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Advance Three-Way Catalyst Technology development for Two-Wheeler Applications

A Cost-Effective and Sustainable Solution

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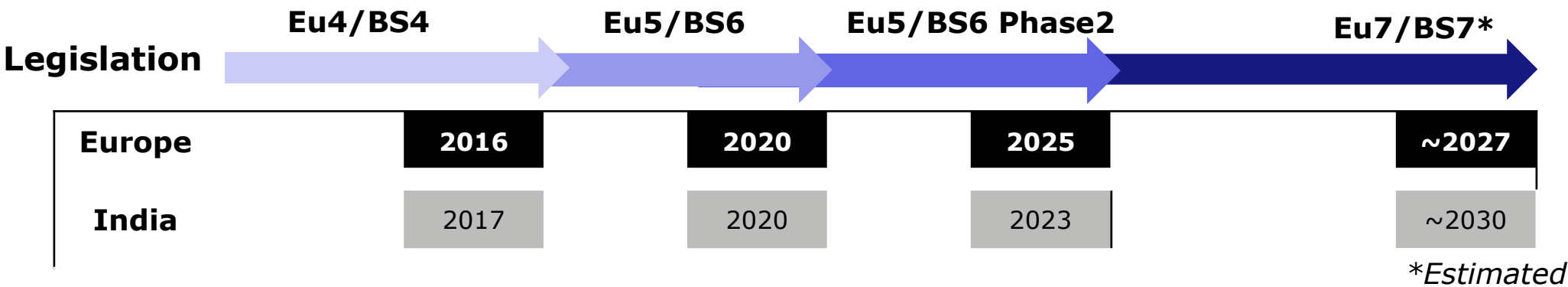
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Outline

- 01** Future Emission Trends: BS7 for 2W Applications
- 02** Understanding Emission Challenges
- 03** Advance TWC Development Strategy
- 04** Critical Parameters Influencing Catalyst Performance
- 05** Advance TWC Screening/Validation
- 06** Demonstrating BS7 Readiness
- 07** Summary

Future Emission Trends: BS7 for 2W Applications

Understanding future compliance challenges



Emissions	BS6.2 Limit for Ref	Anticipated– BS7
CO mg/km	1000	Tightening of Emissions
HC mg/km	100	
NOx mg/km	60	
NMHC mg/km	68	
PN #/km	-	Introduction on PM, PN10, Aldehydes limits

India BS6 Phase-2 is broadly aligned to Euro 5 technology levels, with BS7 expected to introduce Euro-7 like emission limits and durability monitoring concepts.

