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US-ABC Recommendation Paper

The Electric Vehicle Ecosystem in ASEAN



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About the Council

Since 1984, the US-ASEAN Business Council has been the premier advocacy organization for US corporations operating within the dynamic Association of Southeast Asian Nations (ASEAN). Worldwide, the Council's membership of more than 165 companies generates almost US\$7 trillion in revenue and employs nearly 15 million people. Today our members include the largest US companies conducting business in ASEAN, and range from newcomers to the region to companies that have been working in Southeast Asia for more than 100 years. The Council has eight offices around the globe, in Washington, DC; New York, NY; Bangkok, Thailand; Hanoi, Vietnam; Jakarta, Indonesia; Kuala Lumpur, Malaysia; Manila, Philippines; and Singapore.

To achieve its objectives, the Council conducts research and analysis of economic, environmental, financial, political, and social, conditions in the ten countries of the Association of Southeast Asian Nations (ASEAN) namely Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. The Council utilizes the results of its research and analysis to provide educational programs, technical information for product innovation, and trade and investment-related activities.

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Introduction

The US-ASEAN Business Council (US-ABC) is honored to have the opportunity to participate in the annual ASEAN Transport Ministers Meeting. For many years, this engagement has served as the centerpiece of the US-ABC Transport & Infrastructure Committee's (now the Supply Chains Committee) efforts to support a more integrated and prosperous ASEAN through efficient, secure, compliant, and competitive supply chains across the region. Recalling the ASEAN Leaders' Declaration on Developing Regional Electric Vehicle Ecosystem¹ and the U.S.' support to develop policy recommendations to improve Electric Vehicle (EV) infrastructure and charging stations in ASEAN², the timing of this discussion is opportune for advancing ASEAN's discussions on the pressing issue of accelerating the electrification revolution in ASEAN for a sustainable future.

In the past half-decade, the Association of Southeast Asian Nations (ASEAN) has demonstrated substantial potential to be a globally competitive commercial hub for EV manufacturing and infrastructure. ASEAN's EV market size is expected to grow from USD 0.86 billion in 2023 to USD 3.54 billion by 2028, at a CAGR of 32.73% during the forecast period of 2023 – 2028³. Not only do ASEAN nations possess a significant capacity to produce the vehicles themselves, but they are also abundant in the natural resources and industrial ecosystems required to manufacture a wide range of EV components including chips, electronics, and batteries. These factors give ASEAN some distinct competitive advantages in EV and EV component manufacturing compared to other global regions. Nickel, for example, is an essential mineral needed for EV battery production. Indonesia possesses the largest nickel deposits in the world, having mined 1.6 million metric tons (MT) in 2022⁴. The Philippines ranks as the world's second largest nickel producer mining 330,000 MT in 2022⁵. Beyond the industrial capabilities and mining of the materials necessary for EVs, investment in the infrastructure and implementation of standards for EV adoption by consumers are also crucial to developing strong and resilient EV ecosystems.

An EV ecosystem encompasses much more than just the manufacturing of the vehicles themselves. It can constitute a broad array of elements, including the essential infrastructure for charging and maintenance, diverse components needed to build the vehicles, standards and regulations to ensure safety and interoperability, and the energy sources powering the vehicles. This interconnected system's growth and prosperity depend on multiple factors. Key among them are: proactive government policies that create an enabling environment, strong and consistent consumer demand driven by awareness and affordability, and crucially, the buy-in and commitment from the automotive industry to innovate and invest in EV technologies.

However, challenges to ASEAN maximizing its potential in EV global value chain also persist. There are evident regional disparities in EV adoption across the ASEAN member states (AMS). Some countries have leaped ahead with advanced technological deployments, while others are still in the early stages of their EV journey. Such disparities can hinder the potential for ASEAN to present a unified front in the global EV landscape. The stakes are high. Globally, there is fierce competition in the EV supply chain, with regions vying to become pivotal hubs for EV production and technology development. ASEAN's position in this

¹ <https://asean.org/asean-leaders-declaration-on-developing-regional-electric-vehicle-ecosystem/>

² <https://asean.org/wp-content/uploads/2023/09/FINAL-Chairmans-Statement-of-the-11th-ASEAN-US-Summit.pdf>

³ <https://www.mordorintelligence.com/industry-reports/asean-electric-vehicle-market/market-size>

⁴ <https://en.tempo.co/read/1748201/us-geological-survey-indonesia-is-world-biggest-nickel-producer-with-21mn-mt-reserves#:~:text=The%20report%20said%20that%20global,planet's%20nickel%20output%20that%20year.>

⁵ <https://www.statista.com/statistics/264642/nickel-mine-production-by-country/#:~:text=The%20country's%20nickel%20mine%20output,is%20also%20home%20to%20the>

race is influenced by its ability to leverage its resources and capabilities cohesively. Furthermore, the role of EVs in the broader narrative of green energy transitions cannot be overstated. Adopting EVs is not just about modernizing and decarbonizing transport; it's an integral part of the energy transition shift towards the utilization of cleaner and renewable sources of energy. As the world battles to curb carbon emissions, ASEAN's embrace of EVs could significantly bolster its sustainable energy endeavors.

In this light, this paper seeks to provide industry recommendations that address these challenges and support ASEAN's interests in becoming a formidable player in the global EV arena.. The roadmap to a thriving EV ecosystem includes supportive government policies, growing consumer demand, and continued industry commitment. Every AMS is on its respective path towards pursuing its green economy goals. The US-ABC and its members believe that by engaging the ASEAN Transport Ministers, our recommendations can help provide a unified blueprint for the region, without limiting focus on countries that currently possess more production, infrastructural, and adoption capacity.

EV Infrastructure Development in ASEAN

Current Status

AMS are currently undergoing a notable transition towards electric mobility, primarily motivated by their commitment to the United Nations Framework Convention on Climate Change and the Paris Agreement to pursue low-carbon and climate resilient development particularly in the transportation sector. With this, institutional efforts are currently centered on the manufacturing and promotion of EVs inside the ASEAN region. However, a notable hurdle arises from the inadequate accessibility of charging infrastructure, presenting a substantial barrier to the sustainable functionality and extensive adoption of EVs in the region.

In terms of the AMS' efforts in the development of EV infrastructure, Thailand aspires to achieve 12,000 charging points by the conclusion of 2023. In Vietnam, VinFast endeavors to establish 150,000 charging stations nationwide in the upcoming years. The anticipated expansion of charging stations is projected to increase from 180 to 7,146 by the year 2030 in Indonesia. Malaysia has set a target of 125,000 charging stations by the end of 2030, while the Philippines aims to deploy 2,000 charging stations by the end of 2030.⁶

At the latest ASEAN Summit in May 2023, the leaders' statement expressed their collective commitment and strategies of the member states in fostering the growth of EVs primarily through cooperation and partnerships with ASEAN's external partners through various ASEAN-led mechanisms, international organizations, and engagement with the private sectors and people to advance the regional EV ecosystem in the region.⁷

Challenges

According to a report published by Mordor Intelligence in 2022, the ASEAN EV market was at nearly \$500 million in 2021 and forecasted it to grow to \$2.7 billion by 2027⁸. With the given data, the growth of EV adoption in the ASEAN region is truly promising. However, there are several challenges that hinder the potential for EV Infrastructure Development in the region.

