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The Next Mile

High Tech Convergence in Transport and Mobility

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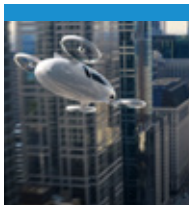

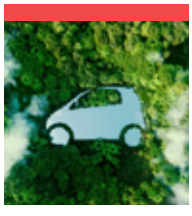

myForesight® is pioneering a national level foresight initiative to facilitate technology prospecting for local businesses. myForesight® advises and provides a common platform for the government, industry and academia to share experience, insights and expertise on 'futures' strategy, both locally and at a larger global level.

Key components of myForesight's mission are intelligence, research, competency framework and community engagement. **myForesight®** raison d'etre is set out to accomplish the following:

1. Anticipate Malaysia's future possibilities;
2. Promote foresighting at national, sectoral and corporate levels;
3. Identify key technologies to support sectoral development;
4. Outline key future R&D areas.

Mohd Nurul Azammi Mohd Nudri
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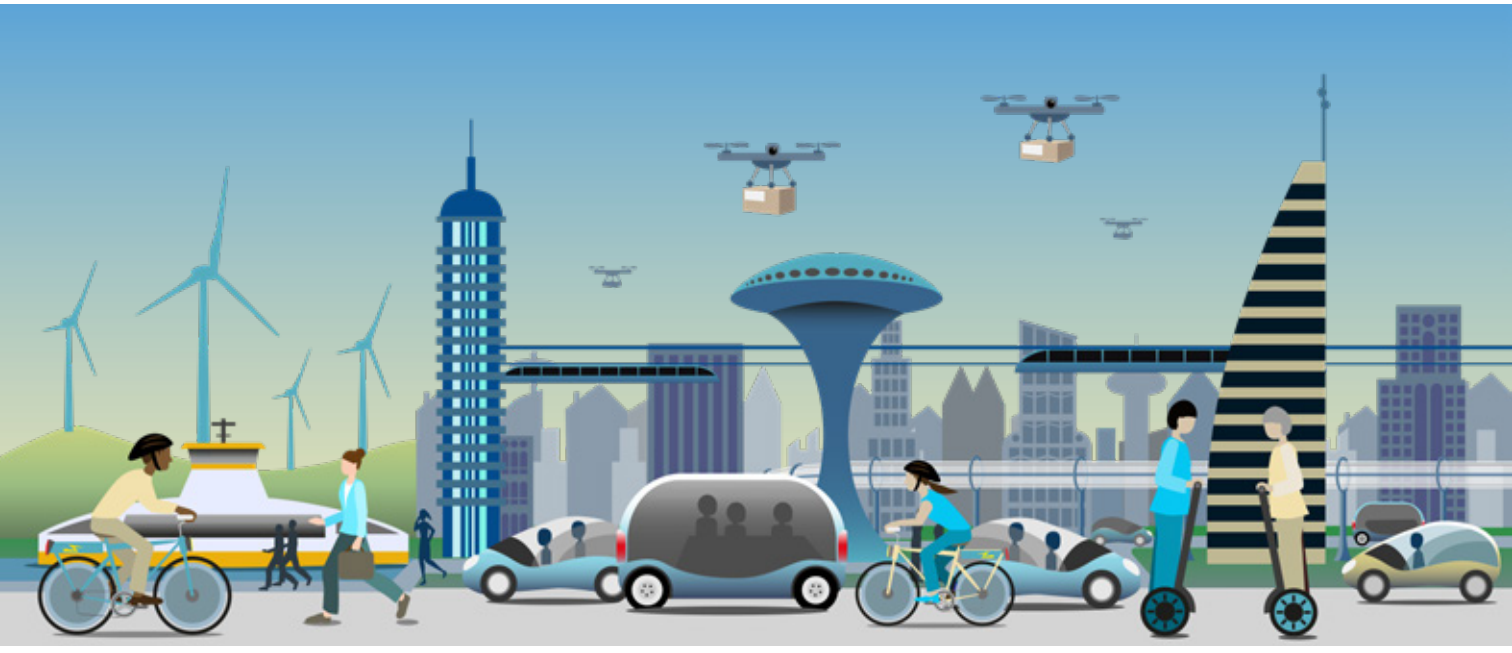
Initial Thoughts



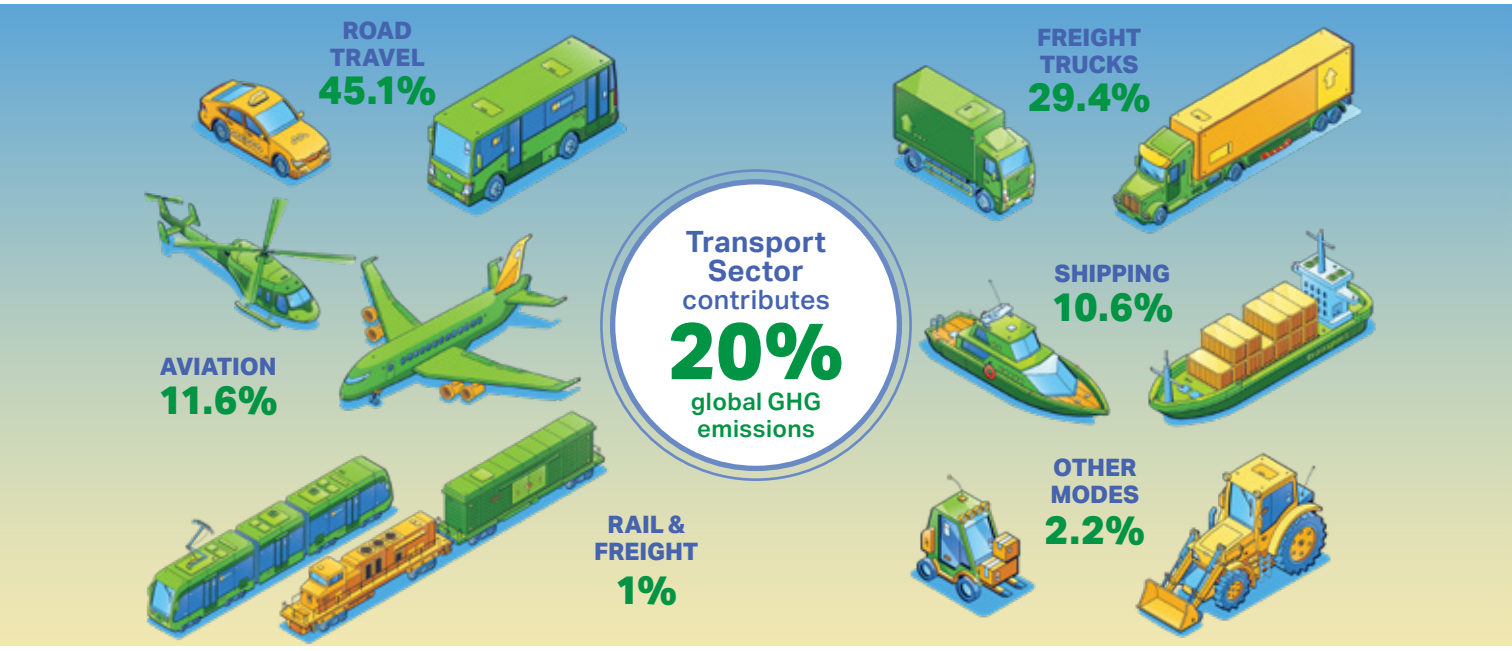
Imagining the future of transportation and mobility today often evokes vivid images of cars from futuristic films like Back to the Future, Tron and Minority Report, among others. However, the reality is not as futuristic as portrayed in the movies. Our future trajectories are still anchored on issues like greenhouse gas emissions (GHG), resource depletion, urban congestion, accessibility and affordability, data privacy and technology reliability, economic disparity, and job displacement.

The transport sector is the second and most significant contributor after the energy sector, which is responsible for 20% of global GHG emissions – of which road travel (cars and buses) accounted for the biggest chunk at 45.1%, while freight trucks add another 29.4%, with the remaining contributors being aviation (11.6%), international shipping (10.6%), rail and freight (1%), and other modes of transportation (2.2%). Given this, the sustainability agenda must be at the heart of sectoral development moving forward.

The World Resource Institute (WRI) estimates that achieving sustainable transportation requires an annual capital investment of USD 2 trillion. This significant investment, along with the Global Infrastructure Outlook's projection of around USD 50 trillion for transportation infrastructure by 2040, provides vast opportunities to drive sustainability efforts. These include the research and development of cutting-edge technologies such as alternative fuel and green batteries, as well as new infrastructure solutions like electrical charging and hydrogen networks, offering a promising future for sustainable transportation.

In the local context, Malaysia has significantly pledged to reduce its GHG emissions by up to 45% by 2030, as per the Paris Agreement. This commitment is reflected in a number of national policies, with the National Energy Transition Roadmap (NETR) being a comprehensive strategic plan to steer the energy system towards cleaner, more sustainable alternatives. In line with this commitment, this edition will focus on mobility and ongoing local initiatives covering air, land and sea.

The key highlights are the shift from fossil fuel-powered internal combustion engines (ICE) to electric engines in cars. The global share of electric vehicles (EVs) has tripled in terms of sales, from around 4% in 2020 to 14% in 2022. Despite proactive government efforts to promote environmentally friendly vehicles, the market share in Malaysia remains relatively modest. There are a number of factors that could contribute to the hesitancy or slow adoption of EVs by Malaysian society, such as lack of charging stations, range anxiety, upfront costs, especially for the B40 group, and charging and running costs. Electricity has powered rail for the past 30 years, facilitating the movement of large numbers of people from one location to another. Technological advancements like MAGLEV have enabled rail transportation to reach higher speeds of up to 450 km/h, enabling people living in rural or sub-urban areas to commute to work in large city centers. However, factors that are currently discouraging people from taking rail transportation pertain to first- and last-mile connectivity. Advanced Air Mobility (AAM) is another new addition to transportation. AAM is an emerging



aviation ecosystem that leverages revolutionary new aircraft and a broad array of innovative technologies to safely, quickly, affordably and sustainably move people and goods among local destinations. Examples include air taxis and drones. AAM's unique value proposition is that it offers a sustainable mode of air travel due to its electric power propulsion system, vertical take-off and landing, as well as low-altitude operation.

Apart from the electrification path, there are pockets of initiatives dedicated to exploring and piloting hydrogen technologies. For example, projects involving the development of feedstock and production, hydrogen conversion, and transport to hydrogen storage or refueling stations involve partnerships from various parties, both local and international. Several states, including Sarawak, Perak and Putrajaya, are pursuing this route, working together with both domestic and foreign enterprises.

Many more alternative approaches to the future of mobility are reflected in the stories and insights shared within these pages. Our goal has always been to inform, inspire and ignite conversations that matter. We hope that the articles and features have provided you with valuable perspectives and sparked new ideas.

MOHD NURUL AZAMMI MOHD NUDRI

From the desk of...

Rushdi Abdul Rahim
President and Chief Executive Officer,
Malaysian Industry-Government Group for High Technology

Space, Avionics and the Art of Leveraging

Embracing Technological Evolution Across Industries

Transportation and mobility have been the mainstay of MIGHT's developmental focus since its inception in 1993. MIGHT has cast its net wide: branding efforts of Malaysia's automotive through the Formula 1; expansion of the aerospace industry and its multi-billion-dollar contribution to the nation's economy and driving strategic development goals for the maritime industry through the National Maritime Industry initiative.

Why does MIGHT have initiatives related to the transportation sector?

> **"As an organisation focused on high technology, MIGHT views transportation as a prime example of the convergence of multiple advanced technologies. Whether it is aerospace, maritime, automotive, or rail, each mode of transportation integrates various technological elements such as advanced communication systems, innovative materials, sustainable energy solutions, and sophisticated electrical and electronic systems. This includes cutting-edge sensor networks, real-time data processing units, and integrated control systems that enhance safety, efficiency, and connectivity. This integration exemplifies the dynamic nature of high-tech advancements and their applications across diverse industries."**

Smart partnerships serves as the bedrock of these initiatives. These were initially drawn along industry lines in the form of 'Interest Groups' in a variety of industries including aerospace, automotive, maritime, telecommunications, and pharmaceuticals, among others. Over the years however, the advent of Industry 4.0 and digital transformation have resulted in a blurring of industry lines. Technologies are no longer strictly sectoral; rather they have become increasingly integrated across industries. This convergence in turn further transformed industry dynamics leading to greater technology interconnectivity and versatility.

The Global Positioning System (GPS) is a case in point. Initially developed for military use, it quickly gained traction across multiple industries and is now a staple in the automotive, drone, logistics and smartphone applications. The same can be said for composite materials. What started out as technology for the aerospace sector to make aircraft lighter and stronger, they are now critical for fuel-efficiencies in motor vehicles and affect both durability and efficiency in sports equipment and wind turbines.

The list goes on. Lithium-ion battery technology, originally slated for portable electronics, now powers electric vehicles. More recently, space technology, especially satellite communication, has crossed over from space mission support to becoming a critical technology in internet connectivity and global telecommunications.

Leveraging on local strength

In making an effective leap into the realm of high-tech, it is worth looking at what is ripe for the picking. Malaysia's industrial sector has several distinct areas of comparative advantage, with the Electrical and Electronics (E&E) industry leading the pack. Over the last five decades, the sector has grown from an eight-company component manufacturing industry known as the 8-Samurai in the 1970s to a major worldwide player today.

The only logical next step would be to leverage this capacity and know-how into new high-growth, high-value areas. The benefits are wide-ranging. Apart from the obvious increase in earnings through merchandise production and trade, such investments create high-tech jobs and enhance areas of strategic interests including national defence, data sovereignty and communications security, and overall strategic capabilities.

In Malaysia, air mobility, avionics, and space represent the new frontiers of high technology. The significance of these sectors cannot be stated enough. From climate tracking to atmospheric changes, border controls, and communications and connectivity, the economic and societal impacts are critical to contemporary human civilisation.

The space industry ecosystem is equally vast. It includes satellite makers, launch vehicle manufacturers, service providers, government security agencies, and research facilities. Drawing upon the entire network of possible collaborators and leveraging on the breadth and depth of knowledge across the different fields, organizations might pursue a number of opportunities, particularly by new production innovation and establishing new business models.

The smart partnership approach long adopted by MIGHT has time and again proven effective for this purpose. MIGHT's members comprise a diverse array of stakeholders, each bringing a unique perspective in fostering dynamic responses and shaping competitive futures. The formation of the Malaysian Space Industry Consortium (MASIC), for example, and collaboration with international players such as Turkish Aerospace (TUSAS), elevates Malaysia's space game and enhances its positioning in the global space industry landscape.

In the emerging field of Advanced Air Mobility (AAM), while the potential is enticing, challenges remain. In this regard, MIGHT works closely with FUTURISE, a national regulatory sandbox to address issues on funding, institutional and infrastructure challenges, regulatory and policy concerns, skills and talent development, and technological innovation. Looking at a twenty-year horizon, this collaboration explores various scenarios of AAM in Malaysia, providing a comprehensive overview of AAM initiatives in the country. It examines the challenges faced by stakeholders in developing the AAM sector and offers forward-looking recommendations for integrating this issue into future national development agendas.

High-skilled, high-income jobs of the future

In the final analysis, the nation and its populace must benefit from all development endeavours. According to the 2023 Future of Jobs Report by the World Economic Forum, technologies are anticipated to have a positive impact on the composition and creation of jobs in the years ahead. The success of Malaysia's continued quest to be a high-tech, high-income nation hinges on a broad-based increase in techno-based capabilities and the corresponding higher-income jobs across a wide array of specialisations. Similar jobs are expected to be created, including those for avionics technicians, drone pilots, data analysts, and others, across industries such as agriculture, construction, and environmental monitoring.

As previously stated, MIGHT is currently engaged in talent development in partnership with TUSAS. This is undertaken jointly with the Consortium of University Malaysia (CMU), TUSAS Malaysia, and TUSAS Akademi with the common aim of opening new frontiers for industry development and expanding involvement in the aerospace technology value chain. This will ideally cultivate a culture of lifelong learning, guarantee the relevance of the curricula, and ensure a consistent supply of qualified labour to the relevant industries.

Beyond its involvement in space technology, MIGHT also engages in strategic partnerships with other countries, including Indonesia, Qatar, Spain, the United Kingdom, and South Korea, across a wide range of sectors including healthcare, food security, energy, and digital technology. These collaborations have thus far led to the transformation of ideas into proof-of-concepts, and we expect further significant advancements in the near future.

In this high-tech race, every nation is implementing its own strategies to maintain a competitive edge. Malaysia must also remain in a state of constant vigilance and take aggressive measures to foster and develop talent and innovation to secure its position in the high-tech game. MIGHT is dedicated to ensuring that Malaysia not only participates, but also emerges triumphant in this high-stakes competition, as the future belongs to those who are best prepared.

Emeritus Professor Tan Sri Dr. Zakri Abdul Hamid

Joint Chairman (Government)

Malaysian Industry-Government Group for High Technology (MIGHT)

Sustainable Aviation Fuel

A New Source of Wealth from Malaysian Biodiversity

1 MAY 2022 was a momentous day for Malaysian science and technology. On that day an Airbus A220 — a popular narrow jet designed for regional and short-haul flights – flew from Kuching to Langkawi loaded with sustainable aviation fuel (SAF).

This was the result of a collaboration between the Aerospace Malaysia Innovation Centre, the National Aerospace Industry Corporation and the Sarawak government via SEDC Energy.

It was a great honour to be aboard that aircraft, and a lasting source of pride that SAF development in Malaysia has kicked off.

Sarawak and the country have reached a major milestone as development of SAF from seeds grown and processed locally is underway.

Not only did we slightly reduce the country's GHG emissions through the A220 flight, but we also demonstrated to the world in powerful fashion our commitment to helping the aviation industry reach net zero by 2050.

SAF is a hot topic across the aerospace industry, which accounts for between 2.5% and 3.5% of man-made CO_2, and other GHGs in the atmosphere.

