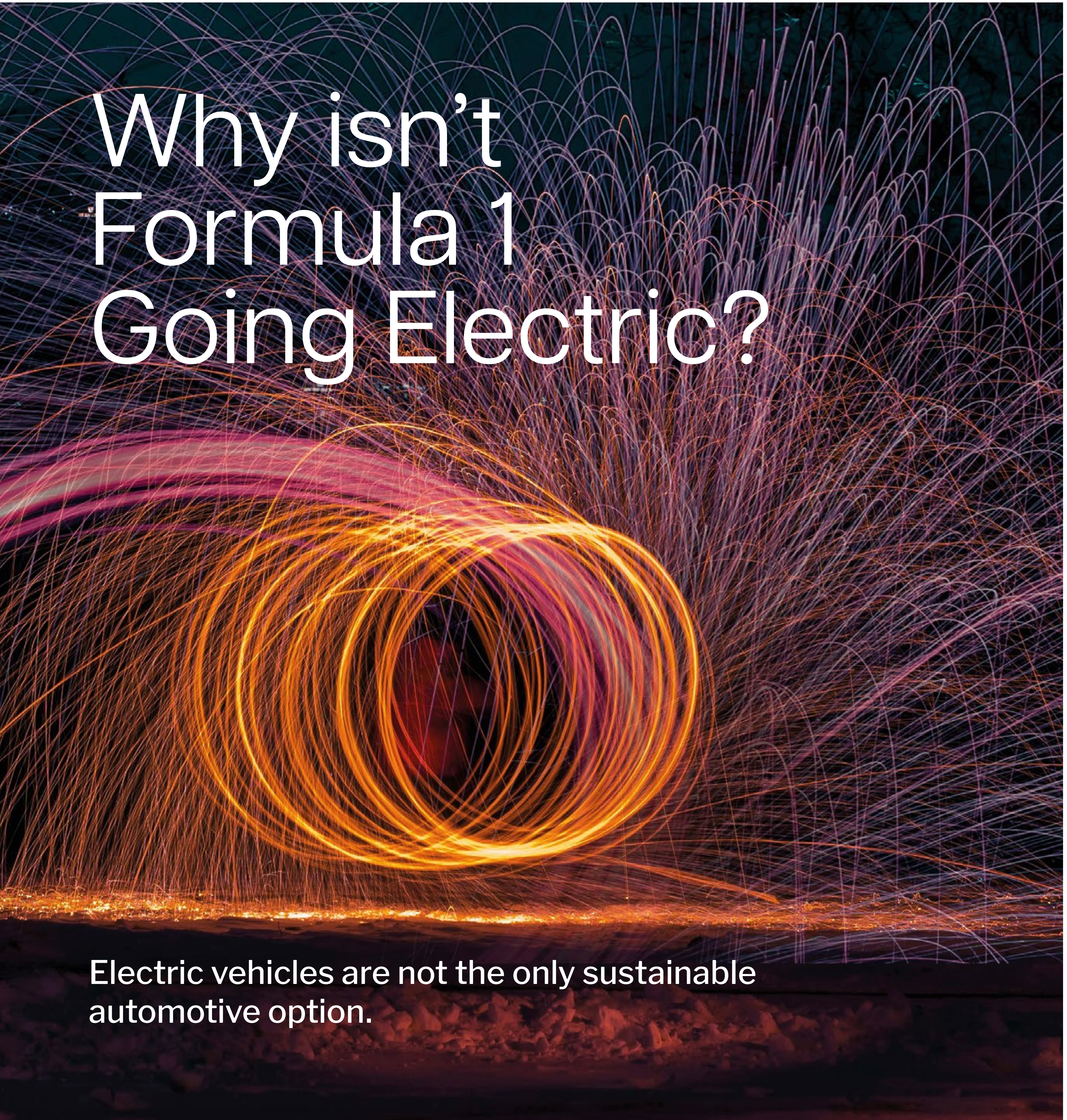
by
Terry van Gevelt



Why isn't Formula 1 Going Electric?

Electric vehicles are not the only sustainable automotive option.

