



**Institute for Energy Economics
and Financial Analysis**

Electrifying Indonesia's Road Transport

*The Quiet Giants in the Room: Perceiving Legacy
Automakers' Directions and Influence*

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Key Findings

Legacy carmakers command a predominant, if not near-absolute, status in Indonesia's market, yet their electric plans remain lackluster in contrast to new entrants' battery electric vehicles.

It is important to avoid blurring the differences among the various electrified vehicle types, and to understand real-world fuel savings and emission reductions as they can differ from claimed figures.

Indonesia's ambition of green travel is running up against excessive production capacity of 36% and 48% for the two and four-wheelers, respectively, reflecting legacy automakers' heavy investment in internal combustion engine vehicles.

Bold fuel economy standards and other active government policies are required to restrain demand for internal combustion engine fuel and make legacy automakers work toward more efficient vehicles.



Executive Summary

The sounds of electric vehicles (EVs) whizzing at the G20 Bali summit venue late last year was a display of Indonesia's ambition, with emphasis on fully electrified battery EVs (BEVs).

Nevertheless, while all eyes were drawn to the flashy new EV showcase, a quieter room of discussion has been assembling to consider the electrification plans of so-called legacy automakers, those which hold a predominant role in the market. The direction of these legacy players matters, particularly as most of them have rather muffled plans for going electric.

Transport is the single largest final energy-consuming sector in Indonesia, outstripping industrial usage and accounting for about a quarter of energy emissions. EVs present a new pathway as they consume energy more efficiently, using 60% to more than 75% of energy from the grid at the wheel, compared to the internal combustion engine vehicle's (ICEV) 12% to 30% efficiency. They also reduce emissions; several studies have concluded BEV life-cycle emissions are lower, *even with coal-dominant power grids*. Realizing the full benefits of BEV will nevertheless require Indonesia to maintain a strong ambition toward greening its power grid.

Given critical underinvestment in the domestic oil industry, reliance on imported oil for transport will grow, and reconciling the 3% annual decline in oil production with the rise in fuel demand remains improbable. As oil import bills rise alongside decarbonization aims, EVs will be crucial in curbing oil demand growth in tandem with the parallel ambition to adopt renewables.

Stakeholders should note a number of critical points about the market:

- **The current focus on BEV growth relying on new entrants leaves a gaping detail: legacy automakers' electric plans for emerging markets remain muted.** Five automakers command 92% of the light four-wheeler (4W) market, while two companies hold 96% of the two-wheelers (2Ws). Such is the high market concentration which can make or break the EV ambition. New entrants are poised to grow, but incumbents will likely put up resistance. Toyota's 4W BEV sales comprised 0.16% of its global business, and Honda's electric 2W sales are largely negligible. With strong reliance on hybrid cars, efforts are also ongoing to redefine electrified vehicles in the public mind. While the

industry is voicing the challenges of making EVs affordable in Indonesia, discourse about small low-cost EVs is evolving in Japan – the origin of most legacy automakers – in response to the Chinese EV threat on their turf.

- **The flood of public discourse on electrified vehicles risks blurring the line on the vast differences between BEVs and various hybrids.** The conventional hybrid (HEV), marketed for more than 20 years, is ultimately powered by petrol, while the benefits of plug-in hybrids (PHEVs) are highly dependent on users' charging behavior. Real-world assessments further underscore wide gaps between actual benefits in fuel savings and emissions and the *claimed* figures. Potential discrepancies have also been noted between emission reduction benefits outlined by the government and other sources.
- **Significant excess production capacities in both 4Ws (48%) and 2Ws (36%) will continue to haunt Indonesia's electric vehicle ambition.** Legacy automakers are heavily invested in ICEV production although Indonesia's ICEV sales peaked in 2011-14 and have not recovered to a similar level to date. Globally, ICE car sales also peaked in 2017, while developed countries are planning ICEV phaseouts, so the risk of legacy players entrenching ICEV products deeper in emerging markets will likely rise.
- **Inconsistent policy in controlling oil demand growth: Indonesia has been lagging in fuel economy progress; for example, new light-duty vehicles use on average 40% more fuel than in India.** The absence of mandated fuel economy standards or measures to control new vehicle growth suggests that the government is leaning toward light-touch regulation, leaving the automakers largely unscathed. Fuel economy serves as a dual-purpose measure as emissions and fuel usage are directly correlated. However, fuel economy plans are largely absent from Indonesia's long-term decarbonization strategy or Nationally Determined Contribution (NDC). Recently, the country has made positive moves toward progressive taxation of vehicles based on emissions and fuel consumption.

While having some of the most ambitious EV targets, Indonesia is potentially lagging behind its Southeast Asian neighbors. Vietnam leads electric 2W sales by a significant margin while competition with Thailand in electric 4W is tightening. Although significant boost in electric 4W sales have been noted last year, Indonesia should take caution that its current trajectory is likely

insufficient to meet the ambitious targets. Thailand's role as the region's leading car manufacturing base further raises the stakes for Indonesia's auto industry and future export markets.

To seriously embark on its EV ambition, Indonesia needs to address the giants in the room. The government and stakeholders should pay close attention to the following:

- **Active policy is necessary to restrain ICEV fuel demand growth through mandated targets and clearer policy commitments.** Mandated targets such as aggressive fuel economy standards should be set up immediately. The push to promote EVs will need to be combined with pull measures to restrain the ICEV market, including through fuel economy, which China and India have adopted. This will help pressure the legacy automakers to better align their production toward more efficient vehicles. Imperfections of the policy model should be evaluated comprehensively for effective adoption. A longer-term phaseout of ICEVs, coupled with realistic near to mid-term targets, should be seriously considered to improve the credibility of Indonesia's BEV ambition. Embedding the direction into high-level policy documents, including Indonesia's NDC commitment, would further strengthen the signal.
- **Legacy automakers and their domestic entities must better align with the country's need to decouple from oil demand growth and to reduce emissions.** Their industrial and market prowess could be important in electrifying future road transport in many emerging markets which face similar challenges to Indonesia. Domestic automaking entities are expected to play an active role in shaping up their principal's views of EV transition in Indonesia.
- **The government can consider facilitating legacy automakers transition through incentives and access to resources under strict conditions.** These should be conditional upon the automakers' alignment with Indonesia's electric plan. A sidestep toward hybrid should be scrutinized closely as it could potentially lead to a different pathway when unmanaged. Attention should also be warranted for the 2W segment, where Indonesia holds a significant market, comprising close to a quarter of Honda's and Yamaha's 2W unit sales globally.

- **The government should pay close attention to *real-world* fuel savings and emission reduction benefits of various electrified vehicles in considering support.**

Comprehensive assessment and clear public disclosure are even more critical, considering the wide array of electrified vehicles being promoted and vying for incentives.

Without the government or industry openly addressing these market concerns, the public will raise serious questions about whether Indonesia's current BEV buildout ambition is aimed at a more efficient and lower-emission domestic transport sector, or targeted largely for export.

The legacy automakers are at a critical juncture. Automotive R&D and investments in Japan are significantly higher than other industries, underlining the country's large bet on the sector. There will certainly be space for various types of EVs, but each path must be assessed openly while evaluating the alignment between Indonesia's aim and the different interests at play. It is noted that while legacy automakers have stressed the need to offer consumers diverse mobility choices, their all-electric options remain largely absent from the table.

Ultimately, EV adoption should not be perceived as a single overarching solution for the transport sector, where public modes of traveling will remain key to addressing both energy demand and emissions. In the meantime, however, the direction of legacy automakers should not be left unchecked, as the position they take can be very influential.

Background

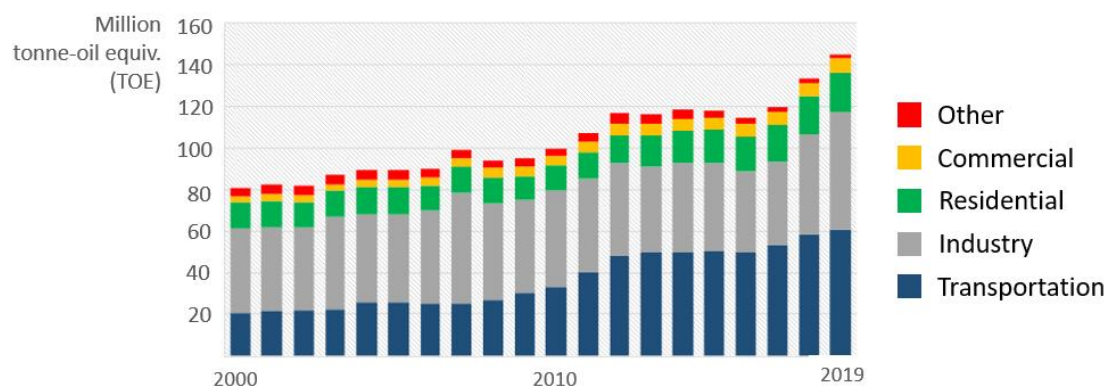
In recent years, Indonesia has seen multiple public announcements on electric vehicle (EV) initiatives, leveraging its position as the world's largest nickel producer. Nevertheless, while all eyes are seemingly drawn to the flashy new EV offerings, a quieter room of discussion is

gathering to look at the electrification plans of “legacy automakers,” those which command a predominant, if not near-absolute, status in the Indonesian market.¹

How these incumbent players intend to move forward matters, as five of them dominate 92% of Indonesia's light vehicle sales; in terms of two-wheelers (2Ws) such as motorcycles, the dominance is even more pronounced with only two companies holding sway over a combined 96% share. To compound the issue, most of them have rather muffled plans for going electric.

EVs operate much more efficiently. Anywhere between 60% and 75% of the energy from the grid is used at the wheel, whereas an internal combustion engine vehicle (ICEV) converts only 12% to 30% of the energy in its fuel tank.² Energy demand growth in the transport sector is rising fast, comprising roughly a quarter of Indonesia's energy greenhouse gas (GHG) emissions (Figure 1).³ Coupled with rising oil import bills and fuel subsidy volatility, the shift toward EVs is a key part of the endeavor to arrest oil demand growth while reducing emissions.

Figure 1: Rising Final Energy Use in Transportation



Source: Adapted from Indonesia Third Biennial Update Report, MEMR.⁴

¹ Throughout this paper, EV terminology primarily refers to the battery electric vehicle (BEV) and plug-in hybrid electric vehicle (PHEV), while distinctions will be made as needed for other electrified vehicles, such as conventional hybrid vehicles (HEVs) and fuel cell electric vehicles (FCEVs). Four-wheeler (4W) terminology refers to vehicles with four wheels or more. Legacy automakers broadly comprise existing automakers in both the 4W and 2W segments, with emphasis on the largest companies in each segment.

² U.S. Department of Energy. [Fuel economy](#). Accessed on 9 December 2022.

³ Government of Indonesia. [Indonesia's Third Biennial Update](#). Pages 2-5. 2021.

⁴ Excluding residential biomass use.

The high upfront cost of EVs, the absence of charging infrastructure, and consumer acceptance will all need to be resolved. But in an increasingly electrified future, efficient consumption of energy will take centre stage as discussions shift away from primary energy sources, wherein 60% to 70% of the energy consumed through various commodities are lost in the value chain and will never make it to usable services.⁵

The move toward EVs will need to address existing market conditions and identify the challenges openly. This paper aims to focus on examining the historical record of Indonesia's

Electrifying the 'Distance Traveled'

The ambition of having personal vehicles in every driveway is largely an inefficient option. Thus, EV adoption should not be seen as an overriding solution to the overarching challenges of the transport sector.

The focus on accessible public transport, well-designed urban development and mobility options will all need to be maintained. Nevertheless, while developments are ongoing, in countries where vehicle ownership per capita is still growing, public attention on the existing automakers should be kept up.

Electrification of both public and private transport will remain key to decarbonizing road transport and suppressing oil demand growth. As fuel consumption and emissions are directly related, the improved energy efficiency of EVs compared to ICEVs benefits markets with strained energy resources.

The pertinent question on transport electrification is not solely on how much impact it can make *now*, but to view it as a *parallel action* toward future goals. The global overarching ambition is to reach a net-zero future, and as renewable energy adoption grows, so will the benefits of electrifying the distance traveled.

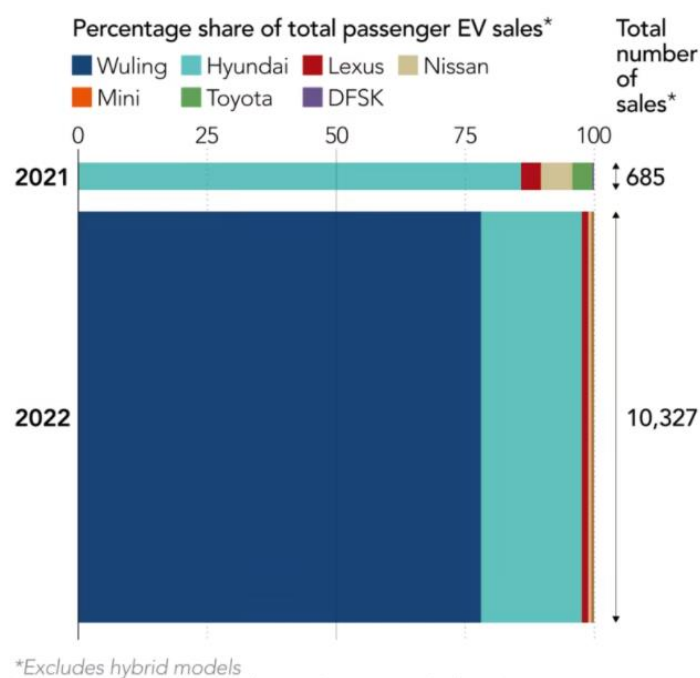
⁵ Lawrence Livermore National Lab. [Energy flow charts](#). Accessed on 12 December 2022.

policy consistency to curb its oil demand growth and the legacy automakers' direction of development on EVs, which can make or break the country's ambition of green travel.

Indonesia's Auto Industry and the Changing Times

The Indonesian auto industry is a large sector, in which transport equipment amounts to 3.6% of GDP and 3.73% of national exports in 2021.⁶ The country is the largest car market in Southeast Asia, and the second largest production base after Thailand.⁷ Domestic annual growth of the four-wheeler (4W) and two-wheeler (2W) within the past five years has been hovering at 5.1% to 5.3%. Official records showed 17 million 4W passenger cars and 121 million 2Ws in 2021.⁸

Figure 2: Indonesia's Electric Car Sales



Source: Nikkei Asia, Gaikindo.

⁶ GDP share based on the Coordinating Minister for Economic Affairs' statement, and export share based on Toyota reportage. Note that the Ministry of Industry reported the transport industry represented 1.35% of GDP in 2020.

Kompas. [Important role of the automotive industry to national economy](#). 1 March 2022.

Toyota Indonesia. [The important role of automotive exports in industrial development and economy](#). 14 March 2022.

Indonesia's Ministry of Industry. [Impacts of Covid-19 pandemic on the automotive industry](#). 2021.

⁷ Ministry of Industry. [Automotive sector's contribution to carbon emissions reduction](#). 15 August 2022.

⁸ National Statistical Bureau (BPS). [Quantity of motorized vehicles by province and vehicle type \(unit\), 2021](#). Accessed in December 2022.

Indonesia is ranked second in car production volume and first in sales volume among the 10 Association of Southeast Asian Nations (ASEAN) countries.

As of July last year, the Ministry of Transportation recorded close to 23,000 registered EVs, comprising 19,700 2Ws, 2,600 4Ws and an assortment of 3Ws, buses and goods transport vehicles.⁹ 4W EV sales rose substantially to more than 10,000 units in 2022 with around 28,000 electric 2W sold in Q1-Q3 2022, although they remain small relative to the market size.¹⁰

In Southeast Asia, Thailand is competing tightly with more than 13,000 BEV reportedly sold in the first nine months of 2022¹¹. With nearly all ASEAN countries being significant net oil importers, more aggressive transport electrification plans in the future should be expected.¹²

On paper Indonesia's absolute transport electrification target, at 13 million electric 2Ws and 2.2 million electric cars by 2030, is among the most aggressive in Southeast Asia, yet EVs have made very limited inroads. In the category of 2Ws and 3Ws, electrics comprise 8.3% of sales in Vietnam and around 1% in Indonesia.¹³ Different market sizes and contexts matter, but this is nevertheless a noticeable disconnect between goals and developments on the ground.

The global context. In 2010, there were 17,000 electric cars on the road globally; just over a decade later in 2021, these vehicles constitute close to 10% of global car sales, a quadrupling of the 2019 market share.¹⁴ The annual EV sales in 2012 is now equaled by a week of sales. BloombergNEF (BNEF) estimated global ICEV sales peaked in 2017, and that global oil demand from road transport could peak before 2030 (Figure 3). At the global level, the trajectory for EVs is shaping up rapidly.

⁹ Kompas. [Total count of electric vehicles in Indonesia by July 2022](#). 1 August 2022.

¹⁰ Nikkei Asia. [Indonesia's nickel riches spur local company EV, battery ambition](#). 3 February 2023.

Bisnis. [Can subsidy increase electric motorcycle sales? Here is AISI's response](#). 23 December 2022.

CNBC Indonesia. [Electric vehicles starting to gain traction, so what is the reality on the ground?](#) 20 September 2022.

¹¹ The Nation Thailand. [Thailand EV sales soar 223% as buyers take advantage of incentives](#). 29 October 2022.