SAF has the potential to reduce GHG emissions by up to 80%. What is also interesting for biologically megadiverse Malaysia is the abundance of feedstocks, such as microalgae, for these new fuels.

> **AMIC is proud to be part of this endeavour. It started the SAF journey in 2013, when Airbus funded four projects in Malaysia to test the potential of our rich biodiversity, the potential of waste transformation, and to study the lifecycle of a SAF economy.**

Microalgae biofuel is devoid of the major drawbacks associated with oil crops and other biofuels. Algae-based biofuels can technically and economically be viable and cost-effective, when managed well to produce multiple products, or co-products.

Microalgae have the highest productivity of oil per unit of area/land, require minimal use of water with a good management strategy, and have high photosynthetic efficiency for CO_2 absorption.

Large-scale and successful commercial production still requires a lot of work due to the costly downstream processes. But we are determined to change that.

Airbus is one of the most ardent proponents of SAF. One of its top goals is 100% SAF capability by 2030 throughout its portfolio of commercial and military aircraft.

A leading competitor, Boeing, is less enthusiastic. Chief Executive Officer (CEO) David Calhoun predicted last week that "climate-friendly biofuels will never achieve the price of jet fuel", pouring unwelcome cold water on the aviation sector's strategy to slash emissions.

I was on a special mission of sorts, together with Malaysian Industry-Government Group on High Technology CEO Datuk Dr. Mohd Yusoff Sulaiman, and Aerospace Malaysia Innovation Centre (AMIC) CEO Dr. Liew Kan Ern.

We accompanied Sarawak Premier Tan Sri Abang Johari Tun Openg on that historic journey from Kuching to Langkawi on a Latvian airBaltic Airbus A220-300.

The premier attended the Langkawi International Maritime and Aerospace Exhibition (Lima '23) to demonstrate his commitment to SAF.

He commented that the success that day would pave the way for other areas in Sarawak to venture into SAF production.

The findings encouraged and fostered greater effort in the region. AMIC went to Indonesia, Singapore, Thailand, Vietnam – even to Japan and South Korea – to promote the work underway here and discover what else Malaysia could do to develop SAF.

Sarawak is ahead of the curve compared with others in the federation in meeting the three-pronged objectives of the UN Convention on Biological Diversity that was signed by Malaysia and other UN member states at the Earth Summit in 1992. These are the conservation of biodiversity, sustainable use of its components, and access and benefit-sharing of genetic resources.

It established the Sarawak Biodiversity Centre in 1997 to explore intensive biotech-based research and development.

Earlier this year, SEDC Energy, a subsidiary of Sarawak Economic Development Corporation (SEDC), signed an agreement with PETRONAS Research Sdn. Bhd. to develop algae production technology, which includes cultivation harvesting and extraction of crude algae oil, that is later refined to produce SAF.

The collaboration was taken a step further during Lima. SEDC Energy, PETRONAS Research Sdn. Bhd. And AMIC signed an agreement to complement technology developments in microalgae, SAF ecosystem and commercial-scale plant exploration.

This a fine example of how ambition supported by science and technology can shake up the status-quo, leading to better innovation and solid entry to market.

Ultimately, it needs sustained political commitment and support from the state's numero uno. And with Abang Johari, Sarawak has a formidable champion.

Congratulations to everyone involved, and to all Malaysians. May our SAF industry accelerate into the future sustainably.

This article was originally published in Science Diplomacy and Sustainability, 3 June 2023, by the Institute of Strategic and International Studies (ISIS).

From FM to Future:

How Infotainment is Transforming Vehicles

The Profound Impact of Infotainment on the Automotive Industry

Li Pu
Chief Executive Officer,
ACO Tech Sdn Bhd

Li Pu, the Chief Executive Officer of ACO Tech Sdn Bhd, is a leading figure in driving the company's vision and strategic initiatives, leveraging his extensive experience in intelligent mobility and telecommunications. With over two decades of involvement, Li Pu has been instrumental in developing the Telematics Service Provider (TSP) platform, that has empowered over a million vehicles within the Geely Group network. His strategic leadership focuses on adopting connected vehicle technology and smart mobility solutions across China and Malaysia. Under his guidance, ACO Tech has achieved significant milestones in product innovation and market expansion. His strengths include strategic vision, operational excellence and integrating emerging trends into the company's roadmap. This interview will explore Li Pu's insights on the impact of in-vehicle infotainment innovation to the ecosystem.

The Future of In-Vehicle Infotainment: Embracing Emerging Technology Trends

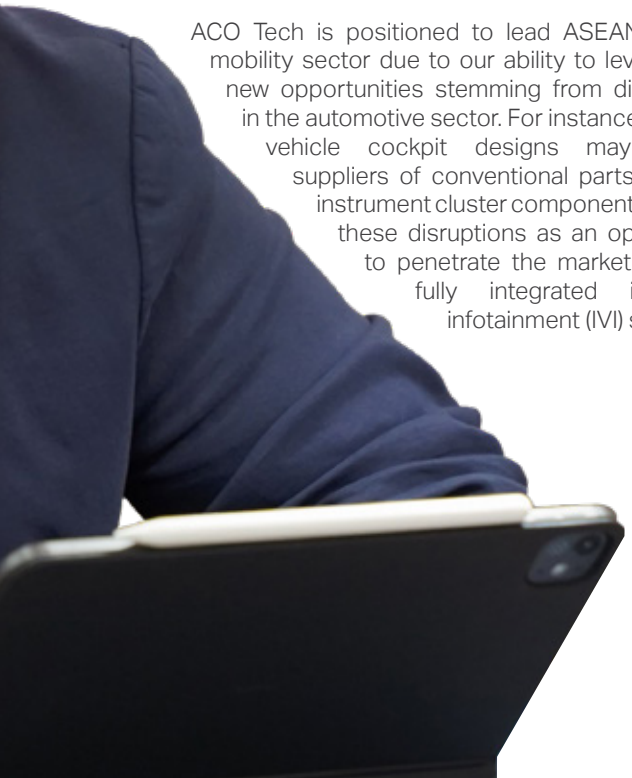
Our vehicle infotainment systems are not just about the technology but the user experience. We understand that people are drawn to convenience and seamless experiences, and this is what we strive to deliver not just inside the car, but even away from it. Our cloud-enabled infotainment head units (IHU) and mobile app, ATLAS Auto (ACO Tech Local Automotive Services), are designed to provide a continuously seamless experience in and out of the vehicle with remote control features, allowing our users to monitor and pre-condition their vehicles well ahead of their journey, ensuring a convenient and comfortable ride.

These innovations come hand in hand with one of the most important aspects of mobility - safety. A seamless digital interface for users behind the wheel helps reduce the chances of distraction that can lead to accidents. One example is how a simple solution like voice recognition (VR) enables users to interact with their infotainment head unit without lifting a finger off the steering wheel or take their eyes off the road.

Electric Vehicles (EVs) are the key trend supporting how in-vehicle infotainment (IVI) systems are changing. As the EV market continues its rapid growth, solutions embedded into the IVI that can assist users in planning their journeys and locating charging facilities around them, become increasingly essential. This is why we believe, connected vehicles will soon be the new standard for personal mobility.

Leveraging Technology Disruptions to Create Opportunities in the Automotive Industry

ACO Tech is positioned to lead ASEAN's smart mobility sector due to our ability to leverage on new opportunities stemming from disruptions in the automotive sector. For instance, modern vehicle cockpit designs may disrupt suppliers of conventional parts such as instrument cluster components. We see these disruptions as an opportunity to penetrate the market with our fully integrated in-vehicle infotainment (IVI) systems.



Similarly, our A01 chipset challenges conventional solutions requiring separate components from separate suppliers. Powered by Malaysia's first automotive chipset, our IHU platform provides an all-in-one solution to power commonly used features such as the around-view monitor (AVM).

While these changes may force traditional suppliers to innovate and adapt to new market requirements, there is plenty of room to expand businesses in the digital space. This is where our ATLAS ecosystem supports other local companies, as our A Store provides a vehicle-integrated applications platform for them to get involved and extend their solutions to our user network.

Shaping the Future of In-Vehicle Infotainment in Malaysia and Beyond

Malaysian users, in general, are primarily reliant on their mobile phones for solutions such as navigation and entertainment. However, our data shows encouraging numbers of users regularly interacting with our voice recognition system and using our built-in navigation system for their daily commutes. We are working towards a future where vehicle infotainment can be a viable standalone interface for the user throughout their time behind the wheel, independent of mobile phones and other devices. This promotes a safer and less stressful environment in the cockpit, especially for drivers who must deal with hectic routines daily.

Beyond this near-term goal, we see autonomy as a crucial pillar for the future of mobility. This is not just about implementing the technology for driverless cars, but also for transport applications within regulated environments. This can include industrial, manufacturing, logistics or other areas of the supply chain where transportation routes can be controlled. In urban areas, autonomous technology can be applied to robotaxis along with dedicated lanes and pathways to integrate them with other vehicles and pedestrians. This is how we envision the future.

I believe, many industry players share a similar view. Our goals are built around achieving the global target of net zero carbon emissions by 2050. Creating a more sustainable transportation sector will be key to achieving this target, which is why electrification and autonomous technology will be essential for the industry moving forward.

Innovation in Motion: From Research to Transportation Solutions

Jaffri Ibrahim
Chief Executive Officer,
Collaborative Research in Engineering, Science and Technology (CREST)

Jaffri Ibrahim, the Chief Executive Officer of CREST, is a visionary leader driving the organisation's strategic initiatives and fostering innovation. With an extensive background in the technology and research sectors, Jaffri leverages his expertise to advance CREST's mission of promoting engineering, science, and technology in Malaysia. His role involves setting the strategic direction of CREST, ensuring alignment with national and international technological trends, and adapting to the evolving landscape, while also promoting a culture of innovation within the organization. Jaffri is instrumental in building and maintaining partnerships with universities, research institutions, industry players, and government bodies, creating a thriving collaborative ecosystem. He oversees the daily operations of CREST, ensuring efficient resource management and effective project implementation, thus reinforcing its position as a key player in Malaysia's research and development landscape.

Bridging the Gap: Accelerating Innovation in Transportation

As transportation evolves to become more multimodal and multidisciplinary, the necessity for collaboration among various technology players becomes increasingly evident. Modern transportation extends beyond merely moving people or goods from one place to another; it encompasses diverse modes such as road, rail, air and sea. It also integrates various fields, such as mechanical engineering, computer science, telecommunications and urban planning. This complexity makes collaboration essential to accelerating innovation.

Autonomous transportation, in particular, relies heavily on the integration of multiple technologies. The development and deployment of electric vehicles (EVs) require expertise in battery technology, electric motor design, power electronics and charging infrastructure, necessitating close cooperation between automotive manufacturers, technology companies and research institutions. Moreover, autonomous vehicles depend on real-time data exchange, which calls for robust communication networks, including 5G technology, for low-latency and high-reliability connections. Ensuring that autonomous transportation meets

safety standards and regulation is also crucial. This requires collaboration between regulatory bodies, industry experts and researchers to create a safe deployment framework.

Collaborative research and development (R&D), as well as design and development (D&D) efforts between industry, academia and various sectors are pivotal in narrowing the gap between groundbreaking ideas and their real-world applications. Universities and research institutions, often at the forefront of cutting-edge research, play crucial roles in collaborative R&D projects that transition theoretical research into practical applications.

At CREST, we champion the spirit of collaboration by consistently forging connections between industry, academia and the government to advance various sectors and benefit the nation. In the transportation sector, we facilitated a successful partnership between Universiti Kebangsaan Malaysia (UKM) and Aerodyne for the 'Drone Delivery Beyond Line of Sight' project, developing a system using GSM signals and obstacle avoidance technology, which was successfully tested over a 10 km route in Sekinchan. Similarly, Universiti Sains Malaysia (USM) collaborated with Synvue to create a drone vibration monitoring system aimed at enhancing flight stability and safety, with potential applications in large-scale drone safety systems. Additionally, Universiti Malaysia Pahang (UMP) partnered with Easy Prolink to develop a vehicle-to-vehicle communication system for autonomous driving, successfully tested at UMP's campus in Pekan. These initiatives underscore the significance of cross-sector partnerships in driving technological advancements and innovation.

By strengthening synergistic relationships between the government, academia, researchers, industry experts and various sectors, Malaysia can accelerate the development and implementation of innovative transportation technologies. These collaborations not only reduce the distance between groundbreaking ideas and real-world applications but also drive the country towards a more sustainable and efficient transportation future.

Nurturing Talent for Future Mobility

A skilled workforce is pertinent for the future of transportation therefore it is important to nurture the next generation of innovators. One CREST example is the Collaborative Research in Engineering, Science, and Technology CREST R&D programme, which is designed to engage and develop postgraduate talent in crucial areas such as digitalisation, IoT, Artificial Intelligence, Embedded Systems, 5G, Drones, Smart Cities, Autonomous Vehicles, and Navigation. This programme emphasises human capital development through collaborative R&D and D&D, which are excellent mechanisms for inculcating the necessary technical competencies and aptitudes.

Additionally, the TGL Talent programme and industry Boot Camps play a significant role in exposing STEM and Engineering talent to advanced technologies that enable modern transportation systems. By focusing on areas like Smart Cities, Embedded Systems, Artificial Intelligence, Drones, and 5G, these initiatives ensure that the workforce is well-equipped to meet future transportation needs.

Recently, we organised the Drone Technology Technomart in collaboration with MIGHT and MRANTI, which explored future drone technologies in areas such as drone delivery and drone transportation. We've also identified numerous Centers of Excellence in drone technology at Malaysian universities, which are major sources of talent and technical competency. By working with MIGHT and MRANTI, we aim to engage and nurture the required talent through this ecosystem, ensuring that Malaysia remains competitive by fostering a skilled workforce and a new generation of innovators in the transportation sector.

Sustainable Transportation and Future of Transportation

Research and collaboration are pivotal in shaping the future of transportation over the next 5 to 10 years. At CREST, our open category R&D has facilitated collaborative research in areas such as Drone Delivery, Autonomous Vehicles, Navigation Systems, Vehicle to Infrastructure (V2X), Vehicle to Vehicle (V2V) communication, Embedded Systems, Artificial Intelligence, IoT, Cloud Computing and Edge Computing. These efforts are critical in promoting advancements in electronic and electrical (E&E) hardware and software, which lie at the heart of modern transportation solutions. As electric vehicles (EVs) and larger drone systems become more prevalent, the use of semiconductors and E&E hardware and software will increase significantly, presenting the E&E and semiconductor sectors with substantial opportunities for innovation and growth.

To maximise these opportunities, it is essential to have a coordinated EV and drone innovation ecosystem supported by focused R&D and D&D initiatives and development funds. Collaborating with larger companies and international technology partners will further enhance Malaysia's capabilities in modern transportation technologies. The transition towards greener and more sustainable transportation options, such as electric vehicles, electric drones, and hydrogen-powered vehicles, will continue to gain momentum. These technologies will be central to our efforts to create a more sustainable and environmentally friendly transportation sector. By fostering a robust ecosystem of research and collaboration, we can ensure that Malaysia remains at the forefront of transportation innovation in the coming years.

Are Flying Cars Such a Good Idea?

Watch a few futuristic films, then decide

Liz Alexander, PhD
Futurist. Author. Consultant.
Speaker

Dr. Liz Alexander has been named one of the world's top female futurists. She combines futures thinking with over 30 years' communications expertise to produce publications that showcase the advice of fellow futurists on issues, including the future of education and how businesses can practically benefit from working with the futures community.

Dr. Liz is the author/co-author of 22 non-fiction books published worldwide that have reached a million global readers. She has contributed to leading US technology magazine Fast Company and also Psychology Today, and her work has been featured in journals such as Knowledge Futures and World Futures Review. She earned her PhD in Educational Psychology at the University of Texas, Austin.

The idea of flying cars has long captured the public's imagination. Most are hugely unrealistic. At the end of the 19th century, a group of French artists came up with depictions of what they thought the year 2000 would be like . Their artistry appeared on cigarette cards and postcards, showing all manner of manned flights, from customs officers "in pursuit of a smuggler," to airborne traffic cops and (perhaps the most puzzling of all) flying postmen who delivered mail through your window, rather than your door. The Jetsons, long before The Jetsons!

You may also have seen flying cars feature in big-budget, futuristic films like Blade Runner, Total Recall, and The Fifth Element, all of which are dystopian. Not least, I would argue, because their futuristic modes of transportation appear quite horrendous.

Nevertheless, perhaps inspired by such films, the public - at least in the United States of America - seems hugely interested in flying cars. Offering one of the most befuddling contradictions I have ever read, a 2017 study conducted by the University of Michigan's Transportation Research Institute (UMTRI) found that some two-thirds of Americans, "would like to ride in or operate their own airborne vehicle." At the same time, "In their study, Sivak and UMTRI colleague, Brandon Schoettle found that more than 60% of respondents are "very concerned" with the overall safety of flying cars and with their performance in congested airspace and poor weather."

As I will discuss shortly, they're not wrong to have such concerns.

Apparently, many of these study respondents felt that a shorter commute time would be worth paying between $100,000 and $200,000 (approx. RM478,000-RM955,000) for such vehicles. (Note: I have bad news for them: Silicon Valley-based Alef Aeronautics, which recently received Federal Aviation Authority approval for their Model A flying car, has priced it at $300,000!). But perhaps these people should watch The Fifth Element to get a sense of what could happen if or when the price of these vehicles drops, and a sizeable minority decides to take to the air. Describing the 1997 film, which was set in the 23rd century, The American Society of Cinematographers wrote: "The result is a visually stunning, living comic book that plays out across a fully realiaed galaxy — from a New York stretching 600 stories in every direction (complete with traffic jams caused by flying cars)."

Watch one part in particular, listed as 'The Fifth Element: Car chase scene | McDonald's scene' on YouTube, and you will see what they mean.

So, here are three of my issues with car-like vehicles that allow anyone with enough money to take to the skies.

