

“Strategic Policy Formulation for the Phase-Out of Heavy-Duty Diesel Vehicles and Adoption of BS-VI Compliant Alternatives: A Comprehensive Analysis”

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Introduction

The global automotive industry stands at a pivotal juncture, compelled to confront pressing environmental concerns and urgently reduce its carbon footprint. Notably, heavy-duty diesel vehicles emerge as significant contributors to air pollution and greenhouse gas emissions. Governments worldwide are actively formulating strategic policies to address this challenge, with a particular focus on phasing out heavy-duty diesel vehicles and fostering the adoption of cleaner alternatives, exemplified by the Bharat Stage VI (BS-VI) compliant vehicles. This paper embarks on a comprehensive analysis of the strategic policy formulation essential for the phase-out of heavy-duty diesel vehicles and the concurrent adoption of BS-VI-compliant alternatives.

The issue of air quality has perpetually been a global concern, particularly amidst the escalating menace of vehicular air pollution¹. While pollution emanates from diverse sources, vehicular exhaust systems, and the pollution they generate have emerged as a highly detrimental and substantial contributor to environmental degradation². In response to this environmental threat, the Indian Government has instituted the Bharat Stage emission standards, aligned with international regulations, to regulate and control vehicle exhaust emissions. Introduced globally in 2000, these standards, based on European regulations, have evolved to address the burgeoning challenge of vehicular pollution.

The regulatory landscape witnessed a significant milestone with the implementation of Bharat Stage IV emissions norms in April 2010, extending nationwide sanction in April 2017. A noteworthy development unfolded in 2016 when the Government of India declared its decision to leapfrog Bharat Stage V norms and instead, commit to the adoption of BS-VI norms by 2020. Subsequent to this commitment, the Supreme Court passed a crucial rule, announcing the prohibition of the sale and registration of motor vehicles adhering to the BS-IV emission norms throughout the country by April 1st, 2020.

Examining the primary sources of pollutants and their repercussions on human health reveals that internal combustion engines (ICEs) play a predominant role. These engines, notorious for emitting carbon monoxide, carbon dioxide (CO₂), oxides of nitrogen, and hydrocarbons, are instrumental in deteriorating air quality. Particulate matter (PM), commonly known as carbon soot, represents another adverse by-product, particularly prevalent in diesel and direct-injection

¹ D. Vashist, N. Kumar, and M. Bindra, “Technical Challenges in Shifting from BS-IV to BS-VI Automotive Emissions Norms by 2020 in India: A Review,” *Archives of Current Research International*, vol. 8, no. 1, pp. 1-8 (2017).

² *Ibid.*

petrol engines employed in BS-IV vehicles. As the vehicular emissions landscape undergoes a transformative shift with the implementation of stringent emission norms, it becomes imperative to delve into a comprehensive analysis of the strategic policy formulation guiding the phase-out of heavy-duty diesel vehicles and the concomitant embrace of BS-VI compliant alternatives.

Effect of BS-IV Vehicle on Eco-system

Bharat Stage IV (BS-IV) vehicles, while representing a significant advancement in emission standards compared to their predecessors, still contribute to environmental degradation and pose several harmful effects. The primary concerns associated with BS-IV vehicles revolve around the pollutants they emit, which adversely impact air quality and contribute to broader environmental issues. Here are some of the harmful effects of BS-IV vehicles on the environment:

BS-IV vehicles, particularly those powered by diesel engines, emit a spectrum of pollutants, including nitrogen oxides (NO_x), carbon monoxide (CO), hydrocarbons (HC), and particulate matter (PM), thereby constituting significant contributors to air pollution. This emission profile is associated with adverse health effects in humans, manifesting as respiratory problems and cardiovascular diseases. Additionally, these pollutants play a pivotal role in the formation of smog, exacerbating the degradation of air quality. Despite advancements compared to earlier standards, BS-IV vehicles contribute to greenhouse gas emissions, predominantly in the form of carbon dioxide (CO₂), thereby contributing to global warming and climate change. The emission of particulate matter, especially from diesel engines, represents a major environmental concern due to its potential to penetrate deep into the respiratory system, causing respiratory illnesses and posing health risks. Furthermore, particulate matter contributes to reduced visibility and aesthetically impacts urban areas. Nitrogen oxides (NO_x) emissions, including nitrogen dioxide (NO₂), emitted during combustion processes in BS-IV vehicles, can lead to the formation of ground-level ozone and contribute to smog. Prolonged exposure to NO_x is implicated in respiratory diseases such as asthma.

