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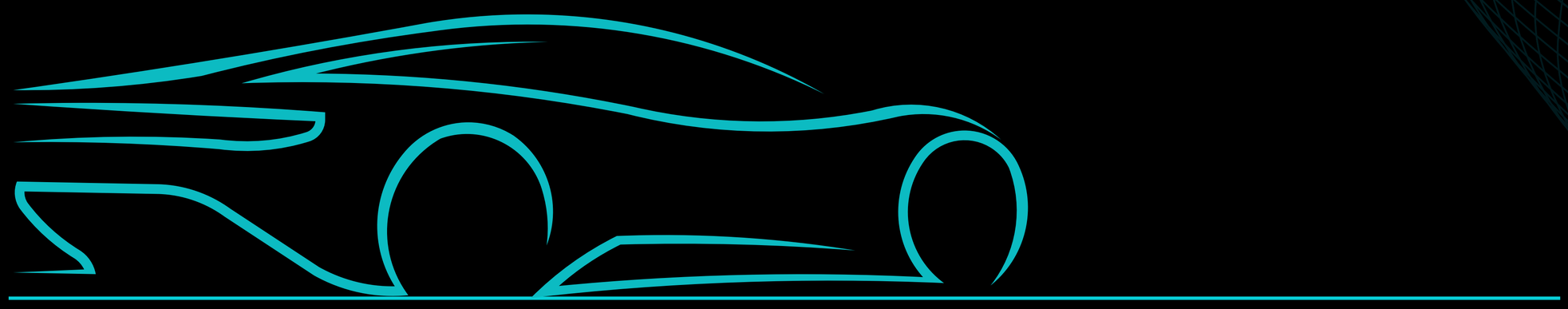
Electric Vehicles race in ASEAN

Historic chance for global Auto players

The rise of the ASEAN countries in the global EV value chain warrants a historic opportunity for international OEMs and suppliers.
This Whitepaper highlights opportunities arising within the world’s 5th largest economy and discusses strategies to capture them, given the still evolving legal and industry framework.



Executive Summary

Navigating Southeast Asia's EV Boom:

Opportunities and Challenges in the ASEAN Electric Vehicle Value Chain

The rapid evolution of Southeast Asia’s electric vehicle (EV) landscape presents strong opportunities for international OEMs and suppliers. This whitepaper explores key trends, challenges, and strategic opportunities across the region’s EV value chain—highlighting market growth, regional differences, and ecosystem development.

Thailand remains the most advanced automotive market in ASEAN, with over 2,300[1] suppliers and robust infrastructure for both combustion and electric vehicles. Its supportive policies and major EV investments have secured its leadership. However, Indonesia is emerging as a strong contender, capitalizing on its rich nickel reserves—critical for EV batteries—and investor-friendly policies, including tax holidays and import duty exemptions, to attract FDI from countries like China.

Vietnam is also progressing rapidly, with domestic EV OEM VinFast gaining momentum. Government incentives are drawing interest from global OEMs, including Volkswagen-owned Skoda, which is building a major plant in northern Vietnam.

These three nations are becoming central players in ASEAN’s EV growth, each contributing in unique ways.

EV demand in the region is set to rise sharply through 2035, fueled by government incentives, growing environmental awareness, and affordable EV models. However, this boom reveals a supply gap. Imports will be needed in the near term while local production scales.

ASEAN governments are actively promoting EV production with incentives targeting both consumers and manufacturers. These efforts are strengthening a full-spectrum value chain—from raw materials to batteries and assembly—creating a more integrated EV ecosystem.

In summary, Southeast Asia’s EV sector is set for strong growth, offering wide-ranging opportunities for suppliers, OEMs, and aftermarket players. This whitepaper provides valuable insights for international companies looking to enter and grow in this dynamic market.

Table Of Contents

The Electric Vehicles Race in ASEAN

Navigating Supply Shortfalls:

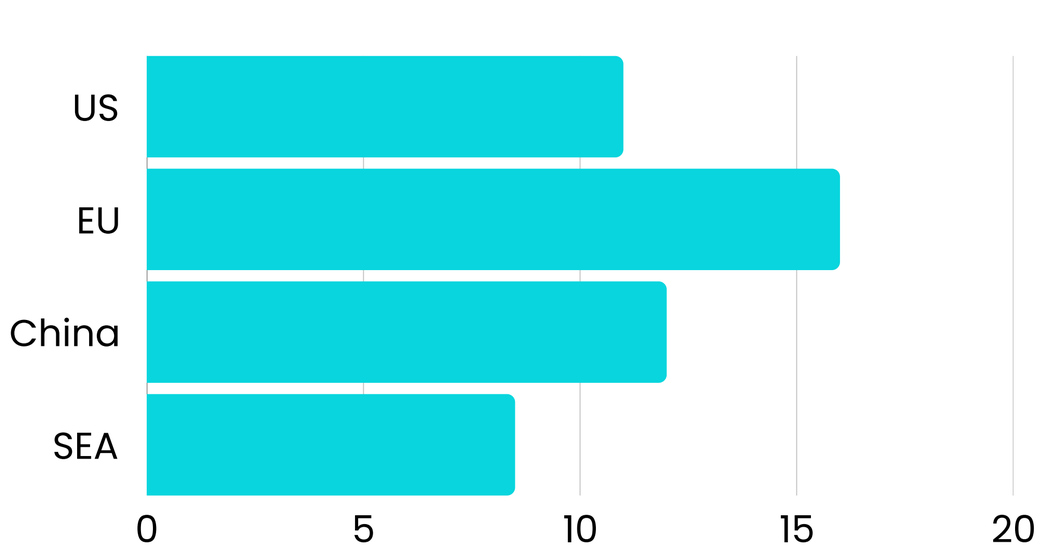
The Surge in Demand by 2035 and the Imperative for Imports from Global OEMs

Understanding the ASEAN EV Market

Southeast Asia is home to a population of over 670M,[2] equal to ~8% of global population. The region is quickly advancing to become the #4 global EV market in 2035, closely catching up on China and the US. With a forecasted demand of 8.5M vehicles,[3] ASEAN's demand in aggregate will amount to more than half of the EU as the biggest market.

This growth projection presents unparalleled opportunities for both incumbents and new entrants to expand in Southeast Asia. By late 2023, ASEAN contributes <2% to global EV sales.[4]

However, especially European players need to keep in mind that such opportunities will not only vary across countries in the region but also across the end-to-end EV value chain from raw materials processing to charging infrastructure and software.



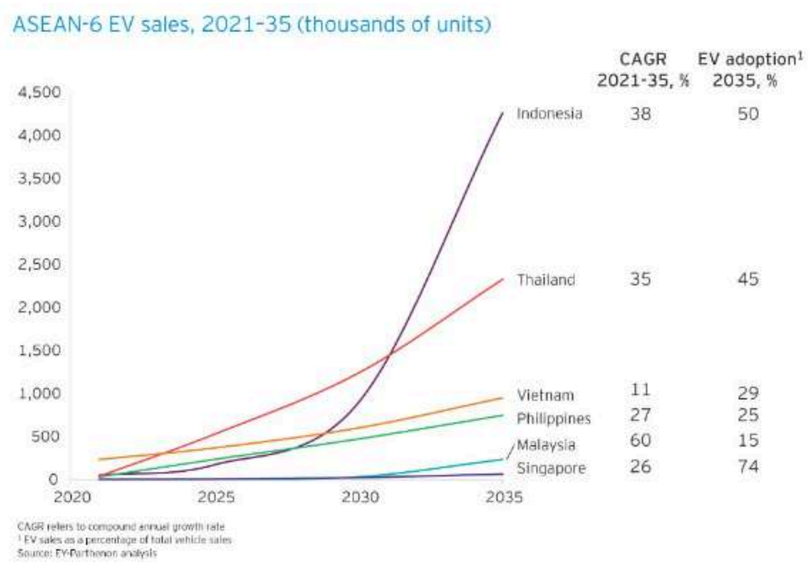


Exhibit 1: EV Forecasted Sales in 2035, EY Parthenon (2024) *(in Million of units)*

Value Pools and Market Share Distribution in the SEA EV Ecosystem

Parthenon, the strategy arm of Big Four Firm Ernst & Young, estimates the region's EV ecosystem (top 6 ASEAN countries) to be worth about **US$100-120 billion by 2035**[3] and suggests a break down into six key value pools, with the bulk to be generated in the mid and down-stream parts of the value chain:

1. Raw materials and processing
2. Energy production
3. Battery production
4. Assembly and recycling
5. Vehicle manufacturing, retailing and aftermarket
6. Charging infrastructure

69% vehicle manufacturing and retailing

11% Battery production and recycling

11% Other

9% Raw material processing

Surging Ahead: The Rapid Growth of EV Demand in Southeast Asia

In the same report, EY Parthenon forecast Southeast Asia's total EV sales volume to grow at 33% CAGR between 2021-2035. This translates into sales of 8.5 million units by 2035.

Of these, Indonesia alone is expected to contribute over half of the region's volume, with forecasted sales of close to 4.5 million units.

Thailand is predicted to closely follow this growth trend with estimated sales volume above 2 million units, among their 4 times smaller population than Indonesia.

Vietnam also boasts high EV sales volumes, leveraging on the growth potential of VinFast, a subsidiary of leading conglomerate Vingroup, who has invested significantly in cutting-edge, highly automated production lines forecasted to manufacture up to 950,000 units per year by 2026.[5]