The Human Element

Speaking at Austin, Texas's famous South by Southwest (SXSW) event some years ago, U.S. automaker chairman, Bill Ford, pointed out that his company would not be developing flying cars, at least not in the short term. Why? Because according to Mr. Ford, most people, "cannot drive two dimensions, let alone three. " He pointed out that if you want to take to the air in your own plane, you need to be a licensed pilot. However, it apparently only takes around 40 hours of flying to earn such a license. What regulations will need to be put in place to ensure drivers know how to drive their flying cars? Not least because they are technically electric Vertical Take Off landing aircrafts (eVTOLs), meaning they take off and land vertically—just like the 'spinners' used by the futuristic LAPD in the Blade Runner films.

One of the people commenting on that article seemed to think that driving in the air would be much easier and safer than doing so on the road, writing: "There is no road boundary to contend with, so rather than deal with traffic rules, you can simply establish altitude separation using rules that are easily codified for software decision-making algorithms. The vehicles in flight can remain always in motion."

This mirrors another point Bill Ford made in his speech, that because human beings can't be trusted behind the wheel, flying cars had "better be autonomous." Yet, according to one statistic, "In 2020, 37% of self-driving car accidents in the U.S. were due to sensor or software failures. " And that is while EVs are still nowhere close to becoming truly (i.e. Level 5) autonomous. So, I am not sure I would fully trust the software decision-making algorithms in eVTOLs that could be hacked or otherwise fail, sending their driver and any passenger(s) plummeting to earth.

Those of us preferring to stay on terra firma would not be safe, either. As Elon Musk pointed out in one interview, "If somebody does not maintain their flying car, it could drop a hubcap and guillotine you".

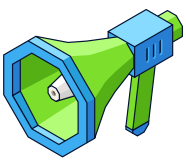
Which brings me to my next point: What happens when flying cars collide with things that are meant to be in the air? Like commercial airplanes, high-rise condos—or birds?

Airborne Obstacles

The person who made the earlier comment cited above also went on to say, in defence of flying cars: "There are far fewer unexpected obstacles in flight as well. You need not worry about a kid running out into the flight-space, or someone pulling out of a roadside parking space without looking."

That sounds like comparing apples and oranges to me. Let us consider a more relevant analogy with drones, another technology that has taken to the air in huge numbers recently. Statistics show that consumer drones are involved in many more accidents than those used by businesses or the military. They have also been responsible for a huge increase in the number of near misses reported by U.S. aircraft, among others. If these much smaller flying objects are causing danger and disruptions at airports across the globe , imagine what could happen when cars take to the air.

While not wishing to underestimate the deaths and injuries caused by cars on our roads, if a vehicle stalls, breaks down, or a part falls off during flight, the damage to the driver, passengers, unwitting pedestrians and buildings, is likely to be much more catastrophic. That is just the way gravity works!



Acoustic Impact

Finally, here is another problem that likely ignores the human and environmental impacts in service of technological advancement. We need to take into account the potential noise pollution emanating from flying cars.

This was something a group of researchers at two universities in Japan investigated . By simulating the sounds of cars flying 15 metres above participants' heads—similar to that of industrial drones—these researchers found that as noise increased, so did their stress levels. Even after this exposure when noise levels had dropped, their stress levels remained high. The authors concluded: "To protect the health of residents, it is important to consider the long-term effects of exposure to chronic loud traffic noise in a world where flying cars are constantly landing, taking off and whizzing above us."

Who will buy?

As you have likely gathered by now, when it comes to the concept of flying cars, I am not a fan. As a futurist, I tend to support the adage: Just because you can, does not mean you should. Personally, I have no desire to fly in one (in the same way that I have chosen never to fly in tiny, single engine aircraft), and I especially do not want to be killed or injured by anything falling out of the sky. While there will always be those who desire—and have the money to pay for—the "shiny new thing" brought forth by technology, I agree with one article that pointed out we should be wary of believing that what "relatively fortunate and influential people find convenient or attractive, is good for society as a whole." As one research analyst pointed out, "This intellectual fallacy does not translate to a real demand."

Now or later?

Of course, the jury is still out as to when we might see flying cars as a mainstream mode of transportation. On the one hand, we have people like Professor Ahmed Banafa of San Jose State University in California, who is enthusiastically in the "pro" camp, according to his 2023 article on LinkedIn. While on the other, a journalist covering the test flight of Xpeng's flying car in Dubai in 2022 deemed it "a bit of a dud," despite the launch having been hailed previously "as a demonstration of cutting-edge technology destined to transform transportation at its core." His article is a particularly useful read, as he points to the need for robust regulatory frameworks, and the fact that regulators are still wrestling with the potential challenges of fully autonomous vehicles, let alone ones that fly!

What worries me is the idealistic propaganda issued by some members of the media. Here is one example: "Blade Runner's original 2019 deadline may have been too optimistic, but the technological, logistical and regulatory barriers appear close to being overcome ".

Technological and logistical barriers, maybe, maybe not. But regulatory? Sorry, but I think we have a long way to go before there are sufficient robust regulatory frameworks in place concerning eVTOLs. Rules that will prevent anyone with a few hundred thousand U.S. dollars from killing or injuring an unsuspecting member of the public because of a software glitch, or their own human error while airborne.

Even while we're waiting for all those "technological and logistical barriers" to be ironed out, regulators and other government bodies have a lot to think about. Because, unlike flying cars seen in films, the reality of them isn't likely to be quite as fun and appealing.

When it comes to naming "the father of aviation," many people in the West cite the Wright brothers and their 12-second flight in North Carolina, USA at the end of 1903. Some even point to Italian Leonardo da Vinci's invention five centuries earlier, the 'ornithopter,' a contraption that would never have got off the ground. However, the person reputed to be the true "father of flight" is, 9th-century Muslim scholar and polymath Abbas ibn Firnas. Here is the rather curious description of his first attempt to fly, by a 17th-century Algerian historian :

Among other very curious experiments which he made; one is his trying to fly. He covered himself with feathers for the purpose, attached a couple of wings to his body, and, getting on an eminence, flung himself down into the air, when according to the testimony of several trustworthy writers who witnessed the performance, he flew a considerable distance, as if he had been a bird, but, in alighting again on the place whence he had started, his back was very much hurt, for not knowing that birds when they alight come down upon their tails, he forgot to provide himself with one.

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Conscious Consumerism: Electric Vehicles and Beyond

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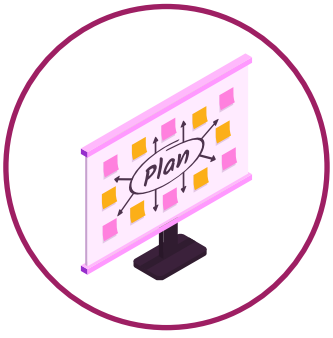
A seamless interconnected network of smart vehicles, powered by clean and sustainable energy sources, navigates cities precisely and efficiently. Mobility is not just about getting from point A to point B anymore. It is about personalised experiences powered by artificial intelligence tailored to individual needs. The revolutionised urban travel offers safer roads and reduces congestion, with shared mobility platforms that redefines ownership, promotes resource optimisation and reduces environmental impact.



What do we need to do to achieve it?

How can the top players spearhead it?

What will Malaysia's case be like?

What are its driving forces?

What do the consumers prefer and what are their concerns?

What lies beyond these Electric Vehicles (EVs)?

Envision the above scenario

What drives EVs?

The world is currently grappling with a pressing global energy crisis, a situation that demands immediate global energy security measures. The Intergovernmental Panel on Climate Change (IPCC) has issued a stark warning to keep global temperatures from rising above 1.5°C, emissions must peak before 2025, with reductions of at least 43% by 2030 compared to 2019 levels and at least 60% by 2035. This necessitates drastic measures to reduce GHG emissions, particularly in the energy sector, where coal, oil and natural gas are the primary culprits. Driven by population and economic growth, global energy demand is projected to increase by 47% by 2050. Hence, immediate and significant actions are required to curb or minimise the escalating GHG emissions that are leading to climate change impacts.

Over 70 countries have committed to Net Zero by 2050, with various targets set by China, Indonesia, Thailand and India. Malaysia aims to become carbon neutral by 2050 at the earliest. Against this backdrop, a new clean energy economy is rising rapidly, led by solar photovoltaic systems (PV) and EVs. In 2020, one in five cars sold was electric, showcasing the escalating demand for EVs.

How does EV demands escalate?

In 2014, Tesla gave up its patents to the “open-source movement" to spur EV technology. In 2017, Mainland China sets targets for new energy vehicles and slowly emerged as the world leader in EV manufacturing and sales. 2022 is the eighth consecutive year with China as the world’s largest market for EVs.

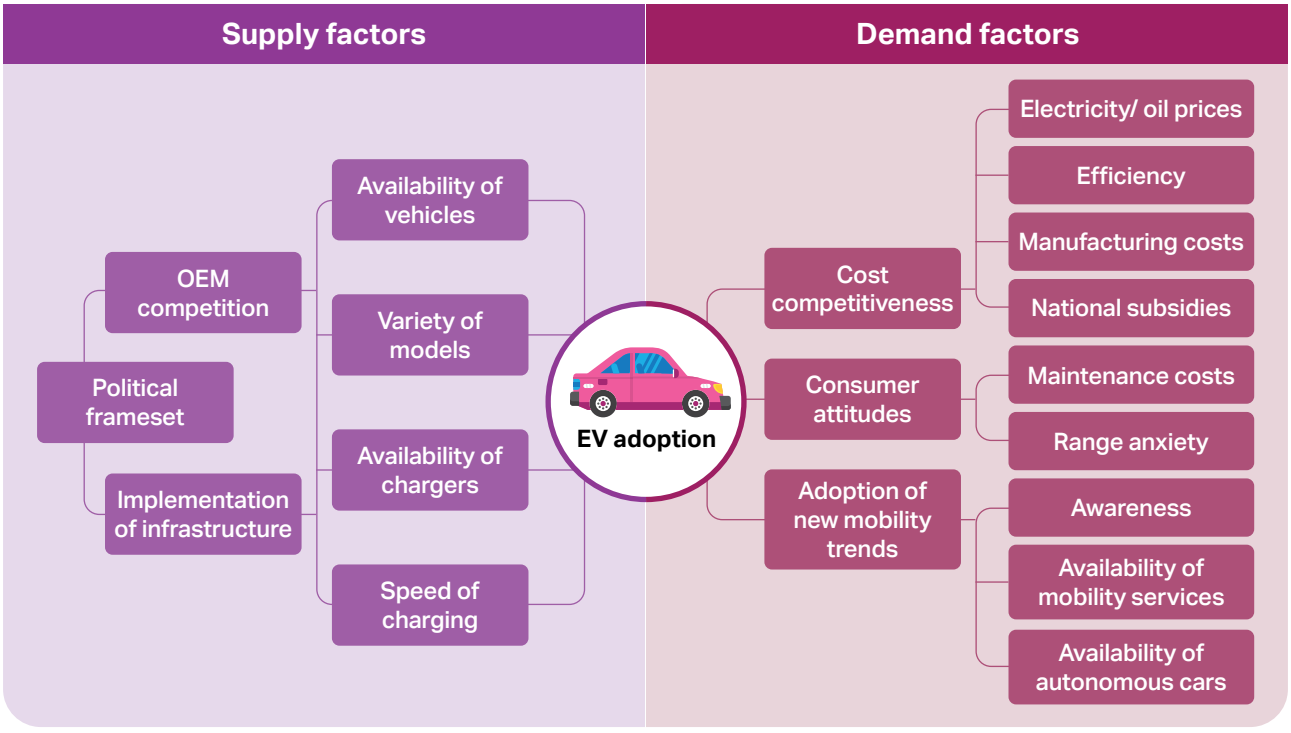
The EV market boomed during the pandemic due to growing environmental awareness and conscious consumerism. Governments worldwide promoted the transition from Internal Combustion Engine (ICE) vehicles through various policies and measures, complemented by automakers' initiatives.

How did they do it?

China drove EV growth through government subsidies, tax breaks and procurement contracts. Generous incentives propelled homegrown EV brands, with BYD challenging Tesla's dominance. In 2022, BYD reported global plug-in electrical vehicle (PEV) market shares of over 18%, compared to Tesla’s 13%. Other countries, including the US, Japan, the UK and France, have also set ambitious EV sales targets and transition plans from ICE to EVs.

Carmakers have also made plans for the transition from ICE to EVs. In 2021, General Motors (GM) announced that it would only offer zero-emission would only offer zero-emission vehicles. Within the same year, Volkswagen also made the same pledge to stop making combustion engine cars by 2035 and Audi is planning to stop in 2033. However, 2023 also saw some reversals to previous commitments. Prime Minister Rishi Sunak announced the scrapping of the ban on ICE vehicle sales as part of a "new approach to achieving net-zero". GM redirected a substantial portion of its investment, nearly a billion dollars, towards new manufacturing, primarily focused on producing ICEs.

Why does diversity exist?

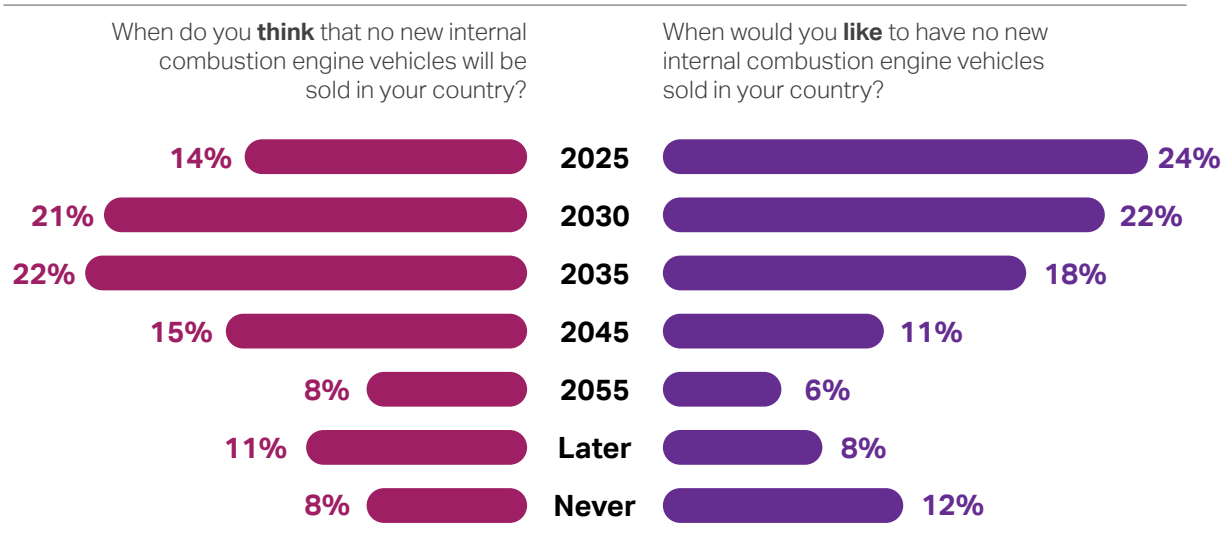


Source: Consumer Affairs; ICCT; L.E.K. Consulting; Renew Economy; Statista; The New York Times

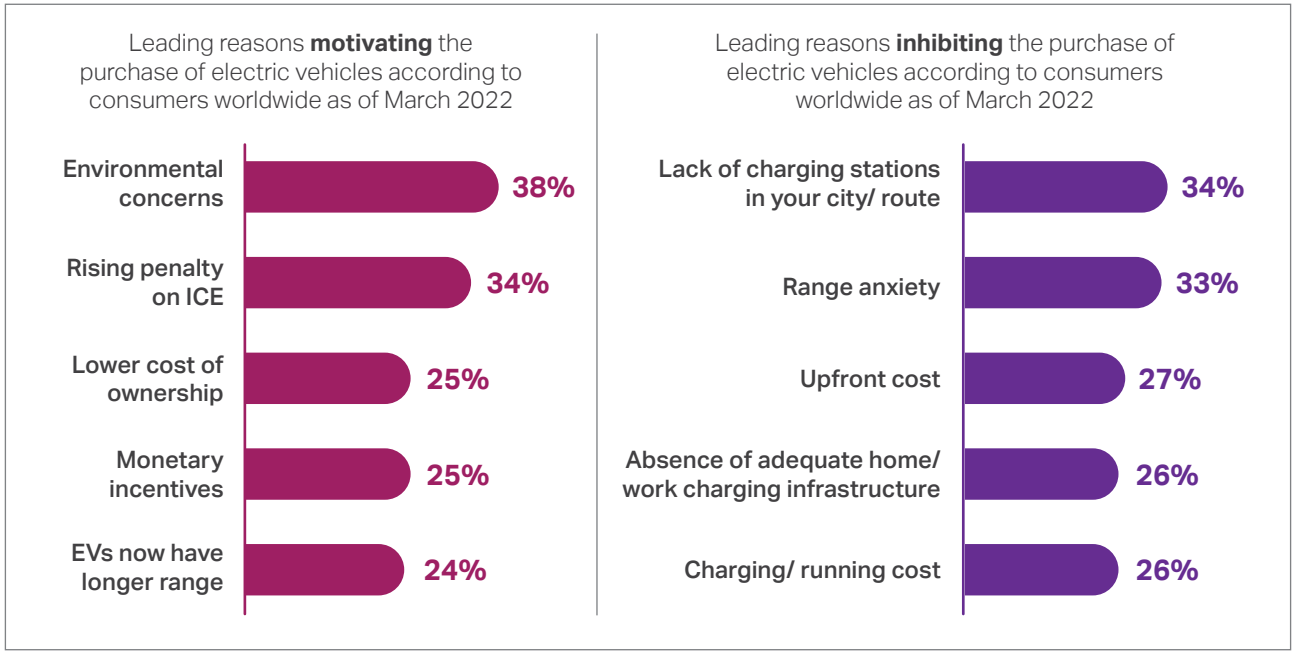
EV acceptance depends on supply and demand, with governments, auto manufacturers and consumers influencing the market. Government initiatives, such as enhancing charging infrastructure, can boost consumer confidence and EV sales.