#1 *While electric vehicles (EVs) are marketed as 'zero-emission', their overall environmental impact is more nuanced, as factors like electricity sources and battery production all contribute to their lifecycle emissions. In fact, their widespread adoption needs significant infrastructural changes like installing new charging networks and upgrading power grids, which come with substantial environmental and financial costs.*

#2 *Considering a diverse array of energy alternatives, including synthetic e-fuels, could offer Singapore a smoother transition to low-carbon transportation that is tailored to the specific needs and infrastructural realities of the country and region.*

Every year, I drive my Honda on Singapore's Formula 1 (F1) street circuit. Sure, my Honda is not powered by the same power unit as the one in Max Verstappen's Red Bull RB20, but driving on the inside lane to hit the apex is still thrilling for an F1 enthusiast like me. As I navigate those turns, I cannot help but think about the future of automotive technology. To the average individual, it may come as a surprise to find out that F1 innovations are behind many of the more sustainable automotive technologies we have today.

Take hybrid technology for example. While hybrid engines did not originate from F1, the sport has contributed significantly to the advancement of the technology. In 2014, F1 introduced hybrid power units, combining traditional internal combustion engines with advanced energy recovery systems. F1 further pioneered and perfected regenerative braking, a technology that recovers energy during braking and stores it for later use. Along with systems that recover energy from exhaust heat, F1 hybrids quickly became arguably the most efficient powertrains in the world.

This refined hybrid technology has influenced the development of more efficient hybrid vehicles for everyday use on our roads. F1 has also led the way in the use of lightweight materials like carbon fibre, which improves fuel economy by reducing vehicle weight. Additionally, the aerodynamic designs honed on F1 tracks to reduce drag and increase downforce have influenced road car designs, thereby contributing to lower fuel consumption and emissions.

While F1 is, in many ways, at the vanguard of sustainable technological innovation in the automotive world, it is not going electric. Instead, it is doubling down on the use of internal combustion engines (ICEs) and its hybrid philosophy. This does not mean to say that F1 is not pursuing sustainability. On the contrary, by 2026, the ICE component of F1 cars will be powered completely by sustainable fuels, specifically carbon-neutral synthetic e-fuels. These synthetic e-fuels are produced by capturing carbon dioxide from the atmosphere and combining it with hydrogen sourced from renewable energy. This process creates a fuel that can power traditional engines without adding new carbon to the atmosphere, effectively creating a closed-loop system. Unlike traditional biofuels, which often raise concerns about land use and food production, synthetic e-fuels do not require agricultural land, making them a more sustainable option that does not compete with food production or contribute to deforestation.

