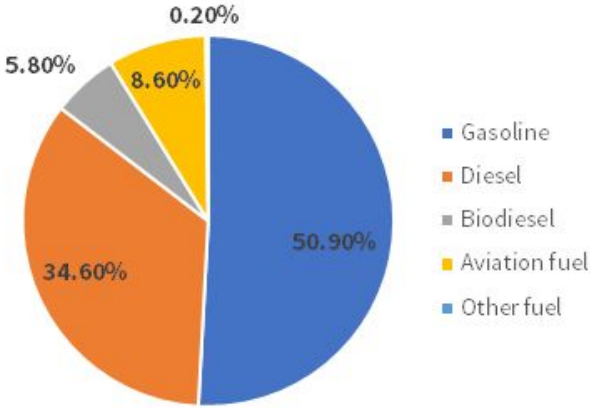
- According to RUEN projection, GHG emission from transport will increase from 143 $MtCO_2$ in 2015 to 218 $MtCO_2$ in 2030
- Climate Action Tracker outlined a 1.5°C compatible scenario for Indonesia which curbs the emissions from the transportation sector to 2 MtCO2e by 2050 that includes:
  - 100% electrification of motorcycles, cars, and buses
  - Increased use of public transport
  - Fuel economy improvement of conventional vehicles
- Emission reduction from transport sector in NDC is limited to biofuel blending (B30) and natural gas refueling station expansion.