City center-based consumer opinion

on the year when new internal combustion engine vehicles will not be sold or should not be sold in their country, as of July 2021



While consumers in city centres globally tend to be more optimistic about EV adoption, demographic factors are not the sole determinants of market demand. Optimism also does not always translate into actual market demand, as various concerns influence consumer behaviour. Increasingly, consumers are mindful of the environmental impact of their choices. However, factors such as the lack of charging stations, range anxiety and the upfront cost of purchasing EVs remain significant concerns, leading to hesitancy in adopting EVs.



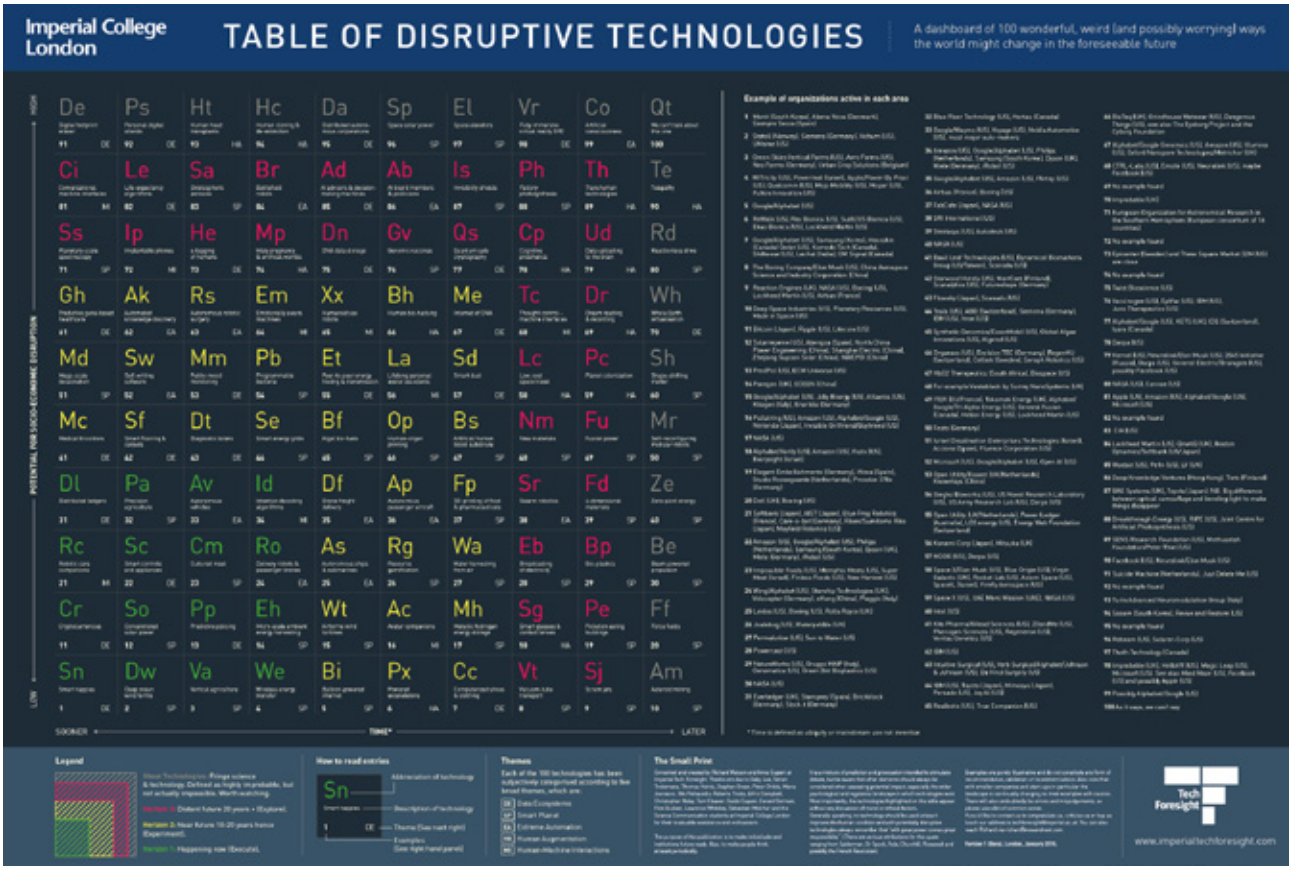
Source: STATISTA, 2023

Where is Malaysia?

Despite the challenges during the recent COVID-19 pandemic, the automotive sector in Malaysia remained resilient. In 2022, it produced 702,275 motor vehicles, a surge of 45.8% compared to 2021, with the total vehicle sales reaching 720,658 units, a 41.6% increase from the previous year. In the same year, out of the 736,783 new car registrations, only 4,309 were for EVs. The number, however, has shown a significant increase from the previous year (1,059 new EV registrations) in line with the full road tax exemption initiative starting 1st January 2022 until 31st December 2025 for Battery EVs, Fuel Cell EVs, and 50% exemption for Plug-in Hybrid EV. Despite the increase, the transportation sector is still intensively suffering from the large number of low energy conversion efficiency of combustion engines, which have increased the overall carbon dioxide (CO_2) emission rate significantly. Since the transportation sector is the second-largest CO_2 emitter in Malaysia after the energy sector, contributing up to 30% of the nation's GHG emissions with predominantly ICE vehicles on the road, a new way out is critical to address consumers' concerns towards the environment. This is especially so since average Malaysians spend approximately one to two hours on the road, stuck in traffic each day.

The government of Malaysia has implemented several policies and initiatives aimed at boosting EV adoption in the country, including the 12th Malaysia Plan, National Automotive Policy, Low Carbon Mobility Blueprint, National Energy Policy, and National Energy Transition Roadmap (NETR). These comprehensive frameworks provide a roadmap for transitioning to cleaner and more sustainable transportation options. Between 2018 and June 2023, the Malaysian Investment Development Authority (MIDA) approved 59 EV projects worth RM26.2 billion. These projects encompass various aspects such as vehicle assembly, manufacturing parts and charging components, contributing significantly to the development of Malaysia's EV ecosystem (Business Today, 2023). The influx of Foreign Direct Investment (FDI) into the country is partly attributed to the growing global demand for EVs, which has led to increased demand for electronics supporting battery management systems, a manufacturing sector in Malaysia that is actively involved in.

Who's next?



While EV adoption continues, it is not too early to explore what lies beyond. Future studies offer valuable insights into potential technological advancements and product innovations. Developing future scenarios can aid in envisioning living conditions and consumption patterns, thereby generating new product ideas to meet evolving consumer needs and demands. The Table of Disruptive Technologies by the Imperial College of London presents a wide array of possibilities for future mobility, ranging from Vacuum Tube Transport to Telepathy to Beam Powered Propulsion (Imperial College of London, 2018). The potential for innovation in mobility solutions is vast and diverse. Autonomous vehicles, as depicted in the initial scenario, remain a plausible focus for innovation and future mobility solutions.

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Tomorrow's Commute: **Demographic Dynamics in Shaping Sustainable Mobility and Technology Trends**

Shifts in demographic patterns and population size have direct impacts on the demand for transportation services. As populations grow, we may see increased traffic congestion and greater need for public transportation. Conversely, declining populations may result in reduced traffic congestion and public transportation services as they become less financially viable.

On another note, the World Health Organisation (WHO) predicts that the population of adults aged 60 and above is expected to reach 2.1 billion by 2050, doubling from the recorded 1.4 billion in 2020. This significant increase in the aging population will have profound implications for mobility. For instance, populations in these demographics may require more accessible transportation options, such as paratransit services or transportation for seniors. This underscores the urgency of adapting our transportation systems to meet the evolving needs of our ageing population.

What factors influence changes in urban mobility preferences?

Demographic shifts can coincide with technological advancements that impact mobility. One inspiring trend is the embrace of innovative transportation options by the younger generation, who are often the early adopters of new technologies. This includes ride-sharing, electric vehicles and other innovative modes of transportation. Younger generations are leading the way in prioritising environmentally friendly modes of transportation, such as biking or public transits, shifting away from traditional car ownerships. Both millennials and ageing populations may also become more concerned about environmental issues, influencing transportation preferences. For instance, a study conducted in Munich, Germany, assessed the willingness of transportation users to pay for ride-hailing services. The results indicated that ride-hailing services are particularly popular amongst those aged 18–39, as well as larger households and households with fewer autos. Additionally, higher-income groups are more willing to pay for ride-hailing services. Individuals, especially urban millennials and Gen Z, embrace ride-sharing platforms like Grab due to convenience, affordability and app-based accessibility.

Demographic shifts toward urban areas can increase demand for mass transit systems, biking infrastructure and pedestrian-friendly environments. Conversely, suburbanisation trends may lead to increased reliance on automobiles and longer commuting distances, contributing to congestion and environmental issues. Changes in household sizes and structures can affect mobility demand. For example, single-person households may lead to increased demand for smaller, more efficient transportation options like scooters or electric bikes. Larger households, such as families, may require larger vehicles or multiple trips to accommodate everyone's needs.

Demographic changes in income distribution can influence mobility patterns. Higher-income individuals may have greater access to private transportation options like cars, while lower-income individuals may rely more heavily on public transit or non-motorised modes of transportation.

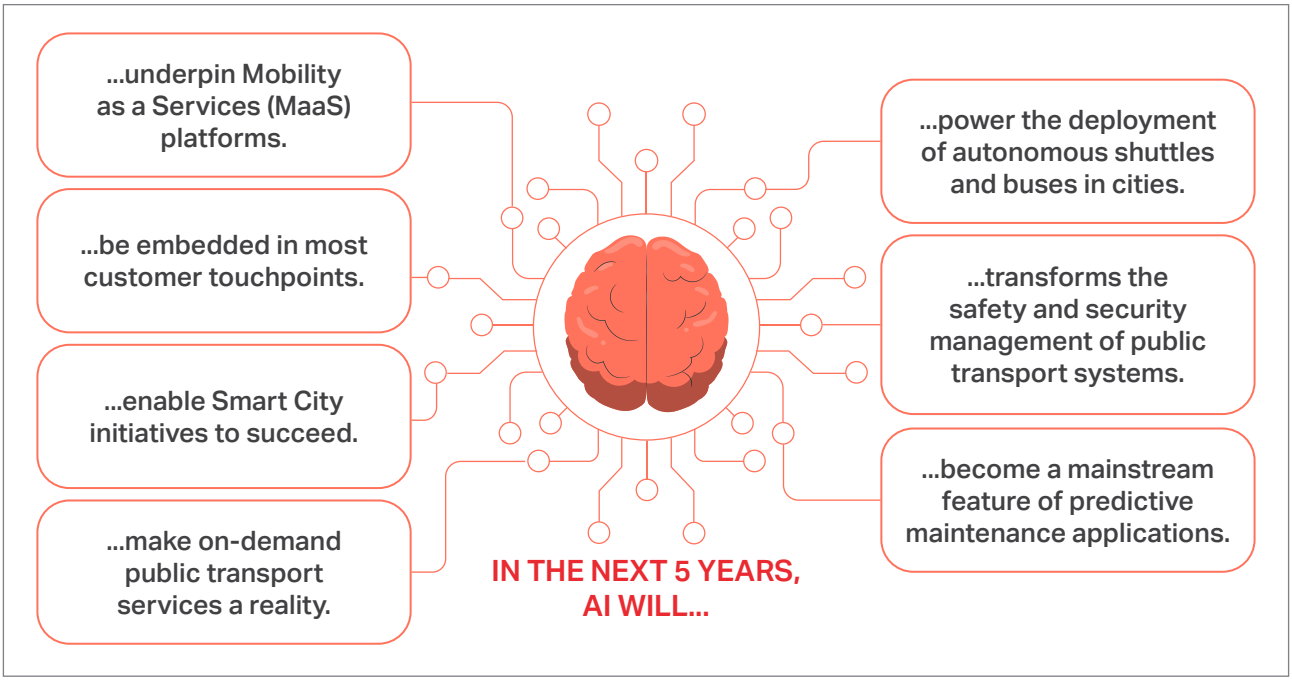
Ride-sharing is considered part of the sharing economy and contributes to sustainable transport. It can reduce car utilisation, increase vehicle occupancy and promote public transport ridership. In this region, where traffic congestion and environmental concerns are prevalent, younger populations often opt for ride-sharing as an eco-friendlier alternative. This could be observed in bike-sharing programmes that have gained popularity amongst young urban dwellers. For instance, in Bangkok, Thailand, the Bangkok Bike Share programme provides bicycles for short trips within the city. It appeals to locals and tourists, offering an efficient way to navigate congested streets and explore the city. Similarly, in Singapore, initiatives like oBike and SG Bike have introduced dockless bike-sharing services, catering to the needs of students and young professionals looking for convenient short commutes and leisurely rides. These services are especially popular amongst students and young professionals for short commutes and leisure rides. In Jakarta, Indonesia, despite traffic challenges, Jakarta has seen the emergence of bike-sharing initiatives like Go-Jek's Go-Bike. Younger residents use these bikes for last-mile connectivity and to avoid traffic jams. However, despite these efforts, challenges have hindered the success of such programmes, highlighting the complexities of urban mobility in the respective cities as well as a sustainable business model for operators.

Transforming mobility through AI

The present trends have seen Artificial Intelligence (AI) significantly influence the choice and preference of transport, particularly regarding demographic shifts and environmental consciousness of the society; AI-powered systems can analyse individual preferences, travel patterns and ecological concerns, to offer personalised recommendations for transportation modes. For instance, AI algorithms can suggest eco-friendly options like public transit, biking or carpooling based on location, destination and time preferences.

Additionally, AI can optimise route planning and navigation by considering real-time traffic data, weather conditions and emission levels, reducing congestion and pollution. Furthermore, AI-enabled demand-responsive transportation services, such as ride-sharing and microtransit, can cater to changing demographic needs and preferences, offering flexible and sustainable mobility solutions tailored to specific groups like the elderly or individuals with disabilities. These services enhance convenience and promote sustainability through shared rides and efficient vehicle usage. Such AI-driven analytics can provide valuable insights into travel behaviour and mode choice preferences across different demographic groups.

By analysing large datasets and social media activities, AI algorithms can identify patterns and trends in transportation preferences, helping policymakers and transportation providers tailor services and incentives to promote sustainable modes of transport. AI can drive the development of innovative mobility solutions that cater to changing demographic needs and environmental priorities. For example, autonomous electric vehicles (AEVs) and mobility-as-a-service (MaaS) platforms powered by AI technology could offer convenient and environmentally friendly transportation options for urban residents, reducing reliance on private car ownership and promoting shared mobility.



Source: Artificial Intelligence (AI) in Mass Public Transport, UITP AsiaPacific Centre for Transport Excellence (AP CTE) under a joint-funded research programme between the International Association of Public Transport (UITP) and Land Transport Authority (LTA)

Overall, demographic changes that interact with various social, economic and technological factors may shape mobility patterns in complex ways. Understanding these dynamics is crucial for policymakers, urban planners and transportation providers to effectively plan for future transportation needs and mitigate potential challenges such as congestion, environmental degradation and inequitable access to transportation services. AI has the potential to revolutionise the transportation landscape by providing personalised, efficient and sustainable mobility solutions that align with environmental consciousness and demographic changes. By leveraging AI technologies, policymakers, urban planners and transportation providers can create a more inclusive, accessible and environmentally sustainable transportation system for all.

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Advanced Air Mobility as A Sustainable Air Transportation of the Future

Advanced Air Mobility (AAM) is a segment of the aviation industry that is rapidly gaining traction. There are numerous descriptions on the internet regarding AAM. As an example, the Advanced Air Mobility Institute describes AAM as an emerging aviation ecosystem that leverages revolutionary new aircrafts and broad array of innovative technologies to safely, quickly, affordably and sustainably move people and goods between local destinations. It also connects communities underserved by existing modes of transportation. In general, most of the descriptions highlight AAM with the following key features:

Transformational or revolutionary aircraft designs

Game changing new and emerging innovative design considerations, such as wingless multicopters, electric helicopters, and novel autogyros, amongst others

Incorporates new and emerging technologies

Various new and emerging technologies have been incorporated into the AAM platforms, encompassing information-enabling platforms (e.g. ride-hailing apps), innovative battery technology, distributed propulsion systems, integration of airspace systems, and shared autonomous vehicles

Electrical vertical take-off and landing

The advancement of technologies in battery-distributed propulsion systems enables aircraft to perform vertical take-off and landing, resulting in enhanced safety, reduced noise level, and lower operating and maintenance costs, compared to existing vertical take-off and landing aircraft, such as helicopters

Connecting underserved areas and communities

AAM presents opportunities for communities currently underserved by existing ground or air transportation to commute easily, particularly from rural or suburban areas to city centres or any points of interest.

Green and sustainable

The AAM vehicle exhibits zero emissions during use and minimal emissions throughout its lifespan.

New business model

A shift from a solely profit-driven model to one focusing on sustainability and user-centricity, such as the mobility-as-a-service (MaaS) model that utilises information-enabled platforms like ride-hailing apps. It empowers people through a unified digital channel to plan, book, and pay for multiple mobility services, reducing car ownership and the number of trips made. It eases mobility, amplifying socioeconomic benefits, particularly for individuals at risk of social exclusion due to poor transport access.

AAM activities

In terms of the range of activities involving AAM aircrafts, it can be described from the movement of passengers and cargo perspective:

AAM for Passenger Movement

AAM focuses on revolutionising passenger transportation, particularly in urban and regional areas.

Urban Air Mobility (UAM)

AAM aims to enable urban air mobility by providing efficient and sustainable transportation options for urban commuters. Electric vertical take-off and landing (eVTOL) aircrasft aircraft can transport passengers between vertiports located in urban centres, suburbs and airports, bypassing ground congestion and reducing travel times.

Inter-regional Connectivity

AAM can enhance connectivity between regions by providing efficient and direct air travel options. It can bridge the gap between urban centres and remote or underserved areas, enabling quicker and more convenient travel for business, leisure or emergencies.

Commuter and Regional Flights

AAM offers the potential for short-haul regional flights, connecting cities and towns within a few hundred kilometres apart, providing an alternative to road or rail transportation for commuters, reducing travel times and enhancing regional connectivity.