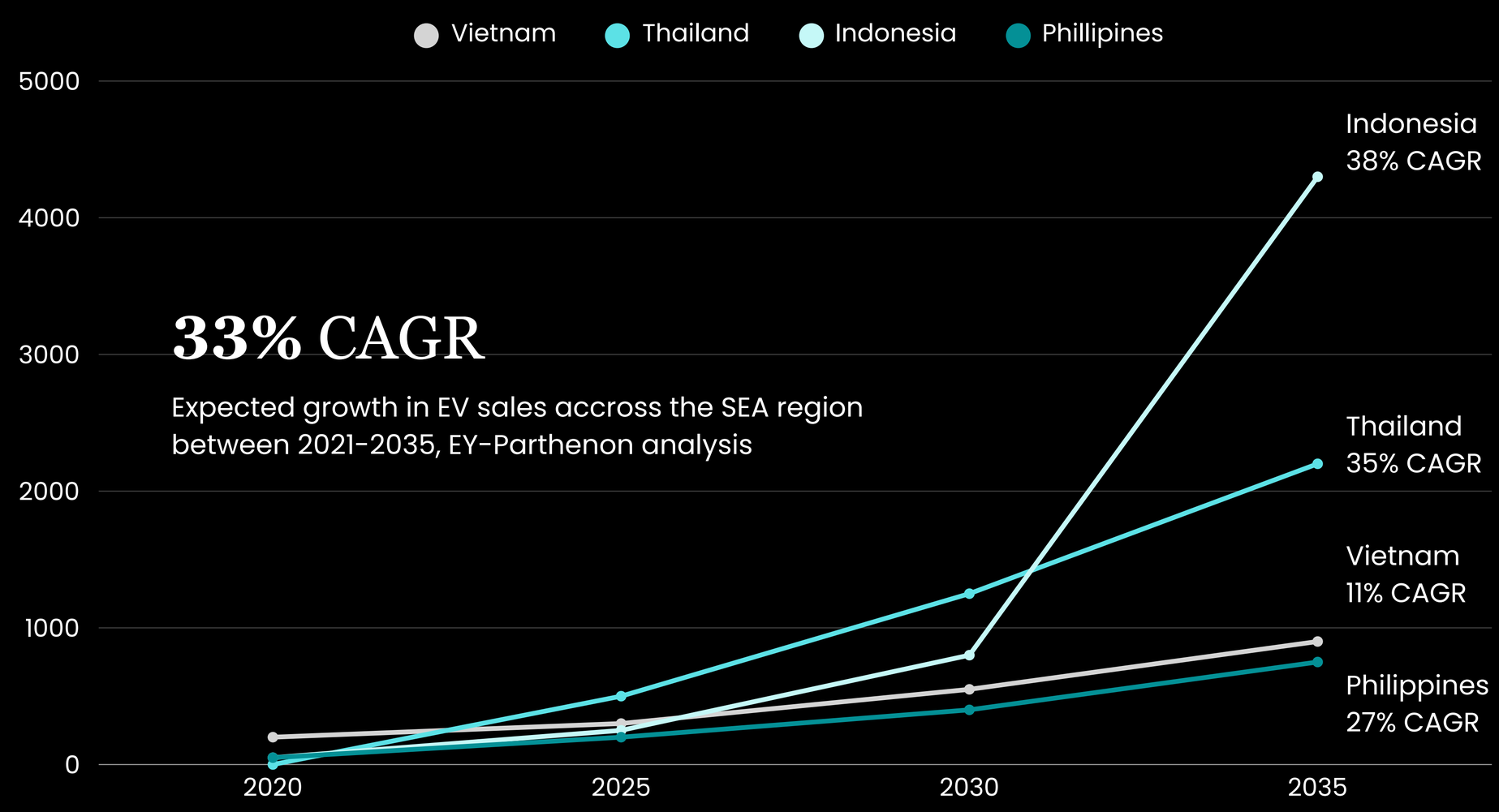


Exhibit 2: EV Forecasted Sales until 2035, ASEAN-4, EY Parthenon (2024) *(in Thousands of units)*

Southeast Asia's EV Manufacturing Capacity

ASEAN's production of Electric 4 wheel vehicles is expected to increase at an average CAGR of 45%[6]

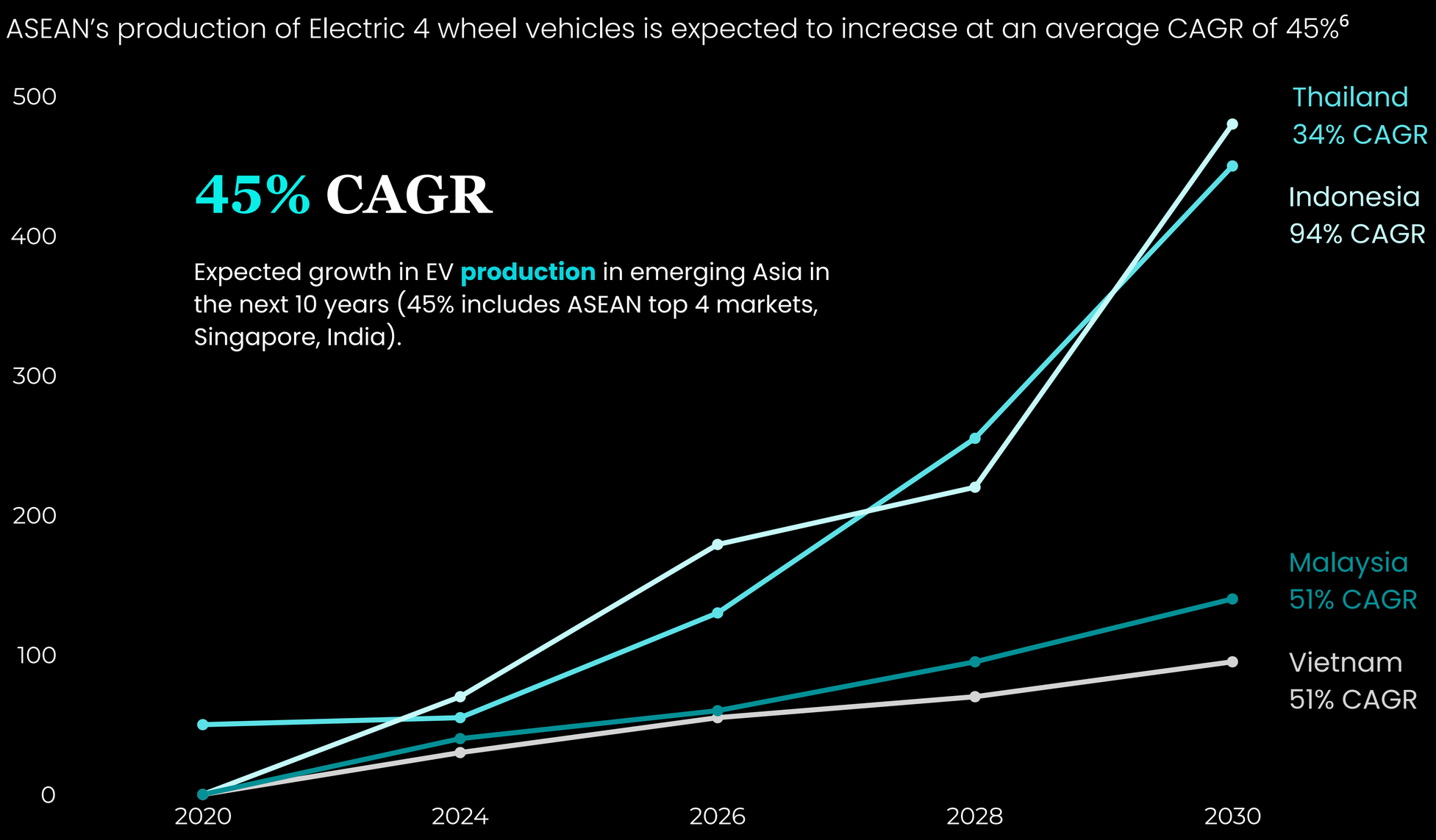


Exhibit 3: SEA E4W expected production, 2022-2030 CAGR, McKinsey analysis (2023), *(in thousands of units)*

Demand Outgrows Regional EV Production Capacity

While the EV production in ASEAN's top 4 economies, incl. Singapore and India, is expected to rise at 45% CAGR ('22-'30), this will not be sufficient to keep pace with the already much higher demand, growing at 33% CAGR ('21-'35).[3] Exhibit 4 underlines this, showing that Indonesia as the largest market will depend to 40% on imports of EVs in 2030, with Thailand and Vietnam much higher at around 64% and 84%.

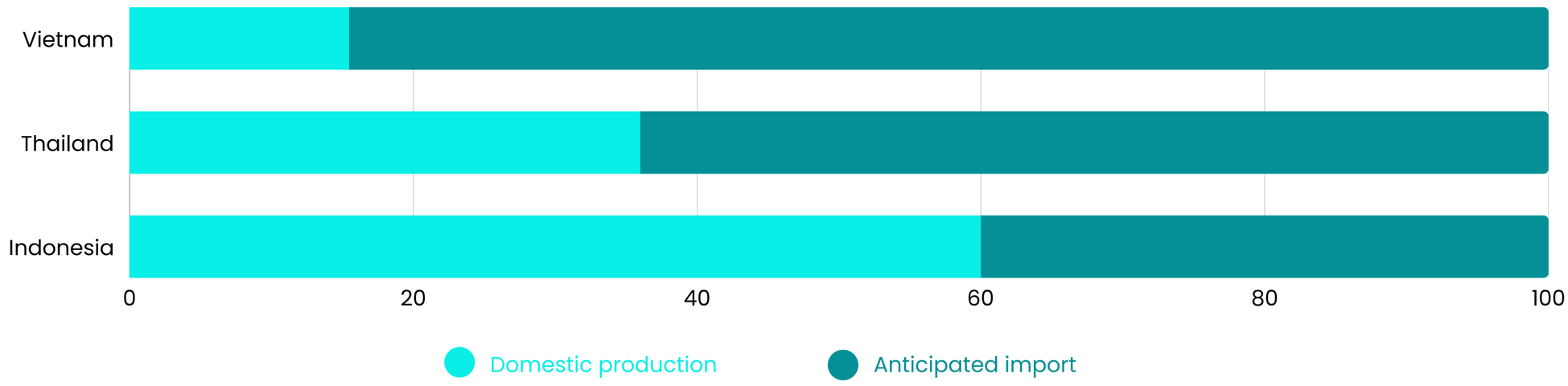


Exhibit 4: Domestic production gap by 2030, CCX Partners calculation, based on research by McKinsey (2022) and EY-Parthenon (2024), *(in %)*

Much of this extra demand is being filled by Chinese companies. China's established EV technology has found a rapidly maturing market in Southeast Asia. Asia-based TMT-focused research firm Counterpoint reported a significant uptick in market share for Chinese auto companies in Southeast Asia last year, jumping from 38 percent in 2022 to nearly 75 percent in 2023.[7]

For example, Counterpoint reported that China's share in Thailand's new-auto market more than doubled to 11 percent in 2023, driven by EV leader BYD. Thailand's EV imports tripled in the first half of 2023 to 33,000 units. BYD accounted for approximately 30,000 units, surpassing competitors such as Nissan and Mazda. Chinese automakers collectively controlled about 80 percent of the Thai EV market share, while Japanese brands lagged behind with less than 1 percent market share.

Furthermore, the same report highlighted that Malaysia-based car producer Proton had leveraged this Chinese dominance to reposition themselves in the EV market via a partnership with China's Geely Auto. In the Joint Venture, Proton revitalised their brand reputation and doubled sales and market share over five years. This exemplifies successful internationalisation going beyond investing capital and showcases how Proton could leverage Chinese expertise in this case to renew their locally rather decadent image.

Regulation & Infrastructure Readiness in ASEAN:

Steering the EV boom in Southeast Asia

Rapid EV Growth Calls For Regulators' Steer

ASEAN is set to quickly catch up to the top 4 global EV markets, but consumers' concerns must be addressed first:

The still underdeveloped charging infrastructure was the main concern for ASEAN-6 consumers (Indonesia, Philippines, Vietnam, Thailand, Malaysia, Singapore) towards a faster adoption of electric vehicles, as raised by 54% of respondents in a Deloitte study in 2023. Besides, safety, cost, driving range of the battery as well as its charging time were relevant, each mentioned by more than 40% of respondents.