⁶ https://theicct.org/wp-content/uploads/2023/01/2.-Prof.-Savitri_Current-Profile-of-Transport-Electrification-in-ASEAN-Countries.pdf

⁷ https://asean.org/wp-content/uploads/2023/05/07-ASEAN-Leaders-Declaration-on-Developing-Regional-EV-Ecosystem_adopted.pdf

⁸ <https://www.mordorintelligence.com/industry-reports/asean-electric-vehicle-market>

- *Inadequate charging infrastructure:* Inadequate charging infrastructure is one of the primary obstacles confronting the EV market in Southeast Asia. The region lags behind in terms of establishing a comprehensive and accessible network of charging stations. Charging infrastructure in Southeast Asia is primarily concentrated in urban areas, with limited presence in rural areas. This concentration contributes to inconsistent adoption rates and hampers the potential growth of the EV market.
- *High price tags for manufacturers:* While transitioning to EV is thought to be more cost-effective in the long term for consumers, the upfront expenditures involved with the development of infrastructure remain significant. This remains as a chicken-and-egg situation as the prioritization of charging infrastructure may be contingent upon existing demand. It can be difficult to attract private investments and secure funding for the establishment and maintenance of EV infrastructure if the return on investment is uncertain with low market demand, particularly in countries with lower per capita incomes.
- *Technical Capacity Limitations:* Fast charging⁹ is a relatively new and critical technology in the near future to encourage EV uptake. DC fast charging, also known as Direct Current Fast Charging (DCFC), level 3 charging has rapid or ultra-fast charging capabilities. DC fast chargers are both expensive and complex which demands designing a robust infrastructure. To accommodate forecast numbers of registered EVs by 2030, ASEAN countries collectively will require¹⁰ an estimated 40,000 DC charging points. On-the-go fast charging is key to EV growth. However, the economics¹¹ of fast-charging provision can be challenging, as low utilization rates by customers can lead to poor profitability outcomes. Several barriers, such as utilization uncertainty, hardware costs, installation complexity, and difficulty in assessing the revenue model, need to be addressed. The installation of Direct Current Fast Charging (DCFC) requires substantial upfront costs and significant public works and electrical upgrades. ASEAN nations will need to invest in sophisticated data management tools and cloud computing networks capable of monitoring energy storage capacity and control scheduling services. Furthermore, the development of smart charging solutions is essential to ensure accessibility¹² and efficient distribution on long-haul routes, at home, and in public charging stations. Without a streamlined process that enables data-sharing between drivers and the charging network providers, ASEAN nations face cyber risks and the potential malfunctioning of power systems. Ensuring the availability of EV charging options at various speeds, costs, and locations is important, and governments play a pivotal¹³ role in promoting technical capacity.
- *Systems Incompatibility:* This includes not only limited charging infrastructure but also interoperability challenges such as differences in charging systems and payment options, as well as technological limitations of the road networks that are incompatible with the needs of EVs. In some ASEAN countries, a single EV charging protocol is promoted which drives charging points to become limited or being exclusive to one particular EV brand only.

Recommendations

Governments, private sector stakeholders, and regional organizations must work together on a multidimensional strategy to address these challenges. The recommendations below are regarded by industry as crucial elements of an effective approach to address these obstacles and promote the advancement of EV infrastructures in the ASEAN region.

⁹ <https://aseanenergy.org/charging-infrastructure-to-accelerate-aseans-electric-vehicle-deployment/>

¹⁰ <https://www.mckinsey.com/featured-insights/future-of-asia/capturing-growth-in-asias-emerging-ev-ecosystem>

¹¹ <https://www.sciencedirect.com/science/article/pii/S1364032121010066>

¹² <https://ptr.inc/wp-content/uploads/2021/09/Electric-Vehicle-Charging-Infrastructure-in-ASEAN.pdf>

¹³ <https://ptr.inc/wp-content/uploads/2021/09/Electric-Vehicle-Charging-Infrastructure-in-ASEAN.pdf>

- *Promote Interoperability:* Interoperability provides flexibility and convenience to EV owners creating reliable access to EV charging networks. Therefore, it is highly recommended to adopt Internationally recognized EV standards and communication protocols to attain interoperability. Collaboration between regulatory bodies and the automotive Industry will play an important role to achieve this. Relevant EV policy and implementing regulations are key to developing EV charging infrastructure and investment in the EV charging ecosystem.
- *Building of EV-friendly road networks and integration with urban planning:* Urban Planning should take into consideration the inclusion of EV infrastructure development. This entails careful selection of strategic locations for the installation of charging stations, the establishment of wayfinding signages for EV charging stations, pavement markings on parking spaces that are only for EVs and the harmonization of uniform traffic control devices. Planning should also involve enforcement of access, time limits, and hours of use of facilities.
- *Encouraging Foreign Direct Investments in EV Infrastructure:* Policy approaches to be considered include attracting foreign technologies and firms to assist in the development of an efficient regional EV ecosystem in the forms of financing, technology transfer and capacity building. This ensures a comprehensive end-to-end transfer of technology, encompassing manufacturing, operations, and maintenance of EVs.
- *Incentives for EV Infrastructure Providers and Locators:* In addition to offering incentives to EV users, it is crucial to provide incentives for corporations to invest in and manage charging infrastructure. Similarly, this applies to individuals or entities who grant permission for the establishment of EV infrastructure on their properties such as shopping malls, parking spaces and transport hubs.
- *Strengthening of Policy and Institutional Support:* The lack of consistent policies across the region hinders the growth of EV infrastructure. It is imperative for governments to implement laws that will incentivize both customers and manufacturers, encouraging their active participation in the EV ecosystem from production to operations and maintenance. While a majority of AMS have adopted a comprehensive policy framework [is that true, or should we say “are developing policy frameworks”?] aimed at fostering the growth of their respective domestic EV ecosystems, advocacies should extend beyond promoting the use of EVs to also emphasize the development of EV infrastructure. This is particularly crucial when incorporating EV infrastructure timeline considerations in setting targets and in the formulation of roadmaps.

Examining Best Practices and Policies in ASEAN for EV Infrastructure Development

Across Southeast Asia, a range of exemplary practices and policies have emerged to promote the growth of EV infrastructure. These regional initiatives collectively contribute to the sustainable transformation of transportation systems. Notable measures include the establishment of regulatory frameworks aimed at encouraging EV adoption, such as incentives for early adopters, enhanced emissions schemes, and revisions in taxation frameworks to favor electric vehicles.

Furthermore, the region as a whole is committed to a vision of widespread EV charging accessibility. Governments across Southeast Asia are investing heavily in expanding EV charging infrastructure. Ambitious targets have been set to deploy a substantial number of charging points by 2030¹⁴. These targets encompass both public car parks and private premises, ensuring that EV users have convenient access to charging facilities. A regional emphasis on fostering Public-Private Partnerships (PPPs) has been evident. These partnerships facilitate the growth, maintenance, and innovation of EV infrastructure, helping to create a seamless experience for EV users.

¹⁴ <https://aseanenergy.org/charging-infrastructure-to-accelerate-aseans-electric-vehicle-deployment/>

In addition to regulatory and infrastructure developments, AMS recognize the importance of research and development (R&D) activities in fostering the growth of the EV industry. Investments are being made to enhance knowledge and technological capabilities, ensuring that the region remains at the forefront of innovation in electric vehicle technology. This collective commitment to R&D aligns with the overarching goal of positioning Southeast Asia as a leader in the advancement and manufacturing of cutting-edge EV technology.

By collectively adopting these best practices and policies, AMS can work towards a sustainable and eco-friendly future for transportation in the region. These efforts reflect a shared commitment to reducing carbon emissions and promoting innovation in the rapidly evolving EV ecosystem across the region.