Passenger vehicles present an opportunity for significant emission reduction

Road transport vehicles growth in Indonesia

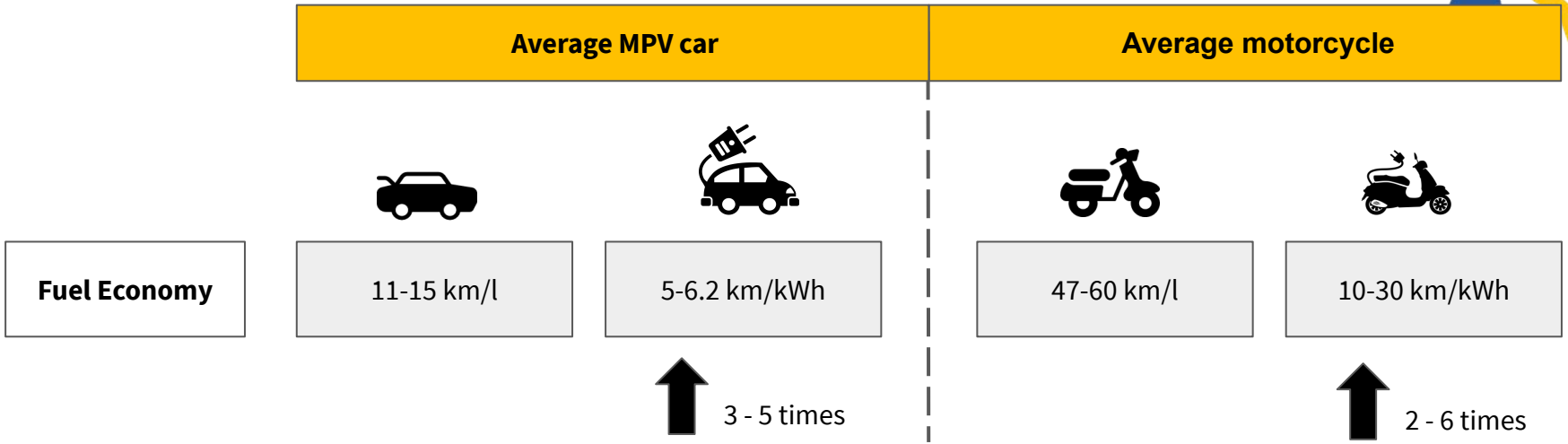


Share of fuel types in transport sector



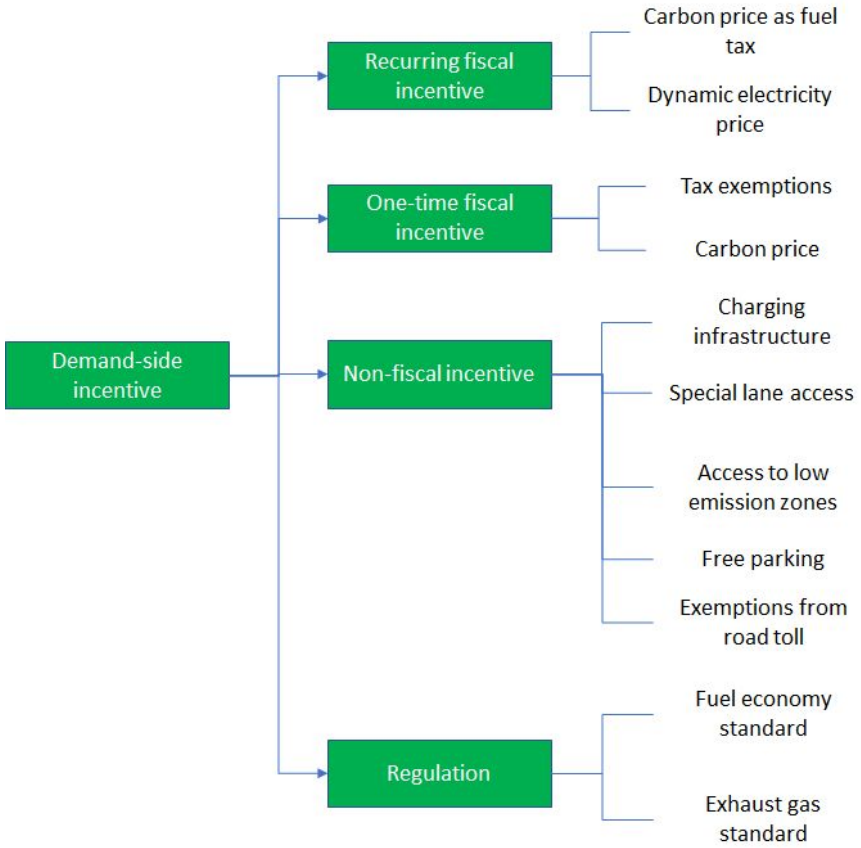
- Gasoline is the main fuel consumed in transport sector, indicating the high share of passenger car and motorcycle
- From 2000-2018, in the road transport, motorcycles had grown the fastest by 13.7% CAGR, followed by passenger cars (10.3%), freight vehicles (9.3%), and buses (8.6%).
- Private vehicles, especially motorcycles, are the main transport mode in urban areas (e.g. Jakarta).

Electric vehicles have potential to decarbonize passenger transport



- Electric motors run with higher efficiency than internal combustion engines
- Electricity can be generated without producing GHG emission by using renewable sources
- Additional benefits of electric vehicles includes less air pollution, reduced oil import, and new industry opportunity
- Electric vehicles consists of battery electric vehicle (BEV), plug-in hybrid (PHEV), and hybrid electric vehicle (HEV)