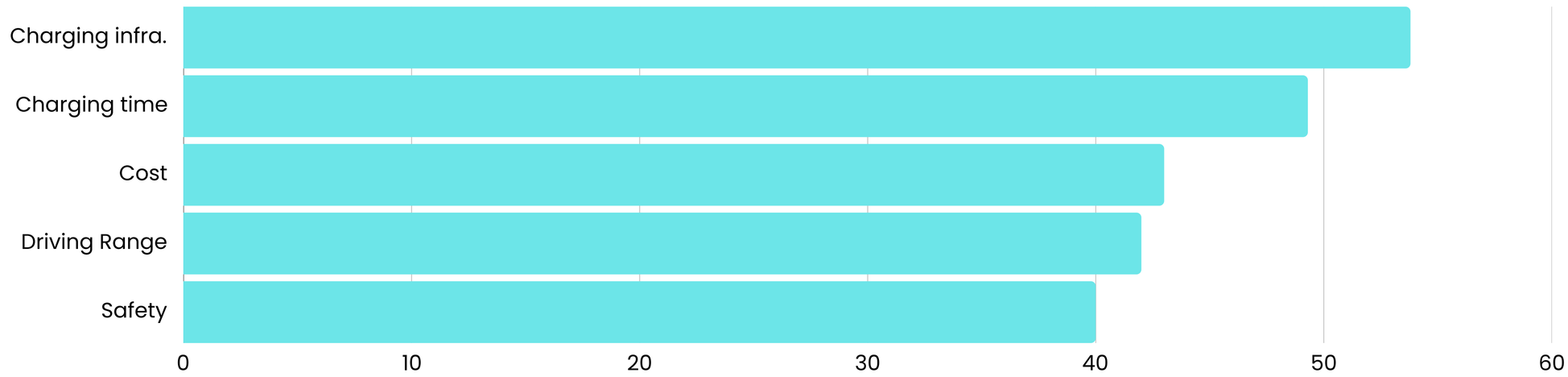


Exhibit 5: Average responses on SEA consumers' to concerns about buying EVs, ASEAN-6, Deloitte SEA (2023), *(in %)*

Regional Governments Are Taking The Driver Seat To Manage the Transition Across 4 Dimensions

McKinsey shared 4 dimensions across which political stakeholders can structure their work to strengthen both the demand for EVs as well as the production of vehicles in the region.[9] We will further elaborate in this chapter:

1. **Set EV manufacturing targets**
2. **Ban internal combustions engines**
3. **Grant consumer subsidies**
4. **Build more EV charging infrastructure**

4 key incentives for ASEAN EV policy makers; following McKinsey, 2022

1. Set EV manufacturing targets

EV manufacturing: ASEAN governments have set ambitious production targets

Country	Current EV production	Target (2023-2030 accum.)	
Thailand	10,000 units	750,000 units	**75x**
Indonesia	8,000 units	2.2m units	**75x**
Vietnam	15,000 units	500,000 units	**33x**
Malaysia	9,000 units	125,000 units	**33x**

Exhibit 6: EV manufacturing 2030 targets for ASEAN-4. World Economic Forum (2023), *(in Million of units)*

By establishing clear EV production goals, Thailand, Indonesia, Malaysia and Vietnam are signaling their commitment to the EV sector, which in turn attracts investment from major automotive manufacturers and stimulates the development of local supply chains for EV manufacturing.

Setting substantial EV manufacturing targets allows ASEAN governments build momentum to drive the remaining three dimensions.

By aligning on specific targets, the region is not only preparing its automotive industries for the future demands of its domestic economy but also enhancing their infrastructure and regulatory frameworks to support a sustainable transition to electric vehicles.

This comprehensive approach ensures that SEA can fully benefit from the environmental, economic and social advantages of widespread EV adoption, while also growing independent from other market players in the US, EU and China.

2. Ban internal combustions engines (ICE)

Most Regulators Have Set a Deadline For ICE Cars Enforcing the Success of EVs

All ASEAN-6 markets have undertaken initiatives to phase out or at least limit the presence of conventional ICE cars (Internal Combustion Engines). Only the Philippines have not yet announced such initiative, while a similar decree is in progress.

Source: CCX Partners research.

Active in promotion of EVs, especially with homegrown ASEAN EV champion Vinfast. However, Vietnam has not yet set an official ICE deadline.

Indonesia plans to ban the sale of ICE motorcycles by 2040 and cars by 2050, as part of its broader goal to achieve net-zero emissions by that year. The country is developing an EV ecosystem, leveraging its rich nickel reserves for battery production.

Thailand intends to phase out ICE vehicles by 2035, aiming to become a regional hub for EV production. The National EV Policy Committee has set ambitious goals for EV sales to comprise all new car sales by 2035. The government's confidence is bolstered by strong automotive industry capabilities and a proactive approach to market changes.

By 2040, Malaysia has outlined a target of 38% EV sales, expecting 1.5 million EVs on the road by that year; and a target of 80% xEV market share by 2050. To support this growth, the government is aiming for 10,000 public charging stations by 2025 (up from 900 in 2021).

Singapore plans to phase out ICE vehicles by 2040, as part of its Green Plan 2030. The government is highly confident in achieving this target, given its strong support for EV adoption, emerging charging infrastructure, and proactive policies.

3. Grant Consumer Subsidies

Governments Must Address the EV Affordability Gap

While ASEAN countries increasingly view EV manufacturing as a step into achieving economic growth, EV readiness presents a significant challenge to the achievement of these goals.

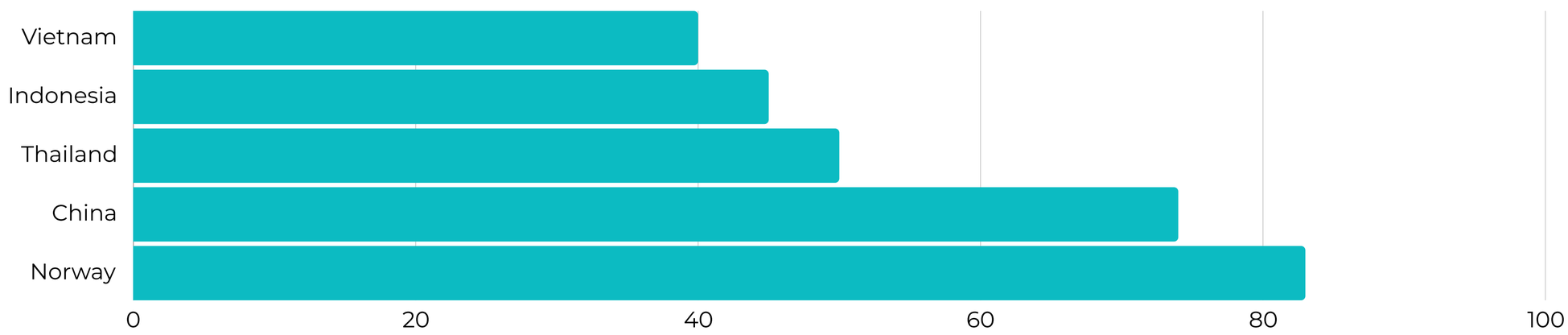


Exhibit 7: EV Country readiness index, CCX Partners calculations.

Both EV affordability and readiness are inversely correlated with GDP per capita, which is plausible. Cars are sold at geographically rather constant prices, hence easier to afford in countries with higher GDP per capita.
For less developed ASEAN countries, the transition to electric is therefoe expected to be driven by 2-wheelers (E2W) initially, with the 4-wheeler proportion to catch up along with GDP.

Decisive action from ASEAN governments is required - and in fact underway, with Vietnam and Thailand deploying 4 different measures each:

Exhibit 8: Overview of EV incentives utilised by selected key ASEAN EV economies, own illustration, based on McKinsey (2022)

VAT Reduction for EV Buyers	✓	✓	✓	
Special Consumption Tax Reduction for EVs	✓	✓	✓	✓
Incentives for EV Manufacturers	✓	✓	✓	✓
Green Investment Incentives				✓

ASEAN-4 governments, at the same time, do utilise the levers at their disposal to accelerate this adoption. Indonesia, Malaysia, Vietnam and Thailand have all implemented various incentives for EV manufacturers and buyers alike. [6]

Malaysia, with its historically strong ICE market, meanwhile introduced only one other incentive, aimed at supporting green investments. This is a pioneering move in ASEAN's EV market. Malaysia's government has launched various initiatives to promote EVs and green energy, such as an extension of tax exemptions on import and excise duties for completely built-up (CBU) EVs. In a bigger scheme, the government will model its administrative center, Putrajaya, as a low-carbon city, installing solar panels on government building rooftops and integrating EVs into the federal vehicle fleet.

4. Build more EV Charging Infrastructure

The Expansion Velocity of it's Charging Infrastructure will be the Bottleneck for ASEAN's EV Adoption

	Stations (as per 2021)	Per 1M population
	500	5
	1,400	5
	900	26
	2,600	36
	10,500	1,920

Exhibit 9: Number of EV charging stations in selected countries, CCX Partners Research.

EV adoption can only accelerate on the back of a tight net of charging stations. The world's most EV friendly country, Norway, has between 50 and 400 times more charging station per 1M population than ASEAN's 4 most promising EV markets.

Public and private efforts are required to ensure infrastructure readiness to promote EV adoption. This challenge is as true for ASEAN's top four markets, as it is for any other global market aiming to normalize EVs on their streets. However, more needs to be done by ASEAN's governments on this journey.

While Norway as one of the world's most EV friendly countries is an ambitious comparison, the dimension of the gap still underlines a key issue in the SEA EV market readiness. To mitigate this growing concern among local manufacturers and consumers, diverse projects have been proposed to exponentially increase access to charging ports.

For instance, in 2020, Malaysia's government announced plans to install 125,000 charging stations by 2030 as part of its Green Technology Master Plan. As of early 2024, around 2,000 have been built.[10]

On the private side, Charge+, a Singaporean company, has launched a significant infrastructure project to establish a 5,000-kilometer electric vehicle (EV) charging highway across five Southeast Asian countries: Singapore, Malaysia, Thailand, Cambodia, and Vietnam. This network will feature 45 direct fast charging stations strategically located directly on highways, aiming to ensure convenient access for EV drivers and facilitate long-distance travel.[11]

Charge+ still acts at micro-scale when comparing to the expected demand for EVs in the region. Nonetheless, this serves as a testament of the development of EV charging infrastructure in SEA as a rapidly evolving landscape, with investment pipeline sourced both from governments and private investors.

Eventually, however, governments need to take charge in driving nationally the density of charging points, as well as in ensuring that their power grids are capable of providing sufficient energy, reliably. Updated construction norms, requiring a minimum number of charging stations in new developments, are one option increasingly leveraged, also within Southeast Asia.

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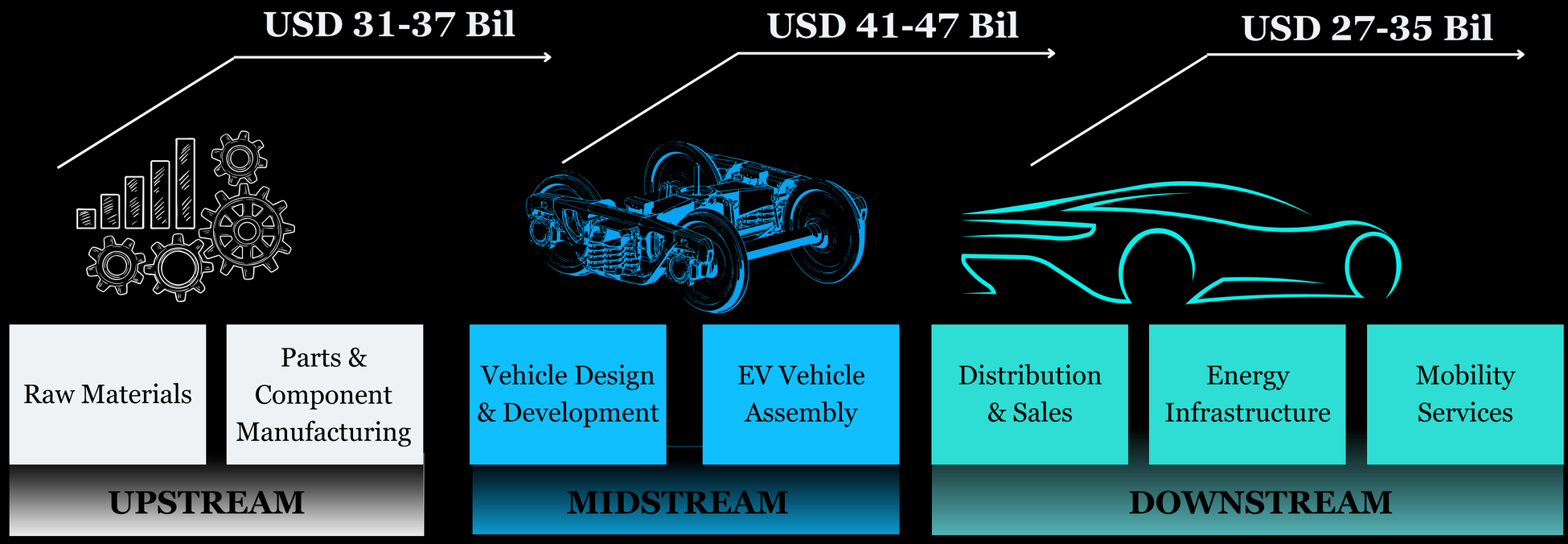
The ASEAN EV Value Chain:

Idntifying Gaps & Opportunities

ASEAN is Rapidly Deepening its EV Value Chain

The electric vehicle (EV) market in Southeast Asia is picking up exponential growth as it starts to outgrow its infancy stage. The increasing adoption in the mass market segment drives the interest of automotive manufacturers and suppliers all across the value chain, encompassing components, batteries, and infrastructure. This optimistic outlook for the EV market in Southeast Asia propells enhanced collaboration, gradually deepening the level of coverage of the domestic value chain.