Air Taxi Services

AAM envisions deploying on-demand air taxi services, where passengers can book flights through mobile applications or other platforms. This flexible and personalised transportation mode can offer convenience and time savings for business travellers, tourists and individuals seeking quick and direct point-to-point transportation.

Tourism and Sightseeing

AAM can play a role in the tourism industry, offering unique aerial experiences and sightseeing opportunities, including scenic flights, aerial tours, and access to landmarks, national parks and tourist destinations.

AAM for Cargo Movement

The AAM industry envisions utilising eVTOL aircraft for goods transportation applications.

Cargo Delivery

AAM can facilitate the efficient and swift delivery of goods, including packages, medical supplies, spare parts, and other time-sensitive or high-value items. eVTOL aircraft can access areas with limited ground infrastructure, bypassing traffic congestion and providing faster delivery times, particularly for last-mile and urban logistics.

Supply chain operations

AAM has the potential to optimise supply chain operations by enabling faster and more flexible transport of goods. It can support just-in-time inventory management, reduce lead times, and enhance supply chains' overall responsiveness and resilience.

Humanitarian Aid

AAM can be crucial in disaster response and humanitarian aid efforts. It can provide rapid delivery of relief supplies, medical equipment, and personnel to affected areas, even in challenging or remote locations.

Environmental Monitoring

AAM can be utilised for environmental monitoring missions, carrying specialised equipment for collecting data on air quality, climate, biodiversity, or other environmental parameters. It can enable efficient and timely data collection in areas that are inaccessible by ground-based means.

Air Ambulance and Medical Services

AAM can support medical services by providing air ambulance capabilities and rapid transportation of medical personnel, organs for transplants, or emergency medical supplies. In this context, the AAM mission prioritises speed, access, and efficient healthcare delivery.

Features of AAM Contribute to Sustainability.

AAM can be considered a future mobility that is more sustainable, as reflected in its design and the range of technologies adopted in building an AAM aircraft. Among these features are:

Aircraft Propulsion

It is based on electric or hybrid-electric systems, which use batteries, fuel cells, or generators to provide electrical power to the motors that drive the propellers or fans of the eVTOL aircraft. Electric propulsion systems have several advantages over conventional combustion engines, such as lower emissions, noise, maintenance costs and efficiency.

The configuration of the eVTOL aircraft

AAM can use different types of eVTOL aircraft, such as fixed-wing, rotary-wing or multi-copter, which have distinct advantages and disadvantages in terms of performance and energy consumption. Fixed-wing aircraft have higher cruise speed and lower drag but require longer runways and more energy for take-off and landing. Rotary-wing aircraft have higher manoeuvrability and hover capability but have lower cruise speed and higher drag. Multi-copter aircraft have higher redundancy and stability but also lower payload and efficiency.

The optimisation of the aerodynamics and the weight

AAM can use various techniques to improve the aerodynamics and the weight of the eVTOL aircraft, such as distributed electric propulsion (DEP), which uses multiple electric motors and propellers or fans distributed along the wings or fuselage of the eVTOL aircraft. DEP can improve the lift-to-drag ratio, stability, and redundancy of the eVTOL aircraft, but it also requires more wiring and control systems. AAM can also use lightweight materials and structures, such as composites, to reduce the weight and energy consumption of the eVTOL aircraft.

Therefore, AAM can potentially reduce carbon emissions from the aviation sector, which accounted for around 3% of world CO_2 emissions in 2019. According to some estimates, AAM could reduce CO_2 emissions by up to 70% compared to conventional aircraft, depending on the type of propulsion, energy source, and operational efficiency. The availability of renewable energy, the use of sustainable aviation fuels (SAFs), the integration of AAM with other modes of transportation, and the regulation of noise and air quality will all have a tangibleimpact on the environment.

Prospects of AAM in Malaysia

Many nations are making attempts to mainstream AAM activities on a global scale. According to the most recent update to the Global Air Mobility Market Map database of programmes, in the first half of 2023, 14 cities and regions worldwide launched new eVTOL and/or AAM programmes, while seven countries and cities updated their urban/ AAM plans with new partners and services. While the AAM sector is still in its early stages globally, there have already been a number of proposals from Malaysian companies looking to use AAM aircraft to offer transport services for both domestic and cross-border routes. But there are problems and difficulties that must be resolved, some of them are as follows:

Finance and Incentives

Because AAM is considered a high risk, getting backing and investment from the government and financial institutions is difficult. The linked technology is new, and financial institutions do not understand its requirements and potential, making investments difficult

Institution and Infrastructure

Absence of the infrastructure needed for AAM, including navigation systems, charging stations, landing and take-off pods, and security and communication systems

Public Acceptance

Currently, there is low level of public awareness and acceptance of AAM, primarily because of safety concerns about AAM flying close to people at low altitudes. Concerns about privacy and public discomfort add to the reluctance

Policies and Regulations

Because there are currently no established laws specially designed for AAM inside the current aviation framework, obtaining the requisite licences, permits and certifications, such as Design Organisation licences for AAM operations, proves to be challenging

Skills and Talent

Talent mismatch issue in Malaysia exacerbates the difficulty of finding skilled talent in the AAM profession. This happens when people's abilities do not match the requirements of the AAM business

Technology and Innovation

Malaysia's AAM technology is still in the very early stage of maturity. A thorough understanding of the technical and developmental components of AAM technology is still lacking, with the majority of information being at the user level

To create an environment that will allow Malaysia to flourish, the growth can be further hastened by active participation of industry participants, government-related organisations and academics, in addressing the problems above and challenges.

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VISIONING THE FUTURE OF AAM IN MALAYSIA

As Malaysia continues its trajectory into the future, the landscape of transportation undergoes a radical transformation with the integration of Advanced Air Mobility (AAM) technologies. Envisioning the year 2040 unveils a possible future where AAM seamlessly weaves into the fabric of everyday life, revolutionising urban, rural and regional connectivity. The emergence of aerial solutions is not merely a futuristic dream but a tangible reality reshaping how Malaysians commute, interact and address critical challenges. The infographic provides a compelling glimpse into Malaysia's AAM landscape in 2040 across various domains. The envisioned utilisation of AAM technology in Malaysia by 2040 encapsulates a paradigm shift in transportation infrastructure, fostering its integration into urban, rural, urban-rural and intra-regional activities.

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Note: The scenarios presented here were developed during a stakeholder engagement workshop, part of a collaborative initiative between MIGHT and FUTURISE. These scenarios are exploratory in nature and are intended to stimulate discussion and insights. They do not represent definitive forecasts or predictions. We welcome any thoughts and feedback on these scenarios and looking forward for a more realistic visioning of the future of AAM in Malaysia.

URBAN

Across urban landscapes, AAM's utilisation primarily manifests in the form of air taxis and drone services, significantly reducing commute times, addressing traffic congestion, and providing swift delivery of goods and emergency medical supplies. Some of the envisioned potential use of AAM include:

Kuala Lumpur:
Use of air taxis alleviate rush hour traffic from 53 minutes to a meagre 10-minutes commute at an affordable fee.

Temerloh:
Man suffering from life-threatening cardiac arrest saved thanks to AED drone (drone-delivered defibrillator).

Penang:
Development of vertiports in land-limited Penang and use of air taxis addresses the issue of lack of extensive public transport system and connection between Penang Island and the mainland.

Melaka:
AAM technology used for smart city infrastructure monitoring and assessment including preservation of vulnerable heritage infrastructure.

Iskandar Puteri:
The use of drone-based traffic monitoring help authorities manage traffic flow and make informed decisions about road infrastructure improvements.

Cyberjaya:
Food and parcel delivery services using drones from door-to-door delivering hot piping food and undamaged parcels.

URBAN RURAL

The intersection of urban and rural areas witnesses the convergence of AAM technology, enhancing connectivity, tourism and accessibility, consequently bridging the gap between remote areas and urban centres. Some of the envisioned potential use of AAM include:

Kelantan:
AAM deployed in search and rescue missions in Malaysia's annual monsoon season floods rescuing 150 people from rooftops and monitoring early warning signals in water levels.

Kedah:
Semiconductor wafers transported seamlessly from Kulim Hi-Tech Park to Penang International Airport on a tracked air traffic control UAV enabling the expansion of Malaysia Free Industrial Zone (FIZ).

Cameron Highlands:
From farm to fork with vegetables delivery within an hour from harvest.

Kuala Terengganu:
Malaysian Maritime Enforcement Agency prevents illegal fishing boats from entering Malaysian waters.

Tioman Island:
eVTOL used to ferry tourists and necessities between Johor, Pahang, Kuala Lumpur and Singapore.

Langkawi:
Air taxi utilised for unique and captivating scenic aerial tours of Langkawi's 99 islands.

Kuching:
Rural-urban connectivity enhanced with eVTOL transporting residents commuting between Kampung Sebuyau Besar taking only 30 minutes.

Subang:
Subang Aerotech Park becomes largest AAM maintenance, repair and overhaul centre in ASEAN.

RURAL

Meanwhile, in rural regions, AAM technology serves as a crucial lifeline by enabling rapid response in emergency situations, facilitating efficient logistics for agriculture, and supporting conservation efforts through aerial surveys. Some of the envisioned potential use of AAM include:

Mount Kinabalu:
Climber rescued after a 48-hours search and rescue mission upon getting lost and injured at Lows Peak Circuit.

Long Unai, Sarawak:
eVTOL ferries doctor and epinephrine from Belaga Clinic to anaphylactic shock child within 25 minutes.

Pahang:
AAM technology used for aerial surveys and exploration in Pahang's mining regions assist in assessing mineral deposits, environmental impacts, and resource extraction activities.

Taman Negara:
Drones and AAM platforms deployed for wildlife monitoring and conservation efforts.

Sabanalang Pitas:
High-Attitude Platform System (HAPS) deployed to provide various communication services including internet, voice and data reducing digital divide in rural Malaysia.

Project Safina

Development of Shipbuilding & Ship Repair (SBSR) Through OSV Niche Market

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Petroliam Nasional Berhad (PETRONAS) provides Malaysian shipbuilders a unique opportunity to collaborate and develop fit-for-purpose Offshore Support Vessels (OSVs) for the Malaysian oil and gas industry through the landmark Project Safina Phase 1. This initiative, launched in 2021, is a testament to the industry's collaborative spirit and potential.

Project Safina Phase 1 is not a mere construction project for 11 new OSVs; it is a platform for the creation of advanced, versatile vessels. These vessels are designed to perform a wide range of tasks, supporting PETRONAS's offshore operations. This level of innovation and adaptability is a clear testament to the cutting-edge capabilities of the Malaysian shipbuilding industry, bolstering the national aspiration to become a hub for the region's offshore oil and gas industry.

The project is derived from the meticulously crafted Malaysian Shipbuilding/Ship Repair Industry Strategic Plan 2020 (SBSR 2020), jointly developed by leading organisations such as MIGHT, Association Marine Industries Malaysia (AMIM), Maritime Institute of Malaysia (MIMA), and the Malaysian Joint Branch of the Royal Institution of Naval Architects and the Institute of Marine Engineering, Science and Technology (RINA IMAREST).

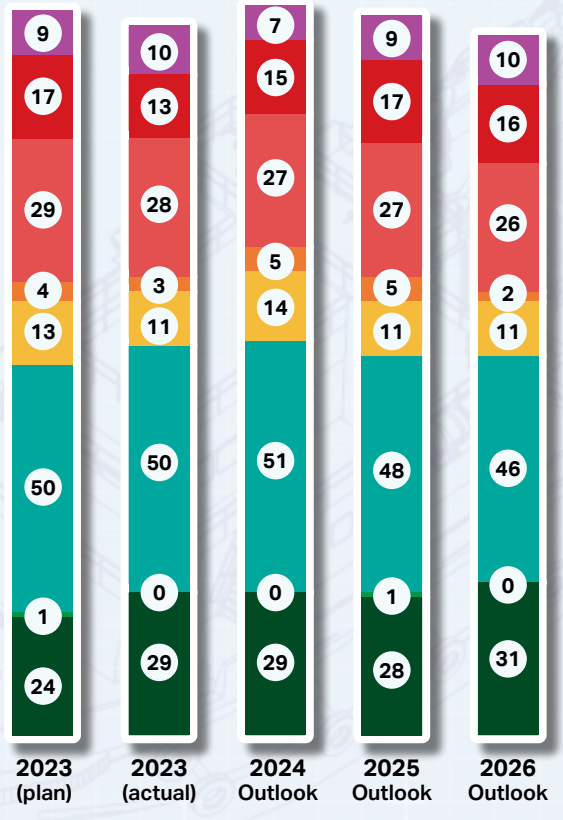
This plan is not just about seizing opportunities in the oil and gas market. It also holds the potential to boost the SBSR industry significantly, catalysing its growth and elevating its global standing. The industry's future is bright, and with the proper support, Malaysian shipbuilding companies can compete on a global scale.

PETRONAS has awarded a new-build long-term charter contract new-build for 11 OSV for Phase 1 to replace the current ageing fleet. Future demand and market conditions will determine the potential for further new-build OSV tenders.

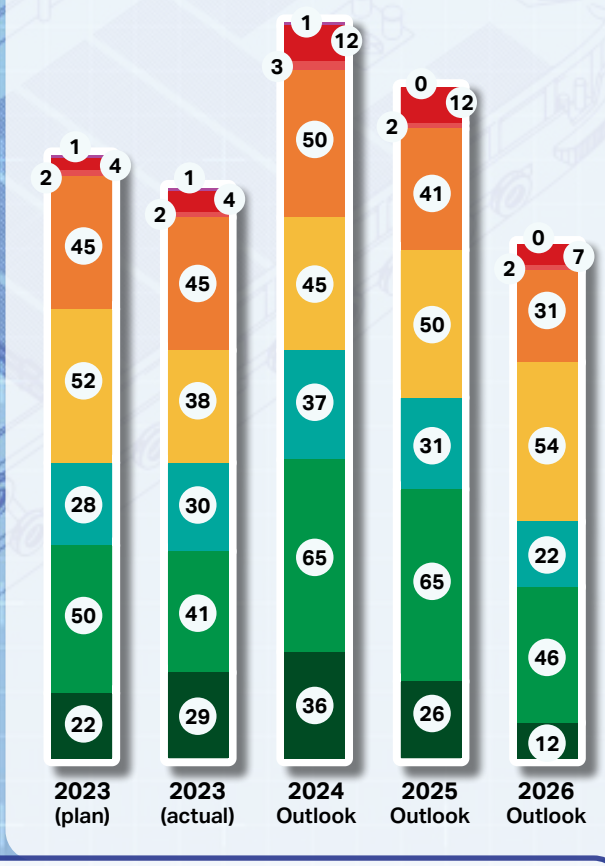
Types of vessels awarded:

- **General Purpose Vessel (GPV)**
- **Landing Craft Tank (LCT)**
- **Utility Vessel (UV)**
- **Fast Crew Boat (FCB)**

Number of Vessels Supporting Production Operations and Production Project



Number of Vessels Supporting Drilling and Projects (Wells)



AHTS < 100 MT | AHTS > 100 MT | FCB | PSV / SSV | Work Boat / Work Barge | GPV / SBV | LCT | UV

Source: PETRONAS Activity Outlook 2024-2026

OSV demand overview for PETRONAS operations as per PETRONAS Activity Outlook 2024-2026 published in December 2023.

OSV owners embarking on fleet renewal should consider fuel-efficient technologies, including diesel-electric with battery (hybrid) vessels, to reduce charterers' total operation costs.

Shipyards contracted in Project Safina Phase 1

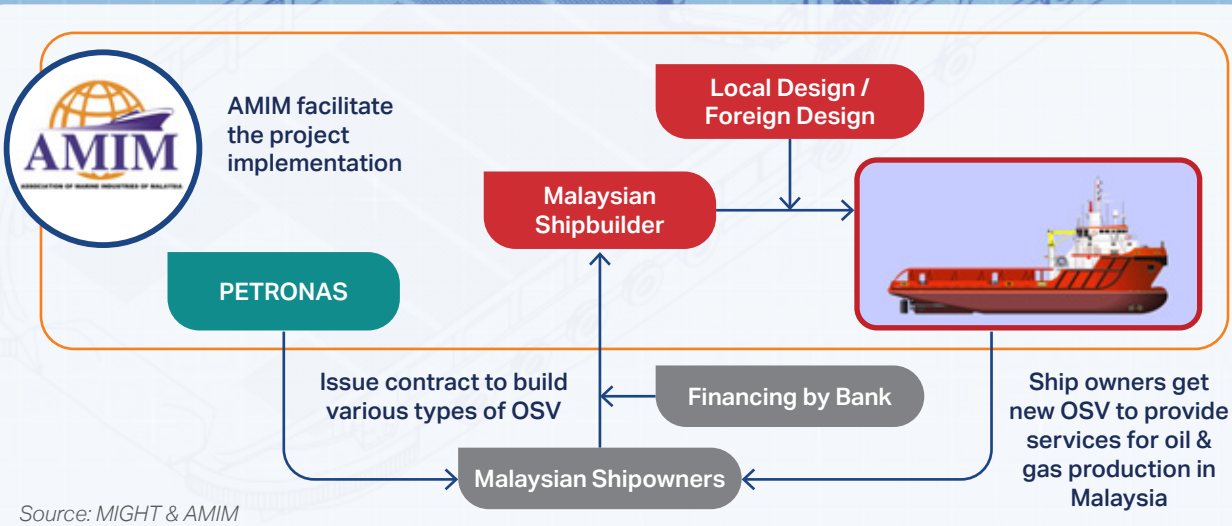
Source: MIGHT & AMIM

One of the partners in Safina Project, is the Association of Marine Industries of Malaysia or AMIM, a non-governmental organisation that represents a vast sector of the Malaysian marine industry, which comprises shipbuilding, ship repair and marine-related industries.

For Project Safina, AMIM signed an MoU with PETRONAS in November 2020 to support the local shipbuilding ecosystem by developing fit-for-purpose OSV designs for the oil and gas industry.

