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Minimizing particulate emission footprint of the Indian two-wheeler segment

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Per ARAI study, transport sector contributes ~25% of total emissions

Report No. ARAI/16-17/DHI-SA-NCR/Exec_Summ
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Executive Summary

Source Apportionment of PM_{2.5} & PM₁₀
of Delhi NCR for
Identification of Major Sources



Prepared for
Department of Heavy Industry
Ministry of Heavy Industries and Public Enterprises,
New Delhi

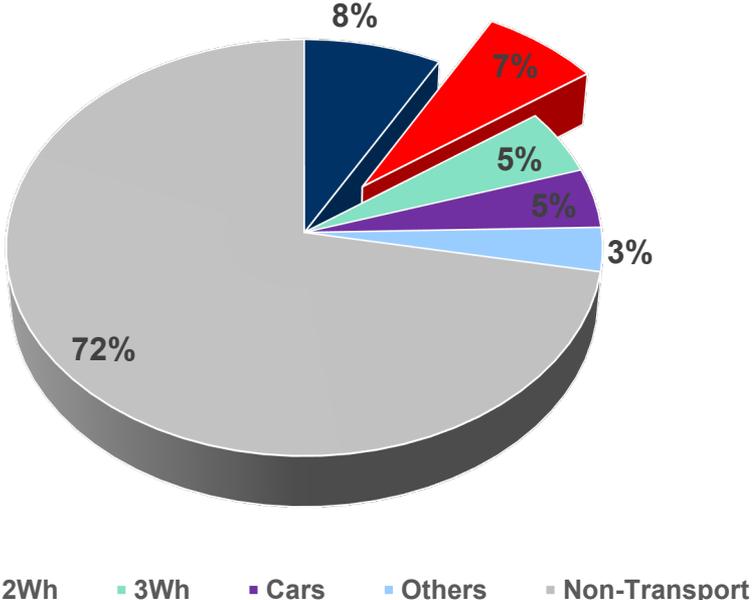
Prepared by



The Automotive Research Association of India
Survey No. 102, Vistal Hill, Off Paud Road,
Kothrud, Pune-411 038, India
www.araindia.com

The Energy and Resources Institute
Darbari Seth Block, IHC Complex,
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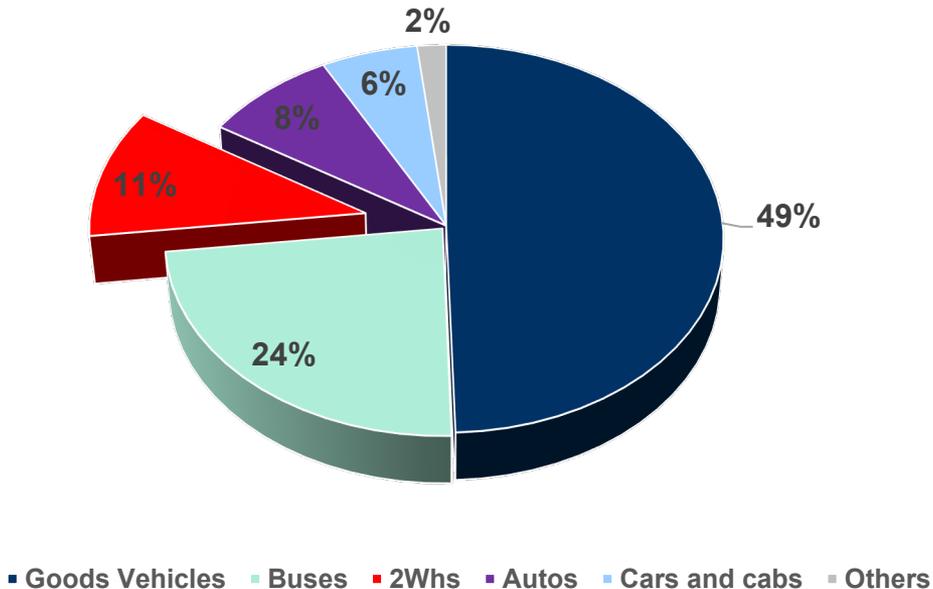
Delhi NCR - PM 2.5



A study by ARAI and TERI concludes that 2Whs are also a source of particulates.