Anticipated BS7 Major Focus Areas

Lower NOx/HC

Catalyst Durability

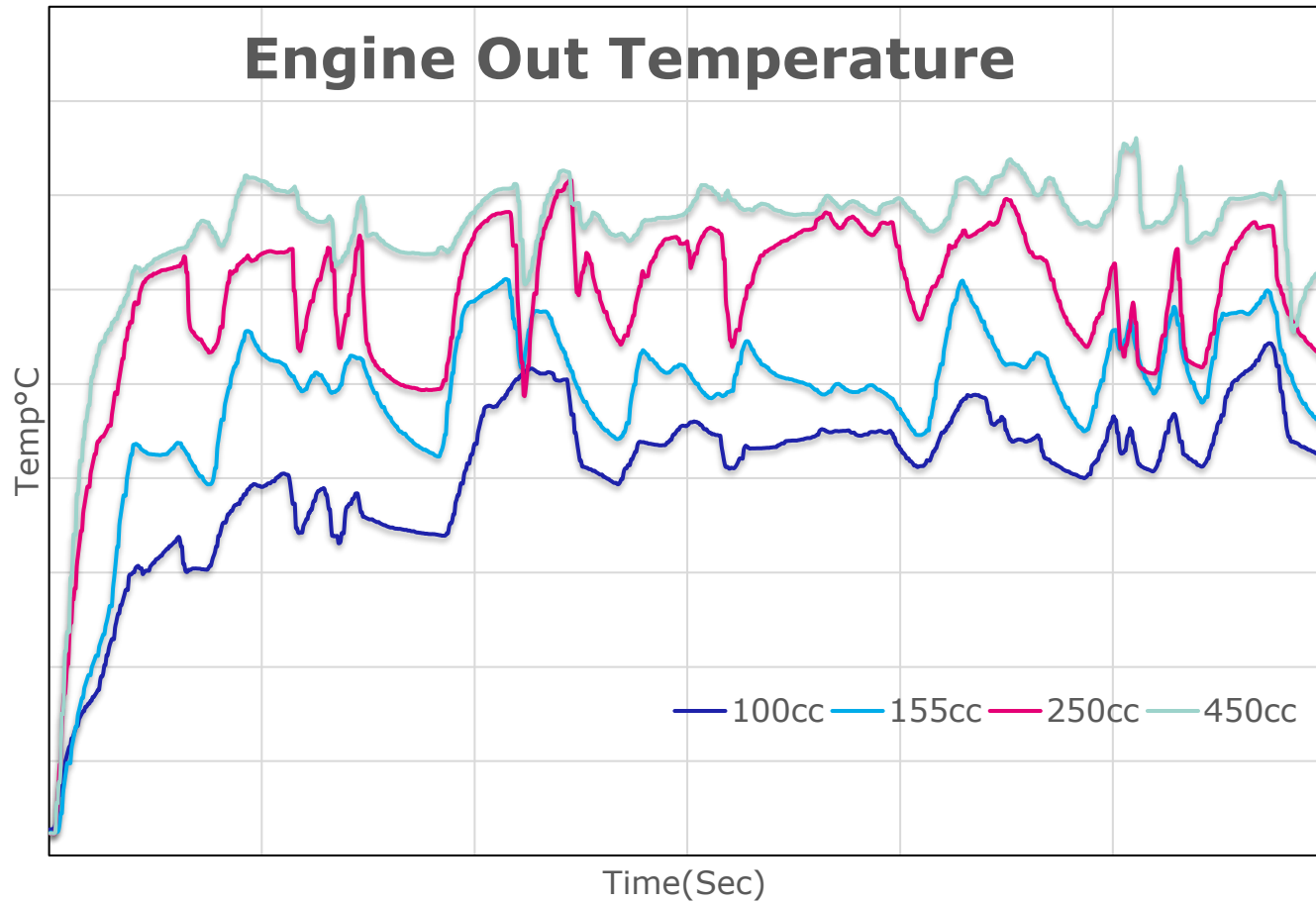
Enhanced OBD compliance

https://timesofindia.indiatimes.com/business/india-business/rollout-of-bs-vii-in-3-phases-from-april-2029-to-april-2035