AMIM is thrilled that PETRONAS is taking the lead in the Safina Project and ensuring that the construction of the vessels is done locally. This support is a testament to the value and potential of the industry.

A total of 28 yards have been shortlisted for the Safina Project, comprising AMIM members that have the capacity and capability to participate in a national project. AMIM's involvement in the Safina Project is pivotal, underscoring the association's significant role in promoting the sustainable development of the Malaysian maritime industry.



Source: MIGHT & AMIM

AMIM plays an important role in supporting the local shipbuilding ecosystem by developing fit-for-purpose OSV designs.

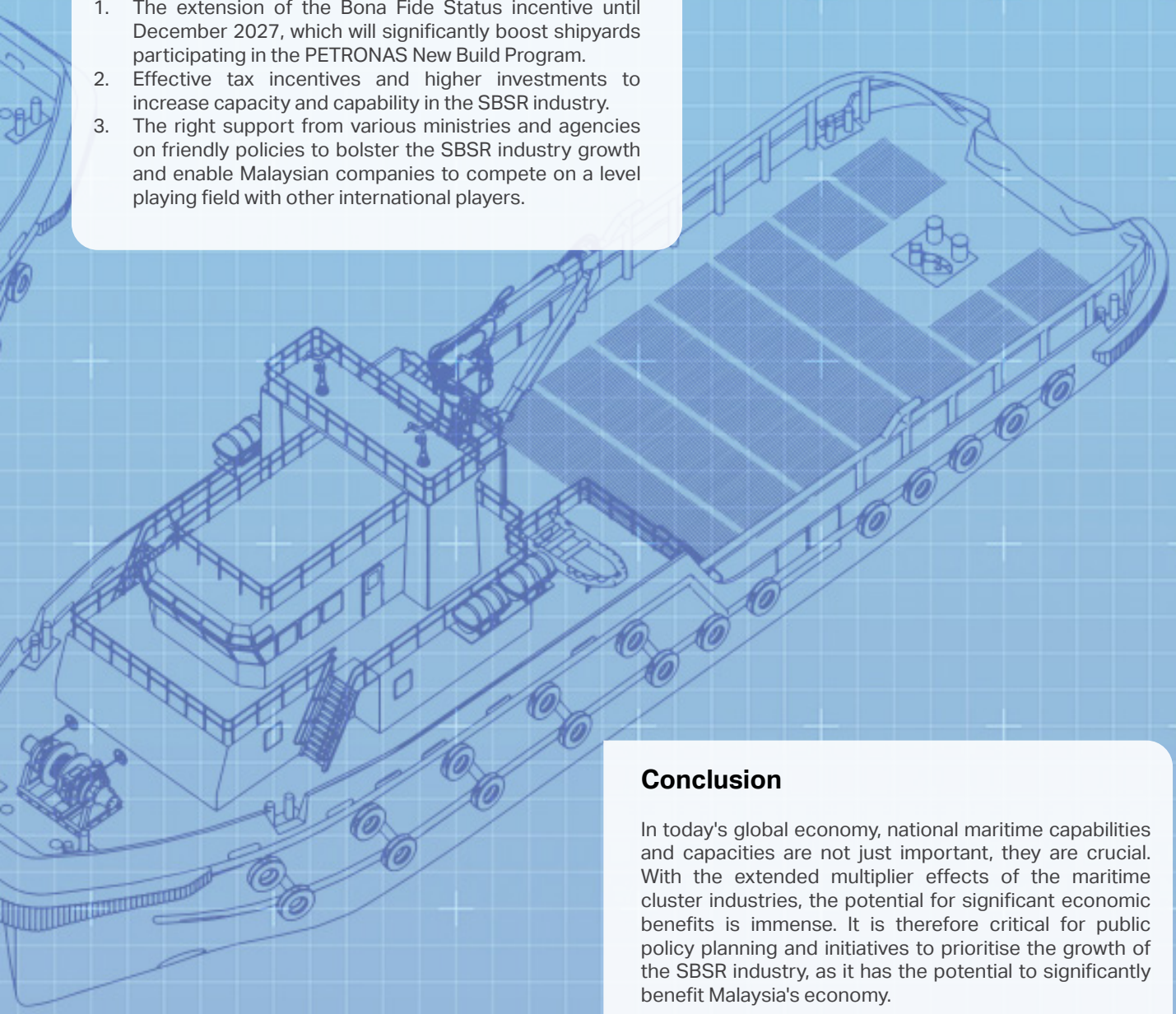
After Phase 1 comes to an end, Project Safina Phase 2, subsequently is expected to commence its contracting exercise in Q3 2024

Impact and Lessons Learned from the Safina Project

The SBSR industry in Malaysia is renowned for its expertise in building and small- and medium-sized vessels. It has a successful track record of exporting Malaysian-made vessels to various foreign countries. However, it is imperative that the SBSR industry receives consistent policy direction and support to maintain its resilience and competitive edge regionally and globally.

Support that is needed to develop the industry:

1. The extension of the Bona Fide Status incentive until December 2027, which will significantly boost shipyards participating in the PETRONAS New Build Program.
2. Effective tax incentives and higher investments to increase capacity and capability in the SBSR industry.
3. The right support from various ministries and agencies on friendly policies to bolster the SBSR industry growth and enable Malaysian companies to compete on a level playing field with other international players.



Conclusion

In today's global economy, national maritime capabilities and capacities are not just important, they are crucial. With the extended multiplier effects of the maritime cluster industries, the potential for significant economic benefits is immense. It is therefore critical for public policy planning and initiatives to prioritise the growth of the SBSR industry, as it has the potential to significantly benefit Malaysia's economy.

We strongly believe that with the right environment and institutional framework, Malaysia can secure its position as a critical global player and reap the rewards of sustained economic growth.

Hydrogen Horizons

Navigating the Future of Sustainable Energy in Mobility

The search for alternatives to accelerate the transition to low-carbon energy has placed hydrogen on the radar in various regions of the globe. The rapid advancements in technology, policy market and investment have driven Malaysia's interest in the hydrogen application. Over the decades, various strategic plannings have incorporated hydrogen as one of the energy solutions; however, the speed of the execution needs to be catalysed.

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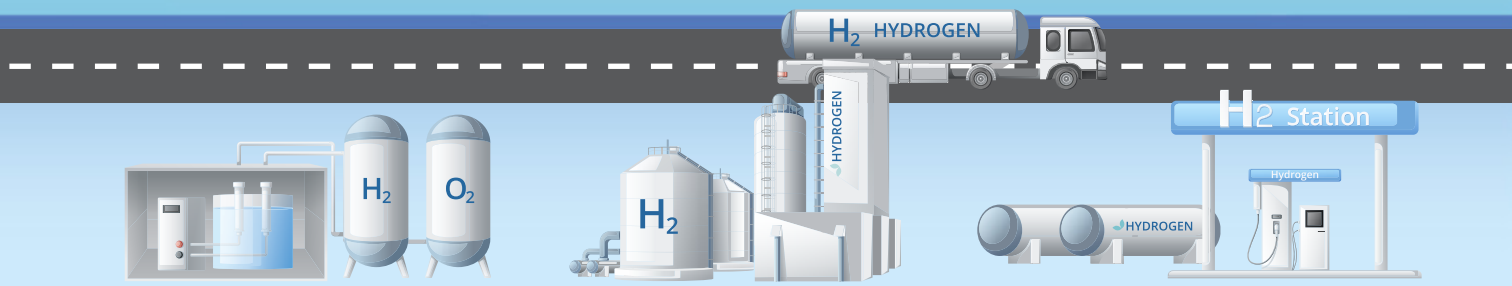

Feedstock and Hydrogen Production

1. One production plant of green hydrogen in Kuching to produce 130 kg H_2/day. (Linde).
2. Upcoming plant in Rembus, Samarahan at 5000 kg/day using (by 2025).
3. Project H2rnbill in Bintulu (by 2027/2028) for Methylcyclohexane (MCH). Partnership with Sumitomo and Eneos.
4. Project H2biscus (Sarawak Petrochemical Hub- Hydrogen Park) by 2027/2028 mainly for export market to Korea in NH3 form. Collaboration with Lotte, Posco and Samsung Engineering.
5. Upcoming project of green hydrogen in Perak by SeRenE and China Power.

Hydrogen Conversion and Transport

1. Existing models in Sarawak focusing on the integrated production and refuelling plant/ station (Sarawak Energy Western Region Office).
2. A few companies such as Linde, Air Products, Praxair, Taiyo Nippon Sanso, Air water, Messer, Yingde Gases and Air Liquide are providing hydrogen transport solutions via tube trailers (imported hydrogen fuel from overseas countries).
3. Hydrexia technology solutions of solid state are embedded with the tube trailer.

Hydrogen Storage/ Station

1. Existing hydrogen refuelling station in Kuching (SEWRO) supported with two storage systems.
2. Existing 3 in 1 Petrol Darul Hana Fuel Depot.
3. Hydrexia is partnering with Toyota on the Mobile Hydrogen Refuelling Station powered by Hydrogen Generator.
4. MOSTI collaborates with NanoMalaysia, UMW Toyota Motor, Petronas Technology Ventures and MGTC on the hydrogen refuelling station in Putrajaya.
5. Hydrexia provides sodium state storage technology (magnesium hydride) for hydrogen storage.
6. Petronas Research Sdn Bhd (PRSB) is inventing technology for metal-organic framework (MOF) storage.
7. Few gas companies are providing hydrogen storage solutions to the manufacturing industry.

MIGHT developed the Green Technology Foresight 2030 in 2014 to identify the green technology applications across nine (9) key sectors based on the scenario to conserve the natural environment and resources, as well as minimise and reduce the negative impact of human activities. In the study, hydrogen is identified as one of the unexpected future developments in the energy sector, with the following attributes:

- **The energy scenario has transitioned to a hydrogen economy**
- **Hydrogen charging stations are widely available with efficient hydrogen-producing systems at low cost**

Hydrogen Application

1. Malaysia Hydrogen Market by Type is Compressed Hydrogen Gas and Liquid Hydrogen. The export market focuses on ammonia and MCH form.
2. 3 H2 Buses, 5 H2 Cars (Toyota Mirai) and 2 H2 Cars (Hyundai Nexo) in Kuching.
3. 1 unit of Autonomous Rapid Transit (ART) in Kuching.
4. 3 units of H2 Cars (FCEV) in Putrajaya (upcoming).
5. The next plan is on the Kuching City Transportation System.

Future Hydrogen Application in Mobility Sector

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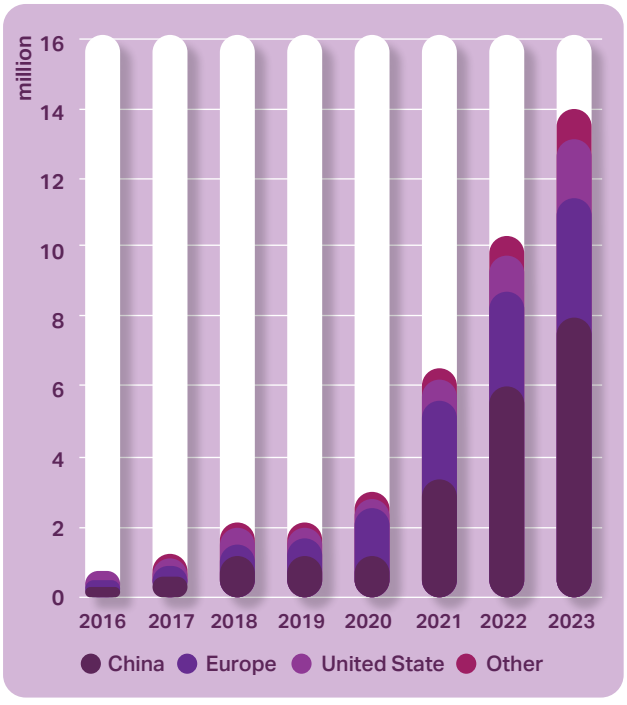
Unintended Consequences: Are Electric Cars 'Green'?

The global transport sector significantly contributes to greenhouse gas (GHG) emissions, which grew at an annual average of 1.7% from 1990 to 2022, faster than any other end-use sector. The situation's urgency is clear - to achieve the net zero emission target by 2030 and emission reduction by 3% annually by 2050. Everyone's action, such as choosing an electric car, can contribute to this collective effort. Electric cars, with their zero-tailpipe emissions, are a greener alternative to hybrid and internal combustion engine (ICE) vehicles. They have emerged as a promising solution for mitigating climate change, starkly contrasting to hybrid and ICE vehicles that still rely on burning fossil fuels and emitting pollutants.

There has been a noticeable increase in the acceptance and use of electric vehicles (EVs) globally. This is mainly due to the proactive efforts made by numerous governments to promote environmentally friendly vehicles in the transportation sector, particularly through the electrification of vehicles to reduce GHG emissions. EVs are not just a trend, but a key strategy in the global effort to decarbonise the transport sector and address climate change. In response, manufacturers of EVs have been investing heavily in research and development, driving technological progress and enhancing the efficiency and capabilities of electric vehicles.

Across the globe, electric car markets are seeing exponential growth, as sales exceeded 10 million in 2022. The global share of electric cars in total sales has more than tripled in years, from around 4% in 2020 to 14% in 2022. As shown in Figure 1, EV sales in China reached 27% of total vehicles sold; in Europe, they made up just over 20%, and EV sales increased to more than 7% in the United States.

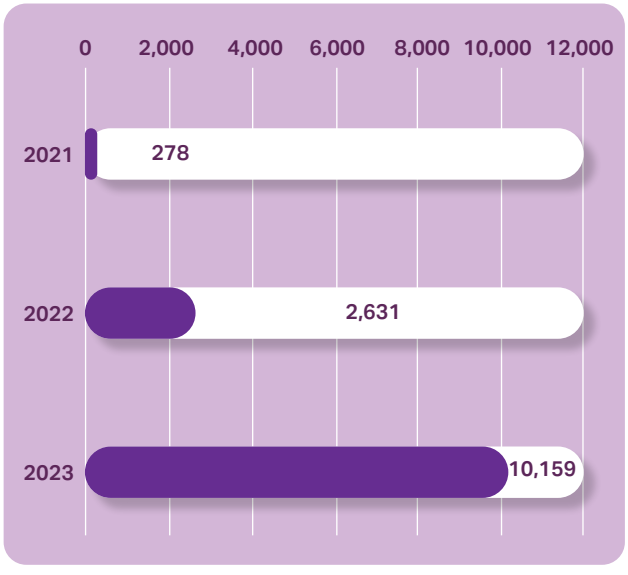
Global Electric Vehicles Sales 2016 -2023 (units)



Source: International Energy Agency
Note: 2023 sales are estimated based on market trends first quarter of 2023.

In Malaysia, the market share of EVs remains relatively modest, comprising only 0.4% of total vehicle sales. Figure 2 shows that there has been a notable increase, with 13,257 units sold in 2023, as reported by the Malaysia Automotive Association (MAA). This brings the total number of electric vehicles on Malaysian roads to 16,763 units.

Sales of electric vehicles in Malaysia from 2021 to 2023



Source: Malaysia Automotive Association

Certainly, as with any emerging technology or trend, EVs also garner criticism and doubts about their "green" status.

#1 An EV charged from the grid is not green

Charging electric vehicles typically results in a smaller carbon footprint, depending on the extent to which local power plants utilise fossil fuels such as coal or natural gas. An EV's environmental friendliness can match that of the electrical grid it relies on for charging.

In Malaysia, the grid remains heavily dependent on coal (50.23%) and gas (45.55%) for electricity generation, resulting in CO_2 emissions for every kilometre an EV is charged from the grid. Research conducted by the Penang Institute, compared GHG emissions from EVs and ICEVs, using the Energy Commission's 2018 electricity generation mix baseline and factoring in automobile-related emissions. The findings revealed that, on average, EVs emit 212gCO_2e/km, while ICEVs achieving fuel efficiency of 15km/L emit 221.5gCO_2e/km. Interestingly, ICEVs with a fuel economy surpassing 15.8km/L emitted less than the average EV.

Average of Electric vehicles vs Internal Combustion Vehicle Per-km Vehicular Emission under Malaysia Electricity Mix 2018

	Internal Combustion Vehicle		Electric Vehicle
Fuel Efficiency	15 Km/L	<15.8 Km/L	28 kWh/ km
Carbon Emission equivalent	221.5 gCO_2e/ km	>212 gCO_2e/ km	212 gCO_2e/ km

Source: Penang Institute

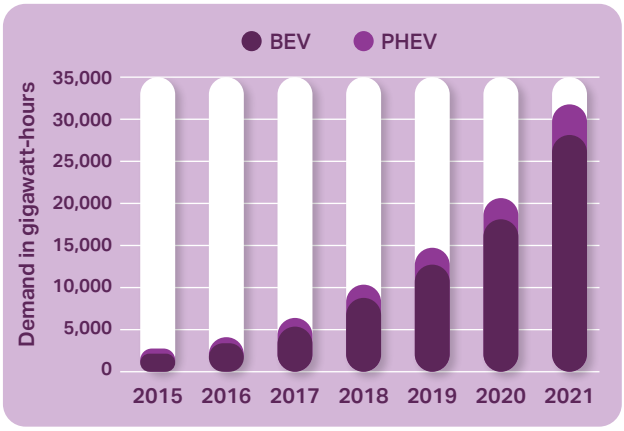
This suggests that in the current energy landscape, promoting the adoption of EVs without addressing the source of electricity may not lead to substantial reductions in GHG emissions within the transportation sector. Enhancing the distribution infrastructure, improving energy efficiency, and integrating renewable energy sources into the grid are crucial, as is prioritising sustainability, reliability and security of the electric power system to cater to increasing EV demand.

However, it is important to recognise that EVs' environmental impact can improve over time as the electricity grid becomes cleaner and EV battery technology advances. As more renewable energy sources like solar are integrated into the grid, the carbon intensity of electricity generation decreases, making EVs increasingly environmentally friendly. This potential for improvement should encourage us about the future of EVs and their role in environmental sustainability.