Per NEERI study, 2Wh contribute ~11% of transport related emissions

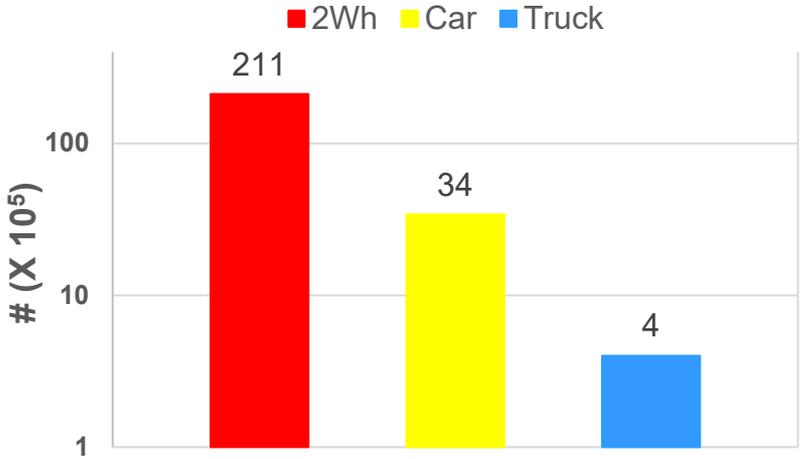
Transport Sector - PM 2.5



A detailed study by NEERI shows that the particulate emission load from 2Whs is high.

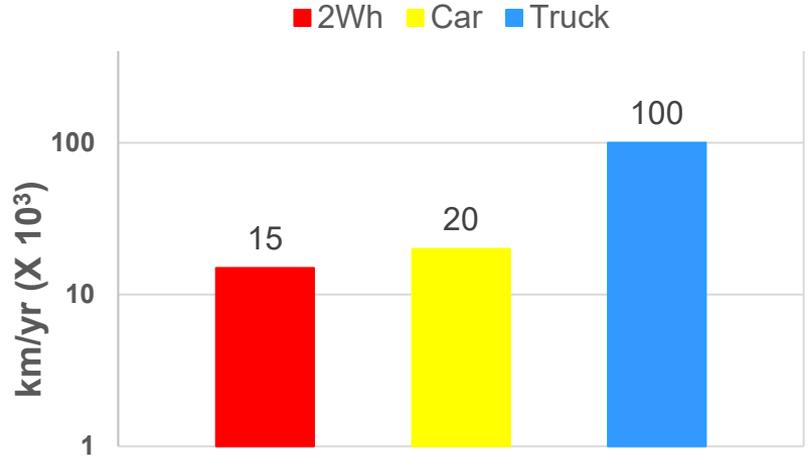
2Wh travel ~ 3X the distance covered by cars and trucks combined