Incentives are needed to support electric vehicles market diffusion

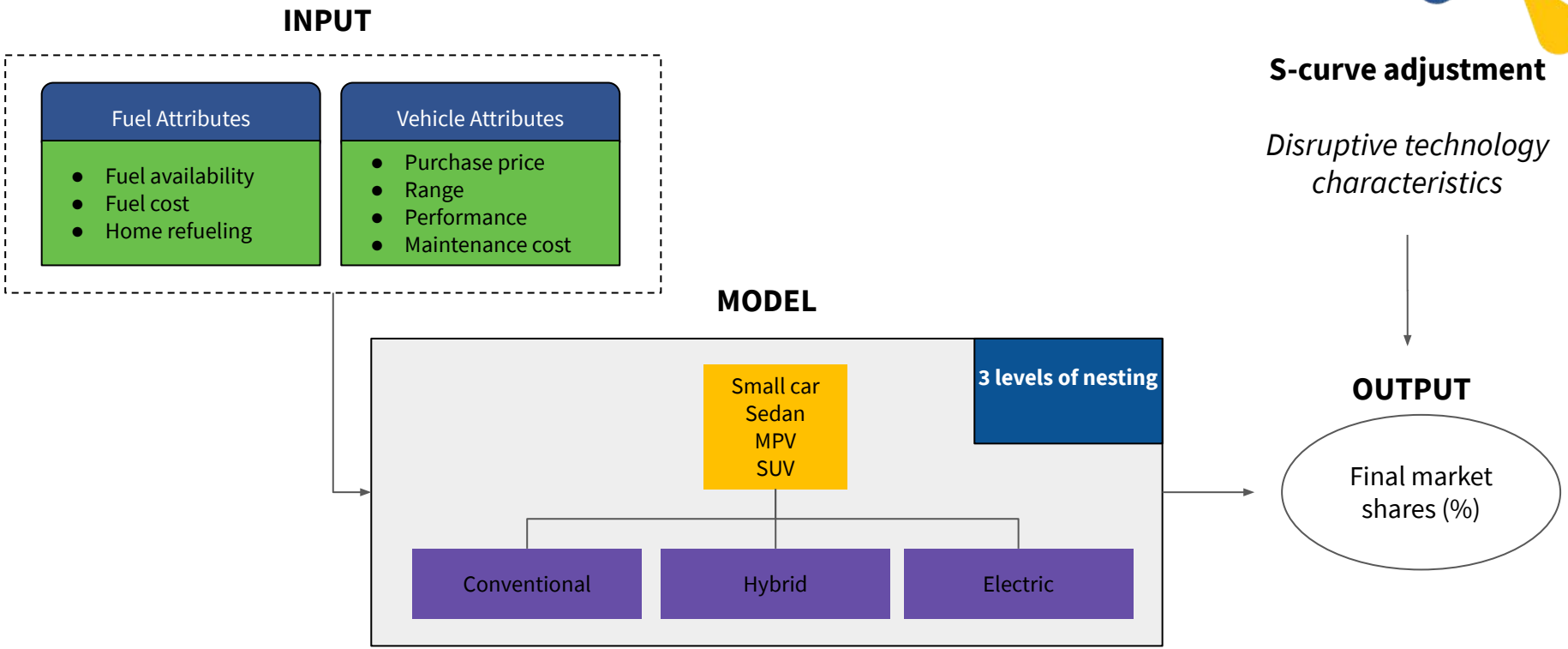


- All over the world, policy support from governments is crucial in driving the early electric vehicle market penetration
- In general, there are two categories of policy instruments: demand-side and supply-side instruments
- Supply-side policies are commonly adopted in countries with strong domestic automotive industry, e.g Germany, Japan, USA and France.
- Countries with weaker car industries favor sales incentives to facilitate electric vehicles market diffusion, e.g. Indonesia

Several forms of demand-side incentives already adopted by countries around the globe

	Purchase price subsidy	Purchase tax exemption	Registration tax incentive	VAT incentive	Annual vehicle tax incentive	Charging infrastructure incentive	Free parking	Road toll exemption	HOV/Bus lane access
Norway		✓		✓	✓	✓	✓	✓	✓
Netherlands			✓		✓	✓	✓		✓
Denmark			✓	✓	✓		✓		
Germany	✓				✓	✓	✓		✓
United States	✓				✓	✓	✓		✓
China	✓				✓	✓	✓		✓
Sweden	✓				✓	✓	✓		
France	✓		✓	✓		✓	✓		
Japan	✓				✓	✓			
Indonesia			✓						✓

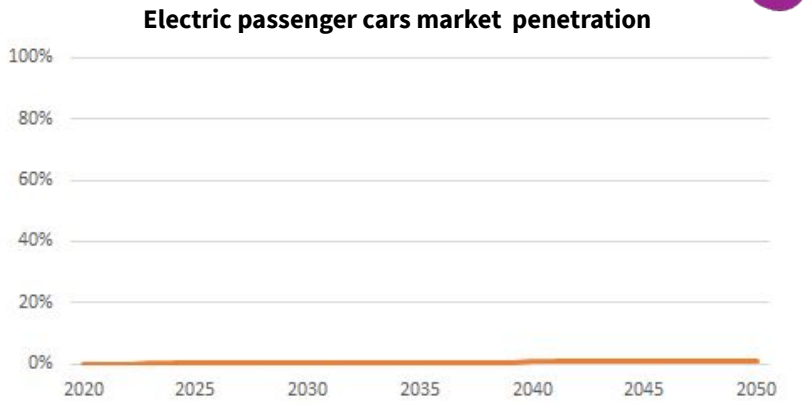
Electric vehicle market penetration model uses consumer preference to estimate market shares of different vehicle technologies

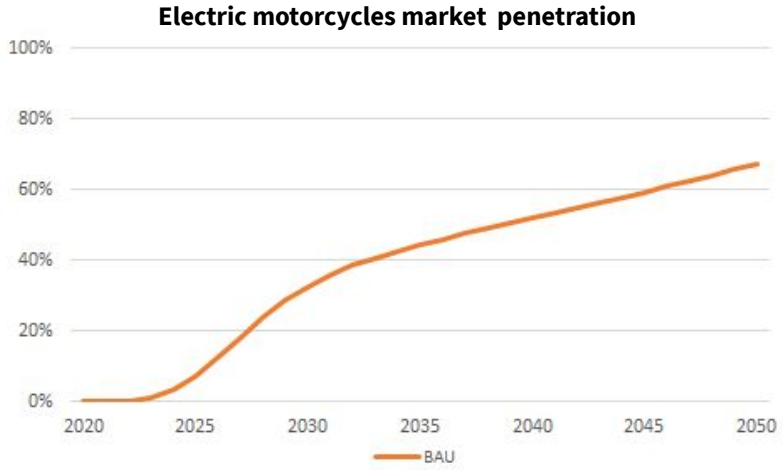


Policy scenario simulation

Business as usual

- No tax reductions for EV
- No additional tax for conventional vehicles
- No improvement in fuel quality
- No carbon price imposed
- Ca. 10,000 public charging spots until 2050
- Flat charging rate at IDR 1,650