#2 Grid will not cope with the uptake of EVs

It is evident that a growing fleet of EVs will drive up electricity demand. As more charging infrastructure is deployed, it increases demands on the electricity grid. When the number of EVs surpasses the available electricity supply, the requirement for grid enhancements becomes substantial. However, EVs can potentially serve as assets for grid stability rather than pose challenges. By integrating them with smart grid technologies, energy demand can be more effectively managed, reducing the likelihood of overloading transformers or transmission lines.

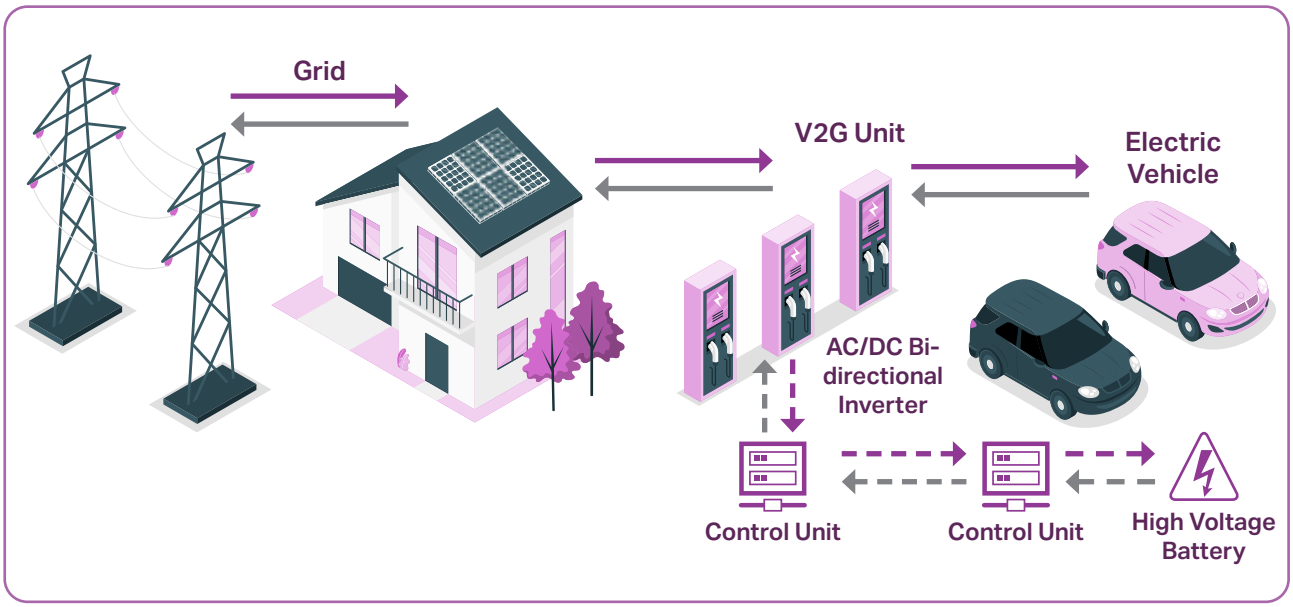
Electric vehicle electricity demand worldwide between 2015 and 2021, by vehicle type (in gigawatt-hours)



Source: International Energy Agency, Statista

Vehicle-to-grid (V2G) charging allows EVs to act as a power source that may help grid reliability by pushing energy back to the grid from an EV battery, as shown in Figure 3. This is done by allowing EVs to charge when electricity demand is low and drawing on them when it is high. Though still at an early stage of development, a UK company, Octopus Energy, has taken the step to launch the UK's first vehicle-to-grid tariff guaranteeing free charging for electric vehicle owners who sell the power from their cars' batteries back to the grid during peak hours. The tariff package offered could save EV owners who drive 16,093kilometre per year more than RM5,077 annually.

Bidirectional Charging (Vehicle-to-grid (V2G)



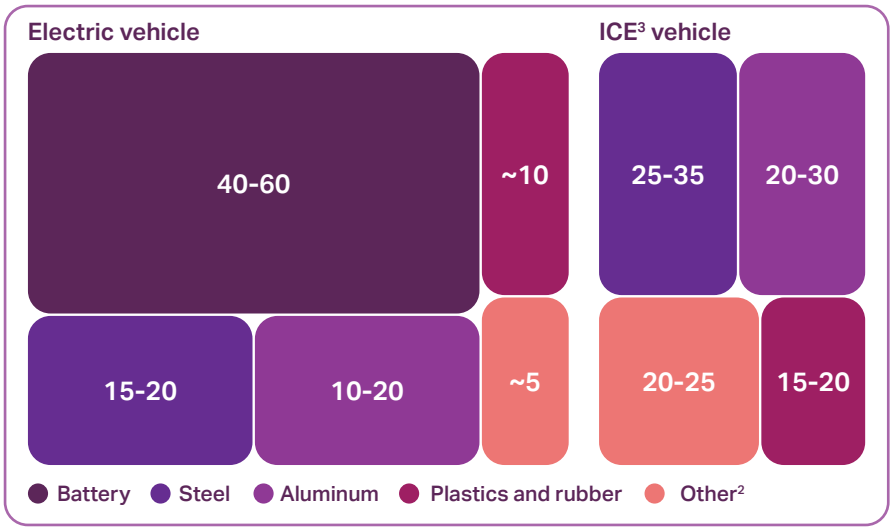
Source:Toka Energy

Several car manufacturers have already embraced V2G technology and integrated it into their EV models. Brands like BMW, Nissan, Mercedes, Volvo/Polestarf and Mitsubishi offer V2G-compatible vehicles, allowing owners to participate in grid-balancing activities . This involvement from manufacturers indicates industry recognition of EVs' role in grid management and the importance of advancing V2G infrastructure.

#3 EV are worse because of battery manufacturing

While electric vehicles are clean, producing the batteries is a highly carbon-intensive process. Indeed, Figure 5 shows that making the large lithium-ion batteries used to power EVs is the most significant source of embedded emissions for both electric cars and trucks, accounting for about 40 to 60% of total production emissions based on McKinsey Analysis. The batteries contain materials that emit substantial GHGs from the mining and refining processes of nickel, manganese, lithium, cobalt, and others.

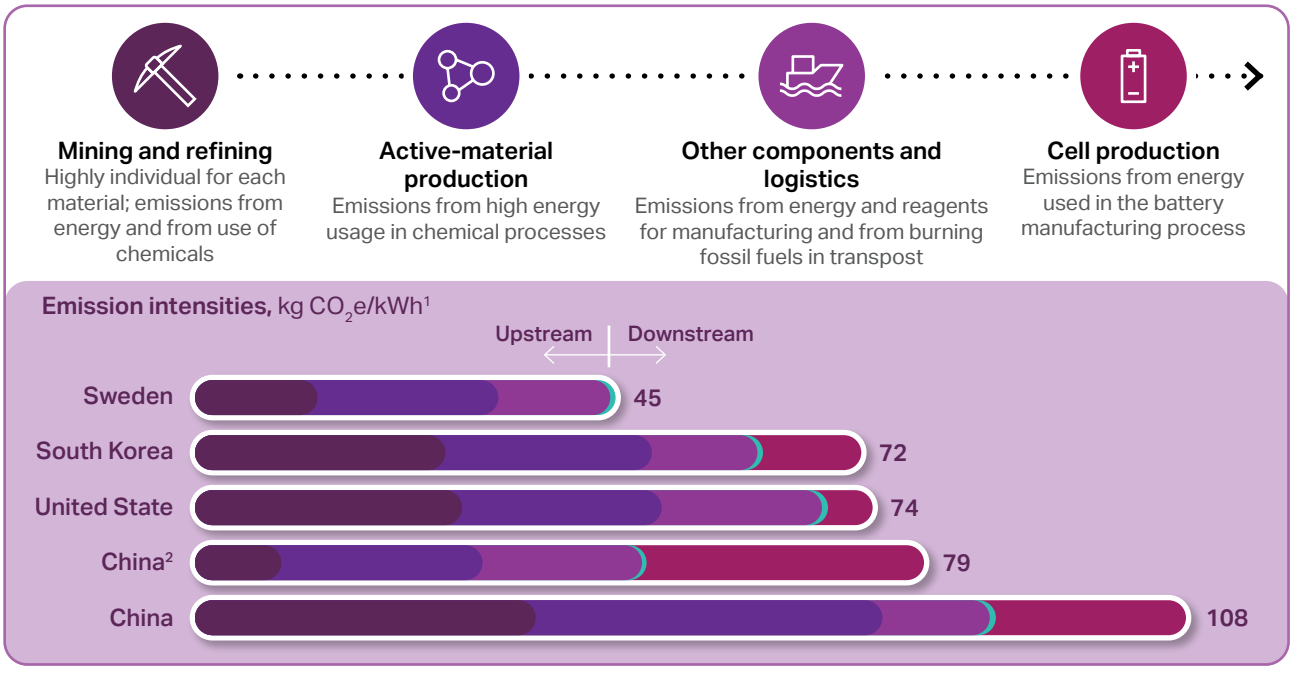
Typical upstream battery-electric-vehicles emissions



Source:McKinsey Analysis
Note:
1. Including upstream emissions from raw materials extraction to the OEM including logistics.
2. Other including glass, copper, electronics, and textiles
3. Internal combustion engine (ICE)

Emission levels from EV battery production depend on various factors, including design choices, vehicle type, range, freight requirements and production and sourcing locations. Figure 6 shows Sweden has the lowest power sector emission intensity, amounting to approximately 45 grams of carbon dioxide per kilowatt-hour. At the same time, China has the highest power sector emission intensity, approximately 108 grams of carbon dioxide per kilowatt-hour. In conclusion, energy sources used to produce various battery components are one of the most significant factors explaining the wide variation in the carbon footprint of different OEMs.

Emissions in the battery value chain are primarily driven by production location and sources of energy.



Source:McKinsey Analysis
Note: 1. Emission intensities were estimated based in existing supply agreements with providers of materials and energy.
2. Based on nickel-free battery

More battery producers have established capacity in Europe, which has helped drive down the global average for emissions per kWh. Electricity has a lower carbon intensity in Europe than in most Asian countries due to a higher share of renewable energy sources.

A growing number of OEMs expect that low-carbon battery production will become a competitive advantage. Some leading players already aim to cut emissions below 20 kg CO_2e/kWh—or up to almost ten times less than the most emission-intensive OEMs today . Any continuing spread between the best- and worst-in-class performers will provide opportunities for leaders to differentiate their offerings.

#4 EV batteries cannot be recycled

The advanced batteries incorporated in electric vehicles are engineered for prolonged longevity but will inevitably degrade over time. While recycling the lithium-ion (Li-ion) batteries found in EVs poses challenges and is currently an underutilised practice, assertions that it cannot be accomplished are unfounded. Recycling EV batteries holds the potential to mitigate emissions associated with EV production by lessening the demand for new materials. Despite the International Energy Agency (IEA) reporting that up to 95% of lithium-ion batteries can be reclaimed, only 5% of EV batteries are presently being recycled.
For instance, an Australian-owned company, EcoBatt, has been disassembling EV batteries and selling the retrieved precious metals for some time. Similarly, other enterprises such as Australia's Relectrify have chosen to repurpose individual cells, revitalising decommissioned EV battery packs and construct battery energy storage systems.

Thus, while the notion that EV batteries cannot be recycled is technically inaccurate, significant progress is still needed in this realm. Enhancing the sustainability of battery manufacturing and encouraging the adoption of clean energy sources can further mitigate emissions from battery electric vehicles (BEVs), thereby improving environmental stewardship within the transportation sector.

Conclusion

In conclusion, it is important to consider the unintended consequences of shifting toward more sustainable vehicle options.

- Firstly, increasing renewable energy in the grid and the using recycled materials in production is crucial to greening EVs. Additionally, transitioning to a global average of 100% fossil-free electricity by 2033 is essential during the usage phase to further bolster environmental benefits.
- With technological advancements, supportive government policies, and growing environmental awareness, electric vehicles are poised to become a mainstream mode of transportation, reshaping the travel landscape and contributing to a cleaner planet.
- Future trends predicted EVs have more advantages over hydrogen-fuelled cars which have many disadvantages, such as limited infrastructure, expensive and unsafe. While electric cars are safer, less costly than hydrogen fuel cells at this moment and have sufficient charging stations available, offering more convenience to the owners. There is a possibility that green hydrogen fuel cells could gain traction soon for commercial and industrial purposes with the innovation and further development of hydrogen fuel cell technology that makes it affordable and commercially viable.
- Waste from end-of-life EV batteries will pose a challenge in the future when the quantity increases and the cost of recycling becomes a burden to battery life and reduce the battery scrap quantity.

Generally, going green and sustainable is not cheap the manufacturer or owner. Thus, alternative use of EV batteries like converting them as a battery storage system will prolong the EV and there is always a price to pay. As technology and new materials evolve or are innovated, we can move towards achieving the net zero emission target by 2050.

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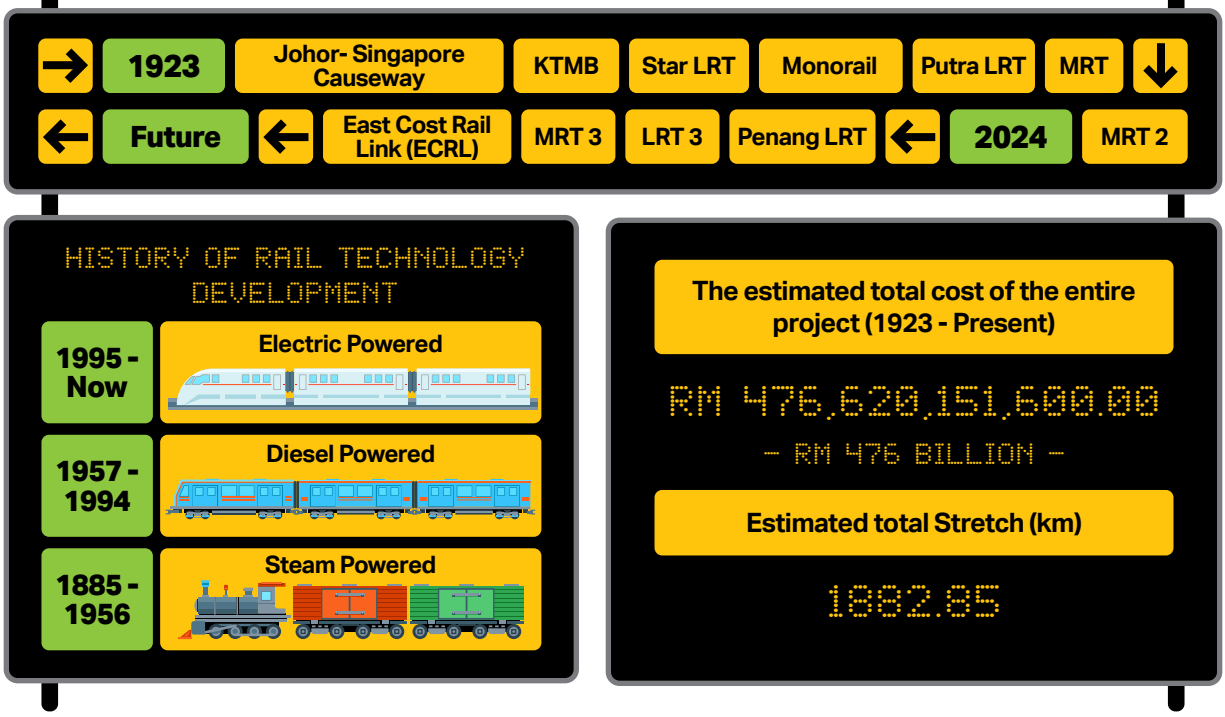
Steaming Ahead with Rail Technology and Mega Projects in Malaysia

History of Rail Development in Malaysia



Source: MIGHT Analytics (2024)

Malaysia,a land of diverse cultures and heritage, has seen its people adapt and evolve with the changing times. A tapestry that weaves in a myriad of traditions, cultures and languages, Malaysia is a testament to the resilience of her people.

Throughout history, people have been able to meet others by exploring the land for trade or migration purposes. How did they travel over the years carrying out these quests? Of course by using the various modes of transportation available during their era, which from humble beginnings have undergone progressive transformations to what we have today.

Just imagine, back then, communities and settlements were connected using horse carriages, bullock carts, river sampans and ships, for trade between countries, utilising the innovations available during that period.

Modes of transportation, from the early days, be it land, sea or air, have gone through leaps and bounds in transformation. Rail, in particular, and the focus of this article, made its first appearance in this country in 1885, thanks to the need to transport tin, or Stannum (Sn) as it is scientifically named.