No. of vehicles sold per annum*



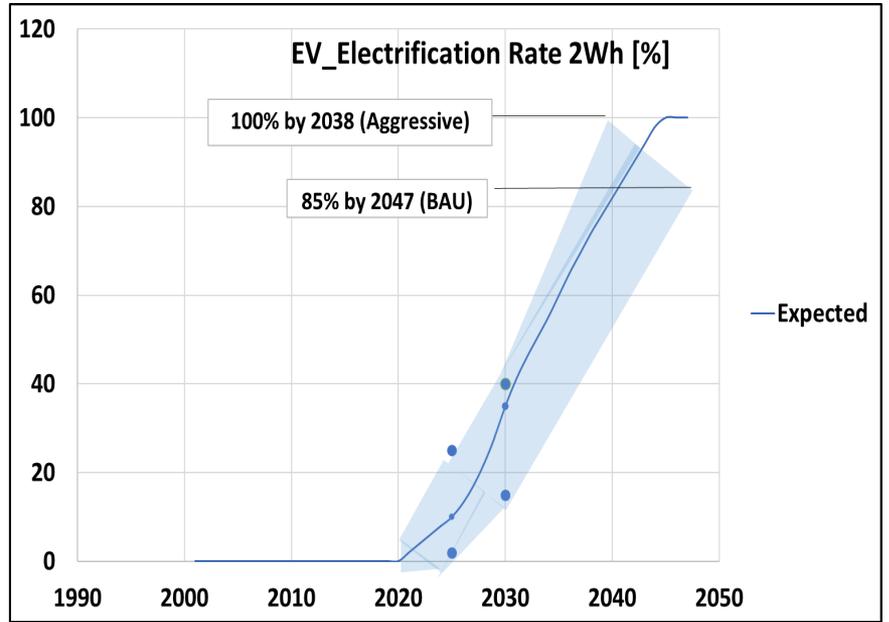
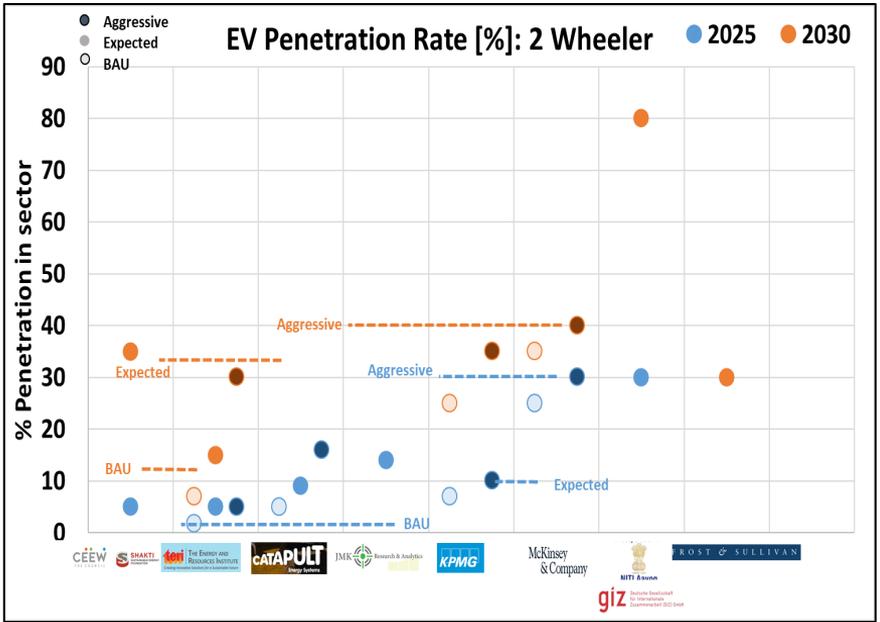
*SIAM 21st annual report

Vehicle km's travelled per vehicle (km/yr)



- **Two-wheelers cover ~ 315 billion km per annum**
 - Cars cover ~ **68** billion km per annum
 - Trucks cover ~ **40** billion km per annum

EV penetration into 2Wh segment



2Wh Gasoline powertrains would continue to be in vogue for the next two decades at least.

Understanding particulate emission from two-wheeler

❑ Objectives

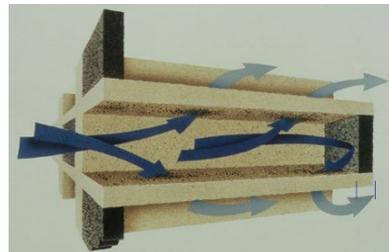
- ❑ Measure emissions from BS6 compliant two-wheeler (2Wh).
- ❑ Understand how GPF can help control particulate emissions from 2Wh.

❑ Selection of vehicles

- ❑ BS6 compliant 2Whs from two engine segments were selected –
 - Class 1 [50 – 150 cc] : 113 cc
 - Class 2-1 [> 150 cc] : 160 cc

❑ Emission Testing

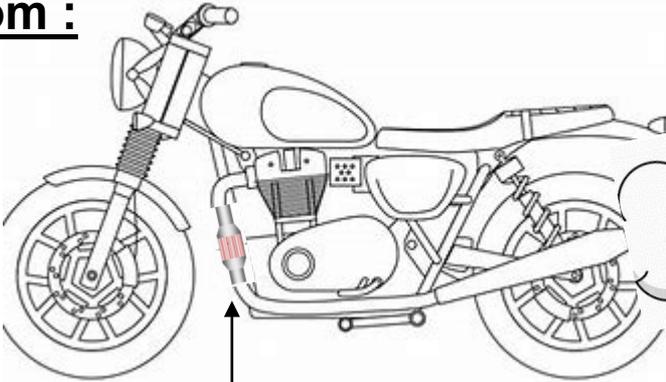
- ❑ As it is : vehicle with OE (Original Equipment) after-treatment system.
- ❑ Retrofitted with GPF (add-on) : vehicle with the retrofitted (OE + GPF) system.



