# Strengthening Air Quality Governance: Integrating Science, Technology, and Policy for Cleaner Skies

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## Abstract

*"Strengthening Air Quality Governance: Integrating Science, Technology, and Policy for Cleaner Skies"* outlines Malaysia's strategic efforts and achievements in managing air pollution in line with its commitment to the 2030 Sustainable Development Goals (SDGs). Aligned with the Twelfth Malaysia Plan (2021–2025), the Department of Environment (DOE) has prioritized environmental sustainability through comprehensive monitoring, regulatory enforcement, and public engagement.

Malaysia's air quality monitoring framework operates through the Environmental Quality Monitoring Program (EQMP), consisting of 65 automatic, 3 mobile, and 14 manual stations nationwide. These stations monitor six key pollutants; $PM_{2.5}$, $PM_{10}$, $SO_2$, $NO_2$, CO, and $O_3$, to calculate the Air Pollutant Index (API), with $PM_{2.5}$ typically being the dominant pollutant. From 2017 to 2024, the average national API remained good to moderate, except during haze, largely driven by trans-boundary sources, significantly affect air quality.

To understand temporal and spatial air quality variations, the cluster analysis was employed. Results categorized monitoring stations into four clusters based on pollution levels. Cluster 3, which includes Greater Kuala Lumpur and urban centers, recorded the lowest air quality due to dense traffic and industrial activities. In contrast, Cluster 2 (mainly in Sabah and Sarawak) showed the best air quality. Seasonal effects, such as sea breezes and transboundary haze, further modulate pollution dynamics. The boxplot exhibits 90th percentile of Daily-Max API during haze years and non-haze year, statistically the Welch's *t*-test revealed that API values were significantly higher during haze years compared to non-haze years ($p < 0.05$), with regional increases ranging from 6 to 7 API units.

The DOE's regulatory and technical responses include stringent enforcement under the Environmental Quality Act 1974, deployment of Continuous Emission Monitoring Systems (CEMS) for industries compliance, and the activation of national plans for peatland fire prevention and haze mitigation. The upcoming Clean Air Action Plan 2040 sets out 5 strategic thrusts and 172 action plans, focusing on strengthening air quality monitoring, industrial management, sustainable transportation, zero-burning waste practices, and fostering environmental awareness. This integrated approach, bolstered by national and international collaborations, positions Malaysia as a proactive actor in regional air quality governance.