EV Battery Supply Chain in ASEAN

Electrification of transportation is gaining momentum in the ASEAN region. While Cambodia, Laos, Myanmar, and Brunei Darussalam lack domestic EV battery manufacturing, their governments encourage EV adoption through tax incentives. The Philippines, Thailand, Vietnam, Singapore, Malaysia, and Indonesia have enticed foreign investments in EV component manufacturing with policies, incentives, and purchase subsidies. Below are brief updates from the Philippines, Thailand, Vietnam, Singapore, and Malaysia, with a particular focus on Indonesia, the leading player in EV battery manufacturing.

- *Indonesia:* As the largest nickel exporter, Indonesia is the region's leading country in EV battery manufacturing. It is also a major producer of tin and copper which are essential for EV batteries. Indonesia aims to produce some 600,000 EVs by 2030 and build an industrial ecosystem for lithium batteries. Indonesia's national energy company, Pertamina, supports battery production and infrastructure, positioning Indonesia as Southeast Asia's primary lithium-ion battery hub¹⁵.
- *The Philippines:* Holding the world's second-largest nickel reserves after Indonesia, the Philippines is partnering with South Korean battery materials producer Posco¹⁶ to produce raw materials for automotive battery cathodes.
- *Thailand:* Aiming for 30% EVs by 2030, Thailand targets 40 gigawatt hours of battery¹⁷ production for 725,000 vehicles.
- *Vietnam:* VinES Energy Solutions, a member of Vingroup, has begun building a facility that will produce 100,000 EV batteries annually for sale and its own EV production. VinES specializes in R&D and manufacturing of advanced batteries¹⁸ [fix footnote font] for mobility and energy storage applications.
- *Singapore:* In anticipation of a sharp increase in EV battery recycling volume, TES Singapore, and Se-cure plan to construct an exclusively designed battery recycling plant¹⁹ [fix font] for EV batteries in 2025.
- *Malaysia:* Hong Seng Consolidated Berhad and EoCell are focusing on innovative electrolyte technologies²⁰, including solid-state and nano-silicon anode materials.

¹⁵ <https://evmarketsreports.com/indonesia-to-lead-sea-battery-manufacturing-by-2030/>

¹⁶ <https://www.recessary.com/en/news/ph-announcement/posco-co-build-nickel-plant-for-ev-batteries-in-philippines#:~:text=South%20Korean%20battery%20materials%20maker,largest%20nickel%20reserves%20after%20Indonesia.>

¹⁷ <https://www.mining.com/web/detroit-of-asia-targets-battery-makers-to-stay-ahead-in-ev-race/>

¹⁸ <https://investors.li-cycle.com/news/news-details/2023/VinES-and-Li-Cycle-Announce-Strategic-Long-Term-Battery-Recycling-Agreement/default.aspx>

¹⁹ <https://www.straitstimes.com/singapore/transport/battery-recycling-firms-to-build-new-plants-to-cope-with-ev-population-growth>

²⁰ <https://www.businesswire.com/news/home/20220614005962/en/Hong-Seng-and-EoCell-plan-collaboration-on-regional-manufacturing-hub-for-EV-batteries-and-energy-storage-solutions>

As AMS progress in their EV battery manufacturing aspirations, three pivotal challenges emerge:

- *Complex Production and Lower Economic Viability*²¹: Batteries with high nickel content require more complex and controlled production processes. While lithium iron phosphate (LFP) is cost-effective and has a longer cycle life, it is not as lucrative for recycling due to the absence of valuable metals such as nickel and cobalt.
- *Upfront Investment*²²: Growing climate ambitions increase demand for metals. Diversified battery chemistries coupled with varied production lead times may result in supply chain bottlenecks, requiring significant upfront investments.
- *Low EV Adoption Rate*²³: The prohibitive cost of EV ownership hinders rapid adoption. Lack of charging infrastructure combined with reliance on fossil fuels or non-renewable energy sources deter green EV adoption, discouraging manufacturers from setting up facilities in ASEAN.

Recommendations

AMS are positioned to take steps toward improving their energy security. EVs can help lead the way if a regionally integrated EV supply chain exists. ASEAN member countries must prioritize regional collaboration²⁴ and an integrated supply chain. Strengthening the flow of automotive parts within the region will foster synergies in both EV battery production and EV manufacturing. Without such cooperation, EV production may outweigh EV adoption capabilities. For instance, Indonesia’s resource abundance can focus on battery manufacturing, while Thailand’s more mature EV market can excel in EV production²⁵. Indonesia could potentially collaborate with Singapore to establish domestic EV battery recycling plants²⁶ and collaborate with cost-effective²⁷ producers such as Vietnam and the Philippines, leveraging each country’s strengths.

Additionally, it's important to note that waste generated by EVs, especially in the form of batteries, can contain hazardous materials that pose risks to human health and the environment. Therefore, it is recommended to have proper disposal guidelines for E-waste. The recycling of Li-ion batteries is a standard practice in other developed markets, and ASEAN can adopt End-of-Life (EOL) or EV disposal and recycling regulations to ensure responsible handling of these materials.

EV Standards & Regulations in ASEAN

ASEAN is a very diverse region with contrasting vehicle environments including from the ecological side. It's imperative for the AMS to integrate cohesive regulations and standards to ensure the region's leadership in sustainable transport. Therefore, it is important for AMS to incorporate global standards and prioritize the principle of interoperability for EV ecosystem development and incorporate these elements into existing national roadmaps, guiding member states to achieving greater regionally harmonized regulations.

²¹ <https://www.nrel.gov/docs/fy23osti/84520.pdf>

²² <https://www.economist.com/asia/2023/07/17/a-battery-supply-chain-that-excludes-china-looks-impossible>

²³ <https://www.thejakartapost.com/opinion/2023/05/22/dont-rush-on-ev-in-asean.html>

²⁴ <https://cleantechnica.com/2023/05/25/asean-battery-conference-wants-collaboration-to-encourage-growth-in-a-region-that-is-about-to-be-ready-for-evs/>

²⁵ <https://asia.nikkei.com/Spotlight/Supply-Chain/Thailand-Indonesia-emerge-as-bigger-links-in-EV-supply-chain>

²⁶ <https://www.straitstimes.com/singapore/transport/battery-recycling-firms-to-build-new-plants-to-cope-with-ev-population-growth#:~:text=TES%20Singapore%2C%20which%20currently%20processes,electric%20vehicle%20batteries%20in%20Singapore.>

²⁷ <https://www.cnn.com/2023/08/07/vietnams-ev-ownership-will-see-strong-growth-in-2023-bmi-report-says.html>

Regional vs National Standards

To ensure the growth of the EV market and maintain technological alignment, it is crucial for ASEAN to adopt international standards and avoid bespoke standards. Adopting international standards allows for a smoother import/export process of EVs and related infrastructure, resulting in global compatibility. International standards often reflect the best in global technology practices, ensuring that the region isn't left behind in technological alignment.

Furthermore, it is imperative that harmonized technical standards and regulations for EVs must also include charging infrastructure, and other equally important EV components. This will facilitate seamless inter-operation and ensure safety, quality, and reliability of EVs across ASEAN. Consistent standards across EV ecosystem aspects in the region can also lead to increased investments as businesses face less regulatory ambiguity, building investor confidence.

On the other hand, bespoke or nation-specific standards can lead to inefficiencies, limiting the growth of the EV market in the region. It can also deter international manufacturers from entering the ASEAN market, due to the increased costs associated with multiple regulations.