Emission testing and exhaust retro-fitment

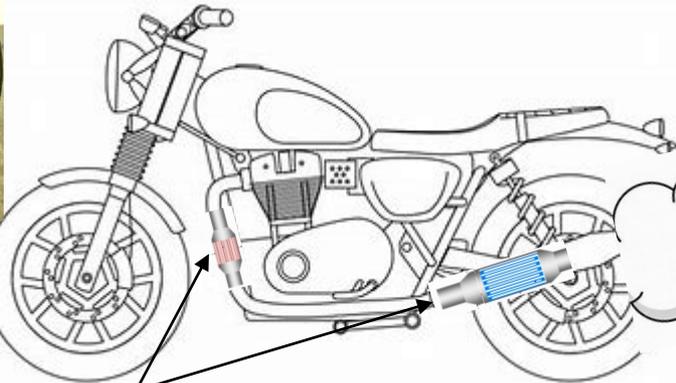
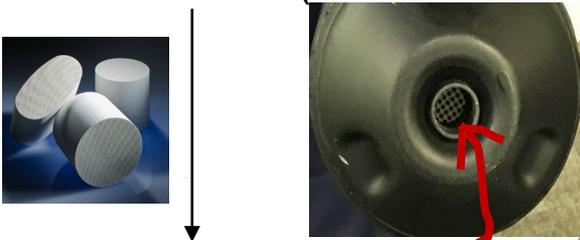
Measurement of particulates from :

- ❑ Existing BS6 Compliant EATS



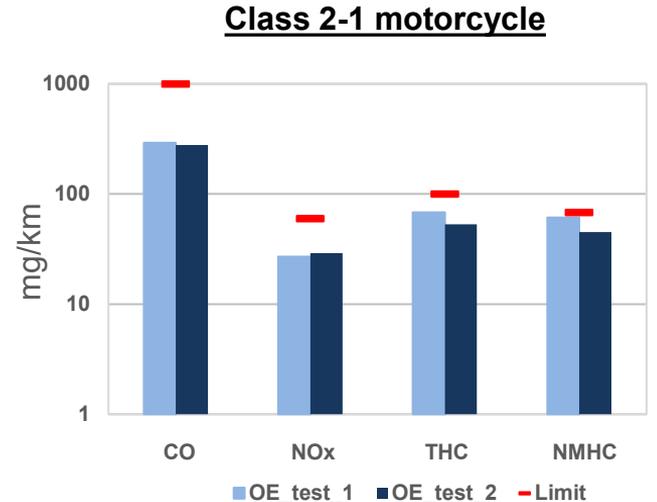
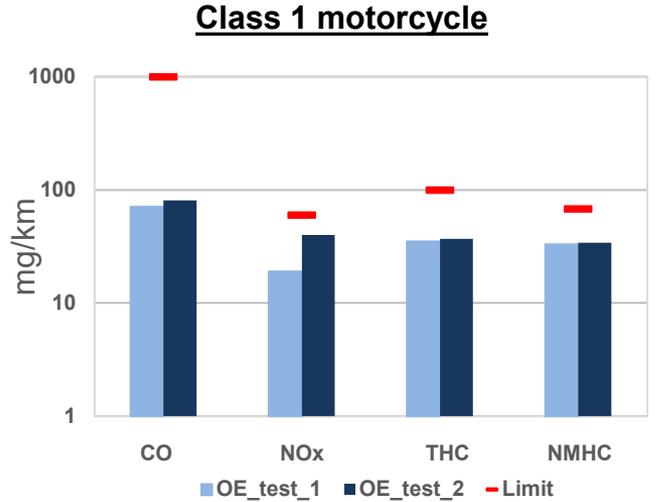
How much/many Particulates?

- ❑ Retrofitted EATS (GPF as an add-on to the existing system)



How much/many Particulates?

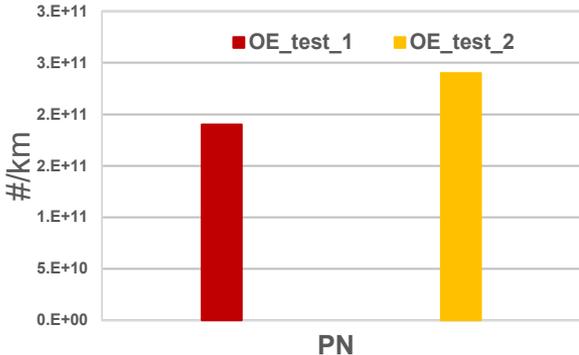
Gaseous Emissions from 2Wh meeting BS6 limits



