

Mandating New Registration of Only Electric 3-wheelers (Passenger and Goods) in Delhi-NCR

The National Capital Region (NCR) continues to experience persistent air quality challenges, with PM_{2.5} remaining the dominant pollutant contributing to adverse Air Quality Index (AQI) levels. The transport sector is a significant contributor to PM_{2.5} emissions, and within this sector, 3-Wheelers (3Ws) account for a notable share due to their widespread usage for both passenger mobility and last-mile goods transport.

At present, CNG-based Goods and Passenger 3-Wheelers constitute a dominant segment in Delhi-NCR. While CNG has served as a relatively cleaner alternative to conventional fuels, emission factor assessments indicate that CNG-operated 3Ws continue to contribute significantly to PM_{2.5} emissions. Given the high density and continuous operation of these vehicles in urban areas, their cumulative impact on ambient air quality remains substantial. Therefore, continued addition of CNG 3Ws is not aligned with long-term air quality improvement objectives.

Simultaneously, a transition towards electric mobility in the 3W segment is already underway across Delhi and NCR. Electric Goods and Passenger 3-Wheelers are being registered in significant numbers, demonstrating both technological maturity and market acceptance. This segment is particularly suited for electrification, as these vehicles typically operate over short distances within city limits and follow predictable usage patterns. The availability of battery swapping infrastructure further mitigates concerns regarding charging time and operational downtime. Accordingly, constraints related to EV charging infrastructure are not significant for this segment.

In addition, diesel-operated 3-Wheelers, which are still in operation in certain parts of NCR, are already under a regulatory phase-out mandate and are required to be discontinued by 31.12.2026 as per directions of the Commission. This provides a clear policy trajectory towards elimination of high-emission 3Ws and strengthens the case for avoiding any further lock-in of fossil fuel-based technologies.

In view of the above, and considering the significant contribution of 3-Wheelers to PM_{2.5} emissions, it is imperative to adopt a forward-looking and time-bound regulatory approach to ensure a complete transition to zero-emission technologies in this segment. Allowing continued registration of CNG 3Ws would delay the transition and perpetuate emissions over the operational lifetime of such vehicles.

Accordingly, a phased approach for mandating only Electric 3-Wheelers for new registrations in Delhi-NCR is necessary to provide regulatory certainty, enable industry preparedness, and ensure smooth transition for stakeholders. The proposed timelines are as follows:

- National Capital Territory (NCT) of Delhi – Mandating only electric 3-Wheelers for new registrations with effect from 01.01.2027
- High Vehicle Density (HVD) cities of NCR (Gurugram, Faridabad, Sonapat, Ghaziabad and Gautam Budh Nagar) – with effect from 01.01.2028
- Remaining districts of NCR – with effect from 01.01.2029

These timelines are aligned with the scheduled phase-out of diesel 3-Wheelers by 31.12.2026, and provide adequate lead time for transition from CNG to electric mobility.

The proposed measure is expected to significantly reduce PM_{2.5} emissions from the 3-Wheeler segment, accelerate adoption of zero-emission vehicles, and contribute to sustained improvement in air quality in Delhi-NCR, while also supporting national objectives on clean mobility and energy transition.

Justification proposal

Air pollution in Delhi–NCR remains a persistent public health challenge, with PM_{2.5} (fine particulate matter) concentrations consistently exceeding national standards. A meta-analysis of studies conducted between 2015 and 2025 for identifying the causes for worsening AQI in Delhi NCR, indicates that PM_{2.5} levels in the region arise from a combination of primary emissions and secondary particulate formation, reflecting the complex and multi-source nature of air pollution in the region.

Key contributing sectors include transport, road and construction dust, biomass burning, and industry (including thermal power plants). In addition, a substantial share of PM_{2.5} is secondary in nature, formed through atmospheric reactions of gaseous precursors emitted by these primary sources. Seasonal variations further shape the relative contribution of these sources. During winter, when pollution levels are most severe (averaging ~178 µg/m³), transport contributes approximately 23 per cent to PM_{2.5} levels, alongside significant contributions from biomass burning (~20 per cent) and secondary particulates (~27 per cent). In summer, although overall PM_{2.5} concentrations decline (~73 µg/m³), dust becomes the dominant source (~27 per cent), while transport continues to remain a substantial contributor at ~18 per cent.