EV Value Chain - Total Market Size in 2035 Estimated at USD 100-120 Billion[3]



While the landscape of EV adoption varies across Southeast Asia's countries, all countries have committed to ban ICE cars by 2050 or earlier, or at least planning to. To support this paradigm shift, they have formed strong ambitions on the supply side - each leveraging their unique strengths, as the markets across the region vary in their level of development.

	Selected Manufacturers	Selected Suppliers
Thailand boasts ASEAN's most developed automotive ecosystem was originally built around the internationalisation of the leading Japanese manufacturers in the 1980's. Several of the 2,000+ suppliers (600-700 Tier-1) are already producing parts and components of EVs.[12] Midstream, the country is in an intensifying competition with Indonesia to attract foreign investment and maintain the pole position in regional automotive production.	Great Wall CHANGAN	AISIN Geared up for the future BOSCH DENSO
Vietnam, with its substantial nickel reserves, is home to ASEAN'S EV powerhouse VinFast, built by private conglomerate VinGroup, and its 14-hectare battery factory. This facility, completed in 2023, with an annual capacity of 5 gigawatt-hours, will be Vietnam's first producer of lithium iron phosphate (LFP) battery cells. The existing automotive ecosystem comprises at least a handful OEMs, as well as ~150 suppliers in the tiers 2 and 3, as well as over 100 tier-1 suppliers.[13]	VINFAST	TOYOTA TSUSHO
Indonesia, ASEAN's largest nation, stands out with the world's largest nickel reserves. Through the implementation of a nickel export ban, the country is looking to consolidate its EV industry. Focusing on the domestic processing of nickel could see Indonesia position itself as a major player in the EV battery supply chain. In 2023, Indonesia attracted around USD 8 billion in FDI for EV-related projects.[14]	BYD	HYUNDAI WULING MOTORS

Also the **Philippines** have ambitions towards its EV supply chain, with their significant nickel production capacity, albeit significantly smaller than Indonesia. The domestic EV manufacturing industry remains underdeveloped in a regional comparison, focused on low value-add components, besides some semiconductor testing and packaging. A limited network of of only 300 EV charging stations and high electricity costs are further roadblocks. The Filipino government is therefore designing incentives to boost local EV production and consumer adoption, pushing towards a projected market size of USD 7-11 billion by 2035 and an adoption rate of 25%.[15]

Malaysia boasts 2 national car makers, one of which, Proton, has entered a partnership with their investor. Chinese EV maker Geely, to produce a Malaysian EV as soon as 2025. The overall EV supply chain, however, is still in its formative stages and will take time to become competitive with more established markets like Thailand and Indonesia. The strong electrical and electronics (E&E) sector, including the country's semiconductor industry, stands for 40% of total exports in Malaysia, pointing at a potentially increasing role in the EV value chain.[16]

Singapore may be a small production market compared with neighbouring countries, but it leads the region in terms of EV charging infrastructure, with over 3,600 public charging outlets currently available, aiming for 60,000 by 2030. With a limited automotive supply chain, Singapore does play a role in the high-value digital and software elements of the value chain. It is the 5th largest global exporter of semiconductor devices.[17]

EV Value Chain Leverages Home-grown Automotive Industries

To achieve their EV ambitions, Southeast Asian countries are investing heavily in local production, aiming to enhance affordability and boost supply. These supply-side initiatives complements demand-side measures such as tax cuts and purchase subsidies on imported models, creating a comprehensive strategy to accelerate EV adoption. While Thailand, Malaysia, and to an extent also Indonesia can develop their EV supply chains on the back of decade-long experience of building ICE cars domestically, especially Vietnam is newer to the mobility value chain, albeit catching up fast.

ASEAN EV Upstream Market is Dominated by Indonesia and Thailand

Southeast Asia is an emerging hub for EV manufacturing, with Indonesia, Thailand, Malaysia, and Vietnam leading the charge. The upstream EV value chain in ASEAN, excluding batteries, shows substantial variation across Malaysia, Vietnam, Indonesia, and Thailand, each excelling in different segments.

Thailand, with over 2300 suppliers, is a leader due to its well-established automotive sector, which smoothly transitions into EV components production. It excels in manufacturing chassis, body parts, and electrical systems, exporting these components extensively within ASEAN and to global markets. Thailand produced approximately 1.88 million vehicles in 2022, bolstered by strategic government policies, making it a unique hub in the region.[18]

Indonesia, with approximately 1500 suppliers,[19] leverages its robust automotive foundation to expand into EV components. The country is strong in producing raw materials and mechanical parts, including motors and inverters. Its rich reserves of nickel and other essential minerals for EV manufacturing give it a unique advantage. Indonesia produced around 1.47 million vehicles in 2022,[20] exporting components primarily within ASEAN and to East Asian markets, making it a crucial player in the regional supply chain.

Vietnam and Malaysia, each with around 640[21] and 400[22] suppliers relatively, are rapidly growing their EV value chains. Vietnam focuses on assembling and producing electrical systems and electronic parts, benefiting from its burgeoning electronics industry. Vietnam produced approximately 250,000 vehicles in 2022, exporting components to ASEAN countries and increasingly to Europe.[23] Malaysia, on the other hand, has strengths in precision engineering and manufacturing of electronic control units and sensors, producing about 575,000 vehicles in 2022 and exporting these components to neighboring ASEAN countries and Japan.[24]

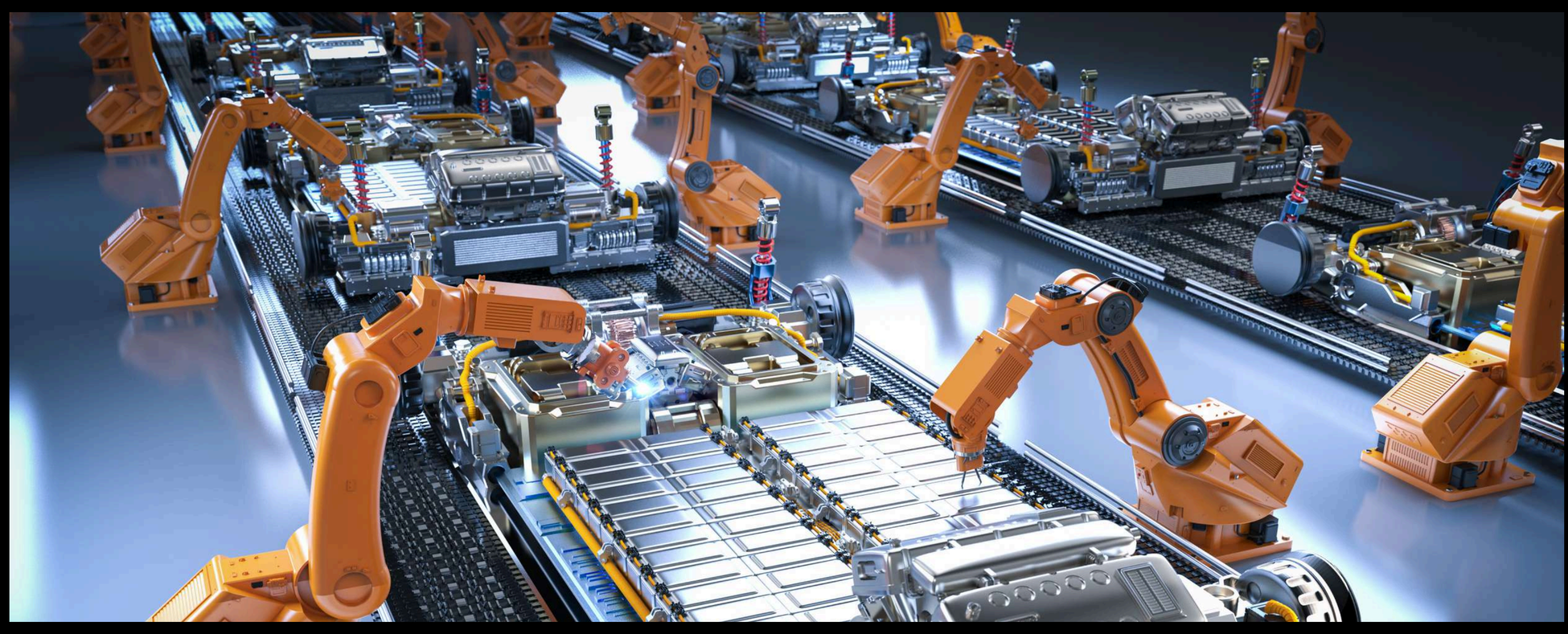
Each country's unique positioning and strengths contribute to a complementary and competitive ASEAN EV value chain. International car companies like Toyota, Honda, and Hyundai have significant operations across these markets, further indicating robust future growth and integration within the global EV industry

Midstream: EV Sales Largely Captured by Thailand while Indonesia and Vietnam are Catching Up

Thailand, boasting the strongest automotive industry in the region, saw over 59% of EV sales in Southeast Asia in 2022.[25] This success is driven by significant foreign direct investment from German, Japanese, Chinese, and Korean automakers, coupled with comprehensive policies linking electromobility to smart grids and automation. In 2023, EV sales in Thailand grew 8-fold to over 78,000. This accounted for 12% of all vehicle registrations in the country in 2023.[26] Besides fully built up vehicles, Thailand excels in exporting EV components like electric motors, converters, and inverters, and has a strong position in conventional starter battery production and exports (ranked 8th in exporting electrical static converters globally).

Indonesia, with the world's largest nickel deposits, attracts global automakers from China, Japan, Korea, and the US, despite concerns over regulatory stability. ASEAN's largest member state hosts already five EV manufacturers, namely South Korea's Hyundai, Japan's Mitsubishi, and China's Wuling, Chery, and DFSK. Experts estimate the country's EV production capacity could reach 500,000 by 2030.[27] In 2023 it realised around 10% of that potential, with 50,000 EVs sold.

Malaysia recently secured Tesla's head office, benefiting from regulatory certainty, and anticipates further investment from Geely through national car brand Proton. Meanwhile, Vietnam's VinFast, which topped regional EV sales last year as a brand, has expanded its presence with a Nasdaq listing and manufacturing facilities in Vietnam, the US, and now targeting India and Indonesia.



Downstream Market is Developing, as EVs Have Arrived in the Spotlight, Following the Significant Sales Growth in 2023

The downstream EV value chain in ASEAN presents a dynamic landscape, with significant variations across Malaysia, Vietnam, Indonesia, and Thailand. In 2023, Thailand led the region with 78,314 EVs sold, marking a 684% increase from the previous year and accounting for 12% of total vehicle registrations. Thailand's robust market is bolstered by advanced EV assembly plants, comprehensive distribution networks, and extensive charging infrastructure, positioning it as a regional leader.