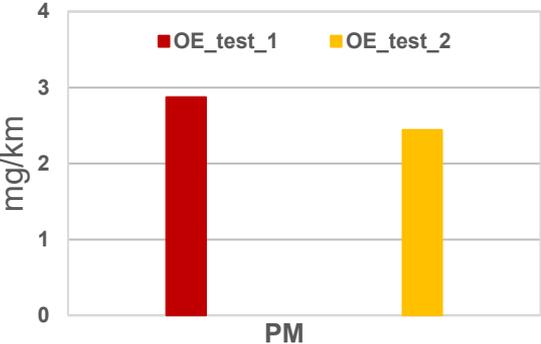
Tailpipe exhaust from a - BS6 compliant - gasoline 2Wh meets gaseous emission limits.

Particulate Emissions from 2Wh

Class 1 motorcycle

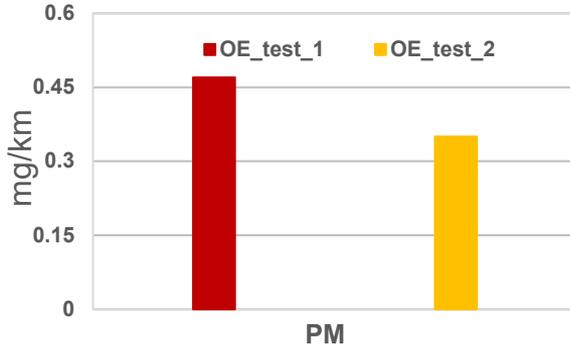
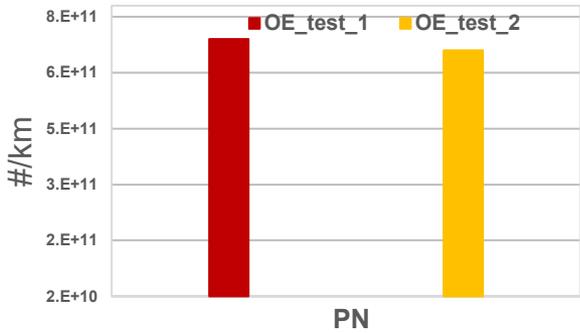


Car PN limit
6 X 10¹¹



Car PM limit
4.5 mg/km

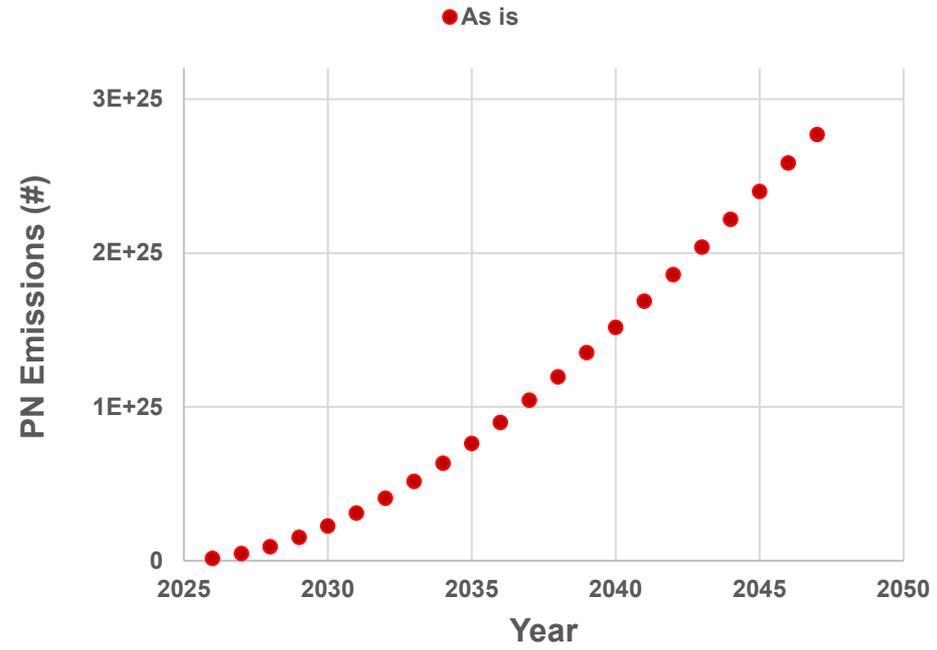
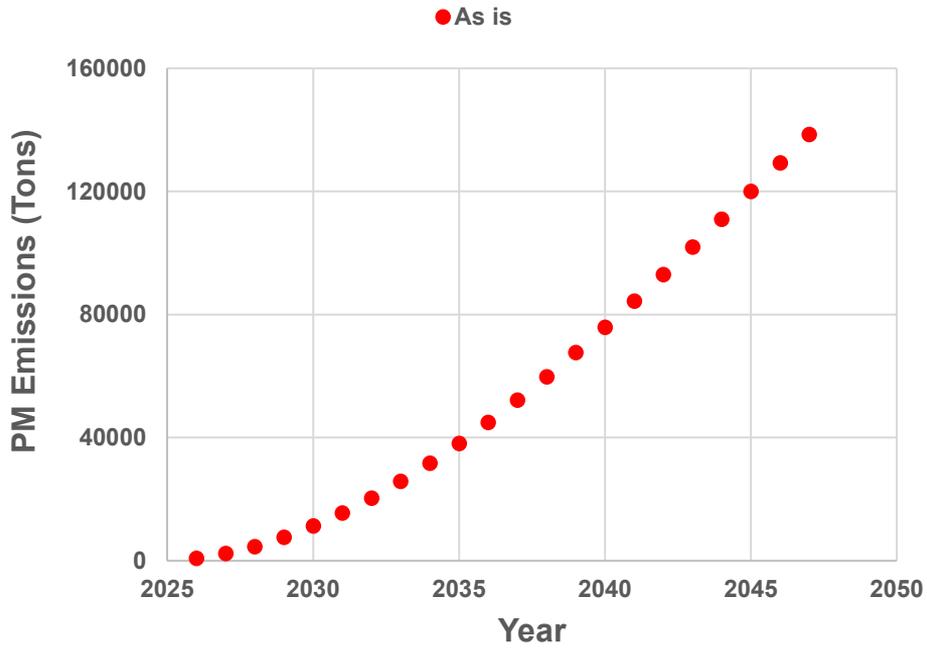
Class 2-1 motorcycle



