Transitioning Towards Zero-Emission Vehicles: Global Trends and Strategies in the Automotive Industry

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The global automotive industry is currently experiencing an unprecedented turning point. As countries worldwide promote ambitious zero-carbon policies and strategies, carbon reduction in vehicles has been considered as a primary strategy, with a strong focus on achieving zero emissions during the vehicle usage phase. This article provides a comprehensive analysis of the recent developments in the industry, highlighting key initiatives and milestones set by different regions.

Firstly, the European Union (EU) has recently approved the path towards zero-emission for new passenger cars and vans (‘light commercial vehicles’) in 2035, a significant milestone in the industry. The legislation approved by the end of March 2023, known as the "Fit for 55 Package," refers to revised and stricter targets. By 2030, passenger cars are required to reduce greenhouse gas emissions by 55%, while commercial vehicles should achieve a 50% reduction. Furthermore, all new passenger cars and vans must be 100% zero emissions by 2035. To encourage the sales of zero- and low-emission vehicles (ZLEVs), the ZLEV benchmark has been upleveled from 15% to 25% for passenger cars and from 15% to 17% for commercial vehicles between 2025 and 2029. The EU's commitment to the 2035 zero-emission echoes its broader goal of achieving a 55% reduction in greenhouse gas emissions (compared to 1990 levels) and climate neutrality by 2050.

Despite disagreements from countries like Germany, Italy, Poland, Bulgaria, and the Czech Republic, the EU's determination to promote zero-emission vehicles is undoubted, motivating automakers to declare their plans for a comprehensive shift towards electrification. Major automakers are strategically introducing battery electric vehicles (BEVs) in response to the EU's market tendency. Some larger models and luxury brands, as well as small commercial vehicles, have already phased out internal combustion engine vehicles starting in 2022 and 2023. By 2027, brands like Alfa Romeo plan to sell only BEV models, with Opel and Lancia following suit in 2028. By 2030, Maserati, Volvo, and Fiat are expected to join the transition, while VW Audi, Mini, and Daimler scheduled by 2035. Might this timeline represent an optimistic scenario for the transition to BEVs in the small passenger car segment, it demonstrates the

preparedness of European automakers to align with the 2035 zero-emission policy.

In addition to light vehicles, the focus on zero-emission policies extends to larger commercial vehicle sector. A couple of countries have embarked on initiatives to achieve zero-emission public bus fleets, and Taiwan has taken a pioneering role by termination of subsidies for diesel buses then exclusively supporting the purchase of electric buses since this year 2023. By 2030, it is aimed to become one of global leaders in operating a fully zero-emission bus fleet in Taiwan, with Denmark and the Netherlands join the group. Other enthusiastic countries, such as New Zealand and California, equivalent targets have been set to 2040, with further expansion to school buses and government fleets. Recognizing the advantages of zero-emission technologies, these initiatives align with urban areas' pollution reduction goals and signal governments' commitment to decarbonizing the transportation sector.

While battery electric vehicles are currently the dominant technology for zero-emission vehicles, there is significant potential for hydrogen fuel cell technology. According to a report by the World Energy Council (2019), countries such as the United States, China, Germany, Japan, the United Kingdom, and South Korea have established clear targets and financial supports for fuel cell electric vehicles (FCEVs). Recent market research of Fourin foresees robust growth for FCEVs in the European market, with sales estimated to reach 300,000 vehicles by 2025 and 1.8 million vehicles by 2035. Notably, Toyota launched the Mirai, the first fuel cell car, in 2014, with approximately 10,000 units sold globally by May 2020. Renault has also introduced hydrogen-powered models, such as the Kangoo Z.E. Hydrogen and Master Z.E. Hydrogen, catering to commercial vehicles. Hydrogen fuel cell technology holds significant promise for heavy-duty trucks, delivery vans, and even rail vehicles. For example, Alstom's Coradia iLint fuel cell-powered trains have been operating in Germany since 2018, replacing diesel trains on commuter routes. In addition, Hyundai Motor has also started production of XCIENT trucks in 2020, and it is expected to ship 1,600 vehicles by 2025 and lease them to Swiss logistics companies.

To support the development and adoption of zero-emission vehicles, governments are actively investing in charging and refueling infrastructure. In the United States, the goal of the National Electric Vehicle Infrastructure Formula Program is dedicated to establish a network of 500,000 charging points by 2030, ensuring widespread accessibility within a 50-mile interval on interstate highways. Concurrently, the EU’s Regulation for the Deployment of Alternative Fuels Infrastructure (AFIR) has been passed, with definition of the density and priority order for charging and hydrogen refueling stations. It’s the goal that the installation of 1.8 million public charging points in the EU by 2025, a five to six-fold increase from 2021, and further

growth to 10.4 million by 2035.

The transition towards zero-emission vehicles goes beyond the focus on fuels. Policymakers are also addressing carbon reduction potentials across the entire lifecycle of vehicles. This includes cutting carbon densities during manufacturing processes, utilizing renewable energy sources, and implementing effective end-of-life vehicle directive. Commenced by the EU's Circular Economy Action Plan, for example, automobile manufacturers will take responsibility for reusing and recovery 95% of vehicle weight, ensuring that 85% of the weight is either reused or recycled. Additionally, EU’s carbon border adjustment mechanism (CBAM) will be implemented to ensure imported products have equivalent carbon density to locally manufactured goods. This mechanism places restrictions on steel, aluminum, and other metals and their downstream products, penalizing non-compliant products with carbon prices three to five times higher.

In conclusion, the global automotive industry is witnessing a transformative shift towards zero-emission vehicles, driven by ambitious policies, technology advancements, and infrastructure developments. This article highlights the progress made in various regions, emphasizing the growing demand for zero-emission vehicles and the need for sustainable practices throughout the entire product lifecycle. Automotive manufacturers and component suppliers must align their strategies with evolving market demands, incorporating low-carbon manufacturing processes, renewable energy sources, and material recycling initiatives to retain competitiveness in the international arena. By navigating these challenges and embracing the transition to zero-emission vehicles, the industry can contribute significantly to global efforts to mitigate climate change and achieve sustainable transportation systems.