Indonesia, closely following, recorded approximately 50,000 (target 2024) - 17,051 (recorded 2023) EV sales in 2023.[28] The country is rapidly expanding its EV dealership and service networks, driven by government incentives and improvements in charging infrastructure. Indonesia's large domestic market and strategic initiatives underscore its significant role in the downstream EV value chain.

Vietnam, with 19,960 (estimated) - 34,855(recorded) - EVs sold in 2023,[29] is developing its downstream capabilities by focusing on expanding EV distribution and service networks. Significant investments in charging infrastructure are underway to support future growth, driven by local producers like VinFast and international partnerships.

Malaysia, with 13,257 EVs sold in 2023,[30] faces challenges despite its strong automotive industry. The country is advancing its EV market through partnerships with international car manufacturers and enhancing its charging station network, although it lags behind its regional peers.

Each country's unique strengths and government policies contribute to a competitive and evolving downstream EV value chain in ASEAN. International car companies like Tesla, Nissan, and BMW are actively participating in these markets, indicating promising future growth and further integration within the global EV industry.

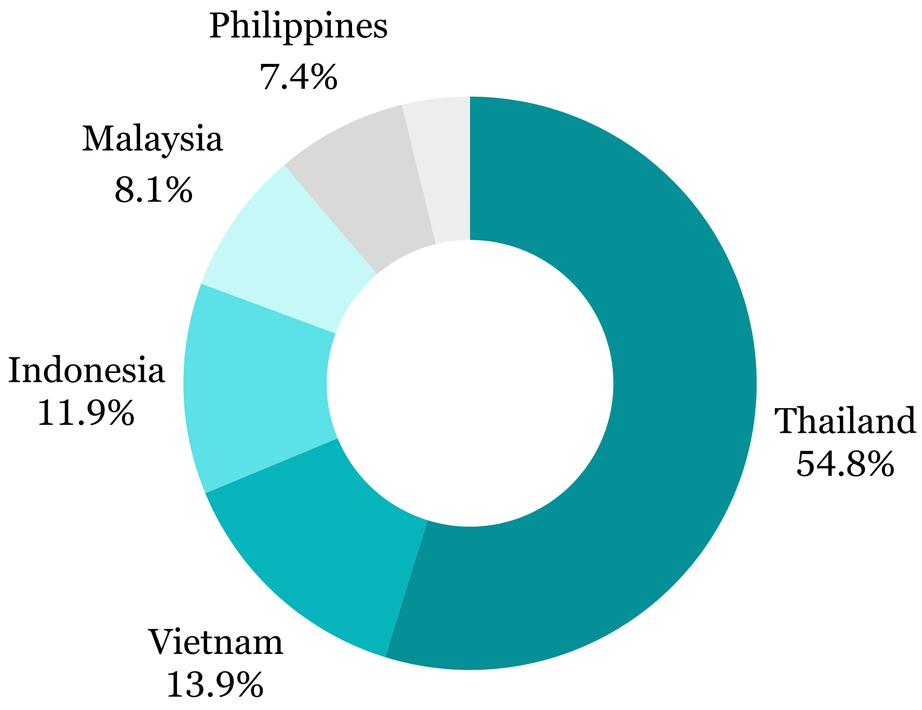


Exhibit 10: EV Sales in ASEAN-6 economies, CCX Partners research (2024).

EV Battery Value Chain - Overview

Upstream Market of ASEAN's Battery Value Chain: Indonesia and Philippines Leading with High-Pressure Acid Leach (HPAL) Plants

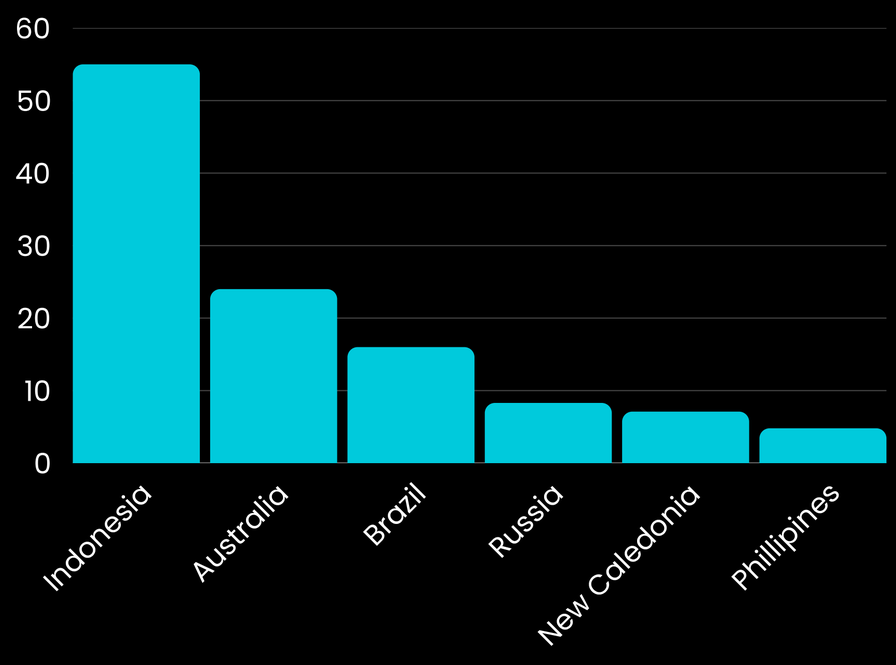


Exhibit 11: Global nickel reserves by countries, Statista
(in Million tons)

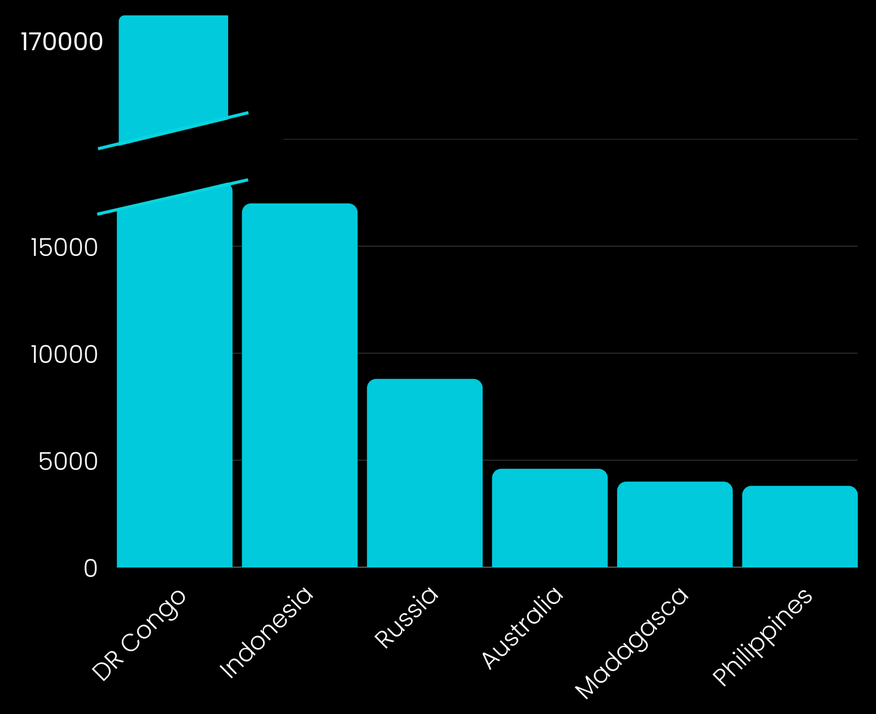


Exhibit 12: World mine production of cobalt, by country (2023), Statista
(in tons)

As the demand for electric vehicles (EVs) surges, manufacturers are encountering a shortfall in battery production capacity. According to a report by the Germany-based Center for Automotive Research (CAR), battery cell production may not meet demand until 2030.[31] This has driven up the demand for battery metals, particularly nickel. The International Nickel Study Group (INSG) reports that global nickel demand has significantly increased over the past five years, projected to reach 3.02 million tons in 2022, 8.6% up from 2.78 million tons in 2021.[32]

Nickel, lithium, and cobalt are key components of lithium-ion batteries. Indonesia leads globally in nickel production and ranks second in cobalt production. However, it lacks rich deposits of lithium. Australia supplies approximately half the world's lithium and is expected to export 120,000 tonnes of lithium to Indonesia annually.[33] Battery makers require Class 1 nickel to produce nickel sulfate, essential for lithium-ion battery cathodes. Around 70% of the nickel supply in Indonesia is unsuitable for EVs without expensive conversion processes.[34] High-pressure acid leach (HPAL) is the only established method for producing battery-grade nickel sulfate from laterite ore.

Indonesia has accelerated HPAL operations thanks to Chinese investment and expertise. The Indonesian government is also in discussions with Tesla regarding investment in lithium-ion battery material manufacturing. Currently, there are around ten HPAL plants operating worldwide, with three in Indonesia (Huayue Nickel & Cobalt, PT QMB New Energy Materials, PT Halmahera Persada Lygend) and two in the Philippines (Coral Bay Nickel Corporation, Taganito HPAL Nickel Corporation), make Indonesia and Philippines becoming market leaders in the refining of battery raw materials.

Midstream Market in SEA: Thailand and Indonesia - Rising Stars in Batteries Manufacturing

Indonesia

Cells (10GWh; planned)

LG Energy Solution
HYUNDAI

End-to-end manufacturing

CATL
IBC Indonesia Battery Corporation

Thailand

Cells and modules (2GWh)

Gotion
dp durapower

Cells ((1GWh; planned)

AMITA Amita Technology (Thailand) Co., Ltd.

Chinese power battery companies are rapidly expanding abroad to fill international capacity gaps, with planned overseas capacities exceeding 579GWh.[35] For reference, demand for EV batteries reached 750 GWh in 2023.[36] SEA is a significant part of this strategy.

Thailand has emerged as a prime destination for battery manufacturers due to its established automotive industry.

Taiwanese Amita Technology, through its parent company Energy Absolute, has committed to developing Thailand's first lithium-ion battery gigafactory, marking a significant milestone in the country's EV ecosystem. This facility, with a future production capacity of 50 GWh per year, aims to create a comprehensive battery manufacturing process from upstream to downstream.[37] Similarly, the recent opening of NV Gotion's factory, a joint venture between Chinese battery maker Gotion and Thai state-owned PTT, highlights Thailand's growing prominence in the sector. This plant focuses on the import, assembly, and distribution of battery modules and packs for energy storage systems and EVs, with an initial production capacity of 2 GWh per year.[38]

These developments are expected to significantly boost Thailand's local EV industry and establish a base for battery exports to other countries.