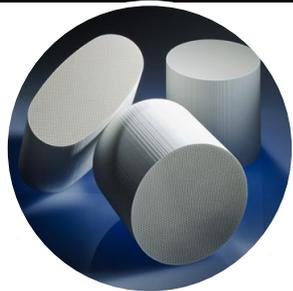
Tailpipe exhaust from a - BS6 compliant - gasoline 2Wh contains particulates.

Gasoline 2Wh fleet would emit ~140 kT of PM and ~27 x 10²⁴ (trillion trillion) of PN by 2047

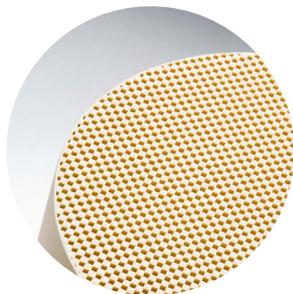
Gov is committed to 100% of EV in new sales by 2047. For a flat market (22 M 2Ws sold every year from 2026 - 2047), gasoline share steadily declining 1 M 2Ws per year and EV share steadily increasing at the same rate.



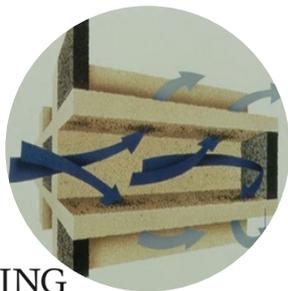
Corning® DuraTrap® GC Filters



Extruded ceramic monolith with low CTE



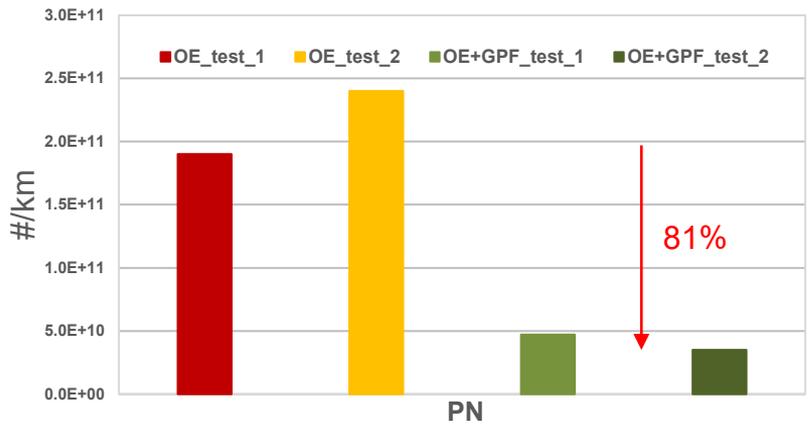
Alternate channels blocked at inlet and outlet