/articleshow/134929389.cms?utm_source=app&utm_medium=share&utm_campaign=social_share

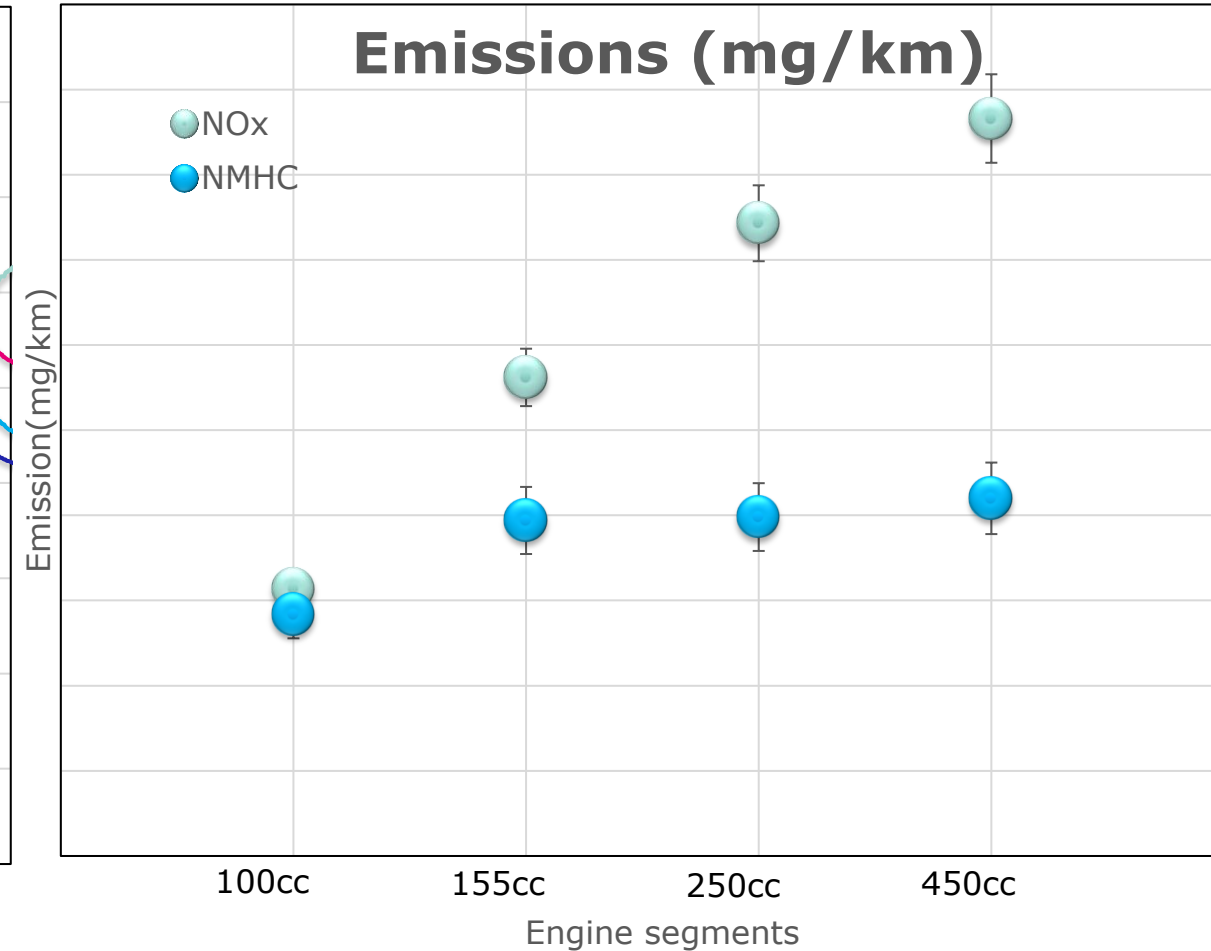
BS7 Overview:
<https://www.cmv360.com/articles/government-initiates-implementation-plans-bs-vii-and-cafe-iii-emission-norms>