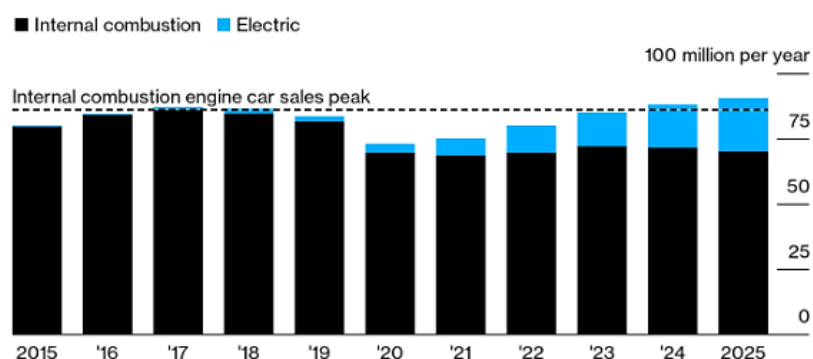
¹² ASEAN Centre for Energy. [The 7th ASEAN energy outlook](#). Page 34. 15 September 2022.

¹³ International Council on Clean Transportation (ICCT). [Zero-emission vehicle deployment: ASEAN markets](#). 20 April 2022.

¹⁴ International Energy Agency (IEA). [Global EV outlook 2022](#). 2022.

S&P Global. [Electric vehicles to set new market share record in 2020](#). 15 June 2020.

IEA. [Electric cars fend off supply challenges to more than double global sales](#). 30 January 2022.

Figure 3: Global ICEV Sales, Peak in 2017

Source: Bloomberg, BNEF. Electrics include PHEVs.

The operational cost savings in energy per distance driven are significant, with estimates ranging from 50% to more than 80% compared to ICEVs. This is especially pronounced in countries with a lower cost of electricity, such as Indonesia. Nevertheless, the entry barriers to EV adoption remain substantial.¹⁵

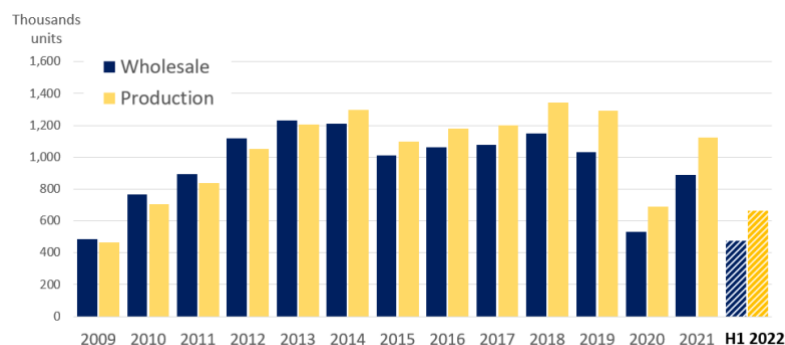
With rising concerns on mitigating emissions, many countries have placed EV adoption at the forefront of their road transport decarbonization strategy. Indonesia, however, has two other good reasons to accelerate EV adoption: a perpetual oil production decline since the mid-1990s and volatile fuel subsidies. These factors, taken together with deteriorating air quality in major cities, raise the stakes for aggressive EV adoption.

Indonesian auto sector's historical context. Annual car sales in Indonesia reached a historical peak of 1.23 million in 2013-14 (Figure 4).¹⁶ The country has had a long-standing relationship with the auto industry, particularly with Japanese brands. From the early 1960 to the 1970s, importers, distributors and assembly plants began to be established.¹⁷ The size and depth of the auto manufacturing sector make it a significant contributor to the Indonesian economy.

¹⁵ Savings are estimated by comparing with the typical fuel consumption pattern of 1 liter per 10km to 12km and fuel costs of Rp7,650 to Rp14,500 per liter. Electricity usage is based on a household tariff of Rp1,500 per kilowatt-hour (kWh) with a conservative estimate of 0.2kWh/km consumption.

¹⁶ Gaikindo. [Indonesian development of electrified vehicles](#). Accessed on 14 December 2022. Ministry of Industry. [Draft analysis of automotive industry](#). 2021.

¹⁷ Gaikindo. [Automotive industry development](#). Accessed on 11 January 2023.

Figure 4: Indonesia's Car Sales, Peak in 2013

Source: Gaikindo, IEEFA analysis.

The government has made significant policy strides to promote electric vehicles, such as plans to replace more than 180,000 official vehicles with EVs.¹⁸ Propelled by the Presidential Regulation No. 55/2019, dozens of policies have been put in place to promote EVs, paying considerable attention to promoting investments in EV manufacturers and their associated battery supply chain, and leveraging Indonesia's nickel resources. More recently in November, the government announced plans to start subsidizing EV purchases this year, beginning with the electric 2W.¹⁹

In parallel to these actions, Indonesia's leadership also needs to ask more pointed questions about its ambition to electrify: what are the legacy automakers' future plans? Is the country willing to take an assertive position on the vehicle market to ease up on oil imports? How likely will the shift toward EVs take place with and without the support of the legacy automakers?

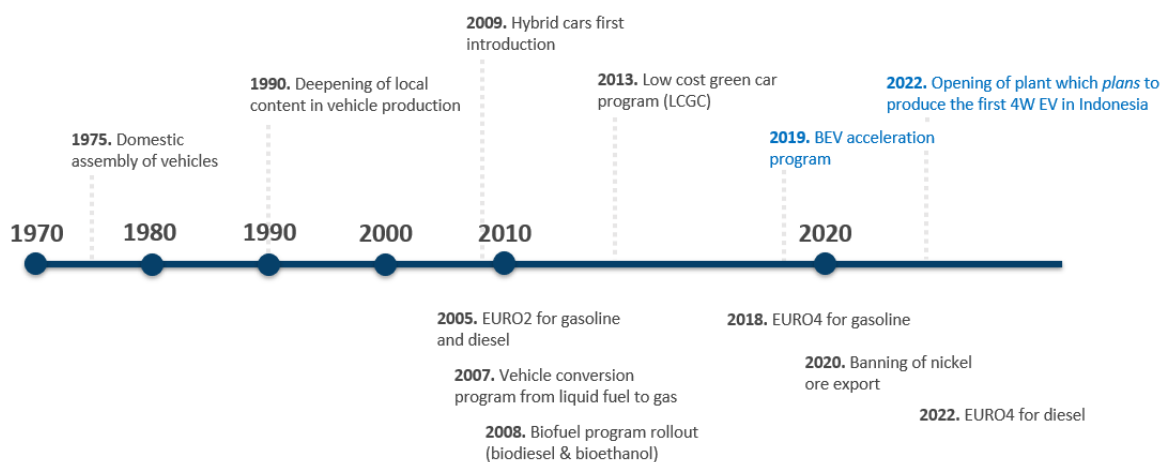
It is implausible to harbor great ambitions on electrification without addressing the presence of legacy players and understanding the historical policy developments. A brief revisit is warranted to the country's oil supply and demand history, and the developments of the automotive sector.

¹⁸ Indonesia's Ministry of Energy and Mineral Resources (MEMR). [Welcoming the age of EV, the government's public launch of BEV](#). 17 December 2020.

Reuters. [Toyota plans \\$1.8bn Indonesia investment to build electric vehicles](#). 27 July 2022.

Kontan. [189,803 government vehicles will be changed to electric](#). 17 September 2022.

¹⁹ Reuters. [Indonesia plans to subsidize EV sales next year](#). 29 November 2022.

Figure 5: Notable Milestones in Indonesia's Auto Industry²⁰

Source: Gaikindo, Compiled sources, IEEFA analysis.

Context: Curbing Transport Fuel Demand Amid Perpetual Oil Production Decline

One key reason for EV adoption is to displace oil demand. At least nine out of 14 strategic programs planned under Indonesia's National Grand Energy Strategy revolve around the changing landscape of the country's oil and gas sector.²¹ During the early 2000s, nearly 40% of the state budget came from the oil and gas sector; in recent years, this number has dived to 4%-6%.²²

Domestic production of oil has been in terminal decline since its second peak, in the mid-1990s, at a rate of 3.1% per year in the past decade.²³ Current output stands at 600-700 thousand barrels of oil per day (bopd), a fraction of the demand today for 1.6 million bopd. Sensible discussions on oil production therefore mostly center on how to *slow* the rate of decline while, concurrently, coping with oil consumption that grew 0.6% in the last 10 years. These two pathways are largely irreconcilable. Even if the country is able to arrest the decline rate and

²⁰ Gaikindo. [Indonesia's electrified vehicle development](#). November 2020.

²¹ The National Energy Grand Strategy is formulated by the National Energy Council (DEN). DEN. [The dynamics of national energy security amid global energy crisis](#). 7 September 2022.

²² Kompas. [Post-golden period of oil and gas industry](#). Accessed on 12 September 2022.

Indonesia's Ministry of Finance. [Realization of APBN State Budget 2020](#). Accessed on 12 September 2022.

²³ Indonesian Petroleum Association. [The industry](#). Accessed in September 2022.

BP. [Statistical review of world energy 2022](#). 2022.

bring it below 3%, the gap between the production decline and increasing consumption will only widen in the absence of assertive control on usage.²⁴

EVs, Emissions and Responsible Supply Chain

Two questions always rise to the forefront in EV discussions: emission reduction benefits in a coal-rich grid and impacts on the supply chain.

BEV adoption can reduce life-cycle CO₂ emissions by about 10% to more than 60% compared with its ICEV peers. This is a conclusion which has been reinforced through numerous assessments by institutions such as ICCT, IEA and the European Federation for Transport and Environment (T&E), even in coal-dominated grids such as Indonesia's. Indonesia will, nevertheless, need to maintain strong commitment toward greening its power grid in order to realize the full benefit of electric vehicles. This topic is elaborated in Appendix A of the current report.

On the production side of Indonesia's nickel and EV-related industries, the stakes are high as investors and financiers are paying close attention to the environmental, social and governance (ESG) standards of their EV supply chain.

Various technological and policy developments will continue to alter the EV landscape by demanding a responsible supply chain. With the global EV drive increasingly spurred by the sustainability agenda, ESG pressures will unlikely dampen in the future, and is a subject deserving of Indonesia's close attention.

In an interview with CNBC in 2021, chairman Dwi Soetjipto of SKK Migas, a regulatory agency in Indonesian oil and gas, said he expected domestic demand to more than double by 2050 from the current 1.6 million bopd to 4 million bopd.²⁵

Liquid petroleum gas (LPG), which was touted as the solution to kerosene as recently as 15 years ago, is now causing a scramble as Indonesia has not been able to produce its own LPG. Instead, the country has had to import 80% of its LPG needs supported with US\$2.6 billion to

²⁴ The growth in oil demand has been modest, tempered by biofuel adoption and lower demand in electricity generation.

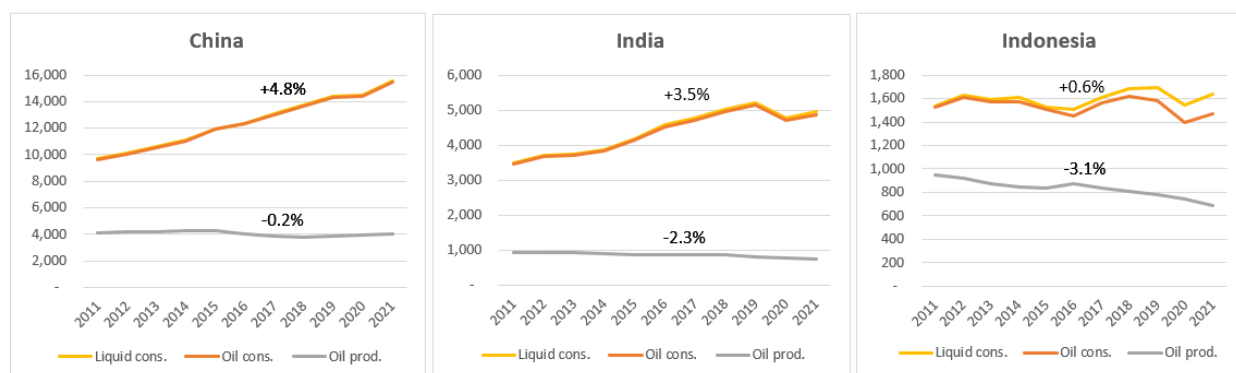
²⁵ CNBC Indonesia. [Not yet sunken, Indonesian oil consumption can reach 3.97 million barrels by 2050](#). 19 August 2021.

US\$4.5 billion of annual subsidies.²⁶ On the other hand, biodiesel adoption based on palm oil has increased rapidly to substitute diesel use, placing Indonesia as the world's largest biodiesel user, backed by US\$3.4 billion of price support in 2021.²⁷

All these costly scrambles should not be interpreted separately, but rather as a manifestation of decades of unmet promises and ambitions to grow the oil and gas sector.

Separating the aspirations from the plans. While the Ministry of Energy and Mineral Resources (MEMR) has been actively promoting a target to increase oil production to 1 million bopd by 2030, historical trends suggest that the likelihood remains slim. The ambition is commendable, but the government will need to ensure that the overarching view and policies issued by various ministries and agencies are based on prudent forward estimates.

Figure 6: Oil Usage and Production in Selected Countries (thousand bopd)



Source: *BP Statistical Review, IEEFA analysis.*

Indonesia's peak oil production, which took place in 1977 and 1995, will much less likely be replicated. The waves of international oil company exits at the end of their contractual period since 2018 have altered the industry landscape, potentially permanently.²⁸ Pertamina, the

²⁶ Subsidies between 2017 and 2021.

CNBC Indonesia. [The public still in trouble and now will 3kg LPG price rise?](#) 5 April 2022.

Bisnis. [3kg LPG subsidy will be diverted to induction stove: ministry's explanation.](#) 20 June 2022.

²⁷ The price support mechanism for biodiesel is provided by the palm oil funding pool, BDPKPS, which is financed through levies on palm product exports.

Bisnis. [Biodiesel incentives reach Rp51.86 trillion in 2021.](#) 28 December 2021.

²⁸ Total Mahakam (2018) and Chevron Rokan (2021) exited at the end of their contractual periods; Shell Masela (divestment plan, 2021), among others.

national oil company, now contributes about 60% of the country's oil production.²⁹ Barring the miraculous discovery of a new oil field, reconciling the supply-demand imbalance will only become more difficult.

Indonesian oil demand has not been growing as steeply as in China or India, yet the persistent decline of its oil production presents a clear challenge (Figure 6). It is implausible to expect Indonesia to decouple completely from oil demand in the next two decades. Refineries to shift crude oil imports to domestic processing and actions to maintain some level of production will remain key to the country's stability. Attention should mainly be focused on, firstly, displacing the oil demand growth in a significant manner through alternative power sources, followed by efforts to erode existing usage.

Worldwide, various types of EVs are estimated to have displaced 1.5 million bopd, about 3% of road transport demand.³⁰ With ICEV sales having peaked in 2017 and oil demand displaced by electrics, the stakes for long-term demand certainty are rising for companies planning multidecade oil investments.

These factors, taken together, mean that Indonesia is facing a challenge the country and the oil industry have not seen in the past. Given the limited prospects in addressing the oil production, the demand side should warrant attention.

Evaluation of Oil Demand Control History

Historically, more public attention has been directed toward oil production and less on demand management, a potential artifact of a country which has a long history of being a major oil producer.

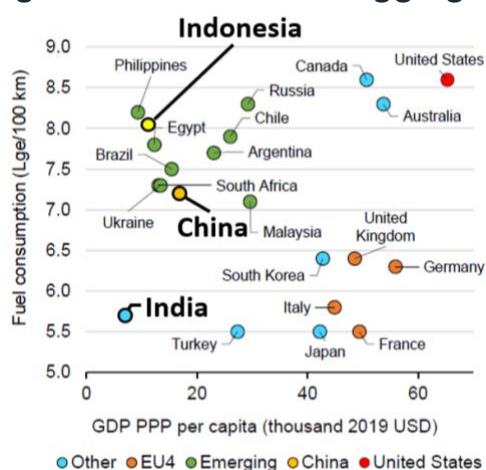
Although EVs are becoming the center of attention, the following examples present useful reference points in understanding the wider context of Indonesia's auto industry and its associated energy demand.

²⁹ IDX Channel. [60 percent of Indonesia's crude oil is supplied by Pertamina](#). 9 August 2022.

³⁰ BloombergNEF. [Electric vehicle outlook 2022](#). 2022.

1. A laggard in vehicle fuel economy standards. Improvement of vehicle fuel economy plays a key role in curbing fuel demand while serving the twin goals of reducing emissions, as fuel consumption is highly correlated with CO₂ emissions. Globally, fuel economy improvement of 1.6% annually in new light-duty vehicles (LDVs) was achieved between 2005 and 2015, although further improvement has slowed down in recent years.³¹ By comparison, Indonesia's progress is lagging behind considerably (Figure 7).

Figure 7: Indonesia's Lagging LDV Fuel Economy



Source: Adapted from IEA.³²

IEA has noted that “Indonesia is among LDV markets reviewed with the least improvement in fuel economy, with fuel consumption decreasing by a total of only 0.5 lge (liter gasoline equivalent)/100 km between 2005 and 2019.”³³ In 2019, India's average LDV fuel economy was about 30% better than Indonesia. ICCT also noted that Indonesia's LDV fleet was on average lighter in weight than those of China, Malaysia and Thailand, yet had poorer fuel economy.³⁴

³¹ Average fuel usage has decreased by about 1.6% annually since 2005. In recent years, the trend has slowed down with a 0.4% decrease in 2017-2019. Japan's domestic car market has also exhibited a similar trend (JAMA 2021).