Recommendations

- ASEAN to assess and evaluate the current national standards of each member state to identify gaps and overlaps.
- AMS to recognize the crucial role played by the ASEAN Consultative Committee on Standards and Quality (ACCSQ) as the custodian for standards, which can prevent the fragmentation of standards-setting bodies.
- ASEAN to engage and collaborate with global regulatory bodies, the private sector, and industry experts to identify internationally recognized standards principles and adopt best practices. This will enable ASEAN to play a significant role in shaping global requirements and provide a unique market/regional perspective for consideration.
- It is imperative for AMS to consider not only participating in the World Forum (WP.29) 1998 Agreement on Global Technical Regulations (GTR)²⁸ but also international standards developed by other Standards Development Organizations (SDOs) that align with WTO TBT Agreement's Principles for the Development of International Standards, Guides, and Recommendations²⁹. This includes the use of internationally recognized standards and best practices as a means to facilitate trade and create a predictable trading environment.
- AMS to recognize the vital importance of accelerating the harmonization of their national standards based on international standards for EV Charging Connectors across the region. This will promote seamless travel for e-trucks, facilitate the electrification of seamless supply chains, support the development of EV and Charging Connectors markets, and enhance safety and consumer confidence in the region.
- AMS to also work towards standardizing and unifying the type approval and certification processes for Vehicles and Charging Equipment. Currently, each vehicle model and charging equipment must be individually type approved, homologated (officially approved), and certified in each country, significantly increasing the engineering effort, cost, and timeline for EV and charger manufacturers to launch new products in the region. This represents a notable difference between ASEAN and the European Union.

²⁸ https://unece.org/fileadmin/DAM/trans/doc/2019/wp29/1998_Agreement_EG.pdf

²⁹ https://www.wto.org/english/tratop_e/tbt_e/principles_standards_tbt_e.htm

- It is imperative for ASEAN, as an emerging market, to align with international regulations such as UN-R100, UN-R136, and FMVSS-305 to support globally implemented safety requirements on electrified vehicles. Emphasizing safety in rule-setting is crucial, as high-profile incidents may hinder EV adoption due to public safety concerns. Collaboration with industry experts and the private sector can significantly contribute to achieving these safety goals.
- AMS to ensure the availability and reliability of components standards before making them available for public consumption. Given the potential for increased interest in EV conversions, related kits must adhere to safety and emissions regulations from relevant authorities.

Conformity Assessment Framework: Addressing Safety, Security, and Sustainability Across the EV Value Chain

EV testing and certification extend far beyond homologation testing for the vehicles and their components. It also encompasses the testing of charging interfaces and the associated systems that enable EVs, charging stations, and back-office systems to communicate with each other, a concept known as interoperability (Smart Grid technologies) or conformance testing. Battery packs and the modules they are composed of, which contain a large number of battery cells, are a source of energy that can pose potential hazards and, therefore, must also undergo testing and certification.

Hence, the development of a conformity assessment framework that includes a robust accreditation, certification, and market surveillance framework is essential. Leveraging global best practices, including public-private partnerships in conformity assessment, offers several advantages. It ensures rapid manufacturing and market access, reduces regulatory oversight, and helps achieve the desired levels of safety, security, and sustainability across the EV value chain.

Case Study: Thailand's EV Regulatory Evolution in the ASEAN Context

Thailand has long been a hub for the automobile industry. As of 2021, Thailand was the largest car producer in Southeast Asia, manufacturing over 1.4 million vehicles³⁰. As the region aims to pivot towards EVs, Thailand realized the need to revamp its national standards to align with international benchmarks and ensure the country doesn't lose its edge in the automobile market.

Thailand had a set of bespoke standards catered towards its conventional automotive industry. In the early 2010s, EVs accounted for a negligible portion of Thailand's automobile market, primarily due to a lack of clear regulatory guidelines and infrastructure³¹. This posed challenges for EVs as these standards were not readily adaptable to the new technology. Imported EVs faced regulatory hurdles, and local manufacturers hesitated to invest heavily in the absence of clear standards.

In an effort towards EV standards harmonization and as part of its Thailand 4.0 vision³², the Thai government began consultations with international regulatory bodies such as the International Electrotechnical Commission (IEC)³³ and the World Forum for Harmonization of Vehicle Regulations (WP.29) to understand global benchmarks and initiated steps to foster the EV ecosystem. The Thai Industrial Standards Institute (TISI) worked on adapting these international standards to the local context, making sure they catered to the unique challenges and opportunities of the Thai market³⁴.

³⁰ <https://www.statista.com/statistics/1026953/thailand-annual-vehicle-production/>

³¹ https://www.boi.go.th/upload/content/BOI-brochure-2015-automotive-20150325_70298.pdf

³² <https://thaiembdc.org/thailand-4-0-2/>

³³ https://www.iec.ch/dyn/www/f?p=103:16:416670926652952:::FSP_ORG_ID,FSP_LANG_ID:1027,25

³⁴ <https://www.trade.gov/market-intelligence/thailand-electric-vehicle-standards>

As a result, the clarity in regulations and alignment with international standards boosted confidence among manufacturers and consumers alike. This led to a noticeable increase in EV adoption rates in Thailand. As of the end of 2022, the Board of Investment of Thailand reported applications for investments related to EVs supply chain alone amounted to almost 54 billion baht, showcasing increased interest in the EV sector³⁵. Global EV giants, recognizing Thailand's forward-looking regulatory framework, started to view it as a prime destination for investments. This has translated to significant investments in local manufacturing units and R&D centers. Global automobile giants such as Tesla have either set up or expressed interest in expanding their EV production capabilities in Thailand.³⁶ Thailand's efforts have been lauded in ASEAN forums, with several member states looking at the Thai model as a reference for their EV regulatory evolution. Thailand's aggressive EV roadmap, aiming for 30% of all vehicles produced to be electric by 2030, has been highlighted in ASEAN forums as an ambitious benchmark for the region.³⁷

Thailand's journey underscores the significance of harmonizing national standards with global benchmarks, especially in rapidly evolving sectors like EVs. By being proactive and collaborating both internationally and regionally, Thailand not only fortified its position in the EV landscape but also contributed to the broader ASEAN objective of sustainable transportation.

Existing Regulatory Framework for EVs in ASEAN

The ASEAN region has showcased varying degrees of adaptability and responsiveness to the EV revolution. Countries like Singapore have rapidly adopted measures to promote EV usage, making them front runners in the region. Nations such as Thailand and Malaysia have been actively working on policies to increase EV adoption, with increased investments and incentives in place. Meanwhile, some member countries, due to economic or other priorities, have been slower in integrating EV policies, resulting in a more embryonic stage of EV infrastructure and adoption. In light of these varied approaches, U.S. industry recommends the following for AMS:

Recommendations

- *Strengthen Policy Framework*
 - Incentivizing greater utilization of EVs by offering tax breaks, subsidies, or discounts for EV buyers can encourage faster adoption.
 - Simultaneously, it is important to disincentivize fossil fuel vehicles. Gradually introducing carbon taxes or increasing levies on fossil fuel vehicles can push consumers toward greener alternatives.
- *Balancing Safety and Technological Development*
 - Policymakers and regulators should prioritize safety while also allowing room for technological development. Many of the technologies used in EVs and charging infrastructure are still in development to become more efficient and safer. Prioritizing safety while allowing technological advancement leads to overall safety and convenience improvements. Therefore, policies, implementation, and regulations should not impede development that can enhance safety.
- *Collaborative R&D*
 - Conduct joint research and development initiatives by collaborating among AMS, industry experts, universities, and research institutes to drive indigenous EV technologies and innovation.