Understanding Emission Challenges

Evaluating segment-specific engine-out emission characteristics



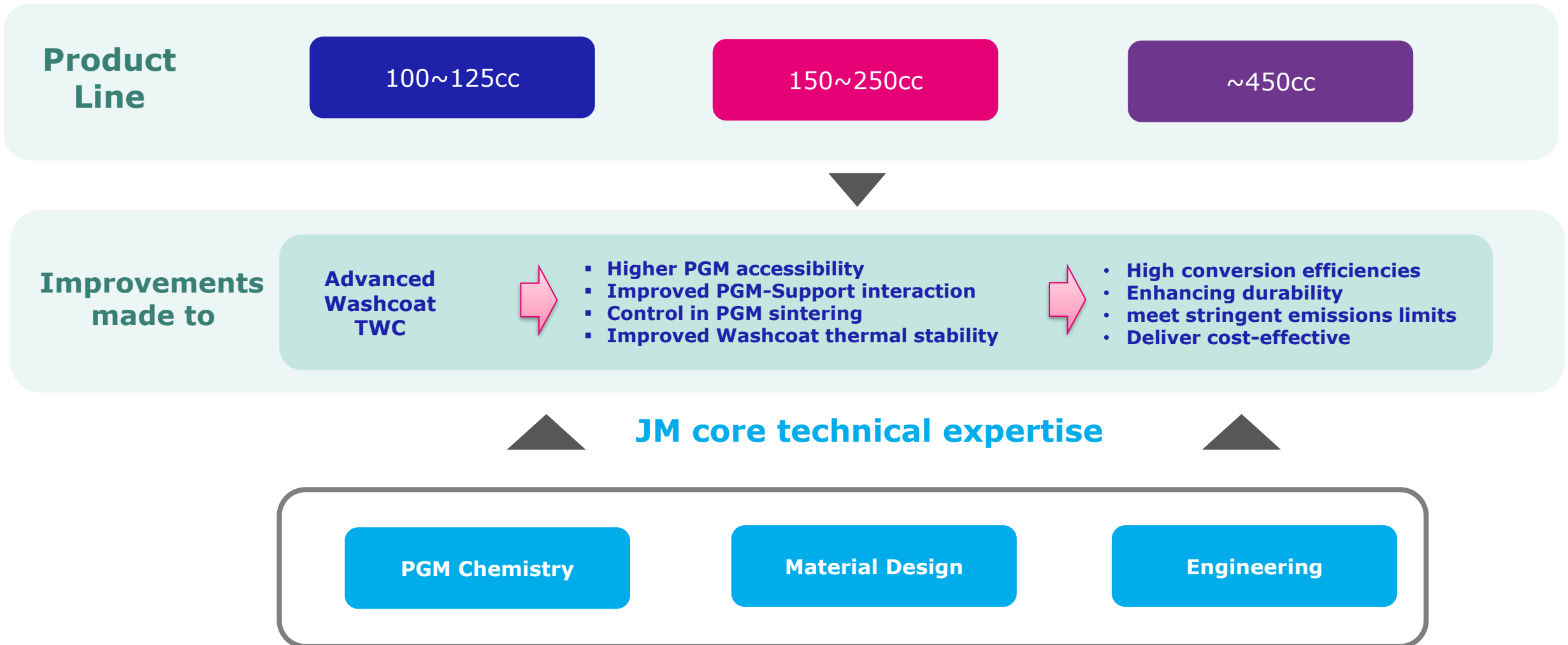
Temperature: ↑ Increases with engine power and specific output, driving higher NOx formation



100cc —————> 450cc NOx Dominated
Higher engine capacity → higher combustion temperature → more NOx.