Global Fuel Economy Initiative (GFEI). [Vehicle fuel economy in major markets 2005-2019](#). Page 39. November 2021.

³² For new vehicles. Adapted from GFEI working paper 22.

GFEI. [Vehicle fuel economy in major markets 2005-2019](#). November 2021.

IEA. [Fuel economy in Indonesia](#). 2021.

³³ IEA. [Fuel economy in Indonesia](#). 13 December 2021.

³⁴ IEA. [Fuel economy in Indonesia](#). 13 December 2021.

ICCT. [Overview of vehicle fuel efficiency and electrification policies in Indonesia](#). 19 July 2021.

Policy measures such as the corporate average fuel economy (CAFE) model, which outlines fuel efficiency targets for each manufacturer, have been adopted in multiple countries including China and India.³⁵ While imperfect, such policies align the market with national goals in managing oil demand and mitigating emissions. Adoption of such policies commonly traces back to energy security concerns, such as the United States' CAFE adoption in the 1970s, which coincided with the oil crisis.³⁶



Fuel economy improvement is largely left out of Indonesia's NDC commitment and long-term decarbonization strategy, which focus on EVs and biofuel adoption instead.

Although Indonesia has outlined its intent to develop a fuel economy standard in the National Energy Plan (RUEN) for a number of years, this has yet to fully materialize.³⁷ Fuel economy improvement is also notably left out of the Nationally Determined Contribution (NDC) commitment and long-term decarbonization strategy in the transportation sector. In addition to promoting public transport, emissions reduction plans largely focus on EVs and biofuel adoption.³⁸

Vehicle characteristics do play an important part, such as in different preferences for diesel or gasoline and car size, but from a broader perspective, the absence of a clear mandated target indicates a lack of commitment to apply the necessary controls on *existing* practices. Fuel economy policies certainly come with their own challenges, but such regulation would send a clear signal on the importance of fuel efficiency to the manufacturers, which have largely escaped attention in the Indonesian market.³⁹

2. Implementation of “low-cost green car (LCGC)” initiative in 2013. Tax incentives for LCGC cars were rolled out a decade ago under a rationale to promote the use of green cars that

³⁵ TransportPolicy. [China light duty vehicles fuel consumption](#). Accessed on 19 December 2022.

Autocar India. [CAFE regulations and why they are important](#). 14 May 2022.

³⁶ ICCT. [US passenger vehicle CAFE and GHG regulations](#). 19 July 2021.

³⁷ Government of Indonesia. [Presidential Regulation No.22/2017 – RUEN](#). Page 89 in Attachment I. 2017.

³⁸ Government of Indonesia. [Enhanced NDC](#). 2022.

Government of Indonesia. [Long-term strategy for low carbon and climate resilience 2050](#). 2021.

³⁹ The Economic Times. [A CAFE without a bite: Fuel-efficiency norms go soft on penalty](#). 3 June 2022.

consumed fuel more efficiently.⁴⁰ The small-car program is somewhat analogous to Japan's Kei-car with its sub-660cc engine, although the Indonesian LCGC requirements are much less stringent, allowing up to 1,200cc for a gasoline engine.⁴¹

In the years prior to 2019, the LCGC segment comprised 20% to 23% of total passenger vehicle sales.⁴² It is notable that Indonesia reached peak car sales in 2013-2014, which coincided with the rollout of the LCGC program. Ideally, LCGCs should displace the use of less efficient cars, but whether expanding incentives on low-cost cars has helped manage oil demand is an open question. It is difficult to ascertain if the LCGC policy *displaced* demand for other types of vehicles, or merely opened up a new facet of vehicle demand by lowering the bar of entry for purchase. The LCGC incentives later underwent a number of adjustments.⁴³

4. Subsidies and fuel taxation. Indonesia's fuel taxation regime is generally categorized as subsidized with weak taxation (Figure 8).⁴⁴ As an emerging economy, the country would have its own political economic calculus in deciding to subsidize fuel, and whether such subsidies are disclosed openly in the state budget or provided implicitly through the mandate of state-owned enterprises.

⁴⁰ Indonesia's policy in 2013 outlined a maximum engine displacement of 1,200cc (gasoline) or 1,500cc (diesel/semi-diesel), with a minimum fuel economy standard of 20km per liter of fuel.

Government of Indonesia. [PP No.41/2013](#), 2013.

Indonesian Ministry of Industry (MoI). [MoI issues LCGC regulation](#), 2013.

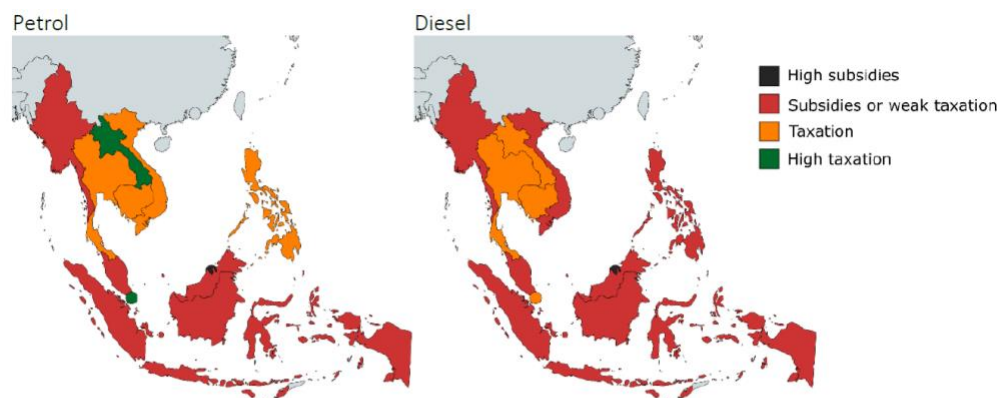
⁴¹ Nikkei Asia. [Asian automakers bet on electric minivehicles](#), 27 May 2022.

Nikkei Asia. [Minicars to play big role in Japan's "all electric" goal](#), 23 December 2020.

⁴² Gaikindo, ICCT.

⁴³ Fiscal Policy Agency – Ministry of Finance (MoF). [Utilizing stronger recovery room, MoF extends vehicle tax incentive](#), 8 February 2022.

⁴⁴ Global Fuel Economy Initiative. [GFEI Working Paper 24 – Implementing the ASEAN fuel economy road map](#), March 2022.

Figure 8: Tax Regimes on Road Transport Fuels⁴⁵

Note: Thresholds defining the different categories of fuel taxation regimes are in line with the analysis developed by GIZ (2020) and earlier versions of this assessment. Retail price of petrol: High subsidies = USD <0.41/litre, Subsidies or weak taxation = USD 0.41-0.87/litre, Taxation = USD 0.88-1.25/litre, High taxation = USD >1.25/litre. Retail price of diesel: High subsidies = USD <0.41/litre, Subsidies = USD 0.41-0.87/litre, Taxation = USD 0.88-1.30/litre, High taxation = USD >1.31/litre.

The category "Subsidies or weak taxation" includes, for diesel, the Philippines and Viet Nam. These countries apply taxes for transport fuels, but they are lower than those applied in the United States. The latter are used as a baseline to define the difference between subsidies and taxes in the GIZ analysis, where all countries applying taxes lower than the United States are deemed to subsidise road transport fuels.

Source: *International Transport Forum, GIZ.*

Various studies have been undertaken on the amount of fuel subsidies spent and have highlighted the regressive challenge of subsidy.⁴⁶ Last year, in response to rising oil prices and the threat of higher subsidy expenditure, the government announced a number of plans to control subsidized fuel distribution.⁴⁷

5. Biodiesel adoption. The use of palm oil biodiesel (FAME) was ramped up rapidly through government policy in the mid-2010s.⁴⁸ Diesel fuel blends accounted for more than 40% of total fuel consumption in transport.⁴⁹ While the biodiesel adoption plan was initiated in the late 2000s, the year 2016 marked a change of pace and made Indonesia the world's leading biodiesel adopter with a 30% blending mandate.⁵⁰ The significant additional cost of biodiesel adoption led

⁴⁵ Adapted from GFEI Working paper 22, IEA. Indonesia data based on IEA fuel economy database.

GFEI. Working paper 22 – *Vehicle fuel economy in major markets 2005-2019*. 2021.

IEA. *Fuel economy in Indonesia*. 2021

⁴⁶ International Institute for Sustainable Development (IISD). *Indonesia's energy support measures*. 21 June 2022.

⁴⁷ MEMR. *The government is preparing a regulation revision for fuel subsidy allocation*. 11 July 2022.

⁴⁸ FAME, or fatty acid methyl ester biodiesel, in Indonesia is derived from palm oil.

⁴⁹ MEMR. *Handbook of energy and economics statistics of Indonesia 2021*. 10 May 2022.

⁵⁰ MEMR. *Biodiesel, the long struggle*. 2021.

to a new price support mechanism funded by palm oil export levies to close the price gap between biodiesel and regular diesel fuel.

The government's stated intention in biodiesel adoption was to reduce GHG emissions, to increase energy resilience and independence, and to stabilize the price of crude palm oil. Reducing imports and the trade deficit was also part of the objectives.⁵¹ It should be noted that biodiesel adoption largely targets the heavier-duty transport segment.

In 2021, FAME consumption reached 9.3 million kiloliters, resulting in diesel fuel import reduction of Rp66 trillion (US\$4.4 billion) with an estimated price support budget of Rp46 trillion (US\$3.1 billion).⁵² The high cost will be one of the determinants in whether the ambition to raise the blending rate is achievable.⁵³

It is also noteworthy that among G20 countries, Indonesia is significantly falling behind in adopting tighter vehicle emissions standards. This is in contrast to the adoption of China 6 and Bharat Stage VI standards in China and India, respectively.⁵⁴ Nevertheless, it is commendable that in 2021, the government outlined a progressive taxation policy for new vehicles which took account of emissions and fuel consumption.⁵⁵

All these examples may not represent the full landscape, but they provide a historical anchor on the mixed policy commitments to curb growth in fuel demand, and by extension road transport emissions. Biodiesel programs are an exception as they are able to displace a sizable amount of diesel fuel consumption, albeit at a significant cost.

⁵¹ MEMR. [Frequently asked questions: Biodiesel 30% \(B30\) Mandatory Program](#). 2019.

⁵² MEMR. [MEMR 2021 performance report](#). 2022.

CNBC Indonesia. [Government estimates of biodiesel subsidy: Rp46 tn in 2021](#). 14 January 2021.

⁵³ Technical considerations will also be important, as blending biodiesel with regular diesel has its limitations due to fuel characteristics.

⁵⁴ The Euro emissions standard is geared toward controlling tailpipe emissions such as NOx, carbon monoxide and particulate matter (PM). While acknowledging supply-side factors such as refinery output, the lag in adopting the Euro standard can indicate a lack of country-level support on emissions controls.

ICCT. [Air quality and health impacts of heavy-duty vehicles in G20 economies](#). 22 July 2021.

ICCT. [Decarbonizing Road Transport by 2050 presented on 2021 Annual Meeting of the G20 Transport Task Group](#). 30 September 2021.

⁵⁵ CNBC Indonesia. [Sri Mulyani made rich people surprised, tax is increasing!](#) 11 November 2022.

While fuel subsidy removal is a delicate political subject, the lack of clear fuel economy targets suggests that the country is unwilling to venture into even softer regulatory measures. The auto industry has therefore been largely roaming in a light-touch policy environment, where there is limited alignment between Indonesia's need to curb oil demand and reduce emissions. In approaching national EV goals, this stance will likely need to be revisited, particularly in light of the legacy automakers' reserved position in adopting electric vehicles.

How Legacy Automakers Have Fared in BEVs

EV discussions in Indonesia are largely dominated by less prominent brands such as South Korea's Hyundai Motor and China's Wuling Motors, while the response from major brands has been far more muted. Japanese automakers captured close to 80% of LDV sales in 2021, a figure which rose further to about 92% when including companies such as Mitsubishi Motors and Nissan Motor, each of which is now backed by a sizable international ownership⁵⁶ (). As global ICEV sales had peaked in 2017, legacy automakers are facing a two-fold challenge: a decline in their main product demand and the need to adapt to the electrified future.⁵⁷

Table 1: Top 5 LDV Brands and Entities

Brand	Market Share	Non-exhaustive list of domestic entities	Ownership
Toyota	36.4%	PT Toyota Motor Manufacturing Indonesia	Toyota Motor Corp., Astra International Tbk. [Jardine Cycle & Carriage Ltd Singapore 50.11%]
		PT Toyota-Astra Motor	Astra International Tbk (50%), Toyota Motor Corp. (50%)
Daihatsu	20.3%	PT Astra Daihatsu Motor	Astra International Tbk (31.87%), Daihatsu Motor Corp.
Mitsubishi	13.2%	PT Mitsubishi Motors Krama Yudha Indonesia (MMKI)	Mitsubishi Motors Corp. (51%) Mitsubishi Corporate, PT Krama Yudha
Suzuki	11.3%	PT Suzuki Indomobil Motor	Suzuki Motor Corporation (94.94%), PT Indomobil Sukses International (4.55%), PT Serasi Tunggal Karya (0.51%)
Honda	11.2%	PT Honda Prospect Motor	Honda Motor Co., Ltd (51%), PT Prospect Motor (49%)
Total Market Share	92.4%		

Source: Gaikindo, company reports.

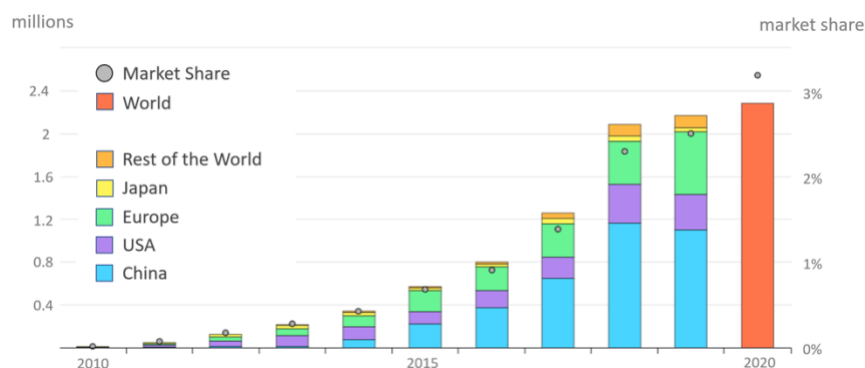
Given the dominance of the Japanese automakers, what happens in Japan matters to Indonesia and many other emerging markets. Japan's influence is even more crucial in terms of EV

⁵⁶ Gaikindo retail sales database. 2021 and 2019 database. Accessed on 29 September 2022. Heavier vehicles such as buses and trucks are excluded from the discussion of this paper to maintain consistency with other statistics.

⁵⁷ Bloomberg. [Rapid EV growth hastens the peak, then fall, of internal combustion](#). 1 June 2022.

adoption, given that its own domestic BEV usage has been paltry at best despite the country being one of the largest car markets, surpassed only by China and the U.S. (Figure 9).⁵⁸

Figure 9: Global Electric Car Sales, 2010-2020



Source: IEA.

Note: Includes passenger and commercial LDVs that are BEVs and PHEVs.

The following section examines the leading automakers and their electrification ventures, ordered based on their significance in the Indonesian market.

1. Toyota

A behemoth in the global auto industry, Toyota Motor has a long history of developing alternative fuel vehicle and innovative technologies. Its launch of the Prius hybrid car in 1997 gave the world the first mass-produced hybrid electric vehicle (HEV), which combined the conventional combustion engine and electric motor powertrains.⁵⁹ Its record on the hydrogen-powered fuel cell electric vehicle (FCEV) goes even further back, to as early as 1992, culminating in the release of the Mirai FCEV in 2014.⁶⁰ By 2021, only about 18,000 Mirai FCEVs

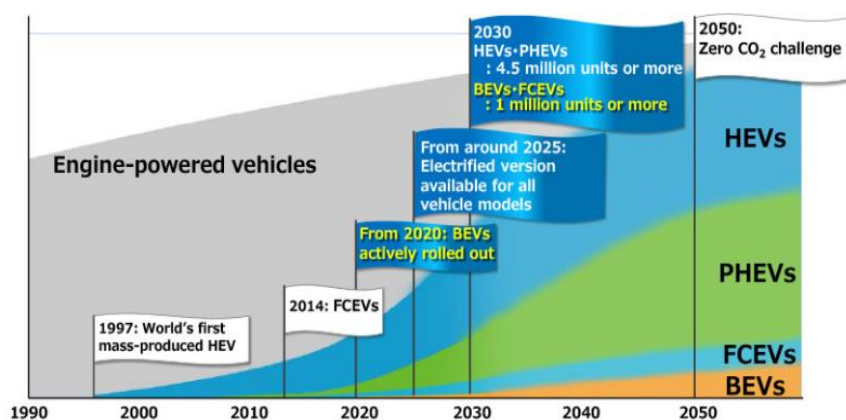
⁵⁸ Car market size based on production statistics from International Organization of Motor Vehicle Manufacturers (OICA). OICA. [2021 production statistics](#). 2021.