This consistent, year-round contribution distinguishes the transport sector from more seasonal sources such as dust or crop residue burning. Importantly, transport emissions contribute not only directly to primary particulate matter but also indirectly to secondary particulate formation, amplifying their overall impact on air quality.

While legacy vehicles account for a large share of the current emissions burden, incremental emissions from new vehicle sales represent a critical and often under-addressed driver of future pollution. Each year, new vehicle registrations add to a long-lived emissions stock, locking in emissions over vehicle lifetimes (typically 12-15 years), even under BS VI norms.

In this context, addressing emissions from high-utilisation vehicle segments and targeting new sales through regulatory mandates becomes essential, as it:

- Prevents future emissions at source
- Avoids technological lock-in
- Delivers immediate and sustained air quality benefits

Stock composition, New sales and their respective PM_{2.5} emissions.

An analysis of vehicle stock vis-à-vis their contribution to PM_{2.5} emissions highlights a critical policy insight: emissions are not proportional to fleet size. Certain segments, despite relatively smaller shares in total vehicle stock or sales, contribute disproportionately to particulate emissions due to higher utilisation and emission intensity (Annexure 2).

Key observations include:

- **3-Wheelers (3Ws):** Despite accounting for a small share of new vehicle sales (~2.2 per cent), 3Ws contribute ~19 per cent of incremental PM emissions, indicating high emissions intensity per vehicle. Their active fleet level contribution to PM emissions range from 3.6 per cent in Delhi NCR to 14 per cent in Delhi NCT.
- **Medium and Heavy Goods Vehicles (MHGVs):** With a limited share of new vehicle sales (1.6 per cent), MHGVs contribute ~55.3 per cent of incremental emissions, driven by high fuel consumption and long-distance operations.
- **Buses:** Though limited in number, buses contribute ~8.1 per cent of incremental PM emissions, reflecting high daily utilisation and urban exposure.

In contrast 2-wheelers, while contributing the largest share in absolute emissions due to their volume, have lower per-vehicle emission intensity.

Contribution of 3-Wheelers New Vehicle Sales to PM Emissions

3Ws emerge as one of the most suitable candidates for electrification mandates, due to:

- High emissions intensity combined with manageable fleet size
- Predominantly urban operation with direct exposure impacts
- Advanced readiness for electrification, unlike MHGVs or buses
- Minimal infrastructure constraints due to short-range usage and battery swapping models

While MHGVs and buses are also high-impact segments, their transition involves greater technological, operational, and infrastructure complexities. In contrast, the 3W segment represents a low-hanging, high-impact opportunity for immediate regulatory action.

3Ws, despite representing a smaller share of total vehicle stock compared to two-wheelers, contribute 19 per cent of total PM emissions from new vehicle sales across NCR annually. This contribution is notably higher in dense urban environments such as Delhi, where 3Ws account for 37 per cent of incremental PM emissions, and remains substantial in high vehicle density (HVD) regions at 20 per cent.

This elevated contribution is driven by:

- High daily vehicle utilisation (para-transit, last-mile connectivity)
- Frequent stop-start driving cycles, leading to higher real-world emissions
- Continued reliance on CNG and legacy ICE technologies, which, despite being considered cleaner fuels, still contribute meaningfully to PM emissions

An analysis of ICAT data on emissions per km for three companies providing retrofitting solutions was conducted. The data only considered retrofitting done on BS4 3Ws. Analysis of the three retrofitting companies revealed a notable reduction in CO emissions in two cases. However, none of the retrofitting efforts successfully lowered NOx emissions; in fact, all retrofits resulted in higher NOx levels compared to the baseline.

Implication for EV Mandates in 3Ws

Given their annual incremental PM emissions in NCR, transitioning this segment to 100 per cent electric in new registrations presents a high-impact, near-term intervention.

Unlike other segments:

- Technological readiness is already established (mature EV 3W market)

- Charging/swapping ecosystems are evolving rapidly
- Total cost of ownership (TCO) is already favourable across multiple use-cases

A full transition of new 3W sales to EVs would effectively prevent the continued lock-in of polluting technologies over the vehicle lifetime.