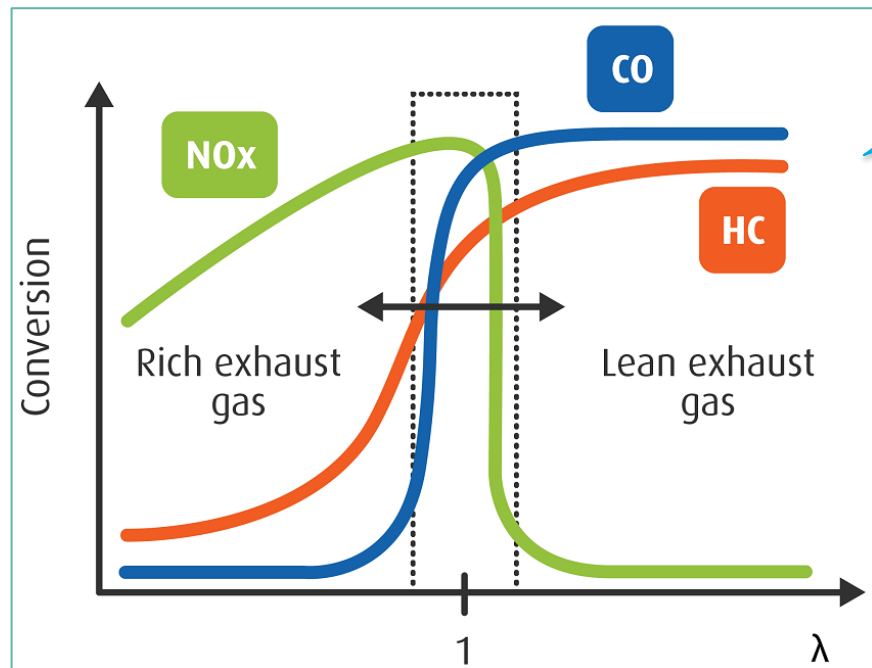
Advance TWC Development Strategy

Cost-Effective and Sustainable Solution | Enabling BS7



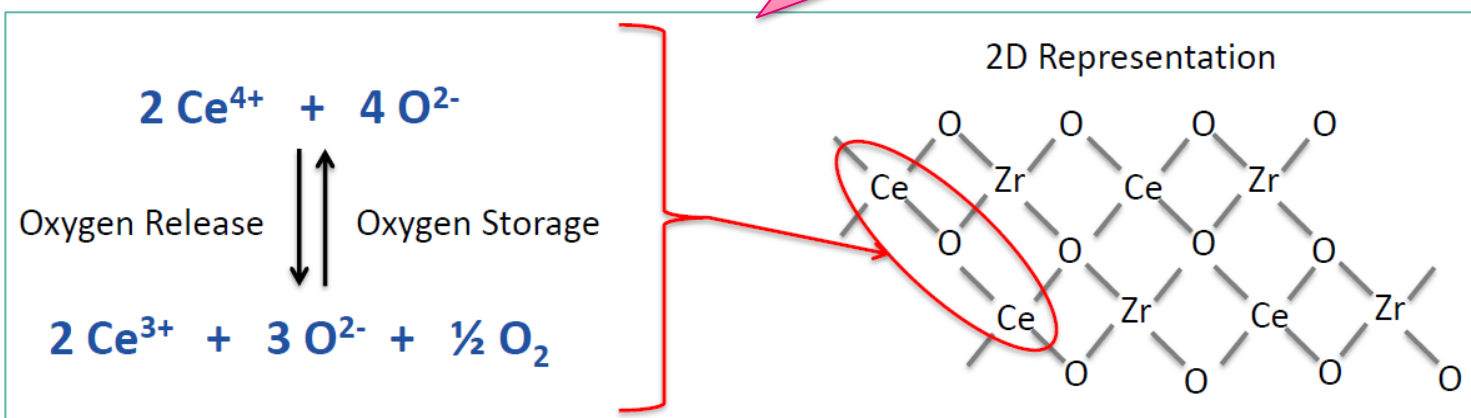
Critical Parameters Influencing Catalyst Performance