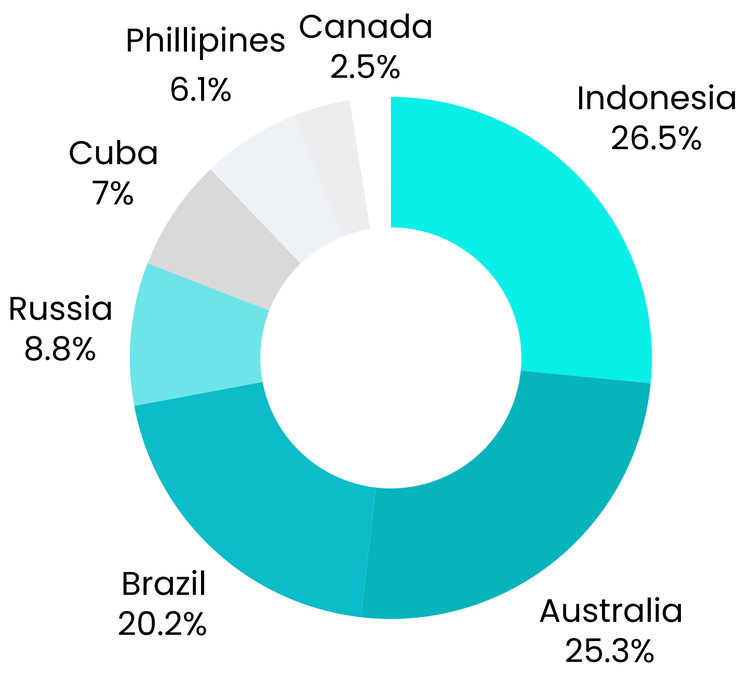


Exhibit 13: Nickel reserves by country, 2022

Significant investments have been announced by major industry players, including CATL, LG Energy Solutions, Tsingshan, BASF, Zhejian Huayou Cobalt, and Posco. These companies plan to invest in facilities for processing and refining nickel and cobalt and producing cathode active materials and precursors. These investments are projected to establish 25 GWh of lithium-ion cell manufacturing capacity by 2025, with potential expansion to 80 GWh by 2030.[39] Mentioned in the same articale, the Indonesian government has also set a target of achieving at least 140 GWh of cell manufacturing capacity by the end of the decade and is actively negotiating with various companies for further investments along the battery value chain.

Indonesia, meanwhile, is particularly well-positioned to benefit from the expansion of battery manufacturing due to several conducive factors. The Indonesian government has set ambitious targets for vehicle electrification, including a national goal for all two-wheelers sold to be electric by 2040. Additionally, the stable price outlook for class 1 nickel, a critical component for battery applications, abundantly available in Indonesia, increases its attractiveness as a battery manufacturing hub. Policies such as tax benefits for building battery manufacturing facilities further enhance the country's appeal to investors.

To capture larger parts of the battery value chain, Indonesia has e.g. secured a US$5.2 billion deal with Chinese battery manufacturer CATL, reinforcing its downstream strategy of processing mineral resources domestically to add higher value.[40] This policy extends to nickel, a critical component in EV batteries, which Indonesia abundantly possesses. Since 2020, Indonesia has banned the export of unprocessed nickel ores to ensure domestic processing and increase economic benefits.[41]

Downstream Market of EV Batteries in ASEAN: Integration and Strategic Partnerships

The downstream segment of the EV battery value chain in ASEAN focuses on the assembly of battery cells into modules and packs, followed by their integration into electric vehicles. This phase also includes the recycling and reuse of batteries, aligning with the growing emphasis on sustainability in the EV sector.

Several ASEAN economies, including Malaysia, Singapore and Vietnam, accounted for over 18% of the region's battery exports to global markets by volume, pre-pandemic. However, the region's export share has yet to recover.[42]

Key distribution models:

- **CATL:** With a significant presence in Thailand and Indonesia, CATL has formed strategic partnerships with global automakers such as Ford and Stellantis. These collaborations aim to enhance the availability and technological advancement of EV batteries.

- **LG Energy Solution:** This South Korean company has established operations in Indonesia and Thailand, partnering with Hyundai to produce EV batteries. This joint venture supports the increasing demand for EVs in the region.

- **BYD:** Expanding its footprint in ASEAN, particularly in Thailand and the Philippines, BYD collaborates with local manufacturers to supply EV batteries, promoting a localized approach to distribution.

Export Trends and Regional Integration:
The share of ASEAN+3 (incl. China, Japan, Korea) EV exports to the United States has declined over the years, with most exports now directed to the EU, UK and other APAC markets. However, in terms of batteries, the US share of ASEAN+3 has been increasing, driven by the Inflation Reduction Act (IRA) in 2022, demanding EV makers to meet local-content requirements.

China remains a dominant player in the global EV battery supply chain, producing three-quarters of the world's lithium-ion batteries. Investments by Chinese companies in Indonesia, particularly in nickel processing, are expected to enhance China's share of global nickel production by 2027.

As the adoption of EVs accelerates, so will the number of used EV batteries. Various adoption scenarios predict a range from 325 GWh to 2,166 GWh of used batteries by 2040.[43] Strategies for reusing these batteries, such as backup power for renewable energy generation, are yet to be determined.

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Opportunities and how to enter:

How to enter ASEAN markets

Entering Southeast Asia's Markets

Navigating Opportunities and Challenges: Entering ASEAN's Diverse Markets

The ASEAN region, with its ten diverse countries, is rapidly becoming a global manufacturing and consumption hub. The electric vehicle (EV) industry stands to gain significantly from this growth, offering numerous opportunities across the supply chain.

Navigating the unique characteristics of each ASEAN country is essential. Differences in legal systems, cultures, and languages require businesses to have deep local understanding. Limited economic integration within ASEAN further necessitates tailored approaches for each market.

Free trade agreements, particularly Vietnam's with the EU, have facilitated trade and attracted investment, boosting the region's appeal to EV industry stakeholders.

Increasingly, more companies in both the B2C and B2B spheres are eyeing the ASEAN EV market, but several critical questions need addressing:

- What is the most suitable business vehicle: distribution partnership, private limited company, partnership, or representative office?
- Are there any rules against or requirements for foreign entities in specific business sectors?
- If cooperation with a local partner is necessary, what is the best approach?
- What does the tax regime look like, and are there any investor incentives?
- What are the key labor law requirements and potential pitfalls for employers?
- What is required to apply for work permits for foreign personnel?
- Can a foreign entity own, lease, or use land?
- Are there foreign exchange rules that could affect business transactions or profit repatriation

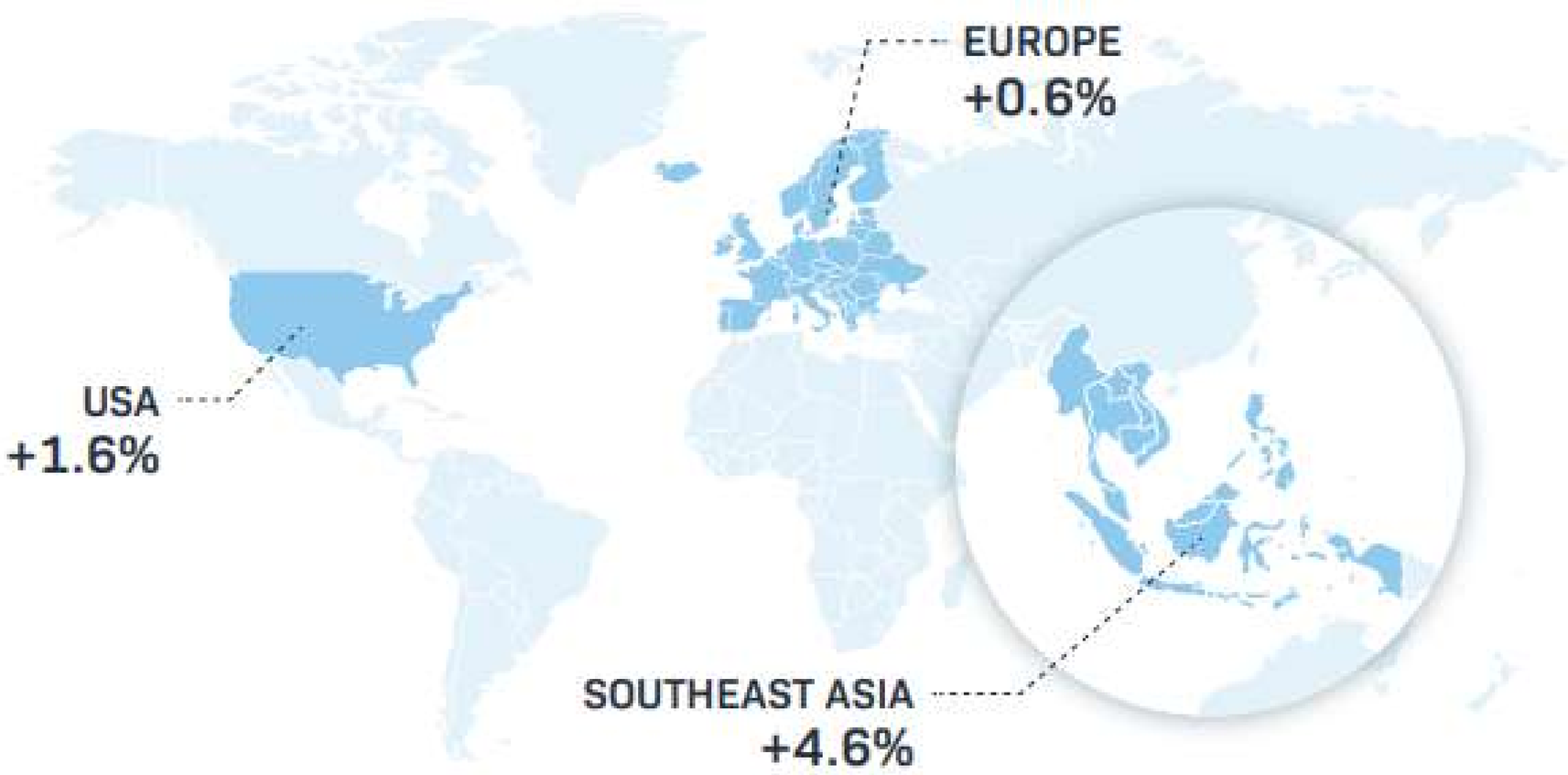
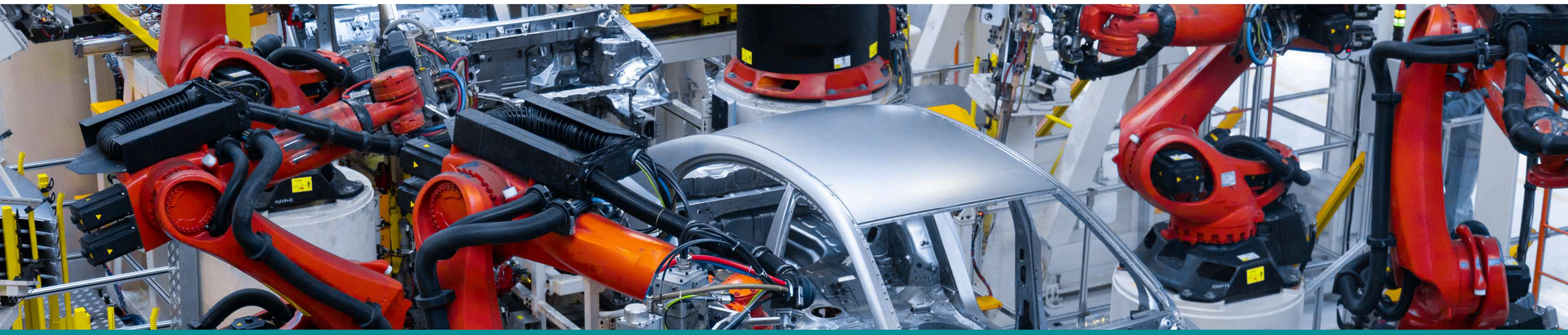


Exhibit 14: Expected regional GDP growth rates for 2024
Source: IMF (Apr 2023)

For detailed guidance on navigating the complexities of entering the EV markets in Vietnam, Thailand, Indonesia, and Malaysia, please reach out under **www.ccx-partners.com**.

Our market entry consulting firm is equipped to provide tailored advice and support to ensure successful ventures into the ASEAN EV industry.



Why ASEAN is the Next Frontier for EV Expansion?