⁵⁹ Further discussion on hybrid vehicles is outlined in Appendix B.

⁶⁰ Toyota Motor. [Annual report 2018](#). 2019.

were estimated to have been sold.⁶¹ The Prius has had a notable presence in Japan, the U.S. and some other markets, but has never gained prominence globally.

Figure 10: Toyota's Outlook, 2017



Source: Toyota.

Toyota's progress on BEVs seems to have taken smaller steps. As early as the 2010s, plans had been around to launch an all-electric iQ minicar, but the project was later canceled.⁶² Toyota's road map, published in 2017, provides a historical reference to the company's earlier views on the future of road transport, which predicted heavy reliance on HEVs, PHEVs and FCEVs. Back then, Toyota spelled out its 2050 vision, in which BEVs comprised about 7% of future vehicle sales (Figure 10).⁶³ While this plan is now obsolete, it is important to note that such a position was prominent in the company as recently as 2017.

From a broader view across all vehicle segments, Toyota's global FY22 consolidated sales were dominated by the North American and Japanese markets. The Asia ex-Japan market trailed in third position, with Indonesia comprising a sizable share of the sales.⁶⁴ In terms of operating

⁶¹ Discussion on FCEVs is outside the scope of this paper, given the lower market potential for emerging markets such as Indonesia. The New York Times. [Toyota led on clean cars. Now critics say it works to delay them.](#) 25 July 2021.

Toyota Motor. [Sales, production and export results for 2021\(January-December\).](#) 28 January 2022.

Recharge. ['Hydrogen car sales almost doubled last year – after drivers were offered 50-65% discounts.'](#) 14 February 2022.

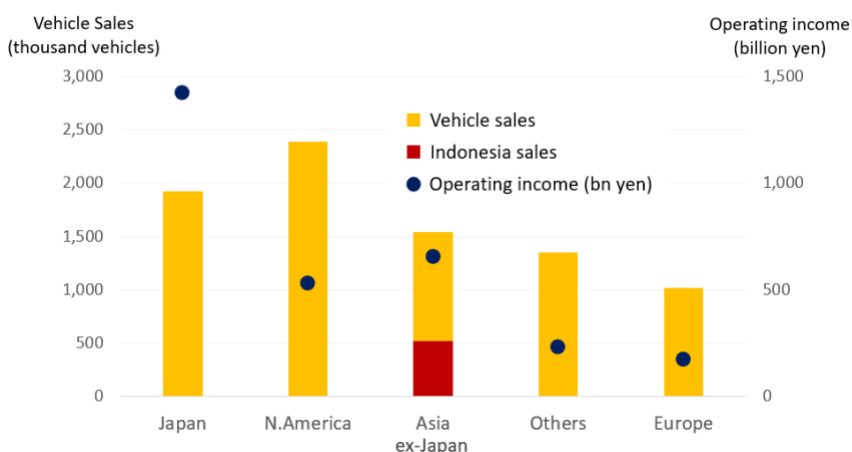
⁶² Reuters. [Toyota drops plan for widespread sales of electric car.](#) 24 September 2012.

⁶³ Toyota. [Milestones in popularizing electrified vehicles.](#) Accessed on 29 November 2022.

⁶⁴ Consolidated sales figures include Toyota's Daihatsu and Hino brands.

income, Asia was the second largest after Japan. Roughly 28% of Toyota and Lexus' 10.4 million units in FY22 retail sales were electrified vehicles, 95% of which were conventional HEVs.

Figure 11: Toyota Global Sales, FY22



Source: Toyota, Gaikindo, IEEFA estimates.

Note: Toyota defined FY22 as the period from April 2021 to March 2022.⁶⁵

In 2020, InfluenceMap, a thinktank which focuses on “how corporations and their industry groups influence policy needed to address climate change,” raised a major concern about Toyota’s level of engagement on EV adoption.⁶⁶ In an assessment of 12 major markets, it concluded that “Toyota has been highly negative on policy mandating the electrification of the automotive sector, promoting an extended role for hybrid vehicles and opposing the long-term phaseout of internal combustion engine (ICE)-powered vehicles.”⁶⁷ Among the top five companies in Indonesia’s 4W market, only Toyota and Honda Motor were covered in the assessment.⁶⁸

⁶⁵ Global consolidated sales figures include consolidated subsidiaries Daihatsu and Hino, while excluding production of unconsolidated entities such as joint ventures in China. Indonesia’s figures are from Gaikindo and Astra International Tbk.

⁶⁶ The New York Times. [Toyota led on clean cars. Now critics say it works to delay them.](#) 25 July 2021.

InfluenceMap. [Our mission and impact.](#) Accessed on 22 September 2022.

⁶⁷ InfluenceMap. [Toyota Motor.](#) Accessed on 22 September 2022.

⁶⁸ InfluenceMap. [Automotive climate tool.](#) Accessed on 22 September 2022.

The Battle to Redefine Electrified Vehicles

As attention to all-electric vehicles grew, a parallel effort is ongoing to redefine what constitutes electrified vehicles.

Various types of hybrids are being rolled out, such as the conventional HEV, which relies on its ICE operation to charge its battery, the PHEV, which can be charged externally, and the mild hybrid (MHEV). Each variant comes with its particular characteristics.

The HEV, around for more than two decades, has largely been concentrated in Japan and the U.S. The recent rise of PHEVs in the European Union and other markets has been backed by incentives, but discrepancies between claimed and real-world emission reduction benefits put it under the regulatory spotlight.

The BEV is unlikely to be the sole electrified means of future mobility. Hybrids remain an option, but stakeholders are advised to carefully understand the vast differences across the technology options, particularly with the ongoing battle to gain government incentives.

Appendix B of the current report explores hybrid vehicles in more detail.

Nevertheless, in December 2021, Toyota launched a BEV strategy with a “bZ” electric line. The sales target rose from an initial two million by 2030 to 3.5 million. This was a welcomed departure from the 2019 target, in which the company aimed for more than one million combined in BEV *and* FCEV sales.⁶⁹

The company has a significant presence in Indonesia, from which Toyota Motor Manufacturing Indonesia (TMMIN) exports products to more than 80 countries.⁷⁰ In a national auto show last

⁶⁹ Toyota. [Video: Media briefing on battery EV strategies](#). 14 December 2021.

Toyota. [Aiming to popularize BEVs](#). 7 June 2019.

⁷⁰ Toyota Indonesia. [Our export destinations](#). Accessed on 22 September 2022.

year, it displayed a concept version of the Innova EV, an electric variant of a bestselling car model in Indonesia.⁷¹

Later in the same year, Toyota also displayed its higher-end bZ4X EV in the Indonesian market. This move aligns well with the company's emphasis on initiating electrification efforts from higher-end product lines, paying particular attention to its flagship Lexus brand. In a number of public statements, Toyota stressed providing diverse options to consumers.

Focus on applying the "xEV" concept to various types of electrification remains strong.⁷² Between Q1 and Q3 last year, Toyota sold 1,400 hybrid cars in Indonesia, holding three-quarters of the hybrid market.⁷³ Conventional, non-PHEV hybrids seemingly remain a priority, with 48 out of 63 models of Toyota's 2022 electrified vehicles being HEVs.⁷⁴ The unveiling of the fifth-generation Prius hybrid late last year further underscores the company's commitment to hybrids.⁷⁵

Last July, Nikkei reported that Toyota planned to invest US\$1.8 billion in the following five years to produce EVs in Indonesia.⁷⁶ This plan will likely focus firstly on a local production of hybrids along with battery assembly manufacturing. The company has also outlined a number of different decarbonization approaches in Indonesia and cited the BEV as a "frontier" of electrification.⁷⁷ Toward the end of the year, Toyota further outlined some of its EV plans in emerging markets.⁷⁸

⁷¹ CNN Indonesia. [2 years of Innova electric car research involve hundreds of Indonesian engineers](#). 3 April 2022.

⁷² xEV is Toyota's concept covering the various types of electrified vehicles, including the HEV, PHEV, BEV and FCEV.

⁷³ Katadata. [Toyota dominated hybrid car market in Indonesia up to Q3 2022](#). 9 November 2022.

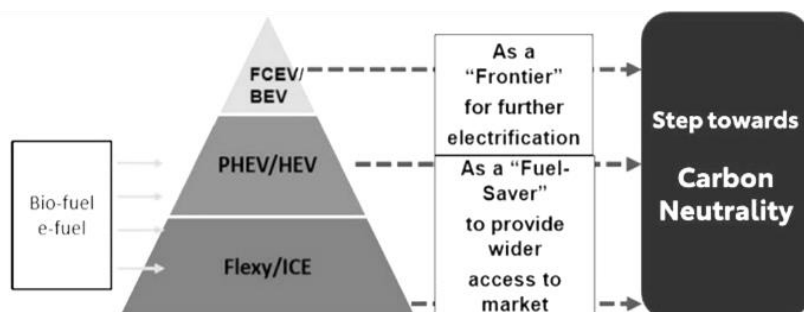
⁷⁴ Toyota Daihatsu Engineering & Manufacturing. [16th GIAC: Integrated green technology](#). 18 August 2022.

⁷⁵ Toyota Europe. [World premiere for fifth-generation Toyota Prius, 100% plug-in hybrid for Europe](#). 16 November 2022.

⁷⁶ Nikkei Asia. [Toyota plans \\$1.8bn Indonesia investment to make electric vehicles](#). 27 July 2022.

⁷⁷ Toyota Daihatsu Engineering & Manufacturing. [16th GIAC: Integrated green technology](#). 18 August 2022.

⁷⁸ Nikkei. [Toyota to launch EV tailored to emerging markets around 2023](#). 21 December 2022.

Figure 12: Multiple Toyota Approaches to Carbon Neutrality

Source: Toyota 16th GIAC Presentation.

2. Daihatsu

A subsidiary of Toyota, Daihatsu Motor is the leading minicar maker in Japan, recording about 60% of its 907,000-unit sales in FY21 domestically.⁷⁹ A significant portion of the company's market outside Japan lies in Indonesia, where 165,000 vehicles were sold in the 2021 calendar year.⁸⁰

Indonesia is home to Astra Daihatsu Motor, a major manufacturing base of Daihatsu outside Japan.⁸¹ The facility is the largest car factory in Indonesia, producing Daihatsu, Toyota and also other brands. In 2021, more than half of the capacity was allocated to non-Daihatsu makes.

⁷⁹ Daihatsu. [Data book 2022](#). 2022.

Daihatsu. [Looking at Daihatsu by the numbers](#). Accessed on 3 January 2023.

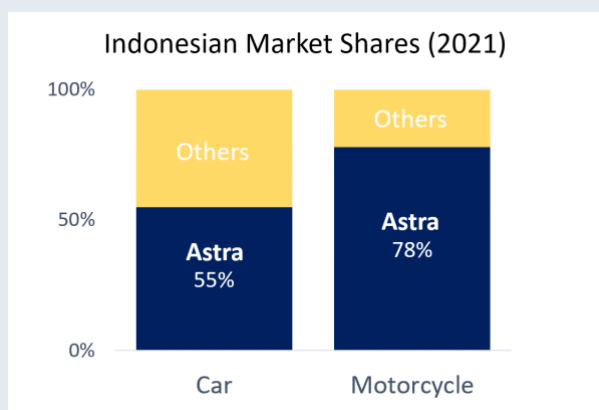
⁸⁰ Gaikindo. [Indonesia automobile industry data](#). Accessed on 29 November 2022.

⁸¹ Daihatsu. [Overseas business](#). 2021.

Astra Group in the Spotlight

As the sole agent of major brands Toyota, Daihatsu and Honda 2W, Astra International Tbk (ASII) plays a significant role in Indonesia's auto industry.

The group singlehandedly held 55% of the car market and 78% of the 2W market in 2021, drawing 41% of its revenue and 36% of net profit in FY21 from the automotive segment, nearly all in conventional ICEVs.



Source: [ASII](#)

The group has outlined an intention to diversify some of its business segments away from coal and to reduce its 2030 Scope 1 and 2 emissions by 30%. Nevertheless, just like the sluggish progress of other Japanese auto brands in electrics, the group has made limited disclosures on its auto segment's push toward electrics and emission reduction.

Increasing pressure on the group and its major shareholder, Jardine Cycle & Carriage (JC&C), to raise their decarbonization efforts should be expected, including their potential role in influencing the principal brands. JC&C is a noted supporter of the Task Force on Climate-Related Financial Disclosures.

A number of hybrid cars have been planned, yet it is not clear what Daihatsu's plan is in a wider adoption of BEVs, especially in overseas markets.⁸² In July 2022, the company announced a cooperation with other automakers to develop mini-commercial BEVs in 2023.⁸³ Daihatsu's focus on minicars is expected, given its long history and dominance in the minicar market.

In an interview with Nikkei, Daihatsu's president Soichiro Okudaira acknowledged the threat of an influx of Chinese EVs into Japan and outlined a plan to release electric minicars in 2025.⁸⁴ The urgency to establish Daihatsu electrics in the domestic Japanese market seemingly escalated when in 2021 Sagawa Express, a major transport company, announced plans to acquire 7,200 low-cost EVs made in China, estimated to cost between US\$11,800 and US\$13,700.⁸⁵

Last year, Daihatsu Indonesia displayed a converted electric version of Ayla, its popular small car in the country. With a reported range of 200km, the display generated notable market buzz, but it remains to be seen when the product will reach the stage of a commercial launch.⁸⁶

3. Mitsubishi

Close to 27% of its global retail sales in FY21 was based in the ASEAN market, where Indonesia hosts 197,000 of Mitsubishi's 814,000-car ex-Japan production capacity.⁸⁷ Nearly all of Mitsubishi's bestselling models come from the sports utility vehicle (SUV) lines, testament to the company's significant role in providing SUVs outside of Japan.

In similar fashion to several other automakers, Mitsubishi launched the i-MiEV in 2009 as "the world's first mass-produced EV," which was later discontinued and relaunched. In May last year, the company announced a plan for an all-electric minicar with an estimated pre-subsidy price of US\$18,000 to US\$22,000.⁸⁸ Separately, plans have been unveiled for a US\$9 billion investment

⁸² Daihatsu. [Daihatsu installs the e-SMART HYBRID, a hybrid system ideal for small cars, in the rocky](#). 1 November 2021.

⁸³ Daihatsu. [Suzuki, Daihatsu, Toyota, and CJPT to introduce mini-commercial van electric vehicles in FY2023](#). 19 July 2022.

⁸⁴ Nikkei Asia. [Chinese EVs pose a 'threat,' Japan's minicar king Daihatsu says](#). 10 March 2022.

⁸⁵ Nikkei Asia. [Japan's Sagawa to buy 7,200 low-priced EVs made in China](#). 13 April 2021.

⁸⁶ CNN Indonesia. [Ayla EV, when will there be an electric Calya?](#) 25 August 2022.

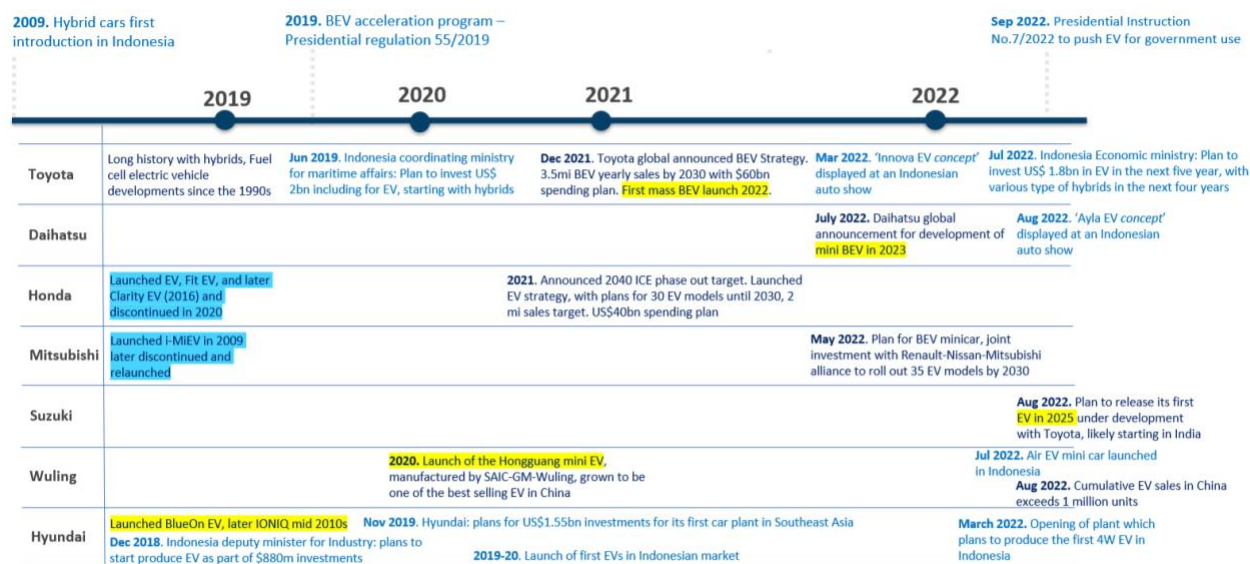
Kompas. [Discussion on electric conversion of Daihatsu Ayla EV](#). 14 August 2022.

⁸⁷ Mitsubishi. [Integrated report 2022](#). 2022. Page 49.