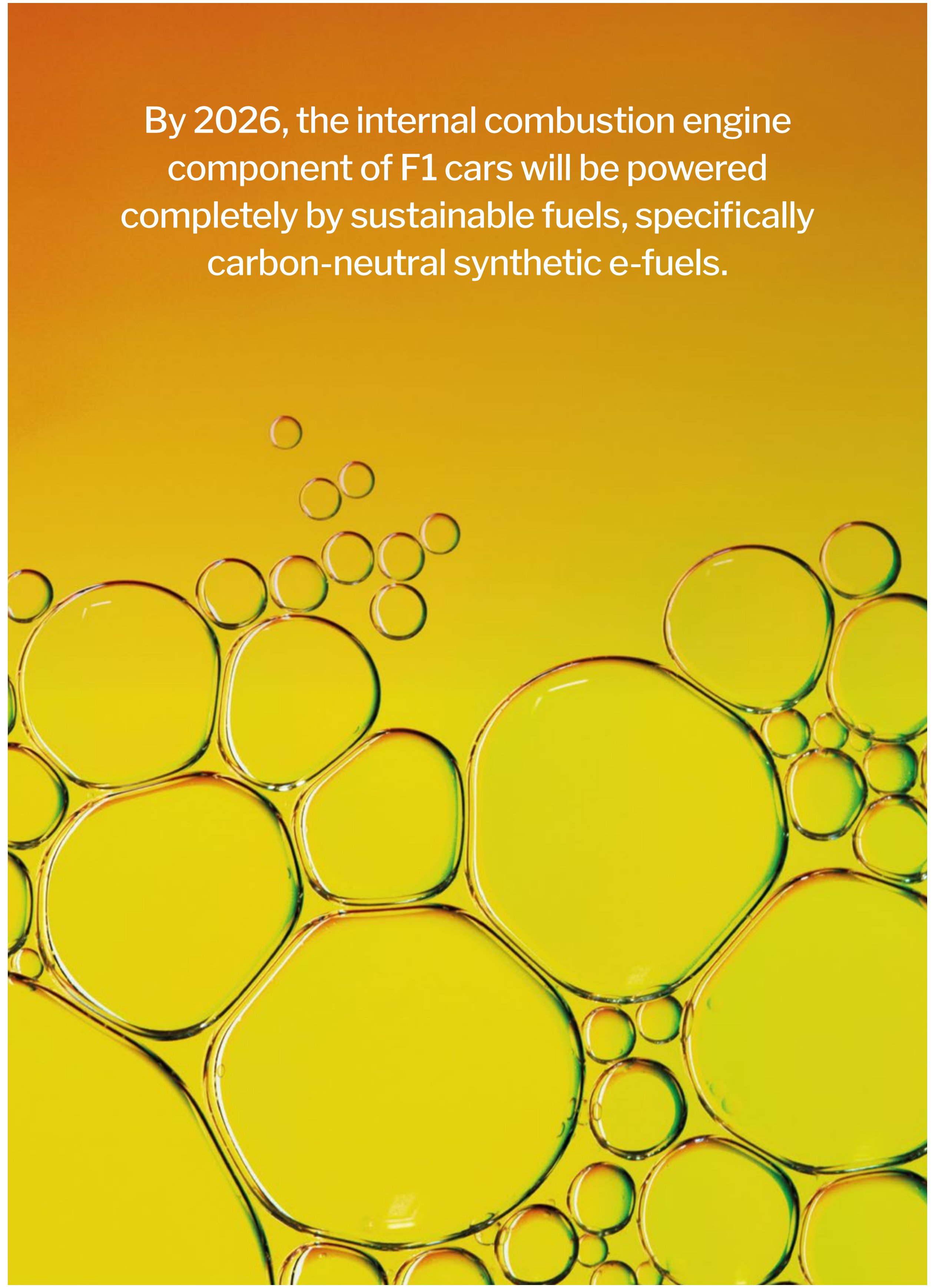
F1 aims to prove that through advancements in fuel technology, even the most powerful and high-performance engines can achieve carbon neutrality. By refining and innovating within the realm of ICE technology, F1 not only preserves the essence of motorsport but also paves the way for sustainable automotive solutions that can be adopted globally. This commitment to synthetic e-fuels also underscores the diverse and often overlooked sustainable pathways available to us. While electric vehicles (EVs) are frequently touted as the ultimate solution to our sustainability challenges, F1's strategy offers a compelling reminder that there are multiple pathways towards sustainability, each with its own strengths and potential for impact.

THE MODERN EV

The modern EV can be traced back to a bold move by General Motors (GM) in the early 1990s. Faced with declining market share, GM introduced a fully electric car (the EV1) not out of sustainability considerations, but out of a desperate need for good public relations (PR). And the EV1 was just that: a high-tech showpiece that positioned GM as an innovator. However, because this was largely a marketing stunt rather than a genuine push for sustainable innovation, the EV1 project quickly lost momentum and was eventually discontinued, with most EV1s being famously recalled and destroyed. While the EV1 may have been a PR-driven experiment, it played a crucial role in setting the stage for modern EVs by demonstrating that electric cars were technologically feasible.

The momentum behind EVs grew significantly when Tesla entered the scene. Tesla was founded in 2003 by Martin Eberhard and Marc Tarpenning, who recognised that lithium-ion battery technology held the key to making EVs more practical and desirable. Unlike lead-acid and nickel-metal-hydride batteries, lithium-ion batteries were lighter, had a higher energy density, and could provide the kind of range that would make EVs appeal to a broader market. Determined to bring their vision to life, Eberhard and Tarpenning worked tirelessly to develop a vehicle that was not only electric but also high-performance and stylish–something that would make people genuinely excited about driving an EV. Their efforts culminated in the Tesla Roadster launched in 2008, which marked a turning point by shifting the public perception of EVs from utilitarian to aspirational.