High Growth Potential

- Economic Growth: ASEAN is one of the fastest-growing economic regions globally, with countries like Vietnam, Indonesia, and the Philippines experiencing robust GDP growth.
- Rising Middle Class: The growing middle class in ASEAN countries increases demand for a wide range of consumer goods, creating opportunities for manufacturers.

Strategic Location with Favorable Trade Agreements

- Free Trade Agreements (FTAs): ASEAN has numerous FTAs with key global economies, including China, India, and Japan, which can provide especially Western manufacturers with preferential access to these markets.
- Part of ASEAN Economic Community (AEC) and RCEP: The AEC aims to create a single market and production base, enhancing intra-regional trade and investment, while the Regional Comprehensive Economic Partnership (RCEP) includes ASEAN and its trading partners, offering broader market access and reduced tariffs

Pro-Business Environment

- Ease of Doing Business: Several ASEAN countries have improved their ease of doing business rankings by simplifying regulations, enhancing transparency, and reducing bureaucratic red tape.
- Investment-Friendly Policies including the protection of foreign investments and intellectual property rights, make ASEAN an attractive destination for European manufacturers.

Labor Cost Advantage

- Competitive Labor Costs: Several ASEAN countries offer a skilled labor force at competitive costs compared to European standards, reducing production expenses.
- Young Workforce: The region has a young and dynamic workforce, which can be advantageous for manufacturing industries requiring labor-intensive processes.

Diversification and Risk Mitigation

- Market Diversification: Entering ASEAN allows European manufacturers to diversify their markets beyond Europe and reduce dependency on any single region.
- Supply Chain Resilience: Establishing operations in ASEAN can enhance supply chain resilience by providing alternative manufacturing bases and access to raw materials.

Entering Southeast Asia's Markets is Promising, but it comes with Challenges.

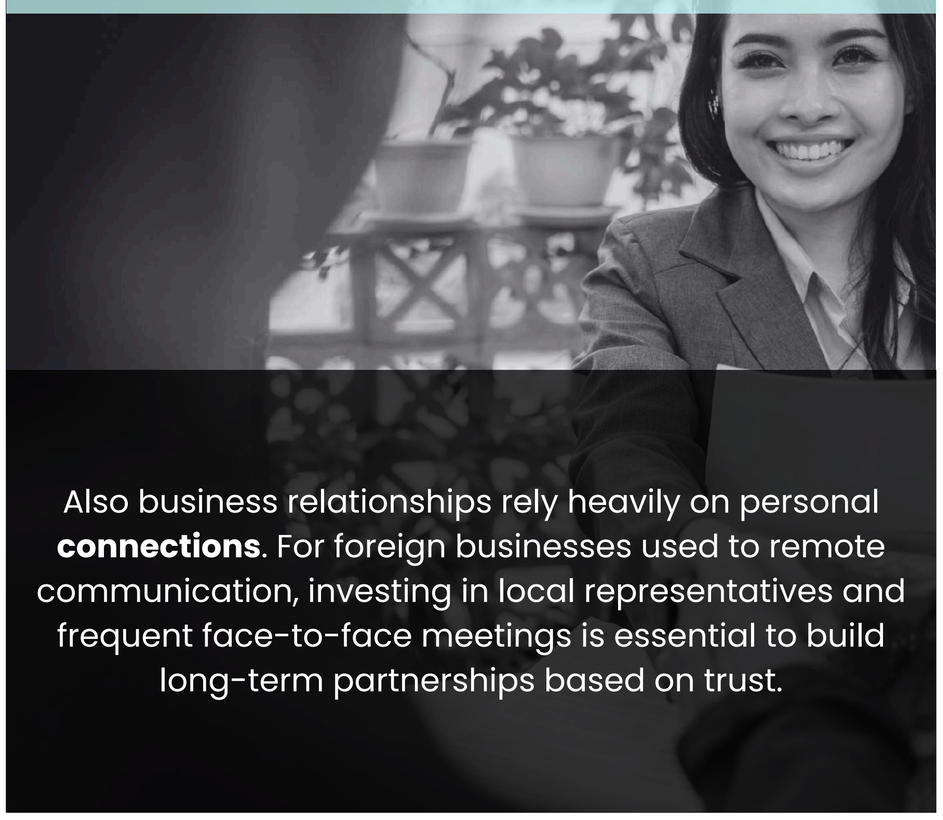
Adapting to a Fragmented Market

ASEAN covers **10 diverse countries**, each with distinct consumer preferences and infrastructure maturity. Businesses must tailor their products and marketing strategies to match each market's unique cultural and economic landscape, ensuring relevance and resonance with local consumers.

Managing Regulatory Differences

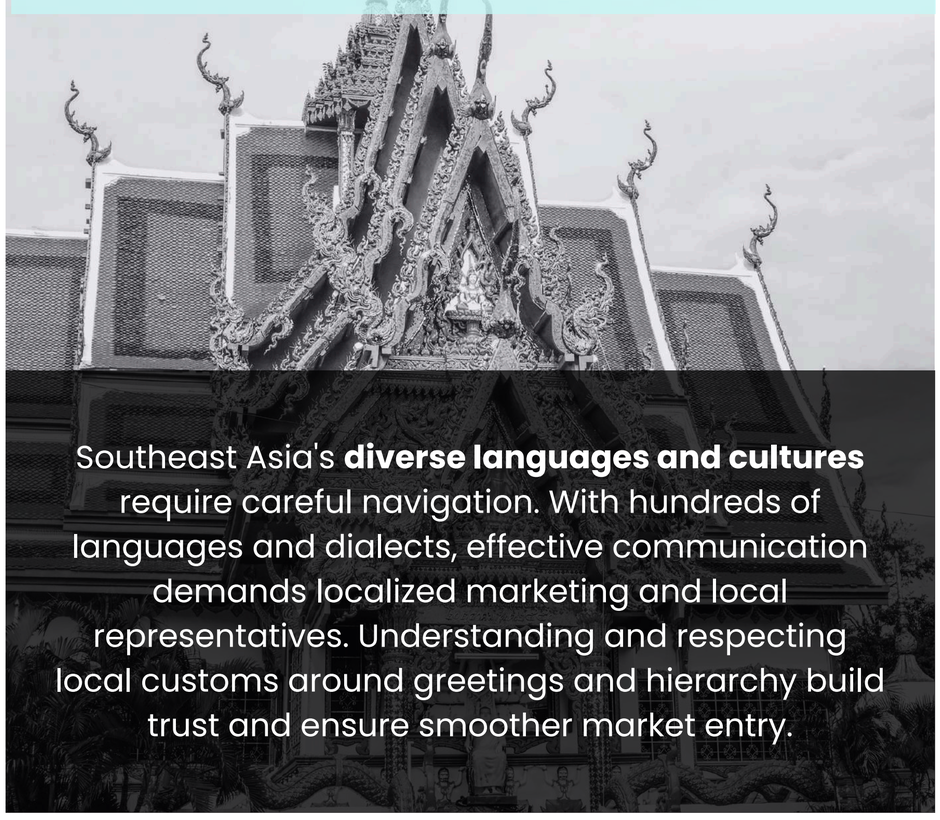
Southeast Asia's **regulatory landscape is varied and complex**. Each country has its own standards, compliance requirements and product certifications. Staying compliant requires **continuous adaptation and vigilance**. Efficiently navigating these regulatory challenges can prevent costly delays and ensure timely market entry.

Building Personal Relationships



Also business relationships rely heavily on personal **connections**. For foreign businesses used to remote communication, investing in local representatives and frequent face-to-face meetings is essential to build long-term partnerships based on trust.

Navigating Cultural and Language Barriers



Southeast Asia's **diverse languages and cultures** require careful navigation. With hundreds of languages and dialects, effective communication demands localized marketing and local representatives. Understanding and respecting local customs around greetings and hierarchy build trust and ensure smoother market entry.

Our Services

Advisory

We think like an investor, looking at how opportunities to buy, sell, partner, fund or fix a company can add & preserve value to our clients value chain

Market Entry

Helping our clients to plan, grow or relocate their business activities to new markets in Asia with our proven market entry frameworks & network of partners

Growth & Operations

We assist our clients' international growth via our Operations offerings: Sourcing, Sales & Marketing, Technology and Process outsourcing

Sustainability

We design & implement ESG initiatives from upstream, downstream to direct operations to green financing strategy

Indonesia | ASEAN's Largest Member State

Indonesia - Overview

Indonesia is rapidly emerging as a key player in the global electric vehicle (EV) and automotive market. With a government committed to sustainable growth and a strategic focus on becoming an EV manufacturing hub, Indonesia offers immense opportunities for European companies. The country's abundant natural resources, including nickel, essential for battery production, position it as a critical link in the EV supply chain.

Population	**Labor Force**	**Median age**
285.7M	**143.1M**	**30.4 years**
GDP	**GDP growth**	**GDP per capita**
$1.37T	**5.03%**	**$4,960**
FDI Inflow	**Household income**	**Inflation**
$55.3B	**$9,872 (2023)**	**1.95%**

Why Enter Indonesia?

Strategic
Government Policies

Incentives for Manufacturers: Tax holidays, import duty exemptions, and other financial incentives.
National EV Roadmap: Ambitious targets for EV adoption and infrastructure development.
Stricter emission standards driving demand for EVs.

Robust
Market Potential

Growing Middle Class: Increasing consumer demand for electric and conventional vehicles.
Urbanization: Rising need for efficient and sustainable transportation solutions.

Resource
Abundance

Nickel Reserves: Key component for battery production, positioning Indonesia as a vital supplier.

Entity Incorporation

- Ease of Establishment: Indonesia offers a straightforward company registration process with supportive government policies.
- Minimum capital investment requirement is IDR 10 billion (~USD 670,000) for foreign companies.

Business Licenses

- Essential licenses include the Industrial Business License (IUI) and specific permits for EV manufacturing.
- The application process typically takes 2-4 weeks, with clear guidelines provided by the Indonesia Investment Coordinating Board (BKPM).

Tax

- Key Taxes: Corporate income tax is 22%, with a VAT of 10%.
- FDI Insights: Favorable policies include tax holidays of up to 20 years for EV manufacturers and exemptions on import duties for machinery and materials.

Labour Force Availability

- Large workforce pool of 135+ million workers, with~55% employed in blue-collar jobs.
- Supply vs. Demand: There is an adequate supply of blue-collar workers, with labor costs lower than in many other ASEAN countries.

Maturity of EV Ecosystem

- R&D: Collaborations with institutions like the Agency for the Assessment and Application of Technology (BPPT) & leading Universities for EV innovations.
- EV Charging Stations: Rapid expansion with 200 new charging stations added in 2023, bringing the total to 500, with a target of 31,000 stations by 2030.

Thailand | ASEAN's Most Mature Automotive Market

Thailand - Overview

Thailand is the undisputed leader in Southeast Asia's electric vehicle market, holding a whopping 79% of total EV sales in the region. This dominance stems from its established position as the automotive hub of ASEAN, coupled with strong government support for EV adoption. Thailand boasts the most developed EV infrastructure and is actively attracting manufacturers with incentives, positioning it as a future powerhouse in the regional EV industry.

Population 71.6M	**Labor Force** 40.1M	**Median age** 40.6 years
GDP $546.2B	**GDP growth** 2.5%	**GDP per capita** $7,985
FDI Inflow $33B	**Household income** $3,756.3 (2023)	**Inflation** -0.22%

Why Enter Thailand?

Production for Regional Export

Thailand is an established player in the Asian automotive sector, with exports of over 1.1 million cars in 2023 alone.