⁸⁸ Mitsubishi. [Mitsubishi Motors to launch the all-new eK X EV in Japan](#). 20 May 2022.

in electrification research and development by 2026 and, through the Renault-Nissan-Mitsubishi alliance, a joint investment to roll out 35 EV models by 2030.

Figure 13: Notable Milestones Across Selected 4W Auto Brands



Source: Compiled by IEEFA.

Current plans outline a target for EVs to comprise 50% of global sales and to reduce average emissions of new sales by 40% compared to 2010.⁸⁹ The company's “environmental targets 2030” mainly involve “promotion of electric vehicles, centering on PHEVs.” In the Indonesian market, some mention has been made of exploring commercial uses of the MiEV line, but a wider EV adoption plan is seemingly absent. It is notable that Mitsubishi Corporation’s investments in Indonesia are ranked second largest globally in its investment portfolio. The company said demand for ICEVs would still be high in the ASEAN market for the time being.⁹⁰

4. Suzuki

Automobiles encompass 90% of Suzuki Motor’s business.⁹¹ The company is preparing for its first EV release in 2025, likely beginning in India with a car pitched at ¥1.5 million (US\$13,700)

⁸⁹ Mitsubishi. *Integrated report 2022*. 2022. Page 26.

⁹⁰ The parent company, Mitsubishi Corporation, encompasses other business segments beyond the auto industry. Mitsubishi Corporation. *Integrated report 2021*. 2021.

⁹¹ Suzuki. *Integrated report 2021*. 2021.

or less after government subsidies.⁹² Maruti Suzuki, the company's domestic entity in India, has also reported plans to phase out pure-petrol vehicles in the next 10 years, and to switch to hybrids, flex-fuel, biofuel and pure EVs.⁹³ The direction is largely in line with Suzuki's active promotion of various types of hybrid vehicles.

Little has been mentioned of BEV adoption plans in Indonesia, although the company has rolled out a number of hybrid cars, some focusing on mild hybrid variants.⁹⁴

5. Honda

Honda has prominent production activities outside the Japanese market, testimony to its strong international footprint. However, the operating margin of its car segment is relatively weak, hovering at 1% to 2.5% in FY21-22, in contrast to its motorcycle business, which had a margin of 12% to 14%.⁹⁵

Honda has a notable history of launching BEVs, although many of the models were later discontinued. In 2020, the company rolled out the Honda 'e' EV, followed by its EV strategy launch the following year. Later, its chief executive revealed plans to launch 30 EV models until 2030 with an annual sales target of two million. Out of its US\$64 billion investment plan, US\$40 billion was earmarked for electrification. The company also outlined a plan for EVs and FCEVs to make up 40% of its global sales by 2030, and 100% by 2040.⁹⁶

Last year, Indonesia's Honda Prospect Motor announced plans for various hybrid variants to enter the market, although mention of a BEV launch has been limited. The company will likely begin global electrification efforts in North America, China and Japan, lining up a US\$7,000 mini-

⁹² Nikkei Asia. [Suzuki to launch EVs by fiscal 2025, in India first](#). 19 July 2021.

⁹³ The Economic Times. [Green drive: Maruti to phase out pure petrol vehicles in 10 years](#). 4 July 2022.

⁹⁴ Refer to discussions on hybrid vehicles in Appendix B for details.

⁹⁵ Honda. [FY2022 financial results presentation](#). 13 May 2022.

Nikkei Asia. [Could Honda's EV strategy be the cost cutter it needs?](#) 30 April 2022.

⁹⁶ Honda. [Sustainability report 2022](#). 2022.

Nikkei Asia. [Honda to invest \\$40bn in EVs as it aims to go all-electric by 2040](#). 12 April 2022.

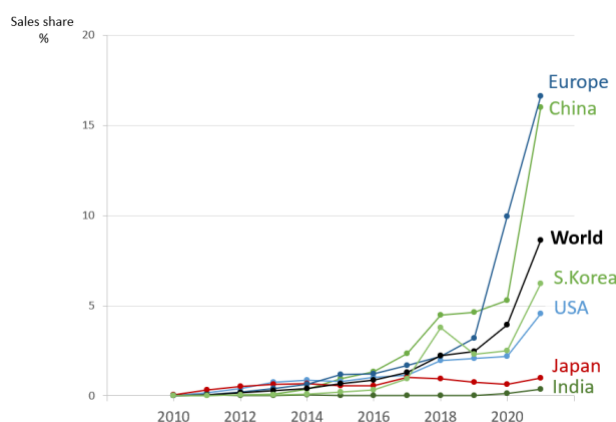
The Verge. [Honda will phase out gas-powered cars by 2040](#). 23 April 2021.

EV model for the Japanese market next year. The company has also said it will not release any new gasoline-powered models in China after 2030.⁹⁷

Japan: The History, and a Wakeup Call?

Given the Japanese automakers' lag in BEV adoption, it comes as no surprise that EV uptake in Japan has been very slow. BEVs and PHEVs *combined* comprised less than 1% of car sales in 2021. The shift in their attitude toward EVs is a very recent occurrence, and the lag is evident when comparing Japan with other developed markets (Figure 14).

Figure 14: Share of BEV and PHEV Sales in Selected Markets



Source: International Energy Agency.

In 2020, the Japanese government outlined a potential plan to ban sales of gasoline cars by the mid-2030s.⁹⁸ In addition to meeting the decarbonization goal, this aim was likely motivated by the worry that the country, which had historically led the automaking industry, was lagging behind in EV adoption.⁹⁹ The ambition met with opposition from the Japanese automakers. In September 2021, the Japan Automobile Manufacturers Association (JAMA) remarked on the

⁹⁷ Honda. [Honda sustainability report 2022](#). 2022.

Reuters. [Honda to begin selling mini-commercial electric vans in spring 2024](#). 7 December 2022.

⁹⁸ Reuters. [Japan may ban sale of new gasoline-powered vehicles in mid-2030s: media](#). 3 December 2020.

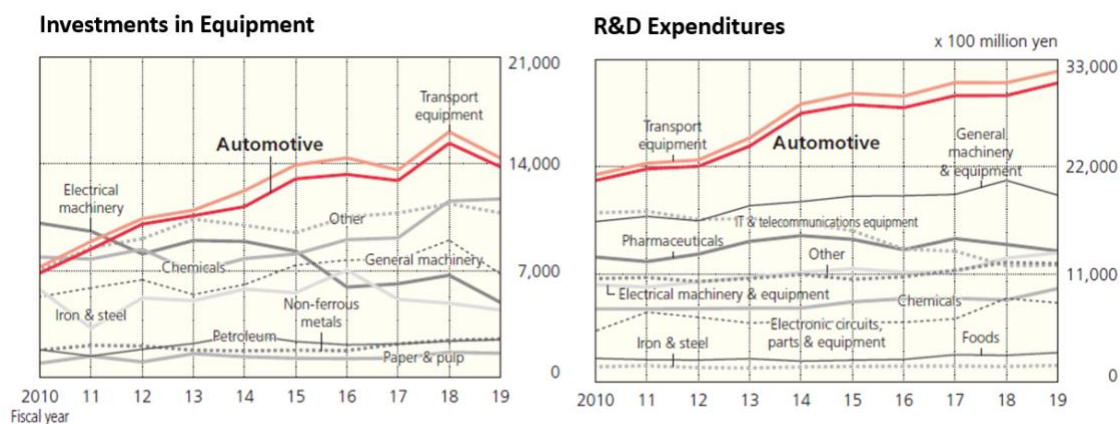
⁹⁹ The Wall Street Journal. [Japan to phase out gasoline-powered cars, bucking Toyota chief](#). 25 December 2020.

enormous role of the industry in the country's economy, which it said generated 5.5 million jobs, roughly 8% of the national workforce.¹⁰⁰

JAMA also placed emphasis on the benefits of electrified vehicles other than BEVs, such as hybrids and plug-in hybrids. Concerns from the automakers highlighted the likelihood that the adoption of EVs would take time, given constraints in resources, infrastructure readiness and consumer acceptance.

Concerns on supply constraints and demand for EVs are indeed challenges to be addressed globally. Nevertheless, the resistance of Japanese automakers will likely be influenced as well by the long history of Japan's investment in alternative powertrains besides the BEV and the rapid rise of BEVs elsewhere around the world.

Figure 15: Japan's Heavy Investment in Vehicles



Source: JAMA.

The Japanese auto sector has indeed constituted the largest and fastest growing expenditures among manufacturing industries in both equipment investment and R&D in the past decade, especially after 2013-15 (Figure 15). Details on the focus areas of these expenditures are limited, but the trend underscores the high stakes Japan is placing on its auto industry.

¹⁰⁰ Toyota Times. [JAMA chairman Akio Toyoda delivers new year message](#). 8 January 2021.

The Japan Times. [Collapsing pyramid: EV shift strikes at heart of Japan's auto sector](#). 7 November 2022.

Furthermore, the recency of the legacy automakers' shift to BEVs suggests that the investments and R&D expenditures could have leaned more heavily toward conventional ICEV or non-BEV alternatives.

The industry groups' pressure on the Japanese government to ease its position on ICEVs seemed to have worked, and in June last year, officials announced a plan to support hybrid vehicles and consider them on an equal footing with BEVs.¹⁰¹ It was a development which chimed with the Japanese government's pushback of the "zero-emission vehicle" targets initially planned by G7 countries by 2035.¹⁰²

Running in parallel to the debates on BEVs, in 2021 *foreign* EV sales in Japan were reported to have nearly tripled. While the quantities are small, this trend will likely have strong repercussions on how the Japanese auto giants view their future position on EVs.¹⁰³ The changing attitudes toward fully electric BEVs in Japan are starting to be felt, although counter views remain strong.

The strongest driver toward BEV adoption potentially comes from the rapid growth of this vehicle type in various economies, the increasing pressure on governments and stakeholders to aim for more ambitious decarbonization goals, and just as importantly, competition entry into the legacy automakers' domestic market.

The lagging of these legacy automakers on their home turf will likely have significant impacts on Indonesia's EV ambition, and on any other markets with similar aims. The picture is further complicated for countries with significant ICEV production capacity and entrenched supply chains, such as Indonesia.

¹⁰¹ Reuters. [After pressure from Toyota chief, Japan emphasized support for hybrids](#). 24 June 2022.

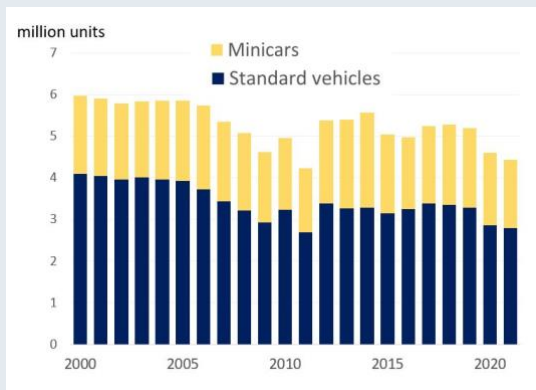
Reuters. [Toyota heads into AGM under pressure from pension funds over climate](#). 14 June 2022.

¹⁰² Reuters. [Japan pushes to remove zero-emission vehicle target from G7 statement, draft shows](#). 27 June 2022.

¹⁰³ Bloomberg. [Tesla escapes tiny niche position as Japan starts to embrace EVs](#). 7 February 2022.

Kei Minicars Versus the Chinese EV

The prominence of Japanese Kei minicars, which constitute 35% to 40% of car sales, indicates a conscious policy preference to promote smaller cars.



Source: [Nippon.com](#), [JAMA](#), [Japan Light Motor Vehicle and Motorcycle Association](#).

In contrast to their emphasis on the difficulties of BEV adoption in Indonesia, legacy automakers have been paying more attention to mini-EVs in their domestic market as Chinese competition enters.

In response to the threat, plans are underway to roll out electric cars with “a limited range but no change in price,” meant to be sold at around ¥900,000 to ¥1.6 million (Rp100 million to Rp180 million).

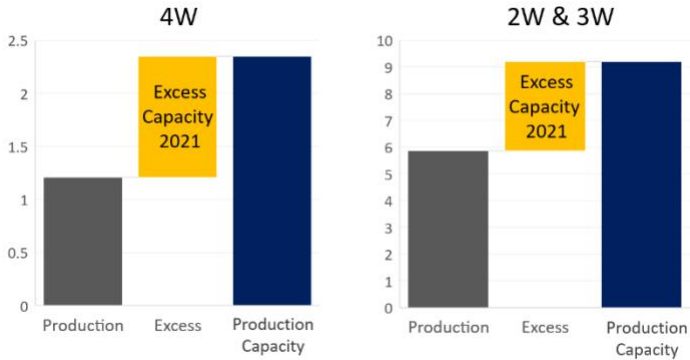
These discussions of low-cost EVs in Japan are the kind that the legacy automakers will be expected to bring to Indonesian shores and other emerging markets.

Excess ICEV Production Capacity in Indonesia

To automakers in Southeast Asia, Indonesia is a stronghold in terms of its consumer base and production, its manufacturing strength second only to Thailand. The country hosts sizable manufacturing capacity tied in with layers of multitier suppliers of auto parts. It reportedly provides 500,000 direct manufacturing jobs and another 1 million by association in the value chain.¹⁰⁴

The Ministry of Industry reported that in 2021, significant production capacity had not been fully utilized in the sector (Figure 16). Current production stands at 48% and 36% below the manufacturing capacities of 4Ws and 2Ws, respectively. It is also notable that the car industry never once exceeded 1.4 million units in the past decade, while the 2W segment never reattained its production peak of eight million, reached in 2011-14. The ministry also reported that the auto industry had cumulatively invested US\$9 billion in 4Ws and US\$640 million in 2Ws and 3Ws as of 2021.

Figure 16: Significant Excess Auto Production Capacity, 2021



Source: Ministry of Industry, IEEFA analysis.

The sluggishness of BEV adoption plans and the significant spare production capacity of these legacy players will likely disincentivize them to shift toward new investments. These heavily invested automakers betting on the ICEV industry are nevertheless *business risks*, and should be treated as such while not relegating other national strategic interests to a lower priority. The

¹⁰⁴ Toyota Indonesia. [Important role of automotive exports to industry and economy](#). 14 March 2022.

government and stakeholders will need to demand a better alignment of the automakers with national strategic interests, whether by deploying a more efficient vehicle fleet to curb oil demand growth, or by moving on to future EV industries.

As an automotive product-exporting country, Indonesia also faces the risk that neighboring countries would aspire to adopt EVs, which would eat into its ICEV export market base in a changing world. The EV took a decade to grow from practically zero to nearly 10% of global car market sales and the stakes are rising.

These trends complicate the picture for the legacy automakers amid Indonesia's own EV ambition, and stakeholders should pay close attention to how these automakers move forward.



The heavily invested legacy automakers betting on the ICEV industry are nevertheless *business risks*, and should be treated as such while not relegating other national strategic interests to a lower priority.

In the absence of a clear policy direction that provides well-planned push and pull incentives to make the switch from ICEVs, a shift from the business-as-usual approach will likely face strong resistance from the incumbents.

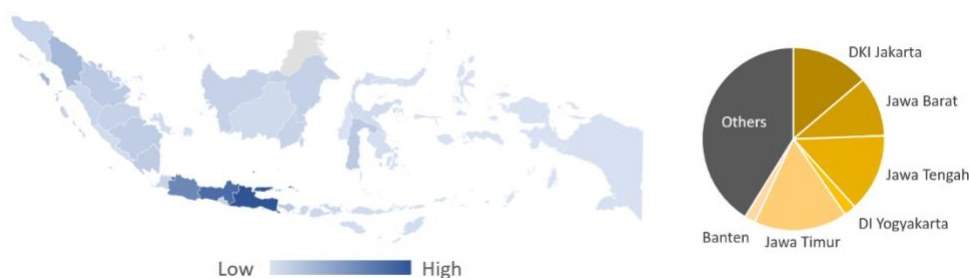
The Two-wheelers – A Closer Battle for Electrification

Uptake of the electric 2W (E2W) has gained traction, particularly in the Chinese and Indian markets. Electric 2Ws and 3Ws have been the cause of significant oil demand displacement, which is estimated at more than 1 million bopd in 2021, five times the oil demand displaced for passenger cars.¹⁰⁵

¹⁰⁵ BNEF. [Electric vehicle outlook](#). 2022.

E2Ws comprised 70% of total 2W sales in China and reportedly took up 3% to 4% in India during the first half of last year.¹⁰⁶ Indonesia's electric uptake is considerably slower despite its higher 2W ownership per capita. The share of E2Ws is rising, but with reported sales of roughly 3,100 units per month last year, this vehicle type hovers at just 0.7% of the two-wheeler market.¹⁰⁷

Figure 17: 2W and 3W Geographical Distribution, 2021



Source: BPS, IEEFA analysis.

As one of the largest 2W markets globally with annual sales of five to six million units, Indonesia was home to more than 121 million registered motorcycles in 2021.¹⁰⁸ As expected, Java island, being the most densely populated, dominates the market with close to 60% of all 2Ws nationwide (Figure 17).¹⁰⁹ As of July 2022, nearly 20,000 E2Ws were registered domestically, a long way from the 13 million targeted by the government for 2030.¹¹⁰

Honda and Yamaha practically own the Indonesian market with a combined share of close to 96%. The concentration of these two brands is among the highest compared to neighboring economies such as the Philippines, Thailand and Vietnam.¹¹¹

¹⁰⁶ Sales include motorcycles, scooters and mopeds. Market share in India as of September 2022.