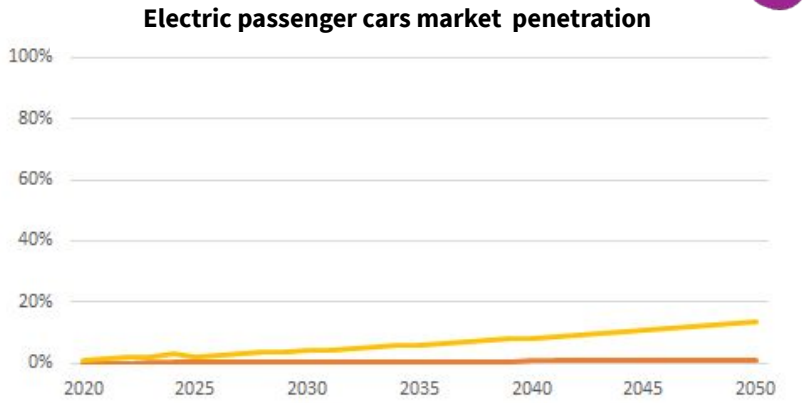


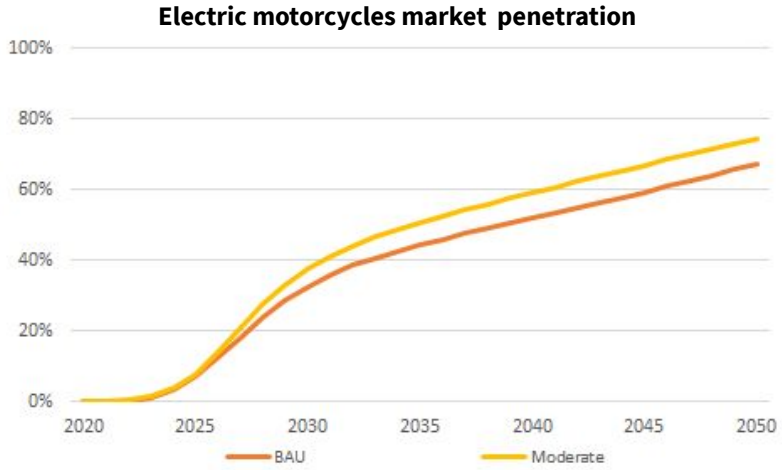


Policy scenario simulation

Moderate

- Tax exemption for EV:
  - 12.5% registration tax until 2024
- Domestic EV production, thus eliminating import related taxes
- No additional tax for conventional vehicles
- Euro 4 as minimum fuel quality by 2025
- Incremental carbon price on fuel (USD 10/tCO_2 by 2025 to USD 100/tCO_2 by 2050)
- Ca. 28,000 public charging spot until 2050 (extrapolate PLN's projection)
- 30% discount for night charging