So synonymous is Elon Musk with Tesla now that it often comes as a surprise that Musk did not actually found Tesla or lay the technical and conceptual groundwork for Tesla EVs. Instead, Musk–initially as an investor–pushed for his vision for the company, which was based on rapid scaling and expansion. His approach clashed with Eberhard's more measured and engineering-focused leadership style, which led to Musk eventually ousting Eberhard from Tesla, with Tarpenning following suit shortly



after. Musk subsequently pushed for mass production, driving Tesla towards the development of the Model S and beyond, thereby giving EVs a scale that would prove crucial in enabling the company to gain a foothold in the car industry.

Tesla's success was not just about the technology; it was also about timing and marketing. The early 2000s saw growing concerns about climate change and oil dependency, creating a favourable environment for EVs. Tesla positioned itself as a forward-thinking company, aligned with the environmental and technological aspirations of a new generation of consumers. The narrative of a 'clean' and 'sustainable' vehicle, free from the emissions of traditional cars, resonated deeply and helped Tesla build a passionate customer base.

Developing extensive charging networks, upgrading power grids, and reconfiguring urban spaces to accommodate new energy demands all contribute to the broader environmental footprint of EVs.

However, despite the popularity of EVs, there remains significant debate over their true environmental impact. The lifecycle emissions of EVs are complex and vary, depending on the source of electricity used for charging, the materials used in battery production, and the vehicle's overall energy efficiency. While EVs produce zero tailpipe emissions, their production involves the extraction of lithium, cobalt, and nickel for their batteries, which incur significant environmental and social costs. Besides, end-of-life management of EV batteries poses challenges, including environmental contamination and energy-intensive recycling processes. Furthermore, EVs tend to be highly data-intensive, generating and processing vast amounts of information through onboard systems, telematics, and connected services. This data is often transmitted to data centres, which require significant amounts of energy to operate. Data centres, depending on their location and energy sources, can contribute further to the carbon footprint of EVs.

Perhaps most significantly, the widespread adoption of EVs would necessitate a significant overhaul of existing infrastructure, which comes with tremendous costs, both financially and environmentally. Developing extensive charging networks, upgrading power grids, and reconfiguring urban spaces to accommodate new energy demands all contribute to the broader environmental footprint of EVs. The production and installation of charging stations, the materials required for grid upgrades, and the land use changes needed to support this new infrastructure carry their own environmental impacts, further complicating the sustainability narrative surrounding EVs.

SIMPLE OPTICS, COMPLEX REALITY

The full sustainability implications of EVs are often not fully engaged with in public discourse. Much of this is due to the powerful optics surrounding EVs. The simplicity of the message 'zero emissions' makes EVs an attractive option for consumers and policymakers alike. This straightforward narrative has created a mental shortcut or heuristic where EVs are equated with environmental responsibility. The image of a 'clean' car, free from the emissions of traditional ICEs, resonates deeply with a public increasingly concerned about climate change.

Governments have capitalised on this perception by offering incentives, tax breaks, and subsidies to accelerate the adoption of EVs. However, the reasons behind these policies go beyond just a strategic push to reduce carbon emissions. The favourable optics of EVs make them an easy and politically advantageous choice for policymakers. Promoting EVs allows governments to align with public sentiment and be seen as taking decisive action on climate change. This is not to say that governments do not act with genuine sustainability objectives. Indeed, many countries have made significant strides in renewable energy adoption and environmental stewardship, and their commitment to EVs is part of a broader, long-term strategy to reduce their carbon footprint and achieve climate goals.

Nevertheless, the political narratives put forward by governments (no matter their motivations) oversimplify the complex realities of EV sustainability. For example, the rise of EVs is not a product of market forces. Instead, it is the outcome of industrial policy. Nowhere is this more evident than in China. Recognising that it would be difficult to compete with established ICE vehicle manufacturers in Europe, Japan, and the US, China pivoted towards EVs as a strategic move. The Chinese government implemented a series of policies to support the development of China's EV industry, including subsidies for EV buyers, significant investment in battery technology, and stringent emission regulations that favour EVs. China further set ambitious targets for EV adoption, aiming to become a global leader in the EV market.

These policies have had a profound impact on the global automotive industry. Automakers with significant exposure to the Chinese market, mostly German, American, and Korean manufacturers, have accelerated their shift toward EVs to maintain their competitiveness in China. Companies like Volkswagen, General Motors, and Hyundai have all made substantial investments in EV technology, driven in large part by the need to comply with Chinese regulations and capitalise on the growing demand for EVs in China.