BNEF. [Two-wheelers on a steeper path to zero emissions by 2050](#). 14 June 2022.

Bloomberg. [The EV revolution rides on two wheels](#). 20 April 2021.

Plug In India. [India: Sales of electric scooters and motorcycles: September 2022](#). 3 October 2022.

Autocar. [EVs account for 3.6 percent of two-wheeler sales in first half of 2022](#). 13 July 2022.

¹⁰⁷ Based on reported sales of 28,000 from January to September 2022 by the Association of Indonesia Motorcycle Industry (AISI).

Detik. [28 thousand electric motorbikes sold in Indonesia from January to September](#). 3 November 2022.

¹⁰⁸ BPS. [Developments of motor vehicles by type \(unit\), 2018-2020](#). 2021.

BPS figure likely includes 3Ws.

MarkLines. [The global market for motorcycles: India, China and ASEAN countries](#). 13 August 2019.

¹⁰⁹ BPS. [Population of motorized vehicles by type and province, 2021](#). Accessed on 21 December 2022.

AISI. [Scooter motorcycles still dominate Indonesian market](#). 8 August 2022.

¹¹⁰ AISI. [Development of electric motorcycle in Indonesia](#). 20 August 2022.

iNews. [In total there are 43 electric motorcycle brands in Indonesia, with 1,000 sales per month](#). 16 September 2022.

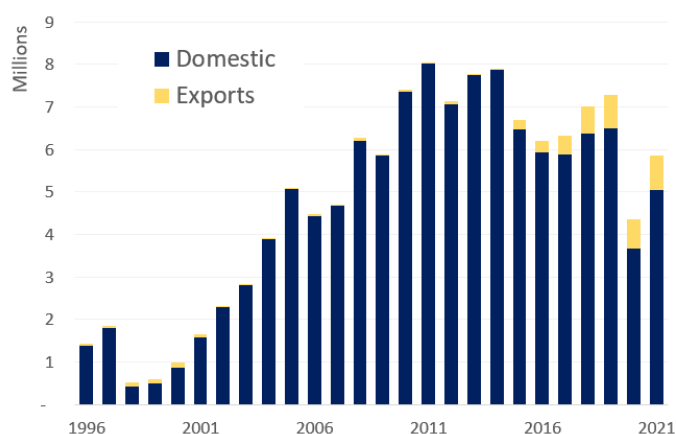
¹¹¹ ICCT. [Market analysis of two- and three-wheeler vehicles in key ASEAN member states](#). 2022.

Table 2: Market Share of 2Ws, 2020

Brand	Market Share	Non-exhaustive list of domestic entities	Ownership
Honda	77.5%	PT Astra Honda Motor	50% Astra International [Jardine Cycle & Carriage Ltd Singapore 50.11%] 50% Honda Motor Co., Ltd.
Yamaha	18.2%	PT Yamaha Indonesia Motor Manufacturing	Yamaha Motor Co., Ltd. — major consolidated subsidiary
Total Market Share	95.7%		

Source: AISI, ICCT, company reports.

It is notable that domestic 2W sales peaked in the early 2010s, giving rise to underused production capacity in recent years (Figure 18). Similar to the 4W segment, this spare capacity of the 2W industry could raise the stakes for legacy automakers as they orientate toward electrics.

Figure 18: Indonesia Domestic and Export Distribution of 2Ws

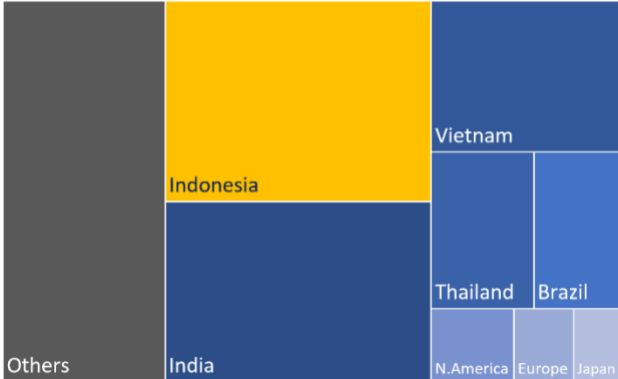
Source: AISI, Ministry of Industry.

On the automakers' home turf of Japan, uptake of electric 2Ws has also been slow. It would come as no surprise given that electrics sales by Honda, the leading brand, have largely been negligible. Annual 2W sales in the entire Japanese market typically hover below 400,000 units, a much smaller market in comparison to car sales of four to five million a year. Within a broader historical context, the Japanese 2W auto industry has long shifted to overseas as their domestic market was eroded from the annual sales peak of 2.5 to three million in the early 1990s.

Honda. Honda leads the global motorcycle business with Yamaha significantly behind.¹¹² The company chalked up global annual sales of 17 million last year, 90% of these in the Asian market, where Indonesia comprises 20% to 25% of global sales (Figure 19). Despite India being a much larger 2W market overall, Indonesia’s 4.8 million Honda 2Ws sold surpassed India’s 4.7 million in 2020.¹¹³ In term of unit sales, in 2020 and 2022 Indonesia was Honda’s largest motorcycle market globally.

While Honda’s global motorcycle business revenue of ¥2.2 trillion (US\$19.5 billion) paled in comparison to its automobile business’ ¥9.4 trillion (US\$83.6 billion) in FY22, the 14.3% operating margin of the motorcycle segment consistently outperforms its automobile sibling’s 2.5%.¹¹⁴ These factors taken together suggest that the Asian motorcycle segment, with Indonesia as a significant component, will likely remain a focus area for the company.

Figure 19: Honda Global 2W Sales, FY22



Source: Honda Motor.

In September 2022, the parent company Honda Motor announced plans to release at least 10 models of electric motorcycles worldwide by 2025. The company further aimed to reach annual sales of 3.5 million electric 2Ws by 2030.¹¹⁵ It is nevertheless interesting to note that its 15%

¹¹² Based on 2021 revenue estimates. Statista. [Motorcycles report 2022](#). 2022

¹¹³ Honda. [FY20, FY21, FY22 Financial results](#). 2020-2022. Fiscal year recorded from April to March of the following year. To give the historical context, Honda’s Hero joint venture in India was dissolved in 2011 after 26 years.

¹¹⁴ Honda. [FY22 Financial results](#). 13 May 2022. The currency exchange is based on Honda’s FY22 financial reporting.

¹¹⁵ The Japan Times. [Honda speeds up electric motorcycle shift to meet carbon neutrality goals](#). 14 September 2022.

electrification target by 2030 for the motorcycle segment is only half of the automobile's 30% target.¹¹⁶

Honda Indonesia introduced its PCX Electric on a business-to-business lease basis in 2019.¹¹⁷ Nearly three years later, as of October 2022, the motorcycle has not been launched on the market and no official price has been clearly disclosed. The slow progress of the electric product is seemingly not unique to the Indonesian market. Outside of China, where a number of Honda electric motorcycle models are on sale, the release of PCX Electric has also been very sluggish. Last November, Astra Honda Motor announced a plan to introduce at least seven electric 2W models in the next eight years.¹¹⁸

With a global E2W sales target of 3.5 million in 2030, it remains to be seen how many will be bound for Indonesia, and at what price range.

Yamaha. The motorcycle business accounted for 56% of Yamaha's ¥1.8 trillion (US\$16.5 billion) FY21 net sales.¹¹⁹ While the company released its first electric Passol scooter back in 2002, progress has been limited in wide-scale deployment of electric motorcycles so far. Similar to Honda, about a quarter of Yamaha's global motorcycle unit sales are based in Indonesia.¹²⁰

Last year, Yamaha released an electric 2W model in Europe and outlined a plan to test other E2Ws in several countries, including Indonesia, Japan, Malaysia, Taiwan and Thailand. The company also announced a target to release at least eight new electric motorcycle models in the global market by 2024.¹²¹

¹¹⁶ The 15% target is composed of "battery electric motorcycles and electric bicycles."

Honda. [Honda sustainability report 2022](#). 2022.

¹¹⁷ Lease rate reported at Rp24 million (US\$1,600) annually.

Astra Motor. Less-known facts about [Honda PCX Electric](#). 16 March 2021.

Honda. [Honda to begin lease sales of electric scooter 'PCX Electric.'](#) 29 November 2018.

¹¹⁸ Honda. [At IMOS, AHM announced strategic road map for electric motorcycle to 2030](#). 2 November 2022.

Kompas. [Honda U-Go electric scooter already registered in Indonesia](#). 10 January 2022.

Kontan. [Astra Honda Motor to announce electric motorcycle road map this year](#). 16 September 2022.

¹¹⁹ Yamaha. [Integrated report 2022](#). 2022.

Yamaha. [Land mobility: motorcycles](#). Accessed on 28 September 2022.

¹²⁰ Statista. [Motorcycles report 2022](#). 2022

¹²¹ Yamaha. [Integrated report 2022](#). 2022.

Yamaha. [Initiatives for 'climate change'](#). Accessed on 28 September 2022.

In a Nikkei article in April 2022, Yamaha disclosed a plan to introduce synthetic-fuel motorcycles to Asia while sounding caution on the full-electrification path. The company's president Yoshihiro Hidaka said: "We are not in such a hurry to launch all kinds of electric ones in the Asian region," noting that widespread adoption of EV could be difficult in some markets. The plan is likely directed at the use of bioethanol fuel blended with gasoline.¹²²

Yamaha's plan for a bioethanol blend does seemingly align with Indonesia's move toward biofuel. Indonesia is no stranger to biofuel, but maintaining its current biodiesel programme has proven to be a complex and costly exercise. The potential for developing a separate bioethanol blend for 2W applications is an open question.

Indonesian electric 2W uptake. Uptake of E2Ws in the Indonesian market has been supported by ride-hailing companies such as Gojek and Grab. These companies, driven by their emissions reduction targets, have been deploying a notable number of E2Ws through various schemes, such as leasing to their drivers.¹²³ Grab, which has an 8,500-strong electric fleet dominated by E2Ws, further aims to provide 14,000 EVs. In January last year, Gojek outlined a plan to have 5,000 EVs while also announcing it wanted to go 100% electric by 2030.¹²⁴ With 1.5 million existing driver partners, the company is poised to make a big change in E2W adoption.¹²⁵

It is noteworthy that compared to its Southeast Asian neighbors such as Vietnam, Indonesia is significantly lagging behind in E2W adoption.

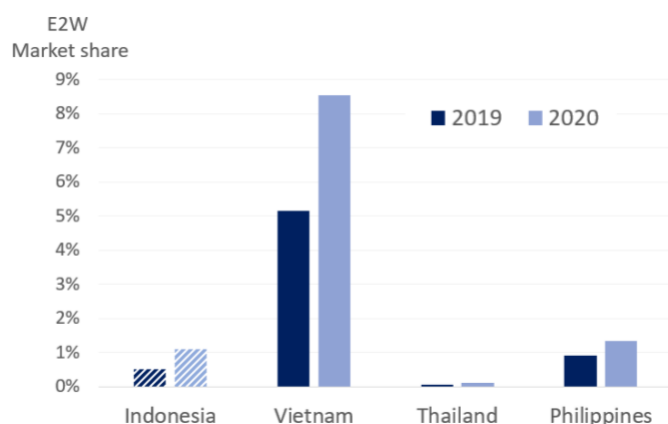
¹²² Nikkei Asia. [Yamaha Motor aims to bring biofuel motorcycles to Asia](#). 11 April 2022.

¹²³ Kumparan.

Kompas. [Here is the reason why Gojek electric motorcycles are rented out to driver partners](#). 20 January 2022.

¹²⁴ Katadata. [In partnership with a Taiwanese company, Gojek aims for 100% electric by 2030](#). 2 November 2021

¹²⁵ Electrum, GoTo. [GoTo recorded double the amount of Electrum electric order on Gojek platform](#). 7 June 2022.

Figure 20: Share of E2W Sales in Selected Southeast Asian Countries

Source: Adapted from ICCT, IEA, Motorcycles Data. See footnote.¹²⁶

E2W development by the legacy Japanese automakers has been slow, and this sluggish pace is pronounced compared with their 4W segment. Despite Japan's leading role in the global vehicle market, China has largely dominated development of the E2W and makes up a significant majority of the E2Ws sold globally.¹²⁷

Honda's plan to electrify 15% of its fleet by 2030 suggests that the ambition to go green does exist, but the low bar indicates it is far from aligning with the urgency for Indonesia to arrest its oil demand growth and get up to speed with the global decarbonization efforts. Positive moves from the legacy players are welcomed, but accelerated plans will be needed as new entrants are moving in.

The New Entrants

Four-wheelers. In March last year, South Korean automaker Hyundai announced completing the construction of its first manufacturing plant in Indonesia, providing a production capacity of up to 250,000 annually.¹²⁸ The plant is Hyundai's first facility to produce BEVs in Southeast Asia

¹²⁶ ICCT and IEA data is based on MotorCycles Data statistics, which may have a different boundary definition of 2Ws, hence a potential discrepancy with nationally reported figures. Note that Covid-19 imposed significant impacts on 2019-20 ICE 2W sales in these countries.

¹²⁷ BNEF. [Two-wheelers on a steeper path to zero emissions by 2050](#). 14 June 2022.

¹²⁸ Hyundai. [Hyundai news release](#). 16 March 2022.

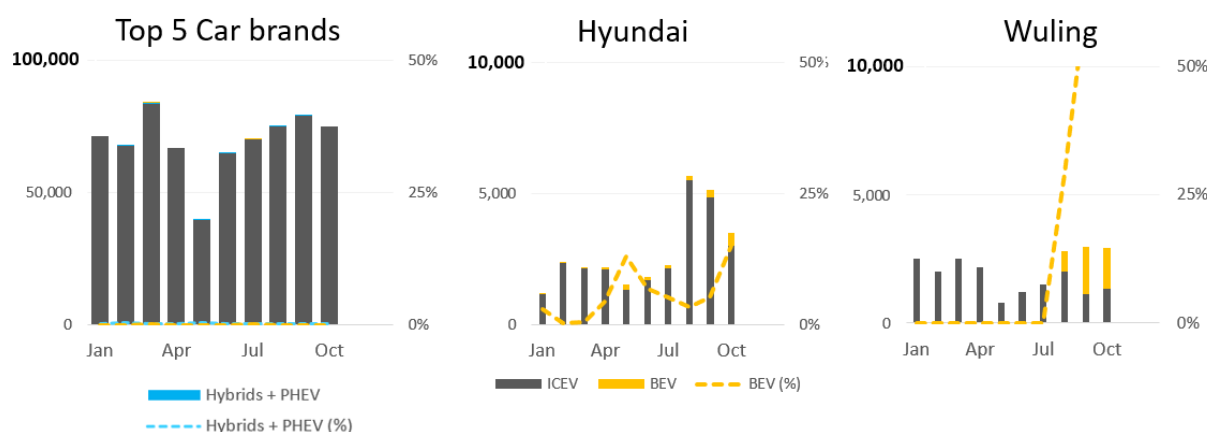
and involves ongoing plans to build a battery cell factory with LG Energy Solution that is aimed to be completed in the next few years.

The automaker has launched a number of EV models in Indonesia since 2020, mostly priced above US\$40,000.¹²⁹ In the middle of last year, it was reported to be planning for a lower-cost EV pitched at the US\$20,000 price range, with the European market in mind.¹³⁰

More recently in September, Wuling launched the minicar model Wuling Air EV in Indonesia. Production began in 2017 with a US\$700 million investment. It is claimed to be the first manufacturing site outside of China and has a planned capacity of 150,000 vehicles.¹³¹

SAIC Motor has achieved notable success in EV deployment on its home turf of China. The company reported that in 2021, sales of the SGMW mini electric vehicle reached 450,000, and that thereafter in 2022, cumulative EV sales exceeded one million units.¹³²

Figure 21: Vehicle Sales and Electrified Vehicles as Percentage of Sales



Source: Gaikindo, IEEFA analysis.

PT SGMW Motor Indonesia is a wholly owned subsidiary of SAIC-GM-Wuling Automobile (SGMW).¹³³ As of September last year, the company had eight ICEV models and one BEV in

¹²⁹ Hyundai. [Hyundai Indonesia price list](#). Accessed on 22 November 2022.

¹³⁰ Electrek. [Hyundai plans a new small electric car for less than \\$20,000](#). 20 July 2022.

¹³¹ General Motors (GM). [SAIC-GM-Wuling expands to Indonesia with \\$700 million facility](#). 29 September 2022.

¹³² SAIC Motor Corporation Limited. [Annual report 2021](#). 2022.

GM China. [SAIC-GM-Wuling's EV sales in China exceeded one million units](#). Accessed on 13 January 2023.

¹³³ Wuling Indonesia. [Company profile](#). Accessed on 29 September 2022.

Indonesia, where sales reportedly totaled 24,000 units in 2021.¹³⁴ While Wuling Air EV has its limitations given its focus on urban consumers, the launch and accompanying price tag of Rp250 million to Rp300 million (US\$15,000 to US\$20,000) put affordable EVs in the spotlight.¹³⁵

A number of other EV models from BMW, Lexus and Tesla have also reached Indonesia, albeit still on a much smaller scale relative to the EV market size, as at July last year, of 23,000.