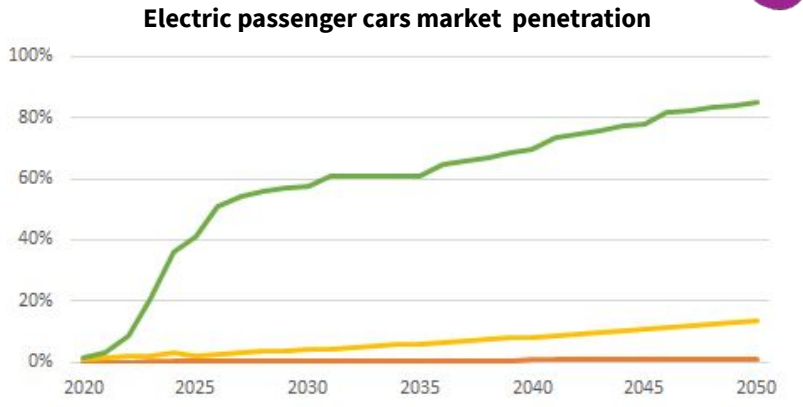


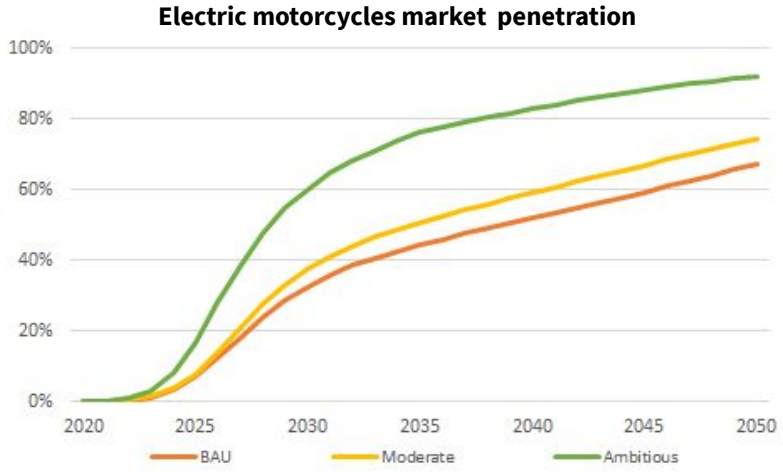


Policy scenario simulation

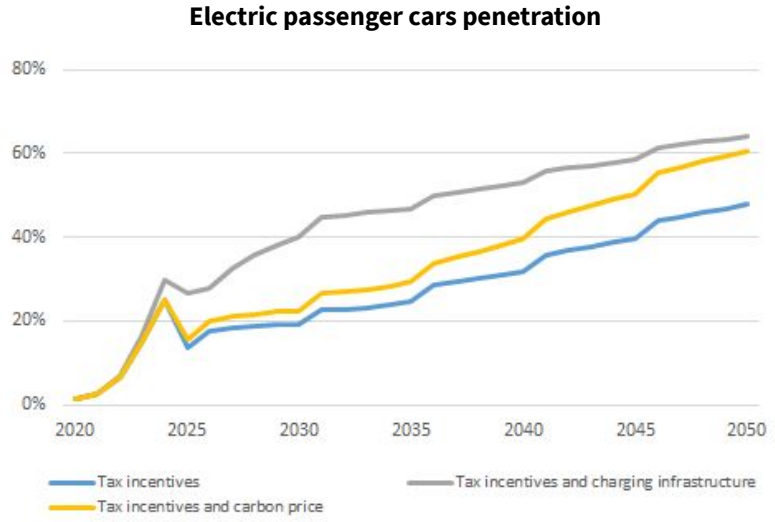
Ambitious

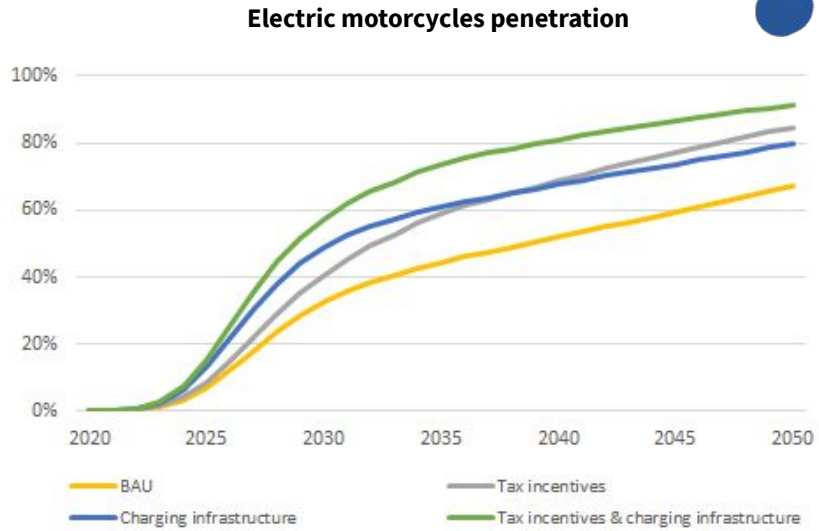
- Exemption from all taxes for EV until 2025 (registration tax, annual tax, VAT, luxury tax, import taxes)
- Additional tax for conventional vehicles
- Euro 4 as minimum fuel quality by 2025
- Incremental carbon price on fuel (USD 10/tCO_2 by 2021 to USD 245/tCO_2 by 2050)
- Ca. 600 thousands public charging spot until 2050
- 50% reduction of charging spending through implementation of TOU





Tax incentives and public charging development are key instruments



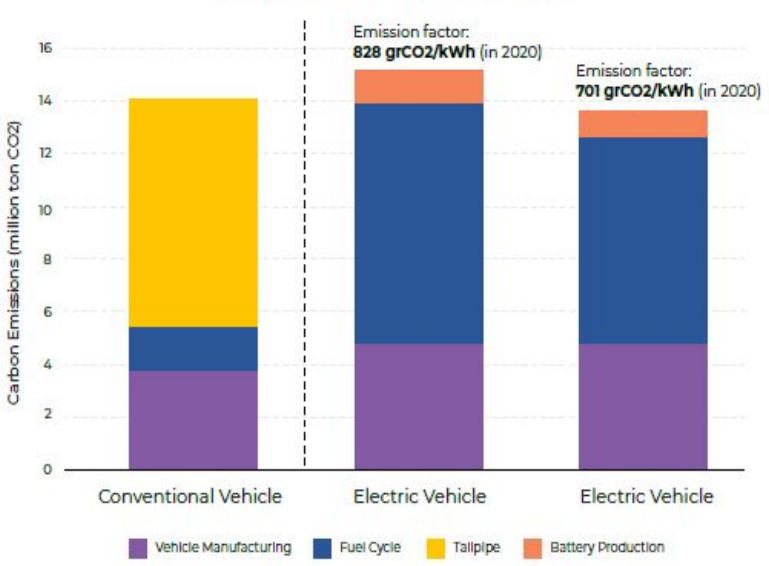


- For passenger cars market, tax exemption is the most important instrument, followed by charging infrastructure
- For motorcycles market, public charging development is the most influential instrument, followed by additional tax for conventional motorcycles
- Recurring incentives are less impactful to the penetration of electric vehicles

Decarbonizing the power grid is key to achieve emissions reduction from electric vehicles

Depending on the grid emission factor, electric cars in Indonesia could decrease or increase the emissions.