³⁵ https://www.boi.go.th/index.php?page=press_releases_detail&topic_id=133546&language=en

³⁶ <https://www.reuters.com/world/thailands-new-pm-meets-tesla-chief-musk-new-york-2023-09-21/>

³⁷ <https://www.aseanbriefing.com/news/thailand-issues-new-incentive-package-for-electric-vehicle-industry/>

- Public-private partnerships are also important to facilitate collaborations between governments and private entities to expedite R&D processes, with a focus on localized solutions and technologies.
- *Mindful Policy Framework to Achieve Net Zero Emissions*
 - The utmost priority underlying mass EV adoption is achieving the net zero emission goal. Countries should carefully balance multifaceted needs. For example, protecting certain businesses and activities for nationals must be thoughtfully balanced with deploying quality charging stations, which are vital for EV enhancement.
- *Infrastructure Development*
 - AMS should encourage investments in EV charging infrastructure. Governments can provide incentives to private sector entities to establish charging stations, including fast-charging hubs in urban areas and extended networks along highways.
 - AMS should also ensure the standardization of plug types and charging methods across the region to facilitate cross-border EV travel.
- *Clean and Safe Transport for All*
 - ATMs should incorporate the goal of clean and safe transport for all into the Ministry's duties. This means ensuring safety for drivers, passengers, pedestrians, and the environment.
 - The ATMs should take on the role of the main catalyst in driving the transition from conventional to electric vehicles, especially when EV policies may conflict with the goals of other ministries.
- *Trust and Experience for Mass EV Adoption*
 - Ensuring that EVs and all related equipment, from home charging to charging stations, meet world safety standards is crucial.
 - Electricity rates should be technology-agnostic and applicable for all types of chargers. For instance, implementing an interruptible rate condition for a lower tariff rate can support the expansion of charging infrastructure, but it may limit the capability of fast chargers. This could potentially lead to a shortage of charging stations in the long run.
 - It is important to promptly and accurately communicate and assess the situation when a fire incident occurs. There is still a misconception in society that EVs are more prone to fire incidents compared to conventional and hybrid cars. Public awareness is crucial to ensure the right and proper understanding and management of the situation when fire incidents happen.

Case Study: Regulatory Models in Singapore

With its well-defined EV standards, tax incentives for EV buyers, and investments in charging infrastructure, Singapore serves as a model for successful regulatory framework. Singapore's policy strength lies from the Land Transport Authority's clear roadmap towards phasing out internal combustion engine vehicles and the introduction of the EV Early Adoption Incentive offers tax breaks for EV buyers.³⁸ Its infrastructure development, namely the Green Plan 2030 by Singapore, promises a robust charging infrastructure, aiming to increase the number of charging points to 60,000 by 2030.³⁹ Continuous campaigns and educational drives have positioned EVs as a primary mode of future transport in the public eye.

³⁸ https://www.lta.gov.sg/content/ltagov/en/industry_innovations/technologies/electric_vehicles/our_ev_vision.html

³⁹ <https://www.greenplan.gov.sg/vision/>

The Role of EVs in Green Energy Transition

AMS recognize the importance of the transition towards renewable energy sources. Based on the AMS power development plans for 2021-2025, approximately 60% of the newly installed capacity will derive from renewables. This strategic shift aligns with increased electrification and the growing use of EVs in ASEAN, as the roles of EVs and renewable energy are intricately linked. The highest-emitting industry in ASEAN is the manufacturing sector, followed by aviation. Fossil fuels still make up over 85% of primary energy sources in the region.

Certain ASEAN countries have shown more significant progress in adopting renewable energy sources, with Malaysia emerging as a frontrunner in embracing the transition to green energy. Each ASEAN nation recognizes the urgency of expediting the transition to cleaner energy resources and shares a commitment to regional collaboration.

Indonesia, the most populous country in Southeast Asia, accounts for 40% of the region's energy consumption. In the Philippines, high electricity prices are among the highest in ASEAN which signals a significant reliance on coal. Additionally, the offshore Malampaya gas field, providing about 20% of the Philippines' electricity, is expected to be depleted by 2027⁴⁰. Coal-fired power generation in the ASEAN region will peak in 2027. Thailand's largest gas field, the Erawan field, faces a sharp decline by 2030 unless new reserves are found. Thailand is exploring renewable energy sources using agricultural biomass and is seeking to extend its two production-sharing contracts in Myanmar⁴¹. Meanwhile, Cambodia is partnering with Singapore to become a major exporter⁴² of clean energy in the region, bolstering its position in the industry with solar and wind projects. Vietnam leads the way in solar generation, accounting for 50% of the Mekong region's capacity, and boasts most of ASEAN's wind-energy capacity⁴³. Laos⁴⁴ aims to expand its solar, wind, and geothermal capacity by 2030. Similarly, Brunei Darussalam targets 30% renewable⁴⁵ energy in its power generation mix by 2035.

Malaysia as a regional renewable powerhouse

Malaysia has set a bold target of achieving 70% of renewables⁴⁶ in the power mix by 2050. The nation boasts substantial potential for harnessing clean energy from solar, biomass, and hydro. As the world's third-largest manufacturer of photovoltaic solar panels, Malaysia is positioned to construct Southeast Asia's largest solar hybrid facility⁴⁷, led by the country's sovereign wealth fund, Khazanah Nasional Berhad. Furthermore, Malaysia is emerging as a key player in the hydrogen economy ecosystem, such as in R&D, technology advancement, and storage. Anticipated to be operational in 2027, the H2biscus and H2ornbill projects are set to be cornerstones of Malaysia's green hydrogen economy⁴⁸.

⁴⁰ <https://www.bworldonline.com/economy/2021/05/19/369673/malampaya-depletion-expected-by-1st-quarter-of-2027/>

⁴¹ <https://www.irrawaddy.com/business/thai-energy-titans-contract-extensions-for-myanmar-gas-in-the-pipeline.html>

⁴² <https://www.prnewswire.com/news-releases/cambodia-takes-bold-steps-in-energy-efficiency-leadership-paving-the-way-for-major-renewable-energy-deal-with-singapore-301789666.html>

⁴³ <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/putting-renewable-energy-within-reach-vietnams-high-stakes-pivot>

⁴⁴ <https://www.evwind.es/2023/07/09/the-role-of-renewable-energy-in-shaping-laos-energy-future/92711>

⁴⁵ <https://www.reuters.com/world/asia-pacific/renewables-make-up-30-bruneis-power-generation-by-2035-minister-2021-10-25/>

⁴⁶ <https://www.enerdata.net/publications/daily-energy-news/malaysia-sets-new-target-reach-70-renewables-power-mix-2050.html>

⁴⁷ <https://www.bloomberg.com/news/articles/2023-07-27/malaysia-plans-to-develop-region-s-largest-solar-hybrid-plant?embedded-checkout=true>

⁴⁸ <https://energynews.biz/green-hydrogen-in-sarawak-bintulu-projects-set-to-transform-the-energy-sector/>

The Sustainable Energy Development Authority (SEDA) spearheads numerous initiatives, including Net Energy Metering (NEM) Scheme, Green Technology Financing Scheme (GTFS), and Capacity Building Programs to promote sustainable energy, particularly among small and medium-sized enterprises (SMEs). The government's Green Investment Tax Allowance⁴⁹ grants allowances for companies that are adopting renewable energies in their operations. The government of Malaysia underscores the importance of aligning the EV policy with the National Energy Transition Roadmap 2030⁵⁰ (NETR 2030).