Understanding the key factors governing catalyst conversion efficiency, thermal stability and long-term durability



Air to Fuel Ratio

Oxygen Storage Capacity

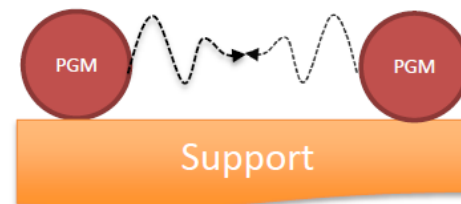


Thermal Sintering

Ostwald Ripening



Particle Migration and coalescence

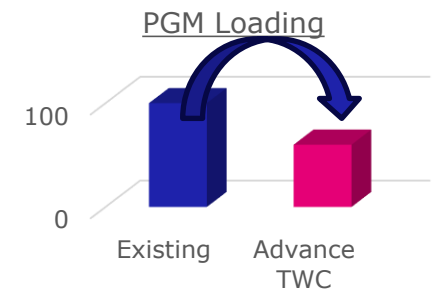


Highly Sintered Particles

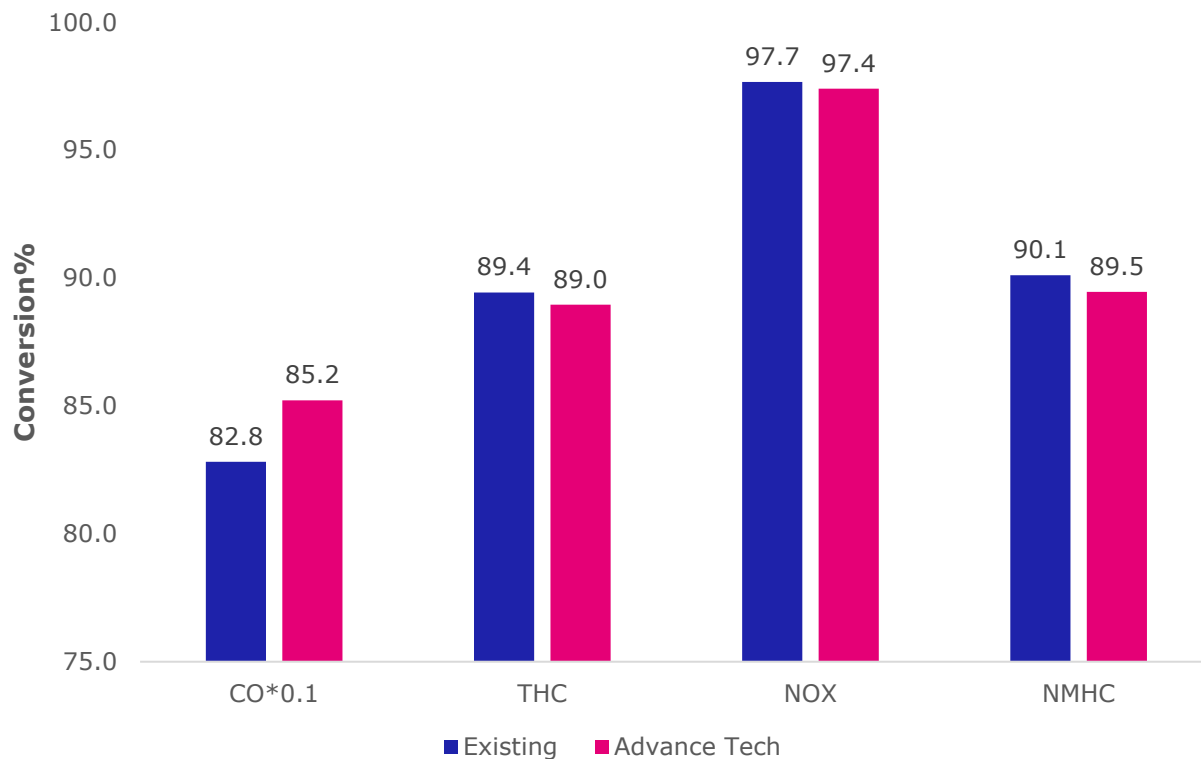


Advance TWC Technology Screening

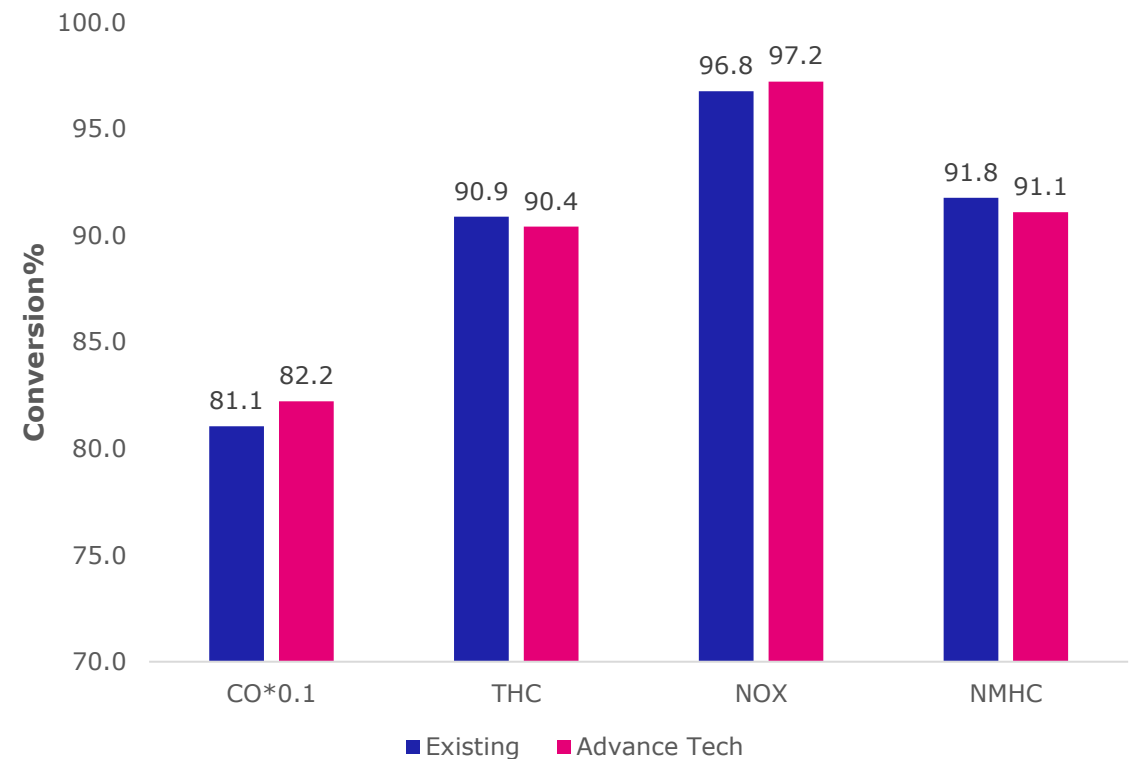
Emission (mg/km)