The manufacturing phase of BS-IV vehicles involves resource extraction, energy consumption, and emissions, contributing to the depletion of natural resources and environmental pollutants. The proper disposal of end-of-life vehicles presents challenges related to waste management. Lastly, the overall environmental impact of BS-IV vehicles extends to ecosystems and biodiversity. The air pollution and climate change associated with their emissions can disrupt ecological balance, potentially leading to the loss of biodiversity and affecting plant and animal species within ecosystems.

In response to these concerns, many countries have progressed to more stringent emission standards, such as Bharat Stage VI (BS-VI), which aim to further reduce vehicle emissions and mitigate their environmental impact. The transition to cleaner and more sustainable transportation technologies, such as electric vehicles and hydrogen fuel cells, is also being encouraged to address the harmful effects associated with conventional combustion engines.

Embracing Progress: The Imperative Shift from BS-IV to BS-VI Vehicles

Phasing Out Heavy-Duty Diesel Vehicles:

Implementing a phased approach to retire heavy-duty diesel vehicles is crucial. The Supreme Court, in its directive on January 11, 2024 has mandated the Union of India to formulate a policy aimed at phasing out heavy-duty diesel vehicles and substituting them with Bharat Stage VI (BS-VI) compliant vehicles. This imperative is to be executed within a stringent timeframe of six months. The court has further tasked the Union to meticulously assess the recommendations put forth by the Environment Pollution (Prevention and Control) Authority, established by the Court, to ameliorate the air quality in Delhi-NCR.

Emphasizing the ongoing exploration of alternative, less polluting sources such as Compressed Natural Gas (CNG), Hybrid, and Electric for heavy-duty vehicles, the Court underscores the necessity to continue this investigative process. The context of these directives emanates from a legal proceeding initiated by the Container Corporation of India, appealing against National Green Tribunal (NGT) directives concerning pollution caused by heavy-duty diesel trailer trucks around Delhi.

In its judgment, Container Corporation of India Ltd vs Ajay Khera and ors³ the Supreme Court disapproved the NGT's suggestion to divert trucks to Inland Container Depots (ICDs) outside the National Capital Region (NCR), affirming that the right to clean air extends beyond Delhi residents alone.

Additionally, the Union Road Transport and Highways Ministry has been made a party to ensure compliance, urging the exploration of less polluting heavy-duty vehicles and enforcing recommendations by consultancy firm KPMG on parking at container depots within six months.

The Court also mandates formulating a plan for optimal ICD utilisation around Delhi within the same timeframe. The case will be monitored, with the next hearing scheduled for July 31, 2024, and the Union Road Transport and Highways Ministry directed to submit a compliance report by that date.

The directives encompass policy formulation, involvement of the concerned ministries, exploration of alternative fuel sources, ICD utilization planning, and parking management improvements, all aimed at addressing the environmental challenges posed by heavy-duty diesel vehicles in the region.