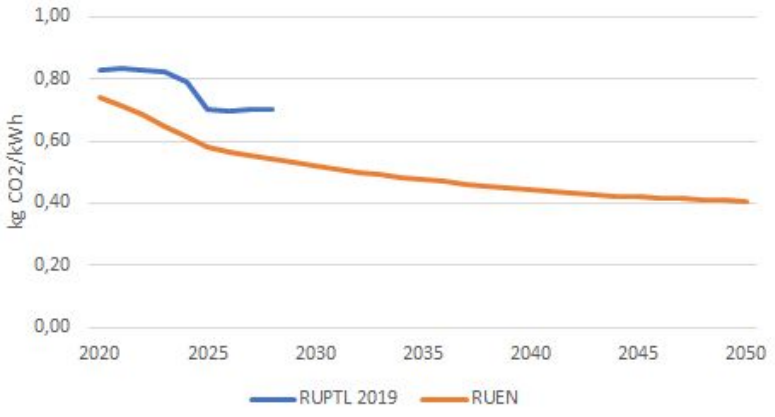
CO_2 emission comparison between conventional and electric car in Indonesia



Relation between grid emission factor and emission reduction potential of electric vehicles

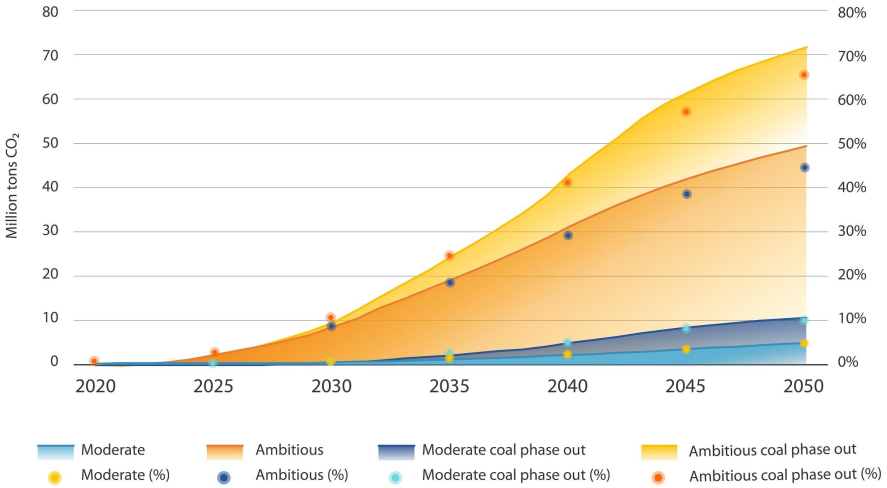
Emission reduction	0%	10%	20%	30%	40%	50%	58%
Grid emission factor (gCO2/kWh)	734	608	482	356	231	105	0

Electricity emission factor projection

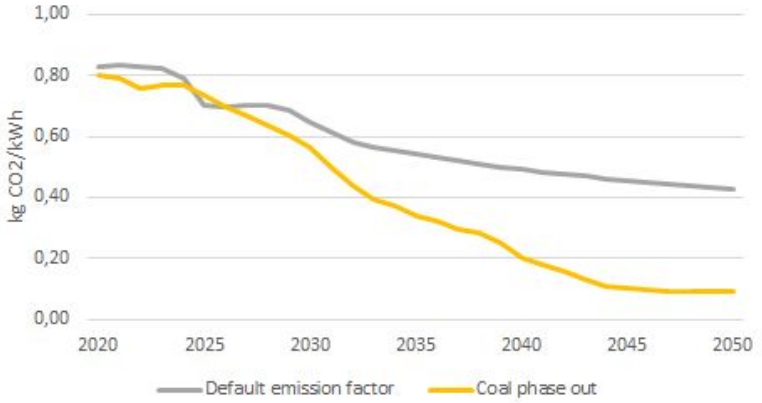


Much higher GHG emission reduction is attainable with coal phase-out

CO_2 emission reduction with ambitious passenger EV penetration in different energy mix



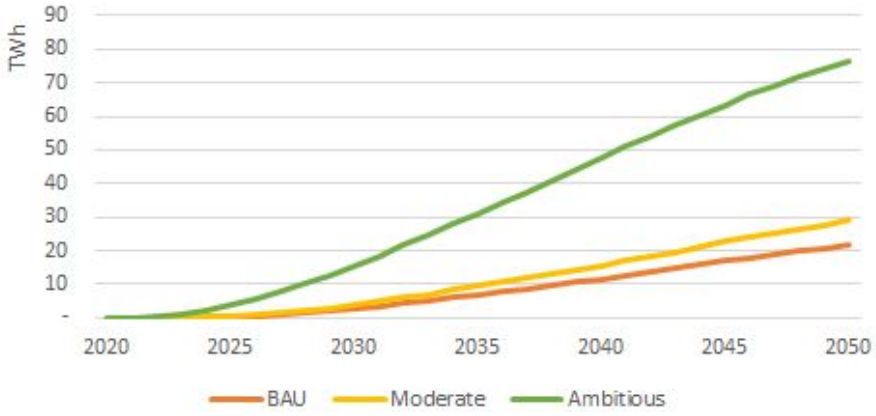
Indonesia electricity emission factor projection