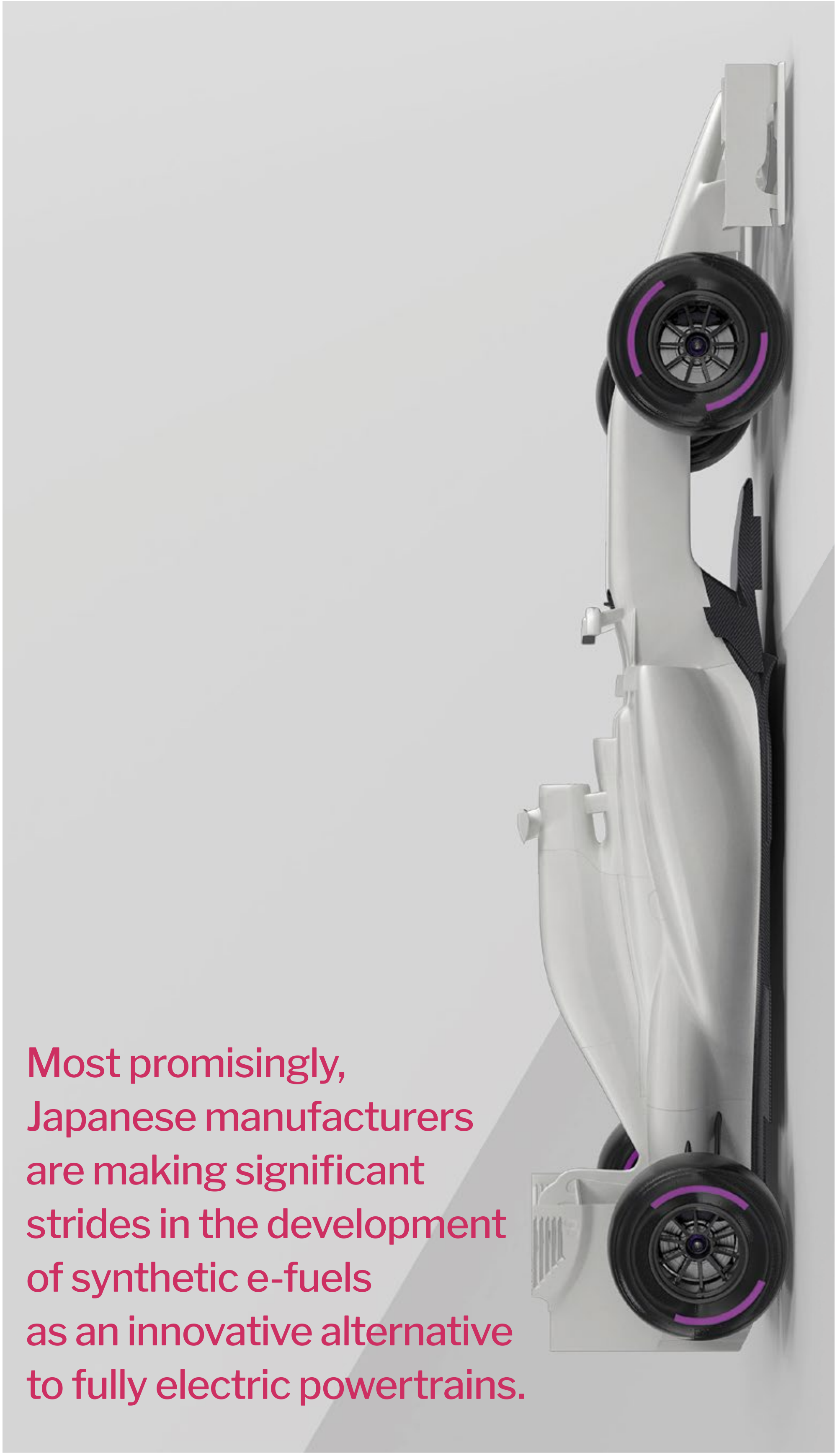
A compelling argument can be made that the push for EVs is driven less by definitive scientific evidence of their sustainability and more by a complex interplay of factors. This nuanced reality is often overshadowed by the powerful and appealing optics of EVs as a 'zero-emission' solution, leading to a simplified discourse that positions EVs as the definitive (and only) pathway forward.