1000 km Emission conversion%



2500 km Emission conversion%

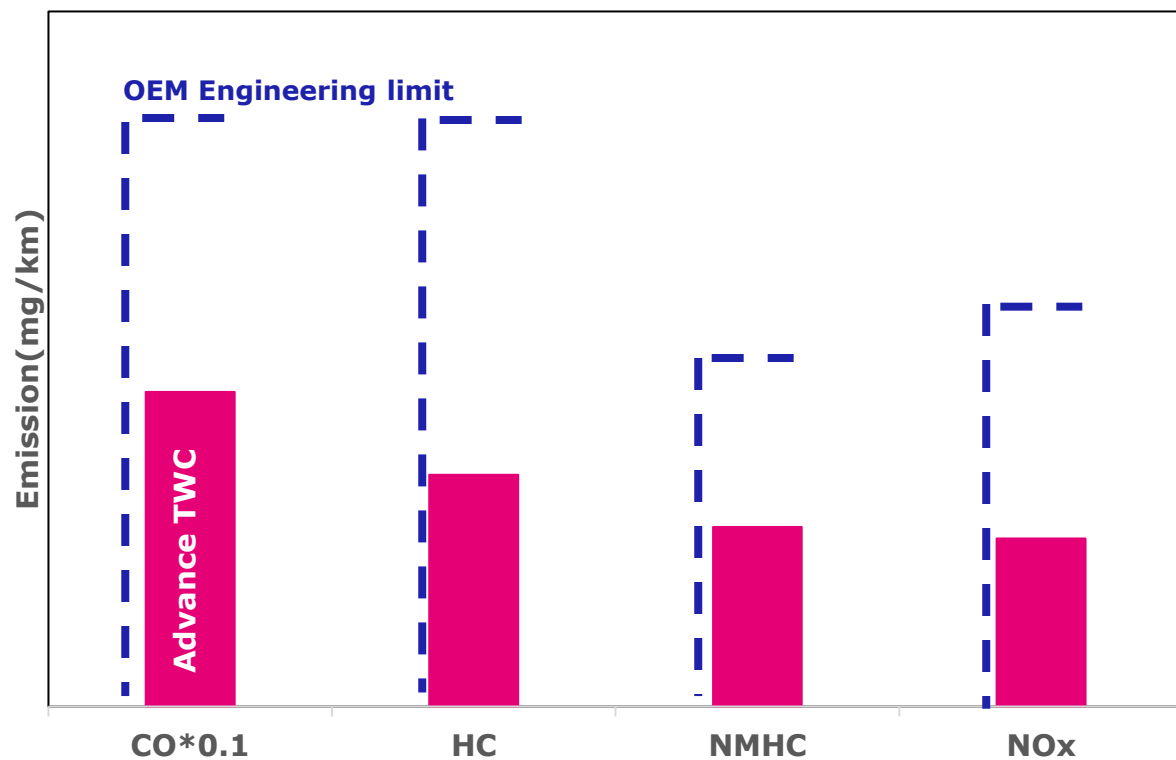


Advance TWC has **significantly lower PGM loading** compared to existing tech but shows **comparable emission conversion**.

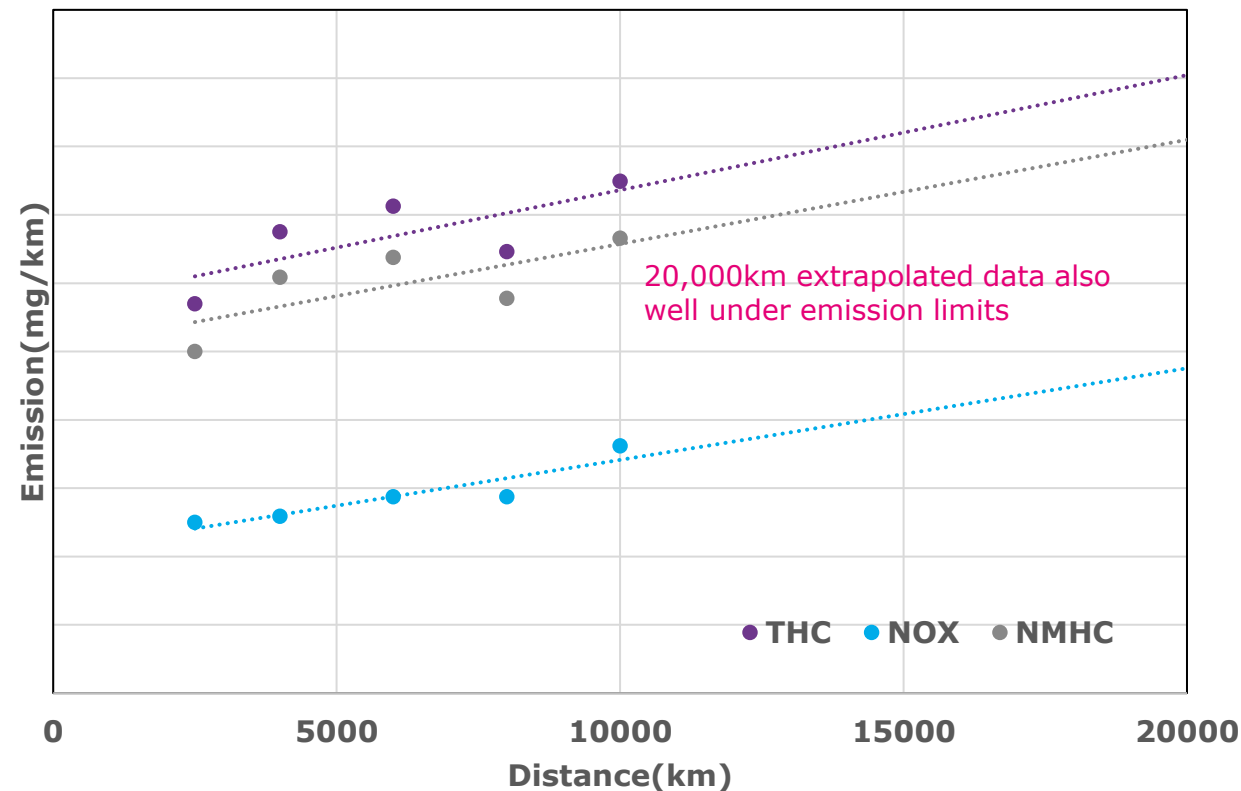
Demonstrating BS7 Readiness

Advance TWC shows sufficient margin against legislative limits

10,000 km Emission _ SRC Run



20,000 km Emission
(Extrapolated)