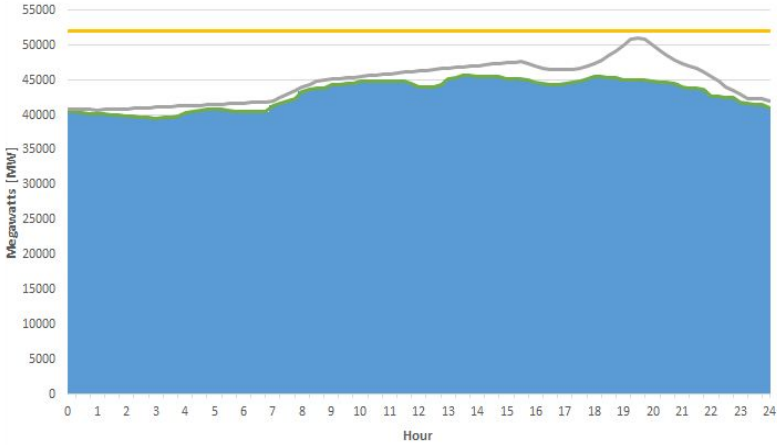
- In ambitious scenario, coal phase out scenario in generation mix can reduce emission 45% more than in the RUEN generation mix scenario
- GHG reduction from EV penetration is more impactful in the longer term, while in short term it is less notable. Banning the conventional vehicle by 2035 will be necessary to accelerate the GHG emission reduction.
- Coal phase out scenario means no coal power plant built after 2028 and the lifetime of coal power plant is limited to max. 20 years

EV penetration increases electricity demand, and potentially also the peak-demand