The EV market size is expected to grow⁵¹ from US\$0.86 billion in 2023 to US\$3.54 billion by 2028 in the ASEAN region. However, there are pressing challenges for the ASEAN region to achieve both their EV targets and meet their renewable energy transition plans.

Lack of implementation plans and investment⁵²

Each ASEAN nation will need substantial foreign investment to avoid further coal-fired power expansion. Low-income countries, such as Cambodia and Laos, rely heavily on concessional finance and loans to advance their transition efforts. While Malaysia has established a comprehensive national energy policy that outlines the transition roadmap, there is no detailed implementation plan. Additionally, extending the existing electricity grid infrastructure to many remote locations in the region is often economically unfeasible. The challenge of deploying intermittent renewable sources such as solar and wind into the energy grid underscores the need for investments in battery storage technology.

Opaque Regulations and Geopolitical Risks⁵³

Several governments in the region are also large stakeholders in fossil fuel production through state-owned energy companies. Their involvement complicates their incentives concerning the energy transition. Furthermore, opaque regulatory policies, political instability and corruption, complex licensing procedures, and protectionism present obstacles to foreign investments in clean energy transition initiatives. Although renewable energy development has demonstrated better resiliency than fossil fuels, policy intervention is still essential to maintain the growth of renewable energy capacity.

The widespread adoption of EVs carries significant implications for the management, monitoring, and control of power systems. Integration of the renewable energy transition and EVs requires a multifaceted approach.

Liquefied Natural Gas as a Transition Bridge

In the ASEAN region, phasing out coal is imperative to accomplish net-zero targets. Natural Gas can serve as a cost-effective transitional energy source. It is considerably cheaper than an immediate switch to renewables and emits far fewer greenhouse gases (GHG) than coal.

Carbon Pricing⁵⁴

Singapore has already implemented a carbon tax, setting an example. It is advisable for all ASEAN countries to consider implementing carbon pricing mechanisms to discourage the use of fossil fuels.

⁴⁹ <https://www.crowe.com/my/news/tax-incentive-for-green-initiatives#:~:text=Green%20Technology%20Tax%20Incentive%20in%20Malaysia&text=For%20easier%20financing%20access%2C%20the,intere st%20or%20profit%20rate%20charged.>

⁵⁰ <https://thethaiger.com/world/news/555392/>

⁵¹ <https://www.mida.gov.my/mida-news/shifting-the-ev-sector-to-the-next-gear/>

⁵² <https://www.csis.org/analysis/clean-energy-and-decarbonization-southeast-asia-overview-obstacles-and-opportunities>

⁵³ <https://www.csis.org/analysis/clean-energy-and-decarbonization-southeast-asia-overview-obstacles-and-opportunities>

⁵⁴ <https://www.iseas.edu.sg/articles-commentaries/iseas-perspective/2023-68-southeast-asias-stakes-in-pricing-carbon-by-vinod-thomas/>

Effective Policy and Collaboration⁵⁵

Energy and economic policy incentives to promote renewables and EVs must be translated into clear and actionable plans. Malaysia's National Energy Policy 2022-2040 serves as a valuable reference for other ASEAN nations. Collaboration among stakeholders is also key.

Investment in Reliable Infrastructure⁵⁶

The widespread adoption of EVs depends on reliable charging infrastructure. To support the growth of renewable energy and smart EV charging infrastructure, governments and private organizations in ASEAN must invest in research and development. Additionally, offering incentives for the deployment of clean energy and charging infrastructure will be instrumental.

Global Best Practices: What have Governments of major automotive markets done to create and enable EV ecosystems?

China, Europe, and the United States account for more than 90% of the world's EV fleet.⁵⁷ By 2050, 80% world vehicle sales are expected to be electric and by 2035 the world's three major automotive markets are expected to sell only EVs.⁵⁸ How did China, Europe, and the United States create and enable an EV ecosystem and promote EV adoption? Climate policy and industrial policy alike motivated these governments to implement policies that support EVs. Common strategies include fiscal incentives and subsidies to reduce upfront costs including research and development funding, mainly to promote manufacturing and to encourage consumers to purchase EVs; investment in charging infrastructure to make EV adoption more convenient and to reduce consumer anxiety; fuel economy standards and emission reduction targets that promote more fuel-efficient vehicles including Zero-Emission Vehicle (ZEV) mandates requiring automakers to sell EVs at a certain percentage in their product line up; green public procurement encouraging federal, state, and local governments to include EVs in purchasing decisions of their fleets; special privileges to EV buyers and owners like direct incentives to purchase and special access to lanes that ease traffic congestion, i.e. high-occupancy vehicle lane access even when driving alone; and outreach and public awareness campaigns to educate consumers about the benefits of EV and dispel misconceptions.

China

China's domestic market is home to the world's largest stock of EVs, with 4.3 million cumulative electric passenger vehicle sales by August 2020, accounting for 47% of the global total.⁵⁹ In 2021-2022, the number of EVs sold annually in the country grew [from 1.3 million to a whopping 6.8 million](#), making 2022 the eighth consecutive year in which China was the world's largest market for EVs. For comparison, the US only sold about 800,000 EVs in 2022.⁶⁰ However, while relatively self-sufficient in EV production, China's export ratio is much lower than those of the United States and Europe. Between 2010 and 2019, China exported about 25,000 light-duty EVs, less than 1% of its production.⁶¹

⁵⁵ https://www.ekonomi.gov.my/sites/default/files/2022-09/National%20Energy%20Policy_2022_2040.pdf

⁵⁶ <https://driivz.com/blog/renewable-energy-and-ev-charging/>

⁵⁷ <https://openknowledge.worldbank.org/server/api/core/bitstreams/4c73ad87-2972-44e3-942e-cd2e3bb32350/content>

⁵⁸ <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/power-to-move-accelerating-the-electric-transport-transition-in-sub-saharan-africa>

⁵⁹ <https://www.ev-volumes.com/datacenter/>

⁶⁰ <https://www.technologyreview.com/2023/02/21/1068880/how-did-china-dominate-electric-cars-policy/>

⁶¹ <https://theicct.org/wp-content/uploads/2021/06/china-green-future-ev-fs-feb2021-01.pdf>

The Role of State Policies

China also took steps early to optimize new technologies and cultivate a large group of consumers. State policies include⁶²:

- In 2001, prioritizing EV technology in China's Five-Year Plan, the country's highest economic blueprint.
- In 2009, the State Council implementing the Auto Industry Adjustment and Revitalization Plan with China's first official goal for massive new energy vehicle deployment: to reach production capacity of 500,000 battery, plug-in hybrid, and hybrid EVs, accounting for 5% of new passenger car sales, by 2012.
- Leveraging structural advantages in existing auto supply chains that had strong manufacturing capabilities and access to cheap commodities.
- Launching in 2009 a landmark EV pilot program "Ten Cities, Thousand Vehicles", where 10 pilot cities were targeted to deploy at least 1,000 New Energy Vehicles (NEVs) annually over three years with a one-time purchase subsidy from the central government.⁶³
- Also in 2009, China's Ministry of Finance issued a Notice on Implementing Energy Saving and New Energy Vehicle Pilot Program which included detailed vehicle eligibility, technical criteria, and subsidy amounts. Larger vehicles received higher subsidies. For example, battery-electric buses received central subsidies of as much as ¥500,000 (\$76,432) per vehicle, and fuel cell buses received as much as ¥600,000 (\$91,718) per vehicle.
- In 2010, purchasing EVs in vast public transportation system, which in turn provided road test data before the consumer market accepted EVs.
- In 2015, investing in charging infrastructure including setting targets for 12,000 public charging stations and 4.8 million home and public charging points.
- Restructuring the EV subsidy program in 2017 into a performance-based system rewarding greater electric range and higher energy efficiency, both of which require tighter minimum technology requirements, enforcement provisions, and incremental phasing out of subsidies by 2020.
- Giving \$29 billion in financial subsidies and tax breaks to EV producers as early as 2009 until 2022 before introducing a more market-oriented system called "dual credits."
- Incorporating a carrot and stick strategy in the "dual-credit" policy, which has a Corporate Average Fuel Consumption (CAFC) credit, where carmakers gain credits for reducing the average fuel consumption to below a certain level and lose credits for failing to achieve it. There is also a New Energy Vehicle (NEV) credit, where carmakers receive positive credits for each EV produced and negative credits for not producing a specified percentage of EVs in a year.⁶⁴ To avoid a penalty in the form of a next-year production cap, carmakers had to either make EVs of their own or purchase NEV credits from other companies.
- In 2018, abolishing foreign ownership limits on local auto companies and removing restrictions on new energy vehicle joint ventures. A month after the 2018 rule was issued, Tesla agreed to build its Shanghai EV factory in the city's newly approved Lingang free-trade zone. Traditional carmakers like BMW, Volkswagen, and Toyota have expanded their partnerships in China.
- Creating a new generation of car buyers, born in a digital environment, and exposed to nationalistic marketing strategies by Chinese companies BYD, SAIC-GM-Wuling, Geely, Nio, Xpeng, and LiAuto.

⁶² <https://www.technologyreview.com/2023/02/21/1068880/how-did-china-dominate-electric-cars-policy/>

⁶³ <https://theicct.org/wp-content/uploads/2021/06/China-green-future-ev-jan2021.pdf>

⁶⁴ <https://www.protocol.com/china/dual-credit-policy>

The Role of Cities⁶⁵

Cities also played a key role in promoting industrial growth and improving air quality. Beijing, Shanghai, and Shenzhen worked closely with EV companies. For example, BYD helped make Shenzhen the first city in the world to completely electrify its public bus system and convert its taxi fleet.

The Role of Battery technology and Battery manufacturing⁶⁶

Battery cells make up around 40% of EV costs. In China, batteries come at a discount, from a stable supply of higher quantities. China's key advantage in battery manufacturing stems from its control of a lot of the necessary materials. It doesn't necessarily have all nor does it have the *most* natural resources for battery materials, but it has the majority of the refinery capacity in the world when it comes to critical components like cobalt, nickel sulfate, lithium hydroxide, and graphite.

Chinese companies have also championed lithium iron phosphate batteries, known as LFP technology, as opposed to the lithium nickel manganese cobalt (NMC) batteries that are much more popular in the United States and Europe. The energy density gap has narrowed for LFPs over the years. However, LFPs are still limited in energy storage and are mainly for short-range EVs (30-100 miles), ideal for short trips and urban mobility.

United States

Of the three major automotive markets, the U.S. market is the slowest growing compared to China and Europe, with the lowest cumulative sales total and relatively low market penetration. However, the United States is the largest exporter by volume and percentage, with more than half a million exports, or about 35% of its total light-duty EV production.⁶⁷

Federal Government Policies

The Biden Administration has embarked on a significant infrastructure investment with specific policies promoting the manufacturing and adoption of EVs. The Inflation Reduction Act ("IRA") enacted in 2022 and the Bipartisan Infrastructure Law signed in 2021 included multiple policies and programs to promote EV U.S. manufacturing and supply chain funding and programs.⁶⁸ Policies in the Bipartisan Infrastructure Law include \$6.135 billion for battery material processing, manufacturing, and recycling grants. Policies in the Inflation Reduction Act include \$10 billion for the Section 48C manufacturing tax credit, with specific inclusion for applicable EV projects; a new Advanced Manufacturing Production Credit (Section 45X) for the manufacturing of batteries and critical minerals facilities; \$3 billion for the Advanced Technology Vehicle Manufacturing program with specific incentive amounts for battery and critical minerals production; and \$2 billion for the Domestic Manufacturing Conversion Grant program.

The Inflation Reduction Act created a long-term extension of the Section 30D tax credit for light-duty vehicles:

- Modify the timeline for compliance on the final assembly, minerals, and battery sourcing requirements to allow for the greatest number of consumers to claim the credit while still allowing for market development.
- Expand the free-trade agreement country requirement for the minerals and battery sourcing requirements to include NATO and Major Non-NATO Allies.

⁶⁵ <https://theicct.org/wp-content/uploads/2021/06/china-green-future-ev-fs-feb2021-01.pdf>

⁶⁶ <https://theicct.org/publication/driving-a-green-future-a-retrospective-review-of-chinas-electric-vehicle-development-and-outlook-for-the-future/>

⁶⁷ <https://theicct.org/wp-content/uploads/2021/06/china-green-future-ev-fs-feb2021-01.pdf>

⁶⁸ <https://electrificationcoalition.org/work/federal-ev-policy/>

- Modify the sourcing requirement for foreign entities of concern to 80%.

Furthermore, the Bipartisan Infrastructure Law included \$5 billion to build out a network of EV charging along highways (alternative fuel corridors) and provided another \$2.5 billion in competitive grant funding to further build out charging infrastructure (though this includes all alternative fueled charging technologies). At least 50% of the funding under the competitive grant program must be put towards communities, with priority given to low-income and rural communities. The Inflation Reduction Act also included a long-term extension of the Section 30C Alternative Fuel Vehicle Refueling Property Credit until Dec. 31, 2032. The Section 30C credit was also modified to allow for bidirectional charging stations to qualify for the credit.

The Inflation Reduction Act also included \$3 billion to electrify the federal fleet. The Biden Administration has already set a goal to electrify all new light-duty vehicles by 2027, and to make all federal vehicle acquisitions electric by 2035.

The White House announced public and private commitments supporting EV transition under the EV Acceleration Challenge. A factsheet outlines the role of private sector investments and efforts of non-profit institutions.⁶⁹

The Role of States and Cities

Every state including the District of Columbia, except Kansas and Kentucky, offers hybrid and/or EV incentives.⁷⁰ Many states adopted California's ZEV regulations, which catalyze the market, expand model availability, and provide assurance for charging infrastructure investments. Markets like Atlanta, Austin, Columbus, Denver, New York, Portland, Seattle, Washington, DC, and those in California continue to construct and implement their own EV promotion policies to help reach their emission-reduction goals.⁷¹

Europe

Europe is in the middle between the United States and China in terms of its export and domestic markets as well as its charging infrastructure.⁷² The European Green Deal⁷³, Europe's key roadmap to make the continent carbon-neutral by 2050, states that by 2025, about 1 million public recharging points will be needed.⁷⁴ The [Sustainable and Smart Mobility strategy](#) outlines 10 key action areas for sustainable, smart, and resilient transport.⁷⁵ To achieve this high level of ambition, the European Union is targeting mobility and transport as part of its package of policy interventions. Transport represents almost a quarter of Europe's greenhouse gas emissions, and the European Commission aims to have at least 30 million EV cars by 2030 in addition to the current 1.4 million cars on European streets today. The EU has the following new and upcoming legislation:

- Clean Energy Package to push EV home charging
- EU Taxonomy establishing a list of environmentally sustainable economic activities and a reporting system required to access financing

⁶⁹ <https://www.whitehouse.gov/briefing-room/statements-releases/2023/04/17/fact-sheet-biden-harris-administration-announces-new-private-and-public-sector-investments-for-affordable-electric-vehicles/#:~:text=Federal%20Government&text=President%20Biden's%20Federal%20Sustainability%20Plan,duty%20EVs%20annually%20by%202035.>

⁷⁰ <https://www.ncsl.org/energy/state-policies-promoting-hybrid-and-electric-vehicles>

⁷¹ <https://theicct.org/publication/the-surge-of-electric-vehicles-in-united-states-cities/>

⁷² <https://theicct.org/wp-content/uploads/2021/06/china-green-future-ev-fs-feb2021-01.pdf>

⁷³ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

⁷⁴ <https://theicct.org/publication/on-the-electrification-path-europes-progress-towards-clean-transportation/>

⁷⁵ https://transport.ec.europa.eu/transport-themes/mobility-strategy_en

- Energy Efficiency Directive (EED) to shift to more energy efficient vehicles
- Renewable Energy Directive (RED)
- Energy Performance of Buildings Directive (EPBD)
- Smart metering systems in using electricity

Policy Implications for ASEAN

ASEAN has success stories and Opportunities in EV battery manufacturing; deployment of low-speed EVs; bus electrification; and raising public awareness. Two ASEAN countries, Indonesia, and the Philippines, are among the 19 countries that are known to have raw materials for batteries and fuel cells.

TABLE 1.3 Major sources of raw materials for batteries and fuel cells

Raw materials	Source countries
Cobalt	Australia; Canada; Congo, Dem. Rep.; Cuba; Philippines; Russian Federation
Copper	Australia; Chile; China; Congo, Dem. Rep.; Peru; United States
Graphite	Brazil; China; Türkiye
Lithium	Argentina; Australia; Bolivia; Chile; China; Russian Federation; United States; Zimbabwe
Manganese	Australia; Brazil; South Africa; Ukraine
Nickel	Australia; Brazil; Canada; China; Cuba; Indonesia; New Caledonia; Philippines; Russian Federation
Platinum	Russian Federation; South Africa; Zimbabwe

Sources: NOW 2020a; USGS 2021.

Source⁷⁶: Briceno-Garmendia, Cecilia, Wenxin Qiao, and Vivien Foster. 2023. The Economics of Electric Vehicles for Passenger Transportation. Sustainable Infrastructure Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-1948-3. License: Creative Commons Attribution CC BY 3.0 IGO. Chapter 1. Why is Electric Mobility a Development Issue, p.9.

However, it faces challenges in higher EV prices compared to low-cost ICE vehicles, lack of ZEV-related regulations that would convey a strong signal to auto manufacturers, insufficient charging infrastructure, and lack of technical expertise related to EV batteries and EV production and operation.⁷⁷ The share of EVs ASEAN markets vary between 0.04% and 0.6% for passenger cars as of 2020, low compared to mature markets. EV transition is fastest in the 2&3-wheeler segment while there are fewer than 500 electric buses across the region.

In addition to the policy recommendations on Building the EV ecosystem in the [US-ABC paper to the 55th ASEAN Economic Ministers Meeting in 2023](#)⁷⁸, ASEAN would benefit from greater collaboration to compete with other trading regions. ASEAN will have to embark on a collective effort to lower the cost of electricity and harmonize EV standards and infrastructure for a regional ecosystem, drive EV manufacturing and supply chains by developing a regional ZEV roadmap and a system of supply-based incentives that send clear policy signals, create domestic demand through fiscal incentives, introduce pilot projects that raise public awareness and promote shared e-mobility, battery swapping and renting, and develop a regional network of charging infrastructure.

⁷⁶ <https://openknowledge.worldbank.org/server/api/core/bitstreams/4c73ad87-2972-44e3-942e-cd2e3bb32350/content>

⁷⁷ <https://theicct.org/publication/hvs-zev-deploy-asean-apr22/>

⁷⁸ https://www.usasean.org/sites/default/files/uploads/AEM2023/us-abc_recommendations_paper_55th_aem_08.16.23.pdf

Future Outlook of EV Ecosystem in ASEAN

The EV revolution presents both a challenge and an opportunity for the ASEAN region. While strides have been made in adapting to this transformative technology, there exist pronounced policy gaps and market entry challenges in certain areas that are hindering the full realization of a seamless EV ecosystem. The EV landscape is not merely about vehicles but encompasses a broader infrastructure vision that falls under the purview of transport ministries. Road networks, charging infrastructure, and seamless connectivity across borders are key areas that require attention and investment.

As stewards of ASEAN's transport networks, there lies an immense opportunity for each member state. Harnessing the potential of EVs promises not only to advance regional economies but also to create sustainable "green" job opportunities within the transport and associated sectors. Furthermore, the urgency of climate action means that the decisions made by ASEAN Transport Ministries will be pivotal. The transition from traditional internal combustion engine vehicles to EVs will significantly reduce ASEAN's regional carbon footprint, directly supporting global commitments to combat climate change.

Therefore, to expedite this transition and realize the potential of the EV ecosystem, the U.S. industry recommends the following short-term and medium-term actions:

Short-Term Recommendations:

- *Harmonized EV Policies:* To be a significant player in the global EV scenario, ASEAN should prioritize the harmonization of EV-related policies across AMS. This should include standardizing incentives, regulations, and safety standards for EVs. This streamlining would enhance the region's appeal to foreign investors and facilitate intra-ASEAN EV trade. A short-term target could be to establish a committee dedicated to policy alignment.
- *Accelerated Charging Infrastructure through PPP:* Governments should prioritize fast-tracking the deployment of EV charging infrastructure. This can be done through PPP to expedite the installation of charging stations along major highways and urban centres.
- *Streamlined Licensing:* Simplify and expedite the licensing processes for EV-related businesses and manufacturers. This will not only encourage local production but also attract foreign investments, fostering growth in the EV sector.

Medium-Term Recommendations:

- *Incentive Programs:* Develop comprehensive incentive programs for both consumers and manufacturers. Consider tax incentives, subsidies, and reduced registration fees for EV buyers. Encourage investments in the new EV eco-system and continue to build infrastructure.
- *Education and Workforce Training:* Invest in training programs for technicians and engineers specialized in EV maintenance and technology. Collaborate with educational institutions and the private sector to ensure a skilled workforce is available for the growing green jobs, which includes the EV industry.
- *Regional R&D Hubs:* Create research and development hubs dedicated to EV technology. These hubs can facilitate collaboration between universities, research institutions, and private companies.
- *Intra-ASEAN EV Trade:* Develop a roadmap for intra-ASEAN EV trade, including the standardization of charging connectors and compatibility. Establish a task force to oversee the implementation of this roadmap, with a target of facilitating seamless cross-border EV trade within the next few years after establishment.

The road ahead for ASEAN in the EV sector is filled with challenges and opportunities. Transport Ministries have a crucial role to play in the EV transition. Recognizing the varying levels of EV readiness among member countries, the US-ABC stands ready to assist, providing thought leadership and facilitating capacity-building activities. Through concerted efforts, information sharing, and leveraging global best practices, we aim to support all AMS in their endeavour to electrify their vehicles and, by extension, their future.

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