Transitioning to BS-VI Vehicles:

The transition from Bharat Stage IV (BS-IV) to Bharat Stage VI (BS-VI) standards not only encompasses advancements in vehicle emissions but also necessitates a concomitant shift in fuel quality. Vehicles adhering to BS-IV standards have the option to utilize BS-VI fuel,

³Container Corporation of India Ltd vs Ajay Khera and ors, (2024) INSC 31.

available at petrol stations. This choice yields a discernible impact on emissions due to the direct interrelationship between sulphur content in fuel and the resultant emissions. Simply put, lower sulphur content in fuel correlates with diminished particulate matter (PM) emissions, leading to a more environmentally benign combustion process ⁴. Typically, petrol exhibits lower sulphur content, resulting in reduced emissions of carbon monoxide, nitrogen oxides (NO_x), and other toxic hydrocarbons. Recent studies indicate that pairing a BS-IV compatible vehicle with BS-VI fuel can result in a substantial 50% reduction in PM emissions ⁵. In terms of specific emission limits, while BS-IV allows a motor vehicle to emit up to 80mg/km of NO₂, BS-VI significantly tightens this threshold to 60mg/km. For petrol vehicles, the BS-VI emission regime restricts Particulate Matter (PM) to a mere 4.5mg/km.

Under the stringent BS-VI norms, pollution limits have undergone significant reductions. Notably, the NO_x emission limit for diesel vehicles has plummeted from 250mg/km in BS-IV to 80mg/km in BS-VI, signifying a substantial improvement. Similarly, the combined emission of Hydrocarbons (HC) and NO_x has been curtailed from 300mg/km to 170mg/km. The PM level, a critical pollutant, has seen a marked decrease from 25mg/km in BS-IV to a remarkably lower 4.5mg/km under BS-VI standards. Importantly, the BS-VI emission norm extends beyond vehicles to encompass the quality of dispensed fuel. Sulphur and nitrogen oxide, pivotal elements in petrol and diesel, have witnessed notable reductions in the BS-VI fuel compared to its BS-IV counterpart. Specifically, the sulphur content in BS-IV fuel, measured at 50ppm, has been substantially reduced to 10ppm in BS-VI fuel. Concurrently, nitrogen oxide levels have undergone a 70% and 25% reduction for diesel and petrol engines, respectively, reflecting a concerted effort to enhance fuel quality and curtail emissions in tandem with the implementation of stringent BS-VI standards.

Conclusion

In conclusion, the implementation of Bharat Stage VI (BS-VI) emission norms by the Indian Government, effective from April 1, 2020, marks a pivotal moment in the country's automotive industry. The adoption of BS-VI regulations heralds a transformative shift, promising reduced emissions and more fuel-efficient vehicles, thereby contributing to a greener and sustainable future. The impact on diesel engines is notable, as the need for extensive adjustments and after-treatments to meet stringent standards renders them more expensive compared to petrol engines. This shift is poised to incentivize Original Equipment Manufacturers (OEMs) toward embracing hybrid fuels and other environmentally friendly technologies. The advancements in engine-after treatment technologies, particularly the requirement for low sulphur content in fuel, underscore the positive consequences of the transition on controlled air pollutant emissions.

⁴ R. Abraham, "Confused by the SC's BSVI ruling? Here's what it means for your existing car," *The Economic Times* (2019), (Feb. 18, 2024, 9:20 P.M)

<https://economictimes.indiatimes.com/magazines/panache/confused-by-the-scs-bsVI-ruling-heres-what-it-means-for-your-existing-car/articleshow/70853624.cms?from=mdr>.

⁵ Ibid.

The transition from BS-IV to BS-VI holds significant promise in mitigating air pollution, particularly in densely populated urban centers where vehicular emissions constitute a primary source of environmental degradation. The reduction in air pollutants due to BS-VI compliance is anticipated to enhance the overall air quality, contributing to a healthier living environment. Future research endeavours could focus on understanding the strategies adopted by foreign car manufacturers in navigating the transition from BS-IV to BS-VI, providing insights into global best practices. Additionally, investigations into the sales strategies employed by leading car manufacturers to manage their existing BS-IV compliant vehicle inventory would further enrich our understanding of the industry's response to emission standard transitions. Overall, the transition to BS-VI signifies a commitment to environmental sustainability and underscores the importance of continued research to monitor and optimize the effectiveness of such regulatory measures in addressing air pollution concerns.