SUSTAINABILITY IS NOT A ONE-TRACK ROAD

In contrast, Japanese automakers, which are less dependent on the Chinese market, have taken a different approach. Japan's automotive industry has been less aggressive in its shift towards EVs, partly due to its strong legacy in ICEs and hybrid technology. Recognising the challenges they would face in the EV market, Japanese car manufacturers are instead exploring a variety of alternative pathways to sustainability.

For example, Toyota has been a pioneer in the development of hydrogen fuel cells, with its Mirai model leading the way for hydrogen-powered vehicles. The company is heavily invested in researching liquid hydrogen, particularly for motorsport applications, which could push the boundaries of this technology even further. Similarly, Honda is set to begin production of a hydrogen fuel cell version of the popular CR-V model, which combines the benefits of fuel cell technology with plug-in hybrid capability.

Most promisingly, Japanese manufacturers are making significant strides in the development of synthetic e-fuels as an innovative alternative to fully electric powertrains. Much like in F1, these synthetic e-fuels are designed to power traditional ICEs (or hybrids) while dramatically reducing their carbon footprint. In addition to developing these advanced fuels, Japanese automakers are also focused on designing a new generation of ICEs optimised for maximum efficiency with synthetic e-fuels. For instance, Mazda is leveraging its expertise in rotary engine technology—a design known for its compact size and high-power output—to develop ICEs that work seamlessly with synthetic e-fuels. Subaru is similarly exploring the potential of synthetic e-fuels in conjunction with a new generation of its iconic Boxer engine.



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What makes the synthetic e-fuels approach particularly promising is that it allows for a sustainable future without the need to overhaul existing infrastructure to accommodate EVs. Instead of requiring extensive investment in new charging networks and grid upgrades, synthetic e-fuels can be used within the current framework of fuel distribution and ICE vehicles, enabling a smoother and potentially less disruptive transition to low-carbon transportation. Synthetic e-fuels therefore represent a promising and versatile solution for reducing carbon emissions across the automotive industry, all while utilising existing infrastructure.

RETHINKING THE ROAD AHEAD

It is worth questioning whether EVs are truly a done deal as the definitive route forward in our pursuit of sustainable transportation in Singapore and elsewhere. The powerful optics of EVs—marketed as 'zero-emission' vehicles—have undeniably captured the public and political imagination, leading to their rapid adoption and the widespread belief that they are the solution to the sustainability issues the car industry is facing. However, this narrative oversimplifies the complex realities of EV sustainability.

Additionally, the narrative tends to characterise the rise of EVs as a market-driven phenomenon. This is not the case, as the EV industry has been heavily shaped by Chinese industrial policy, which has significantly influenced the global automotive landscape.

Singapore, a city-state known for its forward-thinking policies and commitment to sustainability, has embraced the EV narrative, promoting its adoption through incentives, infrastructural development, and ambitious targets like phasing out ICEs by 2040. However, this singular focus on electrification risks overshadowing other viable pathways to sustainability. A more nuanced approach for Singapore might be to consider alternative technologies such as synthetic e-fuels. Synthetic e-fuels can be integrated into existing fuel distribution infrastructure, reducing the need for massive overhauls and allowing for a smoother transition to low-carbon transportation. This approach could be particularly beneficial in the context of Singapore, where space is limited and the demands on its infrastructure are already high. Furthermore, as Singapore positions itself as a leader in sustainability within Southeast Asia, considering a broader range of technologies could provide it with a more inclusive and regionally appropriate strategy, given the significant economic and logistical barriers that many of our neighbouring countries face in transitioning to EVs.

The road to a greener future is unlikely to be as straightforward as it seems. Rather than committing absolutely to EVs at this juncture, Singapore and our Southeast Asian neighbours might benefit from considering a more diverse array of technologies. By exploring and potentially integrating solutions like synthetic e-fuels, we can ensure that our approach to sustainability is both resilient and adaptable to our unique challenges and opportunities. This flexibility could allow for a smoother transition to low-carbon transportation that is tailored to the specific needs and infrastructural realities of each country without the risks associated with putting all of our resources in a single technology.

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