Additional annual electricity demand from passenger vehicles

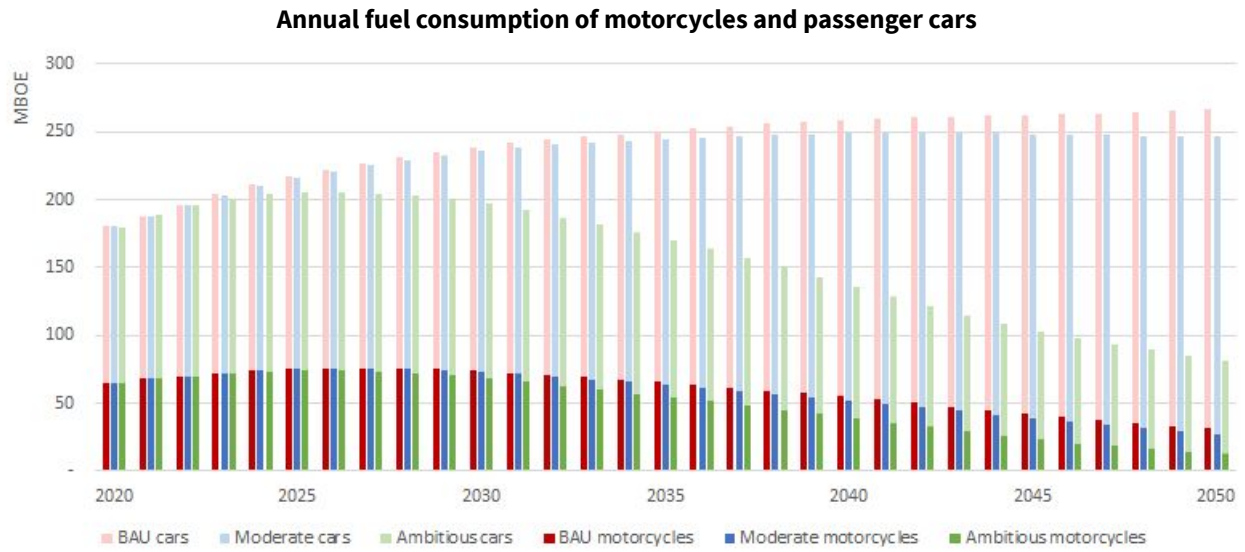


EV electricity demand curve considering charging at peak demand period in 2028



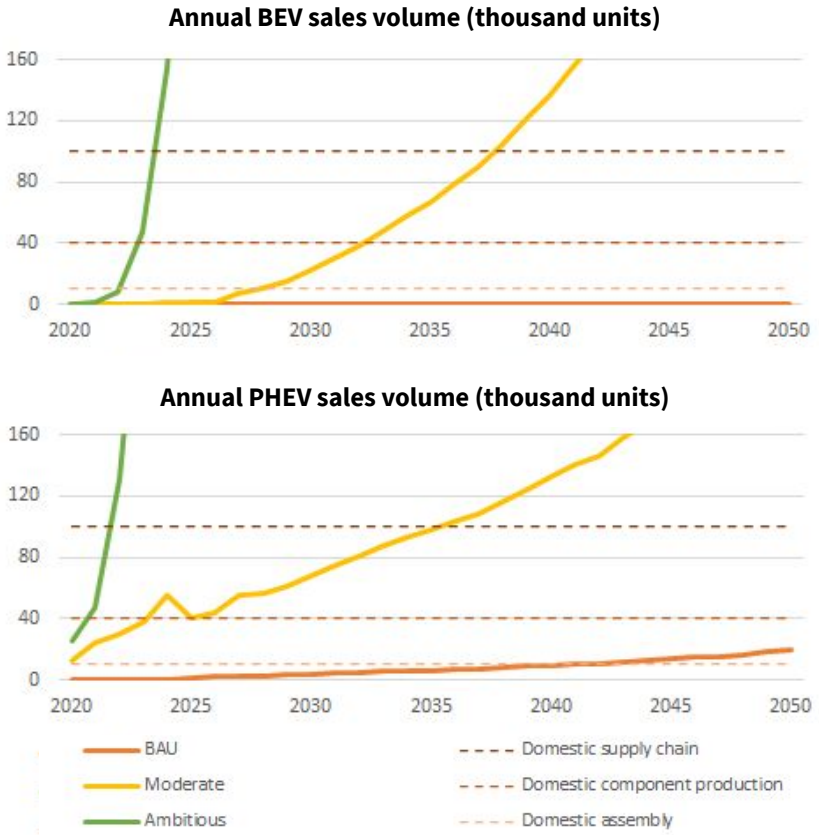
- In ambitious scenario, EV potentially increase the peak demand by 6 GW with ramping-up rate of 3 GW/hour if EV owners charge during peak load period
- This need to be avoided by implementing dynamic electricity pricing such as Time-of-Use

EV penetration can stabilize the oil fuel consumption and reduce import



- Implementing the ambitious scenario could avoid about 170 million barrel oil consumption in 2050, which equals to about 19% of oil fuel consumption from transport sector in RUEN (887 MBOE).
- This could avoid about 5% and 11% of oil import (according to RUEN) in 2030 and 2050

The prospect of developing domestic EV industry



- In 2017, the automotive industry and trading contributed to 2% and 2.5% of national GDP respectively.
- Automotive manufacturing industry employs 35 thousands, components industry employs 480 thousands, and the service and spare parts outlets employ 2.5 millions.
- In BAU scenario, manufacturers will not be interested to even build EV assembly line. In the moderate scenario, domestic EV industry could be developed in the 2030s. In the ambitious scenario, domestic EV supply chain could be needed before 2030.
- Supply chain industries that needs to be developed:
  - raw materials (aluminium alloy, metal alloy, steel rod, etc.)
  - components that require precise machining (bearing, gear, bolt, piston, etc.)
  - electronic parts (ECU, sensor, camera, IC, semiconductor, etc.)

The costs associated with developing electric vehicles

Revenue potential from vehicle sales and fuel taxes

- In most years, in all scenario, loss of revenue potential from tax exemptions is insignificant.
- In ambitious scenario, only during 2023-2027 period, there is significant drop in revenue potential (7%-20% reduction)
- In longer term, additional tax will generate more revenue

Investment cost required for charging infrastructure

	2025	2030	2050
Moderate	USD 6,750,000	USD 12,700,000	USD 38,400,000
Ambitious	USD 181,000,000	USD 345,000,000	USD 1,072,000,000

- For the ambitious scenario, required investment until 2025 is about IDR 500 billion per year. As comparison, energy subsidy amounts IDR 125 trillion per year in 2020.

What to do to accelerate EV penetration

- Increasing **public charging** infrastructure investment, both by public and private funds.
- Transforming the **taxation scheme** into one based on tailpipe CO2 and pollutant emission.
- Providing **purchase incentives** that can create EV competitiveness, e.g. tax exemption.
- Providing **non-financial incentives** for EV users, such as road toll exemption, free-parking, allowance to use bus lanes, exemption from odd-even policy, and establishment of low emission zones.
- Creating an initial market through **public procurement of EV** such as for public buses and official vehicles for government officials.
- **Increasing the fuel price** through fuel quality standard improvement and implementation of carbon price.
- Establishing a **mandatory fuel economy standard** to reduce transport emission while EV is not yet competitive.
- Put a **ban on internal combustion engine vehicles** (passenger cars and motorcycles) by 2035.
- **Increasing renewable energy** and reducing coal consumption in electricity generation.
- Introducing **different electricity tariffs** for peak and off-peak periods.

THANK YOU

Institute for Essential Services Reform is a think tank in energy and environment. We work to accelerate a just low carbon energy transition in Indonesia. IESR combines data and fact-based analysis with our insight on policy making process to drive policy and regulatory change to ensure sustainability and public benefits.

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