Two-wheelers. AISI reported that the country had 43 E2W brands, of which three non-legacy players accounted for nearly three-quarters of the entire market: Viar, Gesits and Volta.¹³⁶ A number of models have reached the minimum 40% threshold on the use of locally sourced cost components, and the government aims to raise the bar to 60% by 2024-25. The ambition to require automakers to use more Indonesian-made parts, local labor and other domestic resources when sales is still hovering at a miniscule level, of sub-1%, relative to the 2W market size is also an open question.

Just as with the 4W segment, the complete absence of Honda or Yamaha in the E2W market further emphasizes the challenges Indonesia is facing in its plan to deploy 13 million E2Ws by 2030. For the new entrants to grow and displace the 97%-market-share behemoths is a question which must be openly addressed.

Conclusions

The premise of developing EVs on a natural transition path has been rolled out in a number of public discussions. Drawing a parallel to the transition from manual-transmission cars to automatic transmission, consumers, so the argument goes, will take decades to adopt the new technology. Such a statement has its merits, but completely dismisses the imperative that Indonesia will need to arrest its oil demand growth aggressively while decarbonizing road transport in its ambition toward net zero.

¹³⁴ Bisnis. [Rocketing sales, this is Wuling's bestselling car in Indonesia](#). 21 January 2022.

¹³⁵ Wuling. [Air ev](#). Accessed on 22 November 2022.

¹³⁶ iNews. [In total there are 43 electric motorcycle brands in Indonesia, with sales of 1,000 per month](#). 16 September 2022.

Given critical underinvestment in Indonesia's domestic oil industry, reliance on imported oil will grow with near certainty while increasing pressure on the trade balance and the risk of price volatility. Reconciling the 3% annual decline in oil production with the rise in fuel demand remains highly unlikely. Improvements in oil production would at best slow down the decline while the supply-demand gap continues to grow.

The push toward EVs is a strategic move which cannot rely on a natural progression. The government must take an assertive position. The following outlines a number of takeaways from examining how current market and legacy players will develop:

- **High market concentration in the auto industry can make or break Indonesia's EV ambition.** With 92% of the light 4W market held by five companies and 96% of 2Ws by two companies, the strength of these legacy players should not be underestimated. New market entrants will certainly grow, but the dominance of these legacy players should be addressed openly. Further, as more developed countries plan to phase out ICEVs, there is a potential spillover risk of legacy players attempting to entrench their ICEV products deeper in emerging markets.
- **Current focus on BEV growth plans relying on new entrants leaves a gaping detail: legacy automakers' electric plans for emerging markets remain muted.** While the legacy players have been paying more attention to full electrics, their plans lack clarity in addressing emerging markets such as Indonesia. This includes the battle to redefine electrified vehicles in the public mind. The discourse in the Japanese domestic market, though acknowledging that Indonesia is dominated by lower-cost cars which are difficult to electrify, is evolving on the topic of low-cost small EVs. In the last decade, the automotive segment has been leading Japan's industrial R&D expenditure, indicating the high stakes the country is placing on the sector. This paper has outlined the historical and current directions of the legacy automakers within various market contexts to help separate the facade from the likely directions of development.
- **Average fuel economy of new LDVs in Indonesia is lagging considerably, the symptom of a long history of inconsistent policy to curb oil demand.** Despite the government continually voicing concerns on oil imports and fuel subsidies, the absence of mandated fuel economy standards or measures to limit new vehicle growth in

congested areas suggests that assertive policy position has never been an option in the policy toolbox. The IEA has noted that Indonesia is among markets with the least improvement in fuel economy, using on average 40% more fuel in its LDVs than India. Biodiesel adoption remains an exception in the policy record, but one which is nevertheless supported at hefty cost.

- **The significant excess production capacities in both 4Ws (48%) and 2Ws (36%) will continue to haunt Indonesia's electric vehicle ambition.** Legacy automakers have invested heavily in production capacity for both domestic and export aims, resulting in considerable underuse thus far. It is also notable to consider that the country likely reached peak ICEV sales in the 2011-14 period. While acknowledging the significance of the industry to the national economy, regulation of the auto industry has had a long history of limited market restraint, and now it will need to better align with the country's strategic goals in managing its oil demand, reducing emissions and meeting aims to build a domestic EV market.
- **Indonesia is potentially lagging behind its Southeast Asian neighbors in EV adoption.** Competition for adoption of electric 4Ws with Thailand is tight, while Vietnam has been leading E2W usage by a significant margin. EV sales have been rising recently, but more effort will be needed to meet the ambitious targets outlined by the government.
- **Push and pull initiatives in other markets.** China, India and other markets rely on both push factors of promoting EV-linked incentives, and pull factors of restraining ICEVs, such as through fuel economy. Current initiatives in Indonesia have largely focused on the development of *new* markets and production capacity, while leaving the existing auto industry more or less untouched. It is also illustrative that fuel economy plans are mostly absent from Indonesia's long-term decarbonization strategy or NDC, opting to focus on EVs and biofuel instead.

In order to seriously embark on its EV ambition, Indonesia will need to address the giants in the room at the center of discussion. The incumbents will not move on their own where sufficient policy direction is wanting, and when they do not move, resistance should be expected.

Recently, regulators have made positive moves toward progressive taxation of vehicles based

on emissions and fuel consumption, and the impact remains to be seen. The government and stakeholders should pay close attention to the following:

- **Active policy is necessary to restrain ICEV fuel demand growth through mandated targets and clearer policy commitments.** Mandated targets such as aggressive **fuel economy standards** should be set up immediately. This will help pressure the legacy automakers to better align their production toward more efficient vehicles. Imperfections of the policy model should be evaluated comprehensively to encourage effective adoption in the market. **Longer-term phaseout plans for ICEVs, coupled with realistic near to mid-term targets**, should be seriously considered to provide a stronger signal that Indonesia's BEV ambition is real. Embedding the directions into high-level policy documents, including **Indonesia's Nationally Determined Contribution** commitment, would strengthen the signal.
- **With their long history in Indonesia, legacy players need to better align with the country's need to decouple from oil demand growth and reduce emissions.** Their industrial and market prowess could play an important role in electrifying future road transport in many emerging markets, which face similar challenges to Indonesia. Numerous studies have converged on the emission reduction benefits of BEVs even in coal-dominant power grids, so their efforts are key to running in parallel to the wider effort of greening the power grid.
- **The government can consider facilitating legacy automakers transition through incentives and access to resources under strict conditions.** These should be conditional upon the automakers' alignment with Indonesia's electric plan. A sidestep toward hybrid should also be scrutinized closely as it could potentially lead to a different pathway when unmanaged.
- **The government should pay attention to *real-world* fuel savings and emission reduction benefits of the various electrified vehicles in considering its support.** Experiences in other markets have shown that *claimed* emission reduction benefits can differ significantly from real-world use. The European Union is reported to be reconsidering the "low CO₂" emissions status of PHEV adoption. There *will* be room for hybrids, but a careful look at PHEV challenges is also warranted even as it aligns with

Indonesia's electric ambitions. Wider adoption of hybrids could leave the existing ICEV industry intact for longer while potentially lengthening the transition to BEVs. Adoption of a single BEV shuts out oil demand for that vehicle today, while hybrid adoption – albeit of higher efficiency and lower emissions – means that oil demand for the vehicle will stay throughout its lifetime of 12 to more than 18 years.

- **Domestic automaker entities need to play an active role in shaping their principal views of EV transition in Indonesia.** The leverage by which the Indonesian market can influence the major automakers will likely vary by segment. Greater market influence should be expected in 2W segments in which Indonesia holds a significant market share, but leveraging access to domestic EV-related mineral resources should also figure in the picture. Domestic automaker entities and their related affiliates should play a proactive role in bridging between Indonesia's overarching electric ambition and the legacy automakers' direction.

Without open addressing of these market concerns, the public will raise serious questions about whether the current BEV buildout ambition is aimed at advancing the domestic transport sector or targeted largely for export.

The Japanese legacy automakers are standing at a critical juncture in the path to a net-zero future. Their concerns on supply-chain constraints and market readiness for all-out EV adoption remain salient, and most of them are leaning toward slower adoption, a scenario that does not align well with Indonesia's ambition. Nevertheless, their experience in the auto industry places them in a leveraged position to alter the course of many countries' transport sector away from the reliance on imported and volatile energy resources.

EV adoption should not be perceived as an overarching solution for the transport sector, where public modes of travel will remain key to addressing both energy demand and emissions. In the meantime, however, the legacy automakers' direction for the future should not be left unchecked.

Appendix A

EVs, Air Pollution and CO₂ Emissions

Air pollution has always been a key consideration behind the adoption of vehicle emissions regulations such as the Euro standard, and EV adoption presents a groundbreaking opportunity to address the concentration of ICEV pollutants such as nitrogen oxides (NO_x) and particulate matter (PM).¹³⁷ Just like the rollout of “Switch Delhi” and China’s program to push EV adoption, concerns about pollution are increasing for urban sprawl such as Jakarta’s, whose air quality challenges are well documented.¹³⁸

Shifting emissions from the tailpipe to power plants? From the perspective of GHG emissions, a number of comprehensive studies concluded that BEV adoption could reduce life-cycle emissions by 10% to more than 60% compared with its ICEV peers.¹³⁹ Life-cycle emissions take into account all the associated emissions of a product through its useful lifetime, from material sourcing to manufacturing, and provide a more detailed view beyond tailpipe emissions figures when comparing across vehicle options.

A number of institutions have performed comprehensive comparisons, among them ICCT, IEA and T&E. All converged on the conclusion that the life-cycle emissions of BEVs were lower than ICEVs to varying degrees, *even in electricity grids with a high proportion of coal power*.¹⁴⁰

In evaluating emissions reductions, it is important to note the assumptions involved, such as regarding grid emissions and vehicle manufacturing. IEA’s emissions scenario presented a high

¹³⁷ Particulate matter includes PM_{2.5} ultra-fine particulates. A rise in SO₂ emissions may be expected from the associated coal power generation. This, however, will need to be placed in the context of the small impact of EV adoption on electricity use, even at a relatively rapid EV uptake.

European Environment Agency. [Electric vehicles and the energy sector – impacts on Europe's future emissions](#). 2016, updated in 2021.

¹³⁸ Tempo. [Awful Jakarta air quality sits atop IQAir list](#). 20 June 2022.

Antara. [Jakarta's air quality not the worst in the world: Minister](#). 20 June 2022.

¹³⁹ Based on a number of assessments by the European Federation for Transport and Environment (T&E), ICCT and IEA outlined in this section. Refer to individual charts for variations in estimates.

¹⁴⁰ For T&E, the data presented is based on CO₂ emissions.

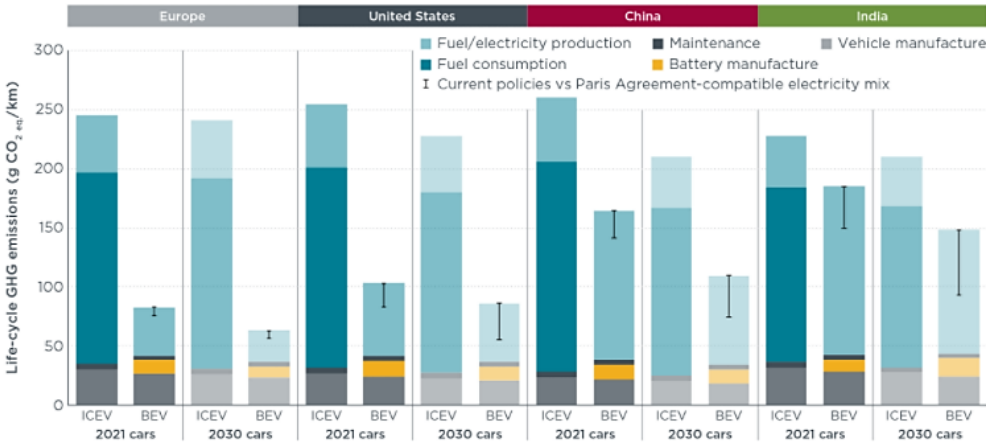
ICCT. [A global comparison of the life-cycle greenhouse gas emissions of combustion engine and electric passenger cars](#). 20 July 2021.

IEA. [Comparative life-cycle greenhouse gas emissions of a mid-size BEV and ICE vehicle](#). 2022.

T&E. [Update – T&E's analysis of electric car life-cycle CO₂ emissions](#). 2022.

emissions range for grids with 800 gCO₂/kWh emissions, a comparable figure to Indonesia’s roughly 750 gCO₂/kWh.¹⁴¹ Some of the studies made the assumption that grid emissions would be static, while others assumed that grid emissions would decrease over time with increasing renewable energy adoption. These studies also outlined the different emissions incorporated in the production process of BEVs. Despite the various assumptions, the conclusions pointed in a similar direction.

Figure A1: Comparison of Life-cycle GHG Emissions



Source: ICCT. See footnote.¹⁴²

IEA emphasized that “although GHG emissions benefits could be partially eroded by future design aspects, such as an increasing battery size or alternative battery chemistries, it is estimated that overall life-cycle benefits of EVs will continue to increase as the energy system decarbonizes, widening the gap between life-cycle GHG emissions of EVs and ICE vehicles.”¹⁴³

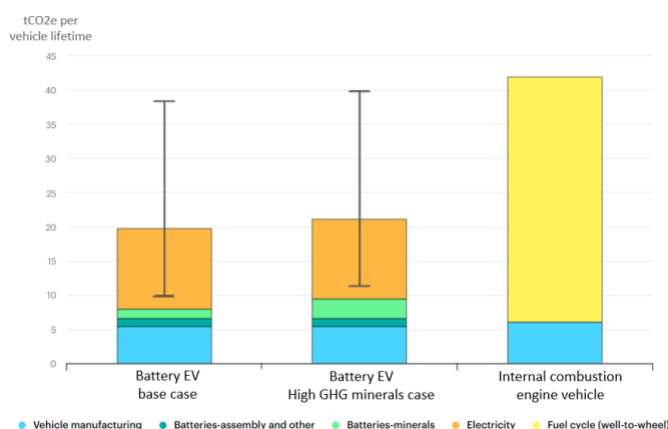
The role of electrics is just as pronounced in the 2W segment. Nearly half of the emissions reduction in China’s EV adoption comes from the electric 2W and 3W segment.¹⁴⁴ In the

¹⁴¹ 2019 grid emission intensity.
 IEA. [Enhancing Indonesia’s power system](#). 2022.
¹⁴² Life-cycle GHG emissions of average medium-size gasoline ICEVs and BEVs registered in 2021 and projected to be registered in 2030. The error bars indicate the difference between the development of the electricity mix according to stated policies (the higher values) and what is required to align with the Paris Agreement.
 ICCT. [A global comparison of the life-cycle greenhouse gas emissions of combustion engine and electric passenger cars](#). 20 July 2021.
¹⁴³ IEA. [Global EV outlook 2022](#). 2022.
 IEA. [The role of critical minerals in clean energy transitions](#). 2021.
¹⁴⁴ IEA. [Global EV outlook 2022](#). 2022

Indonesian context, IEA estimated that the energy efficiency gains from the use of E2Ws could cut emissions by more than half, a crucial reduction considering the sizable 120 million-strong 2W fleet domestically.¹⁴⁵

In IEEFA’s view, it is important not to consider emissions too narrowly when evaluating the benefits of EV adoption *today*. Vehicle stock on the road will take considerable time to change given the long useful life of vehicles, which according to the global average can last anywhere between 12 and more than 18 years.¹⁴⁶ It is nevertheless important to emphasize that realizing the full benefit of electric vehicles in emissions reduction require Indonesia to maintain a strong commitment toward greening its power grid.

Figure A2: Comparison of Mid-size Vehicles’ Life-cycle Emissions



Source: IEA. See footnotes.¹⁴⁷

¹⁴⁵ IEA. *Enhancing Indonesia’s power system*. 2022.

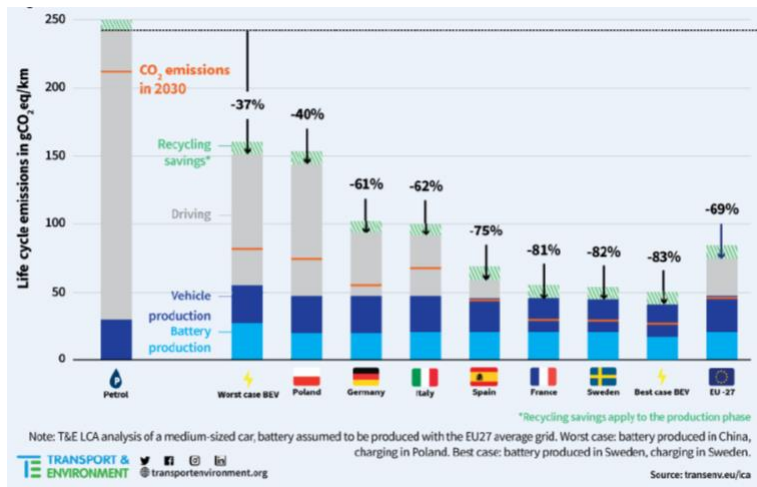
¹⁴⁶ Kyushu University. *In the race to reduce car emissions, don’t forget longevity*. 24 September 2021.

Held, M. et.al. *Lifespans of passenger cars in Europe: empirical modeling of fleet turnover dynamics*. 25 January 2021.

ICCT. *A global comparison of the life-cycle greenhouse gas emissions of combustion engine and electric passenger cars*. 20 July 2021.