Wall flow mechanism traps exhaust particulates

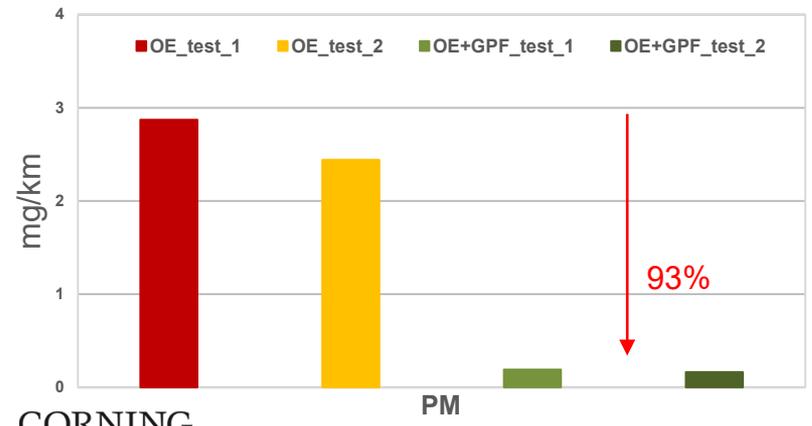
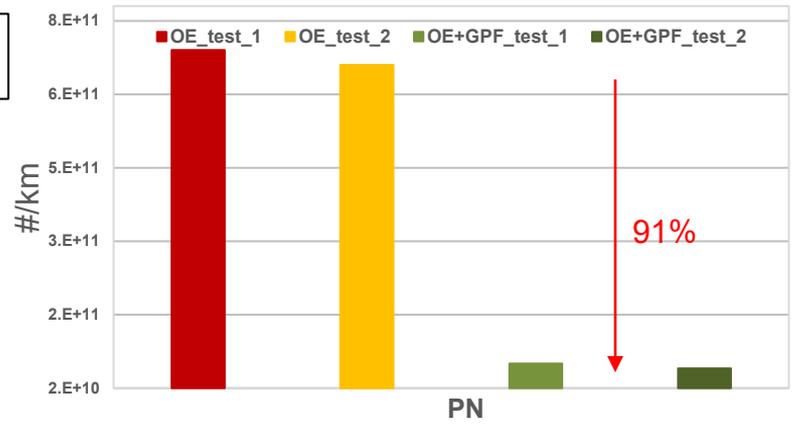
GPF helps in more than 80% particulate emission reduction