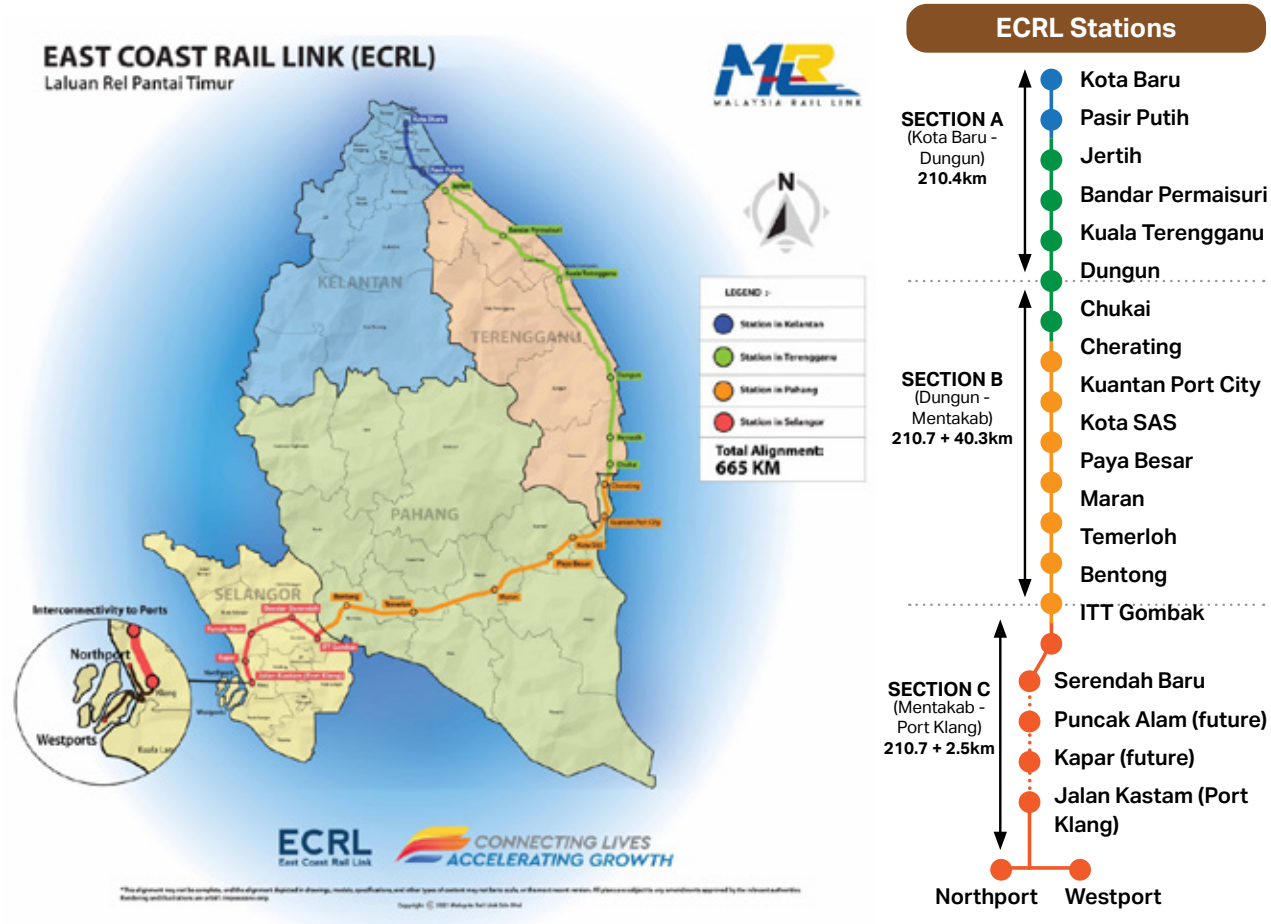
The inaugural locomotive, the Federated Malay States Railway (FMSR) No 1, was fabricated in 1881 (Source: KTMB). When it began operations about four years later, it commuted on a 12 kilometer stretch between Taiping and Port Weld (Kuala Sepetang). It was not long after, that rail became an important mode of transport, crossing over into the 20th century and making strides with every decade passing, with the construction of more railway lines and stations, discounting the damages and delays that World War 2 had inflicted on the country.

Today, rail transportation in Malaysia, whether for passengers or cargo, is a testimony to the country's commitment to progress. The need for improved connectivity, speed, reliability and comfort has driven a non-stop transformative journey for rail.

The above infographics provide a visual representation of this continuous evolution of rail technology in Malaysia.

Let us take a look at the East Coast Rail Link (ECRL) project which is expected to be operational in early 2027. This 665-kilometer railway project spans four states – Kelantan, Terengganu, Pahang and Selangor. With a maximum speed of 160 kilometres per hour, it is expected to cut down commute time between Kota Bharu and Gombak to a mere four hours.

East Coast Rail Link (ECRL) Project



Source: Malaysia Rail Link Sdn Bhd, 2021

The alignment correlates with the railway catering to 70% freight and 30% passenger, with close connectivity to ports in the four states. The economic low-hanging fruits of this development are the freight hubs and the Economic Accelerator Projects (EAP) that would spur opportunities for socio-economic growth.

Technology Transfer in the Local Rail Industry by Leveraging the Klang Valley Mass Rapid Transit Project

The Klang Valley Mass Rapid Transit (KVMRT) project in Malaysia was an Entry Point Project (EPP) of the Economic Transformation Programme (ETP) under the Greater Kuala Lumpur/Klang Valley National Key Economic Area (NKEA). It is an ambitious government project that aims to improve rail connectivity of the Klang Valley.

The project consists of three lines:

- **The KVMRT Line 1,** which is 51 kilometres long from Sungai Buloh to Kajang with a construction cost of RM23 Billion
- **Line 2,** which is 52.2 kilometres from Sungai Buloh to Putrajaya with a construction cost of RM30 billion (Source: Kaur, 2016), and
- **Line 3,** which will be a circle line that completes the overall KVMRT rail system.

The project's construction stage for Line 1 started in 2012 and was completed in 2017. Subsequently, the construction for KVMRT Line 2 was officially launched on 15 September 2016 and is expected to be completed and open by 2023.

The KVMRT line will serve an area with an estimated population of 1.2 million people with 31 stations in Line 1, of which seven are underground stations. The construction of the KVMRT line will consist of elevated and underground sections. The underground section will run underneath the centre of Kuala Lumpur and together with the elevated section, will run from the northern to the southern parts of Klang Valley, when the line is fully operational.

Each train set in the KVMRT rail network will have four cars with up to 1,200-passenger capacity and daily ridership of estimated 400,000 passengers at a train frequency of 3.5 minutes.

The development and construction of the KVMRT project were expected to create more than 130,000 jobs with a contribution of between RM3 billion to RM4 billion Gross National Income per annum to the country. The government has procured foreign rail systems for some of the critical components of the rail infrastructure, such as the electric trains, signalling and the automated fare collection system. Some studies have shown the need to import technology to complete a project faster so that it can contribute to economic growth in a shorter time. However, in the long term, the local industry will not be able to grow in tandem with the implementation of this public project due to limited capacity and capability.

The government has realised the need to establish a proper structure for the technology transfer programme within the government's procurement process by introducing the Offset/ICP policy as a mandatory requirement for any government project that reaches a specific threshold value. The Offset/ICP policy was also applied to the KVMRT project.. The supplier or contractor that won the project has proposed and implemented a structured technology transfer back into Malaysia as a trade-off for the country's capital outflow. The technology transfer in the KVMRT project has benefitted the local rail industry tremendously and has uplifted our local capability in rail technology, such as in the area of Rolling Stock, Signalling and Power Supply and Distribution System.

We are now in an era where time is of the essence, and the need to move fast. High Speed Rail (HSR) seems to be the solution to reduce our commuting time for long-distance travel. In a few years, we will be looking forward to the HSR that will connect us from Malaysia to Singapore. It is part of the aspiration to transform the country into a high income nation that the ETP initiated the KL-Singapore HSR. Many of us would have experienced traveling in an HSR in other countries, and whilst this KLSingapore HSR would revive such experiences, it would be an experience to look forward to for all. Imagine, taking a seat, and as the train starts to move, you feel a gentle push against your back, and as the momentum picks up, the landscapes start blurring. The speed becomes exhilarating, probably mixed with disorienting too, when you see the landscape is merely streaks of colours.

As we traverse from KL to Singapore in those 90 minutes, there will not be much sensation of movement, thanks to technology and advanced engineering to provide us with a wonderful journey without any discomfort.

Whether it is ECRL, HSR or inter-city rail commutes, technological advancement is crucial in enhancing rail systems and infrastructure. The ECRL, for example, is the first in Southeast Asia to implement 4G, namely LTE-Railway. Along the ECRL alignment, tunnels are bored using the latest tunnelling technology especially to manage the geological terrains crossing the Titiwangsa range, special equipment enables the laying of tracks at an installation rate of 1.5-2.5 kilometres a day, compared to 500-700 metres achieved previously.

Connecting the dots between rail mega projects and first and last-mile connectivity

Rail is the land transport of the future, as it is undisputedly the most energy-efficient mode of transport and has the lowest carbon emissions. What currently hinders most of us from commuting on trains is the first-mile and last-mile connectivity. Whether we want to jump on the LRT, MRT, Komuter, etc, if the connectivity is lacking, we would think twice and resort to driving instead.

The overall infrastructure will need to be catered to enable first-mile and last-mile connectivities. Who knows, not long from now, besides feeder buses, we will be looking at tram services to serve communities in the cities and suburbs as a means to connect us to the intercity or interstate train stations, or any desired destination.

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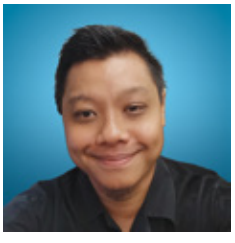

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Mobility by Design:
A Seamless Experience for City Dwellers

Muhamad Razif Nasruddin is the Director/Founder of Thinklab Malaysia, a design research-led company that created 'thnklb', a media company focused on Design and Lifestyle since 2007. thnklb is also the organiser of 'Kuala Lumpur Design Festival', an annual design festival that promotes good design and lifestyle to public and businesses, now in its third year running. To know more, visit our Instagram @ thnklb or website at www.thnklb.com

The ability to travel through time and space is today's fundamental tenet of freedom of movement. Designing a seamless mobility experience is seen as the next frontier for future city dwellers.

If one takes less time to reach a destination, be it by private or public transportation, the idea of being able to move from one place to another gives a sense of control and freedom that rewards the user with more access to personal time and energy.

We live in an age where roads, railways and air space are becoming more prone to traffic congestion, as freedom of movement is becoming more accessible to everyday people as more automotive companies fight to futureproof their existence, whether by competing for the energy investment space of electric, hydrogen or even ICE (Internal Combustion Engine), the government must focus on scaling the basic freedom of movement, beginning with the pedestrian, focusing on Universal Design, as fundamental to mobility within the cityscape.

Universal Design, as described via the Centre of Excellence of Universal Design, is the design and composition of an environment to be accessed, understood and used to the greatest extent possible by all people, regardless of their age, size, ability or disability. An environment (or any building, product or service in that environment) should be designed to meet the needs of all people who wish to use it. It is not a special requirement for the benefit of only a minority but the fundamental condition of good design.

The Principles of Universal Design

Equitable Use	Useful and marketable to people of all abilities.
Flexibility in Use	Accommodates a wide range of preferences & abilities.
Simple and Intuitive Use	Easy to understand, regardless of language knowledge, experience, or concentration level
Perceptible Information	Clearly communicates regardless of sensory abilities or ambient conditions.
Tolerance for Error	Minimizes hazards & consequences from accident or misuse
Low Physical Effort	Effectively & easily used with minimum effort.
Size & Space for Approach and Use	Appropriate size & space is provided for approach, reach, manipulate, and use for all body sizes, postures, or mobility.

Simply put, universal design is good design.

This is an image of an example at Masjid Jamek MRT Station, one of the many examples of Universal Design as Primary, with pedestrian access via zebra strip and access to MRT as Secondary to Freedom of Movement.

Focusing on Universal Design as primary to mobility will inevitably have a positive impact on the way we plan our public transportation with deep integration between work, live and play. Universal Design creates a social cushion to the harsh reality of the urban scape of steel and concrete, along with the chaos of congestion and construction that is familiar with today's city fabric.

This brings us to the next stage, mobility.

Every city has a pulse, its own cadence.

The way we move around the city reflects its speed of delivery and frequency of movement. Some cities are fast-moving, and some are not. How public transportation is designed into the city or place reflects the way the city envisions itself in the world.

However, managing the operations of these important infrastructures is extremely costly, and in many countries, they are almost always running at a loss.

An Operation Control Centre for a public transportation monitoring agency is needed to monitor the way the city moves. In many advanced nations, a monitoring control centre is required to create a healthy human traffic management system in and around the city daily.

How is this different from traditional practice and why is it better? As with many organically developed cities, infrastructures are built gradually to accommodate a growing population without realising that cities are growing exponentially as the demands of the economy expand. Monitoring was not part of the initial plan for observing movements within the mobility realm. By having macro and micro views of our city movement, we can have a better understanding of how to tackle the data produced and understand the pattern of vehicular movement, thus creating clarity in an attempt to improve public transportation delivery and handling of traffic.

A cohesive effort to create a more hospitable experience of movement creates a more efficient, fluid experience for city dwellers for them to do their daily chores. At every level of the working class, public transportation efficiency and comfort provide two things every mobility ideally should: punctuality and space to occupy. This simply means the more frequent punctuality and availability of space to occupy occurs; it will grow in usage by users.

The way we design our primary and secondary freedom of movement is extremely important in creating a seamless mobility experience. It creates a reliable system, one that allows users to plan their journeys and calculate the cost of their movement.

Based on Universal Design as the primary rule of mobility, one of the better ways to redesign the personal mobility experience is to create an A.I. cloud-based information that allows users to calculate the cost and craft an experience for the user's daily journey. This will help to alleviate the burden of time and energy required to plan a trip not only for a day, a month, or even for a year but also to allow users to explore the happenings within the city.

Delegating prediction and trip planning will be the way forward for mobility as technology becomes more intelligent in catering to our lifestyles.

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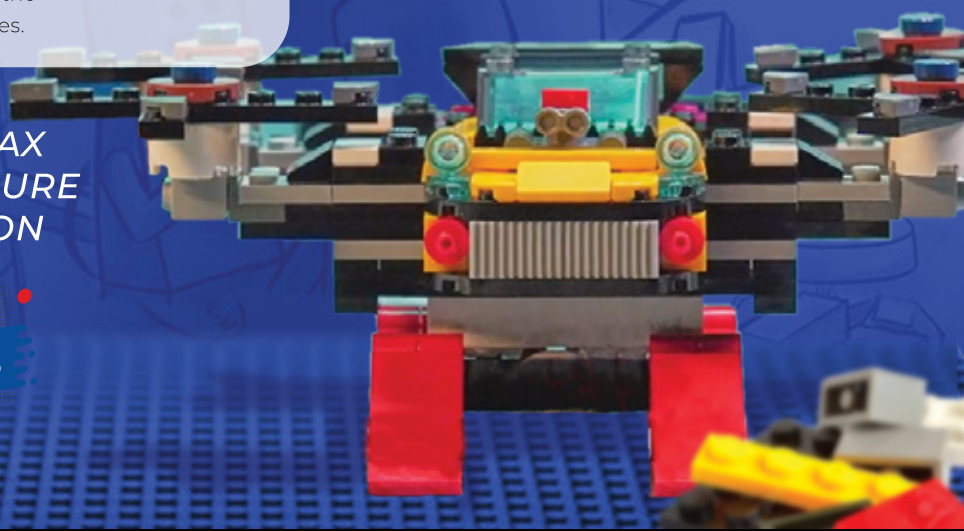

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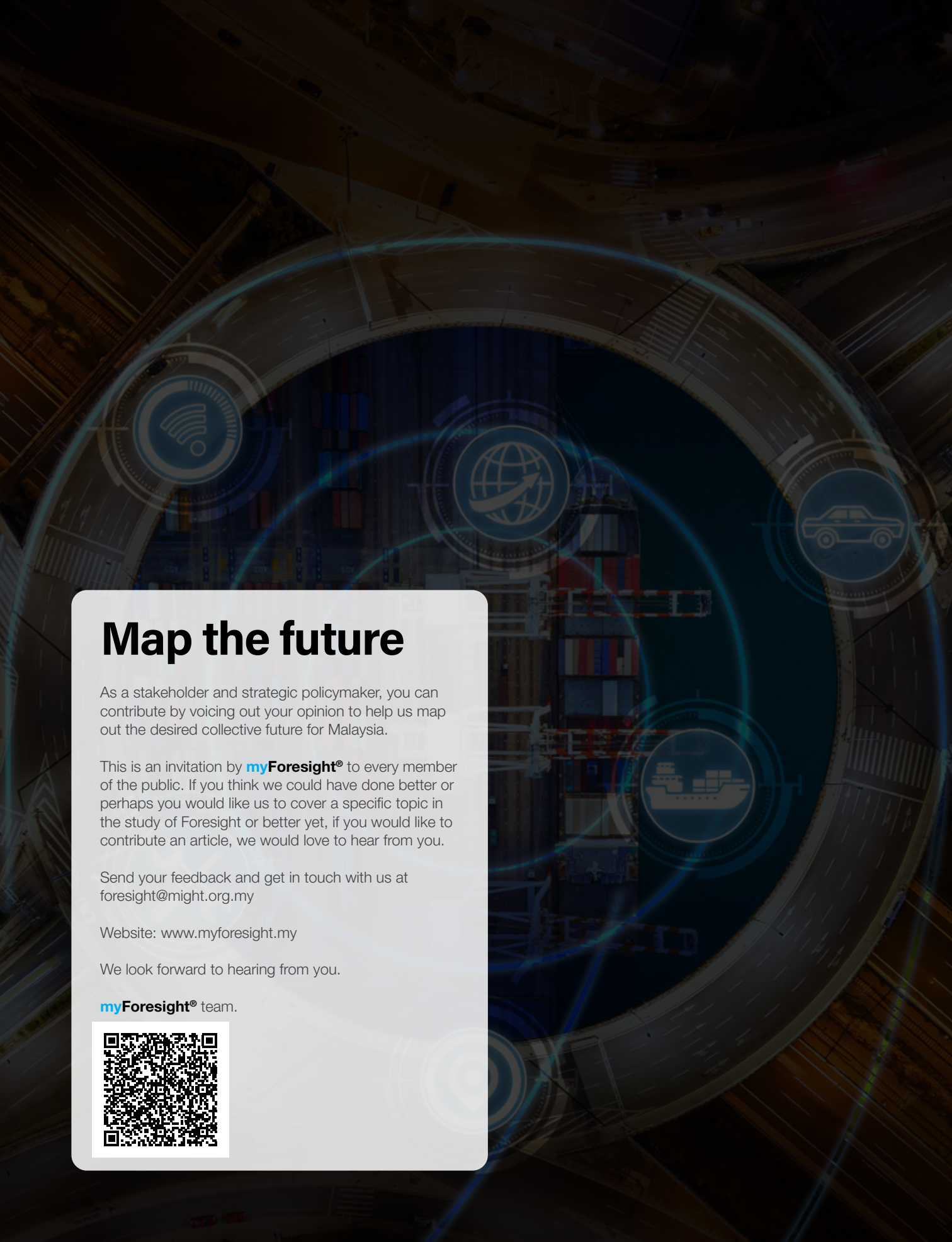

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