¹⁴⁷ The “High-GHG minerals” case assumes double the GHG emission intensity for battery minerals (70 kgCO₂-eq/kWh compared to 35 kgCO₂-eq/kWh in the base case) while other assumptions are the same. The values are for a vehicle manufactured on today’s assembly lines, assuming dynamic global average grid carbon intensity in the SDS, including transmissions, distribution and charging losses, weighted for mileage decay over a 20-year lifetime. The ranges shown for the BEV represent cases of charging with a static low-carbon (50 gCO₂-eq/kWh) and high-carbon (800 gCO₂-eq/kWh) electricity mix. Vehicle assumptions: 200,000km lifetime mileage; ICE fuel economy 6.8 Lge/100km; BEV fuel economy 0.19 kWh/km; BEV battery 40 kWh NMC622. NMC622 = nickel manganese cobalt in a 6:2:2 ratio. Lge = liter of gasoline-equivalent.

Figure A3: BEV Life-cycle CO₂ Emissions in EU



Source: T&E. Poland has a coal-power generation mix of 70% to 80%.

The convergence of conclusions on BEV emission reduction benefits means that electrification will likely continue to spearhead road transport decarbonization. Restricting the discussion to today's grids provides a conservative estimate but does not reflect longer-term *parallel ambitions* of grid decarbonization. Postponing the push to EVs will only further delay consumer adoption and the establishment of associated supply chains and, just as importantly for Indonesia, tolerate unrestrained growth of imported oil.

Appendix B

The Battle to Redefine Electrified Vehicles – the Various Hybrids

The push to support electrified vehicles beyond BEVs has not registered strongly with the Indonesian government, but the presence of various hybrids – mild hybrids (MHEVs), hybrids (HEVs) and plug-in hybrids (PHEVs) – in the domestic market is slowly rising. While hybrid adoption in Indonesia is miniscule, this section outlines notable facts to help readers understand developments in the hybrid segments in relation to the legacy automakers.¹⁴⁸

A hybrid car is traditionally defined as one powered by a combination of internal combustion engine and electric motor. The electric motor allows the car to burn less fuel. It is a self-contained system with no external charging ability because the battery is charged as the car is driven in ICE mode. The concept started to take off with the introduction of the Toyota Prius in 1997, the first mass-produced hybrid passenger vehicle.¹⁴⁹ In Indonesia, hybrid cars were first introduced circa 2009.¹⁵⁰

Multiple iterations of the hybrid car were developed in the years that followed, including the PHEV (Figure B1). Fuel efficiency ratings of the HEV also reportedly improved from 28.0km/liter in the first-generation Prius to 40.8km/L in its fourth generation; the fifth generation was released last year. It should be noted that the fuel efficiency rating is typically based on a number of different “test cycle” methodologies, which may differ from real-world use.¹⁵¹

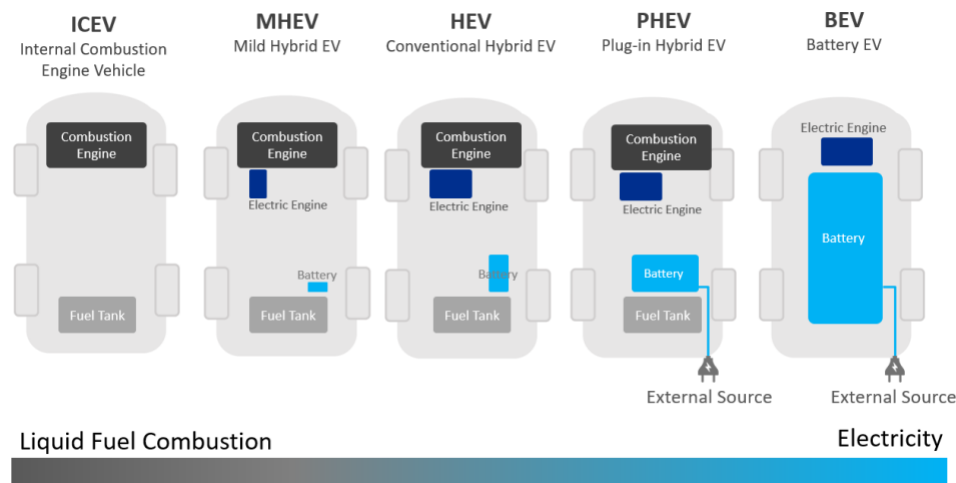
¹⁴⁸ The hydrogen-based FCEV is outside the scope of this paper.

¹⁴⁹ Toyota. [The evolution of the Prius](#). 4 August 2017.

¹⁵⁰ Gaikindo. [Indonesia challenges EV development](#). 25 November 2020.

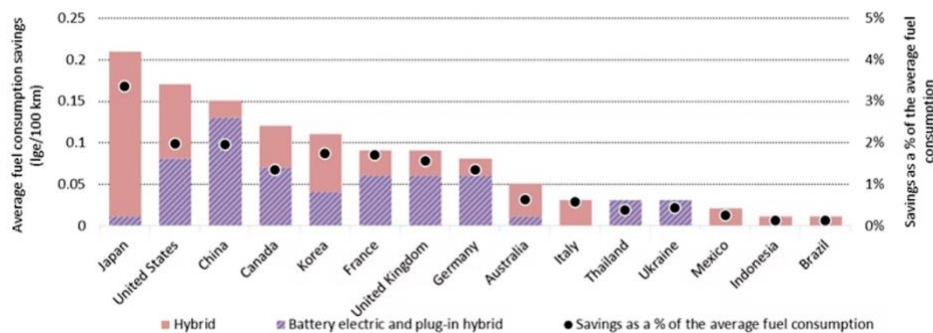
¹⁵¹ Test cycle refers to the different protocols used in emissions tests. The first-generation Prius was tested with the 10-15 test cycle, and the fourth generation with the Japanese JC08 test cycle.

Figure B1: Non-Exhaustive List of EV Variants



Source: IEEFA, adapted from Midtronics.

Figure B2: Comparison of Fuel Savings



Source: IEA.¹⁵²

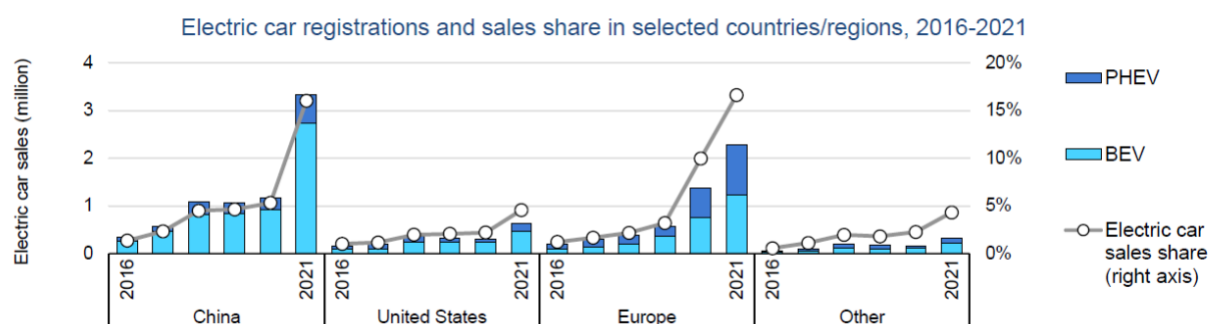
The global hybrid market has historically been concentrated in Japan and the U.S. Support for conventional hybrids (HEVs) in Japan is expected, given the country's long history with hybrids and its significant role of fuel savings in the market, as seen in Figure B2, which also outlines the different path taken by the Japanese compared to the rest of the world, which leans much more toward BEVs and the plug-in hybrid, PHEV.

¹⁵² IEA. Savings are calculated by substituting electrified vehicles, in each market segment and power class, by vehicles characterized by the average fuel use of the market segment and power class. Based on IEA elaboration and enhancement for broader coverage of IHS Markit database 2018.

The **plug-in hybrid** is a hybrid variant equipped with a larger battery and the key ability to plug into an external power source and charge the battery. While the HEV is ultimately powered by gasoline or diesel fuels, the PHEV's ability to be charged from an external source opens up the option to power it with greener electricity.

In contrast to a full BEV, whose average battery capacity is 55kWh, the PHEV is equipped with a smaller 14kWh battery.¹⁵³ This translates into a shorter distance that the PHEV can cover in electric driving mode, typically in the 30km to 60km range, compared to BEVs.

Figure B3: PHEV Sales on the Rise



Notes: The countries/regions shown are the world's largest EV markets and are ordered by size of the total car market (i.e. all powertrains) in the upper half of the figure and by sales share of electric cars in the lower charts. Acronyms and geographic groupings are defined in the Notes of the previous figure. Regional EV registration data can be interactively explored via the [Global EV Data Explorer](#).

Sources: IEA analysis based on country submissions, complemented by [ACEA](#); [CAAM](#); [EAFO](#); [EV Volumes](#); [Marklines](#).

Source: IEA.

It is notable that PHEV sales have been rising, particularly in Europe since 2020 (Figure B3). Market share of the vehicle type rose significantly from 1.9% in 2019 to 9.1% in 2020, largely due to the EU's strict CO₂ emissions target necessitating automakers to find ways to adjust their average vehicle fleet emissions, supported by government incentives.¹⁵⁴

Emission reduction benefits. Studies have indicated that the use of HEVs and PHEVs offers an opportunity to reduce both fuel consumption and emissions. T&E has reported that hybrids offer 21% (HEV) to 26% (PHEV) of life-cycle CO₂ emission reductions when charged by the EU power grid. In contrast, BEVs reduce emissions by 37% in a worst-case scenario of being charged in a

¹⁵³ IEA. [Global EV outlook 2022](#). Page 138. 2022.

¹⁵⁴ T&E. [Battery electric cars climbed to 9% of sales in 2021, driven by EU targets](#). 2 February 2022.

grid that has a 68% to 80% coal mix, and by 69% when charged from an EU grid.¹⁵⁵ Indonesia's coal power mix in 2021 was around 67% and is projected to decline to 60% in 2030.¹⁵⁶

There are several notable points. Firstly, although HEVs are more fuel efficient, they are ultimately charged through fossil fuel combustion, with limited upside potential to decrease emissions, hence the strong opposition in classifying them as green vehicles. Secondly, PHEVs have been under the spotlight as real-world assessment has indicated that the claimed emission reduction benefits are highly conditional upon particular user behaviors, such as a regular charging habit, which are apparently less common.

An assessment report by ICCT suggests that privately owned PHEVs “emit three times more CO₂ than recorded in official tests,” while company cars performed even worse with only 11% to 15% of the traveled distance driven electrically. In June last year, T&E reported ongoing developments in the EU to reassess the “low-CO₂” status of PHEVs.¹⁵⁷ While the EU standard for low-CO₂ status comes with quite a stringent emissions standard of 50 gCO₂/km or less, these developments highlighted the importance of a comprehensive evaluation of the vehicle requirements included in government incentive schemes.

Hybrids offer the partial benefits of having an electric car while also posing the challenge of having two powertrains. The smaller battery of hybrids, it is argued, would lessen reliance on battery minerals compared to BEV adoption. On the other hand, increased complexity and reduced efficiency due to the additional powertrain weight will need to be taken into consideration as well.

¹⁵⁵ BEV use in the worst-case scenario is based on Polish electricity generation as a representation of a high-coal electricity mix. IEA reported a coal mix of 68.5% in 2020 and 79.7% in 2021. T&E's worst-case scenario assumes BEV batteries are produced in China with a bigger carbon footprint.

IEA. [Poland 2022 energy policy review](#). 2022.

T&E. [Update – T&E's analysis of electric car life-cycle CO₂ emissions](#). 2022.

¹⁵⁶ MEMR. [Dissemination of RUPTL PT PLN 2021-2030](#). 2021.

¹⁵⁷ Reuters. [European Union to toughen emissions test for hybrid cars – sources](#). 4 February 2022.

T&E. [Plug-in hybrids to lose 'low-CO₂' status as EU reassesses how green they really are](#). 30 June 2022.

ICCT. [Real-world usage of plug-in hybrid vehicles in Europe](#). June 2022.

Further complicating the topic is the presence of hybrid varieties, including the mild hybrid, which has a significantly reduced hybrid capability. All these factors should be considered to avoid glossing over the details of the various hybrids.¹⁵⁸

Figure B4: Different Types of Hybrids

Type of hybrid vehicles	Battery type	HV battery voltage	Electrical power	CO ₂ reduction potential
Micro hybrid	Lead-acid	12V	<5 kW	-3%
Mild hybrid	Li-ion	24-48V	5-20 kW	up to 15%
Full hybrid	Li-ion	200-400V	20-80 kW	15-30%

Notes: The CO₂ reduction potential refers to chassis dynamometer type-approval tests, not real-world driving. Sources: Englisch & Pfund (2018), Guzzella & Sciarretta (2013), Herbel (2014).

Source: ICCT. Refer to paper for detailed definitions.

In summary, the HEV has been on the market for more than two decades, yet the global market uptake remains limited. Proponents of hybrids argue that it allows emissions and fuel savings to be realized earlier, a particularly important point for countries which expect a struggle to build adequate charging infrastructure. While improvements have been made, critics point to the limited benefits the hybrids can bring, to both emissions and fuel consumption.

An open question is whether the move to hybrids is worthwhile enough to be considered green, or whether it will become a sidetrack on the path to full electric car adoption.

The battle on redefining electrified vehicles is taking place across different markets; some are meant to secure a green status to ensure market access, and others to gain government incentives. Currently, the Indonesian government's support of hybrid vehicles is relatively limited. Discussions are ongoing, however, to introduce hybrid incentives in parallel to the BEV incentives. The Ministry of Industry has mentioned plans to provide subsidies of Rp80 million (US\$5,200) per BEV and Rp40 million (US\$2,600) per hybrid car.¹⁵⁹

¹⁵⁸ ICCT. [Mild-hybrid vehicles: A near term technology trend for CO₂ emissions reduction](#), 2022.

¹⁵⁹ CNBC Indonesia. [These cars can get subsidies although they are not fully electric/hybrid](#), 30 December 2022.

Figure B5: Ministry of Industry's Views on Emissions Reduction Options

Technology	CO2 Reduction	Add. Price	Challenges	
xEV	HEV	49%	LOW	-
	PHEV	74%	HIGH	OTR Price and charging station
	BEV	100%	HIGH	OTR Price and charging station
	FCEV	100%	HIGH	OTR Price, Hydrogen Station, Hydrogen Price
CNG Vehicle	20-30%	LOW	CNG specification, CNG station	
Flexy Engine Vehicle (Biofuel)	100% (carbon neutral)	LOW	Biofuel specification	

Source: Ministry of Industry.

It is interesting to note that the Ministry of Industry considers HEV adoption as low cost with a significant CO₂ emission reduction of 49%, a figure notably higher than other assessments (Figure B5).¹⁶⁰ Although these figures are likely to be “tailpipe emissions” instead of life-cycle emissions, the claim of high emissions reductions further emphasizes the need for comprehensive assessment on the costs of various subsidies against the promised benefits.

Figure B6: New Registrations of Passenger Cars in Japan

In vehicle units

Year	Hybrid vehicles	Plug-in hybrid vehicles	Electric vehicles	Fuel cell vehicles	Clean diesel vehicles	Total
2008	108,518	0	0	0	0	108,518
2009	347,999	0	1,078	0	4,364	353,441
2010	481,221	0	2,442	0	8,927	492,590
2011	451,308	15	12,607	0	8,797	472,727
2012	887,863	10,968	13,469	0	40,201	952,501
2013	921,045	14,122	14,756	0	75,430	1,025,353
2014	1,058,402	16,178	16,110	7	78,822	1,169,519
2015	1,074,926	14,188	10,467	411	153,768	1,253,760
2016	1,275,560	9,390	15,299	1,054	143,468	1,444,771
2017	1,385,343	36,004	18,092	849	156,162	1,596,450
2018	1,431,856	23,230	26,533	612	176,725	1,658,956
2019	1,472,281	17,609	21,281	685	175,145	1,687,001
2020	1,346,841	14,680	14,574	761	147,139	1,523,995
2021	1,434,719	22,677	21,658	2,464	149,298	1,630,816

Source: JAMA.

Considering that PHEV sales in Japan comprised a mere 23,000 units in 2021, the legacy automakers are seemingly placing their bets on the HEV. It remains to be seen whether they will lean more toward PHEVs or even BEVs in the future. Ultimately, going hybrid will likely leave existing ICEV investments largely untouched for longer and lengthen any transition to BEVs.

¹⁶⁰ T&E. [Update – T&E's analysis of electric car life cycle CO₂ emissions](#). 2022.

Goldman Sachs. [New era in CO₂ regulation: EVs to be tested across life cycle, not only on running performance](#). 5 December 2019.

Despite the significance of Japanese legacy automakers, multiple forces are at play that will significantly influence the future of hybrids. Firstly, aggressive decarbonization ambitions are on the rise in developed states, including the EU's plans to phase out new HEVs and potentially exclude PHEVs as low-CO₂ vehicles.¹⁶¹ Secondly, and perhaps more importantly, there is the global rise of the BEV, bolstered by China's persistence in paving the way for a BEV future.

¹⁶¹ European Parliament. [EU ban on the sale of new petrol and diesel cars from 2035 explained](#). 3 November 2022.
Reuters. [European Union to toughen emissions test for hybrid cars – sources](#). 4 February 2022.

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