Class 1 motorcycle

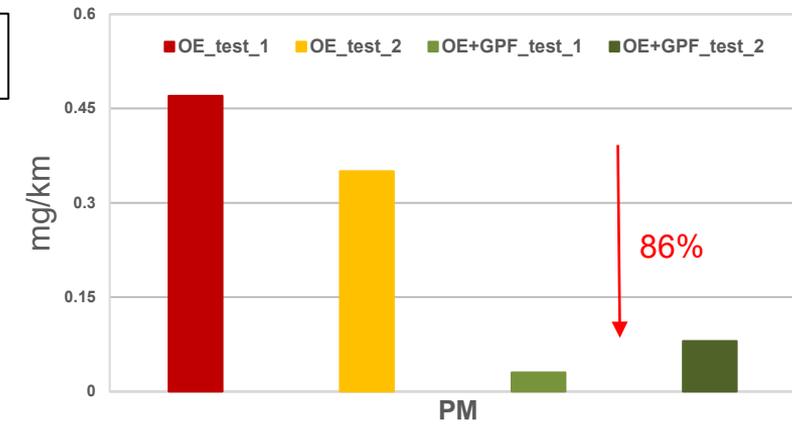


Car PN limit
 6×10^{11}

Class 2-1 motorcycle



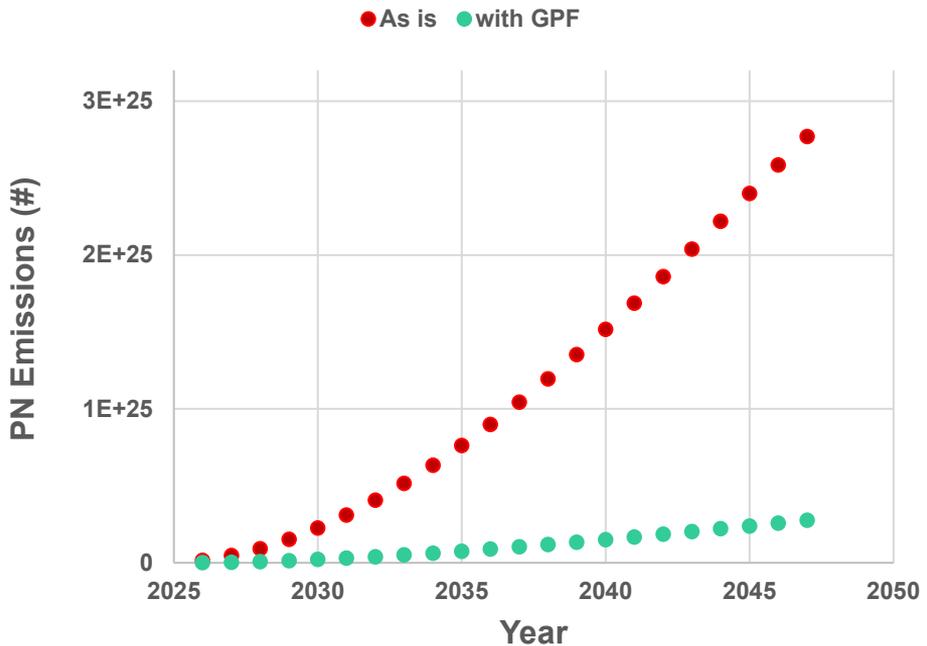
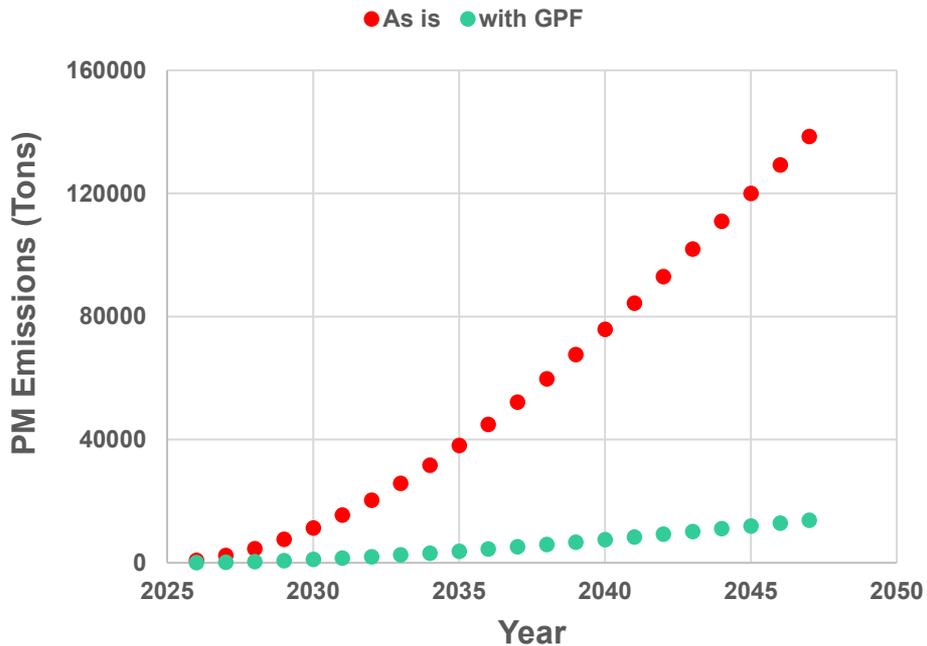
Car PM limit
4.5 mg/km



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Use of GPF can prevent ~120 kT of PM and ~23 X 10²⁴ (*trillion trillion*) of PN from entering our atmosphere

Gov is committed to 100% of EV in new sales by 2047. For a flat market (22 M 2Whs sold every year from 2026 - 2047), gasoline share steadily declining 1 M 2Whs per year and EV share steadily rising at the same rate.



Summary

Tailpipe exhaust from the BS6 compliant gasoline 2Wh also contains particulates



Gasoline powered 2Wh will be used and sold for the next two decades at least



GPF is a ready-to-use solution to clean up the 2Wh tailpipe exhaust



Collective efforts required to arrive at a GPF solution customized for the 2Wh market



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