Demand for Sustainable Mobility

Consumer: Increasing awareness and demand for environmentally friendly transportation solutions.
Government: Incentives and policies to reach Zero Emission Vehicle by 2030.

Mature EV ecosystem

Infrastructure: A well-developed network of 2,500 charging stations which will evolve even further in the future.
Manufacture: An extensive supply chain for traditional vehicles, easily converted to EV production.

Entity Incorporation

- A private limited company can be registered for THB 6,000 (USD 163) per THB 1 million (USD 27,245) registered capital.
- BOI Promoted Company application might take 8-12 weeks, while a Foreign Branch registration can be completed within 2-4 weeks.

Business Licenses

- Foreign Business License (FBL) for foreign-owned companies required.
- Manufacturing License from Ministry of Industry to produce EVs or components.
- Factory Licensing, depending on factory size and pollution (2 levels obtainable).
- Environmental Impact Assessment (EIA) Approval, if manufacturing involves hazardous materials or waste disposal (Department of Environmental Quality)

Tax

- Corporate income tax (CIT) rate: 20%. Exemptions of corporate tax and dividend for qualified foreign EV companies for up to 13 years.
- Import duty exemptions on various goods for EV production
- Tax deduction incentives for Research and Development (R&D) activities.

Labour Force Availability

- Large workforce (850,000+) experienced in traditional automotive manufacturing.
- Government budget of USD 296M towards EV-focused skills development programs.
- Average monthly manufacturing wage in Thailand: ~THB 18,000 (USD 489).

Maturity of EV Ecosystem

- Strong positioning as a regional EV powerhouse, with the Thai government supporting from both the demand side (targeting for 30% of new car sales to be EVs by 2030), as well as the supply side, aiming for a deep value chain covering 40% of local content in EV production by 2030.

Singapore | Ideal Hub for R&D and Regional Expansion

Singapore - Overview

Despite high labor and land costs, Singapore excels as a hub for EV research and development and representative offices. Its advanced infrastructure, supportive government policies, and commitment to sustainability create a highly EV-friendly environment. Strategic location and excellent connectivity further enhance its appeal for innovation and strategic business operations in the EV sector.

Population	**Labor Force**	**Median age**
6.0M	**2.4M**	**39.4 years**
GDP	**GDP growth**	**GDP per capita**
$547.39	**4.4%**	**$90,689**
FDI Inflow	**Household income**	**Inflation**
$192B	**$11.927**	**0.9%**

Why Enter Singapore?

Business-Friendly Environment

Clear policies and regulations surrounding EVs in place, including charging infrastructure mandates, and emissions standards. This transparency minimizes uncertainty and bureaucratic hurdles for foreign EV companies.

Superior Innovation Ecosystem

Well-established innovation ecosystem including research institutions with focus on EVs. Engineering and advanced manufacturing talent enable to leverage Singapore as a regional R&D hub.

Financial Gateway of Asia

Large pool of international banks and investment firms, providing access to a variety of financing options, e.g. to fund R&D as well as regional expansion.

Entity Incorporation	• Company registration ideally via Third Party Provider (Corporate Secretariate) within a few days; some requirements such as a Local Director (must be SG resident) can be circumvented by the service provider, however may drive incorporation cost. • Licenses for manufacturing units under Economic Development Board (EDB) through ACRA - if manufacturing is desired in Singapore. • Selling of electricity directly to consumers (e.g. through own charging stations), requires an Electricity Retailer License (ERL) from the Energy Market Authority (EMA).
Business Licenses	
Tax	• Competitive CIT rate of 17% on chargeable income, for local and foreign companies. • GST (similar to VAT) of 9% (exports of goods and international services are exempted). • Tax incentives for foreign companies focused on EV in SG: R&D incentives (up to 250% of project expenses); Pioneer Incentive Scheme (PIS) (CIT exemption for several years). • Further government-provided finance grants, e.g. for M&A.
Labour Force Availability	• Talent pool ranking #2 globally with strong technical skills in engineering, manufacturing, R&D (Global Talent Competitive Index). • Strong English language proficiency, also on blue-collar.
Maturity of EV Ecosystem	• Target of 60K charging points by 2030 signifies commitment, addresses range anxiety. • Rise in EV-related startups, covering battery technology, electric vehicle manufacturing, and charging solutions. • Singapore-based (and Indonesia focused) Charged Asia raised US$ 40 million for future development and expansion to Vietnam.

Vietnam | Home to ASEAN's Largest EV Producer

Vietnam - Overview

Vietnam is an attractive destination for foreign EV companies . With a rapidly growing domestic EV market, a young workforce, and government incentives, Vietnam offers significant manufacturing potential. A testament to this is also the success story of Vinfast, ASEAN's largest and most prominent EV maker.
An increasingly maturing ecosystem and competitive labor costs position Vietnam as an ideal springboard for tapping into the region's flourishing EV market.

Population	**Labor Force**	**Median age**
101M	**57.1M**	**33.4 years**
GDP	**GDP growth**	**GDP per capita**
$476.3	**7.09%**	**$4,700**
FDI Inflow	**Household income**	**Inflation**
$25.35B	**$2,502**	**3.12%**

Why Enter Vietnam?

Manufacturing Prowess

Competitive labor costs compared to Thailand and Singapore and a growing pool of skilled labor in manufacturing, esp. in electronics, lures global manufacturing powerhouses to Vietnam.

FTAs & Government Incentives

Attractive incentives for EV companies cover tax breaks, import duty reductions, and subsidies for battery production. Vietnam also has a wide network of FTAs, facilitating exports to major markets like EU & ASEAN.

Resources for Battery Production

The significant reserves of lithium and nickel, key materials are key ingredient for a strong EV battery industry. Alongside, Vietnam's government is investing significantly in battery technology R&D.

Entity Incorporation	• Accelerated and less complex incorporation process for foreign entities. • Entities in most sectors can be set up without minimum capital requirements. • Foreign investors can opt for 100% foreign-owned limited liability companies (LLCs).
Business Licenses	• Investment Registration Certificate (IRC) serves as investment project approval and must be obtained via Ministry of Industry and Trade (MOIT). • Enterprise Registration Certificate (ERC) officially establishes a legal entity in Vietnam. • Industry-Specific Licenses, e.g. for Import, Export, Environmental Compliance.
Tax	• The standard CIT rate is 20%, whether local or foreign enterprise. • Many tax incentives: preferential tax rates (as low as 10%), tax holidays of up to 9 years, • Free Trade Zones offer foreign investors various fiscal and non-fiscal benefits.
Labour Force Availability	• Young and rapidly growing population eager to improve their economic situation. • Government initiatives promoting vocational training and upskilling programs. • Well-established and export-oriented manufacturing sector, particularly in electronics. Workers familiar with high-precision assembly lines and quality control procedures.
Maturity of EV Ecosystem	• Government heavily invested in expanding public charging infrastructure. • Growing number of startups focused on various aspects of the EV ecosystem. • Comprehensive policy framework under way, promoting sustainable EV development.

Malaysia | ASEAN's Technology Manufacturing Hub

Malaysia - Overview

While Malaysia's EV scene is in its early stages, the government is pushing for national pride, car maker Proton, to produce its own EV in a JV with its minority investors and Chinese EV giant Geely. The first model could be introduced as soon as 2025. Around this, ambition, policy makers are increasing consumer incentives and building charging stations to accelerate the EV adoption.

Population 35M	**Labor Force** 17.32M	**Median age** 31 years
GDP $491B	**GDP growth** 5.1%	**GDP per capita** $12,613
FDI Inflow $10.09B	**Household income** $5,731 (2022)	**Inflation** 1.4%

Why Enter Malaysia ?

Established
Automotive Industry

Well-established automotive industry with a strong presence of major international car manufacturers like Proton, Honda, and Toyota, providing a solid foundation for foreign EV entrants.

Developed
Logistics Network

Well-developed network of ports, highways and logistics infrastructure facilitating the im- and export of EV components and finished vehicles.

Green Tech &
Sustainability

Position as a leader in green technology within ASEAN, with a focus on green technology development with incentives and extensive research.

Entity Incorporation

- Online registration platforms and a dedicated agency for company registration.
- Resident director and company secretary required for foreign investors.
- Industry-specific ownership restrictions and compliance requirements must be navigated.

Business Licenses

- Incorporation leads to a Company Registration Certificate (CRC) - the official confirmation of a company's legal existence.
- Specific business licenses: Approved Permit (AP) from MITI (for import of EVs, components), Manufacturing License from Investment Development Authority (MIDA).

Tax

- 24% corporate tax rate for local and foreign businesses.
- EV incentives for R&D and Production: tax breaks, import duty reductions, subsidies.
- Import duty and excise tax exemptions for fully or partially imported EVs.
- Exemptions on sales tax make locally assembled (CKD) EVs more price-competitive.

Labour Force Availability

- Over 1 million manufacturing workers, typically well trained. 60%+ speak English.
- Government has allocated USD 212 million to developing future mobility talent.
- Average monthly manufacturing wage is around MYR USD 650.

Maturity of EV Ecosystem

- Consistently expanding charging infrastructure - 1,200 public stations as of 2024.
- Incentives to fulfill target of 30% local content in EV production by 2030.
- Establishing several special economic zones (SEZs) dedicated to the EV industry.
- Aiming for 20% of new car sales to be EVs by 2030 (ie. 50,000 EVs p.a.).

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Exhibits

Exhibit 1: EV Forecasted Sales in 2035, McKinsey (2022) (in Million of units)
Source: https://www.ey.com/en_ph/strategy/how-to-seize-opportunities-across-southeast-asias-ev-value-chain

Exhibit 2: EV Forecasted Sales until 2035, ASEAN-4, EY Parthenon (2024) (in Thousands of units)
Source: https://www.ey.com/en_ph/strategy/how-to-seize-opportunities-across-southeast-asias-ev-value-chain

Exhibit 3: SEA E4W expected production, 2022-2030 CAGR, McKinsey analysis (2023) (in thousands of units)
Source: https://www.mckinsey.com/featured-insights/future-of-asia/capturing-growth-in-asias-emerging-ev-ecosystem

Exhibit 4: ASEAN Domestic production gap by 2030, McKinsey research (2022) (in %)
Source:

Exhibit 5: Deloitte, 2023 Global Automotive Consumer Study Southeast Asia perspectives, 2023
Source: https://www2.deloitte.com/content/dam/Deloitte/sg/Documents/consumer-business/sea-cb-2023-global-automotive-consumer-study-southeast-asia-perspectives.pdf

Exhibit 6: EV manufacturing 2030 targets for ASEAN-4 World Economic Forum (2023), (in Million of units)

Exhibit 7: EV Country readiness index, CCX Partners research.

Exhibit 8: Capturing growth in Asia's emerging EV ecosystem.
Source: https://www.mckinsey.com/featured-insights/future-of-asia/capturing-growth-in-asias-emerging-ev-ecosystem

Exhibit 9: Number of EV charging stations in selected countries, CCX Partners Research

Exhibit 10: EV Sales in ASEAN-6 economies, CCX Partners research (2024).

Exhibit 11: Global nickel reserves by countries, Statista (in Million tons)
Source: https://www.statista.com/statistics/273634/nickel-reserves-worldwide-by-country/

Exhibit 12: World mine production of cobalt, by country (2023), Statista (in tons)
Source: https://www.statista.com/statistics/264928/cobalt-mine-production-by-country/

Exhibit 13: Nickel reserves by country, Government of Canada, 2022
Source: https://natural-resources.canada.ca/our-natural-resources/minerals-mining/mining-data-statistics-and-analysis/minerals-metals-facts/nickel-facts/20519

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