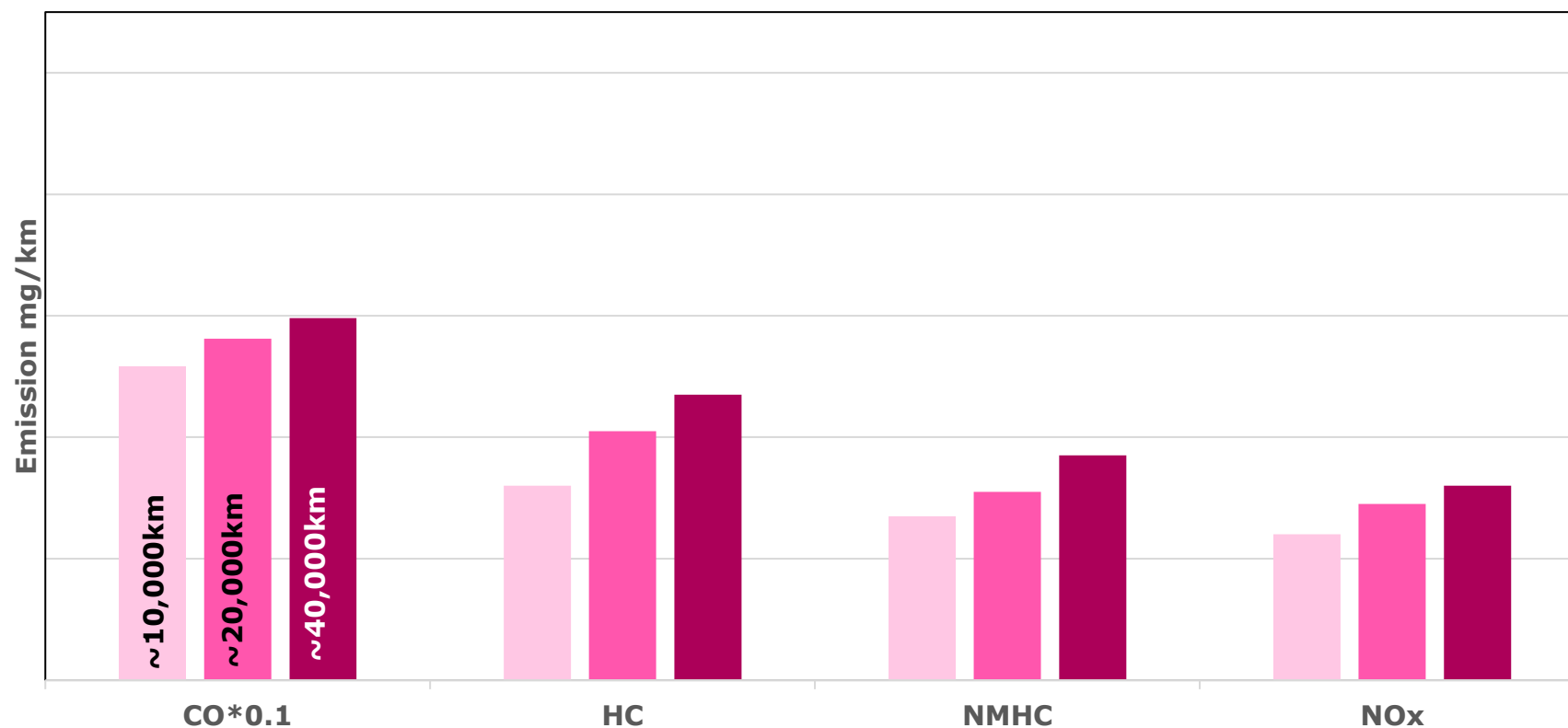


Available emission margin can be leveraged to support future BS7 compliance requirements.

Leveraging Durability to Enable BS7 Compliance

Advance TWC shows durable performance

On-road Durability Performance



Despite aging, catalyst performance was not significantly impacted, demonstrating readiness for the anticipated BS7 durability focus.

Summary

- BS7 is expected to drive greater focus on stricter emission limits, higher durability requirement, and enhanced monitoring requirements.
- Motorcycle emission challenges vary by segment, requiring differentiated catalyst development strategies.
- JM Latest Advance TWC with significant lower PGM loading than existing, has been demonstrated to provide significant PGM cost saving and is durable to real world ageing.

Existing TWC → Advanced TWC

Higher PGM → Optimized PGM

Comparable Performance

- JM Advance Low PGM TWC systems has strong emission margin and durability robustness against existing legislation. This will provide a solid technical foundation for addressing future BS7 requirements with minimal impact on catalyst cost