Current Fleet Composition and EV Penetration in 3-Wheelers

An assessment of the existing vehicle stock and new sales composition of 3-wheelers (passenger and goods) across Delhi, HVD NCR, and the Rest of NCR highlights a clear structural transition already underway in this segment.

Table 1: Passenger 3Ws fuel wise active fleet and new sales across the region

Fuel type	Delhi		HVD		Rest of NCR	
	Active Stock as on 31.12.2025	New sales During 2025	Active Stock as on 31.12.2025	New sales During 2025	Active Stock as on 31.12.2025	New sales During 2025
Diesel	0	0	462	0	4,052	0
Petrol/LPG	1	0	0	0	0	0
Petrol/CNG	67,678	0	14,492	0	2,877	0
CNG	24,395	4,895	31,960	9,981	10,157	3,539
EV	2,807	0	15,651	8,714	3,226	1,993
Total	94,881	4,895	62,565	18,695	20,312	5,532

Table 4: Goods 3Ws fuel wise active fleet and new sales across the region

Fuel type	Delhi		HVD		Rest of NCR	
	Active Stock as on 31.12.2025	New sales During 2025	Active Stock as on 31.12.2025	New sales During 2025	Active Stock as on 31.12.2025	New sales During 2025
Diesel	0	1	750	2	1898	7
Petrol/LPG	1	0	0	0	2	0
Petrol/CNG	10,276	0	802	0	148	0
CNG	33,032	3,283	10,470	3,703	6,181	2,887
EV	29,480	7,781	2,819	1,391	389	200
Total	72,789	11,065	14,841	5,096	8,618	3,094

The segment is witnessing a rapid market-driven as well as policy induced transition towards electric mobility. Electric passenger and goods 3Ws are already being registered in substantial numbers across Delhi and NCR. Given that these vehicles typically operate over short intra-city distances, and that battery swapping ecosystems are increasingly available and operational, the requirement for extensive fixed charging infrastructure is comparatively limited. As such, infrastructure constraints are not a binding barrier to further electrification in this segment.

- Around 18 per cent of the existing fleet has already transitioned to EVs, while majority (80 per cent) is dominated by CNG and Petrol/CNG vehicles, reflecting historical policy push and infrastructure availability
- **New sales are also increasingly shifting toward EV (40 per cent share)**, indicating strong market momentum and economic viability.

This trend is reflected in NCR as well, where:

- **Passenger 3Ws** show significant EV uptake in new registrations, particularly in HVD
- **Goods 3Ws**, have shown EV uptake in Delhi, while slightly lagging in HVD and rest of NCR.

CNG-based passenger and goods 3Ws currently constitute a dominant share of the operational fleet across Delhi-NCR. This is a result of earlier policy support for CNG as a relatively cleaner alternative to conventional fuels. However, despite this transition, the contribution of CNG 3Ws to PM_{2.5} emissions remains significant, particularly due to high vehicle utilisation and dense urban operating conditions.

In parallel, diesel 3Ws—though now limited in number—continue to operate in parts of NCR. These are already mandated to be phased out by 31.12.2026 as per directions of the Commission for Air Quality Management (CAQM), indicating a clear regulatory intent to eliminate higher-emitting technologies from this segment.

Given the above:

- Continued registration of CNG 3Ws will perpetuate avoidable PM emissions over the vehicle lifecycle
- The segment has already demonstrated high readiness for full electrification
- A regulatory shift is now required to complete the transition and prevent further lock-in of polluting technologies

Furthermore, emerging evidence indicates that even relatively cleaner fuels such as CNG continue to contribute meaningfully to particulate emissions under real-world conditions, reinforcing the need for a decisive transition toward zero tailpipe emission technologies, particularly electric vehicles (EVs) (*Refer Annex 1 for details*).

The 3W segment is at a clear inflection point, where the market transition to EVs is already underway. A regulatory intervention to restrict new registrations of CNG and other ICE 3Ws in a phased manner would formalise this transition and prevent further emissions lock-in. Accordingly, it is proposed that registration of new CNG or other ICE 3Ws be restricted in a phased manner.

Proposed Mandate for New Registration of 3-Wheelers (3Ws)

In view of the segment's readiness and emissions impact, a phased mandate for 100 per cent electrification of new 3W registrations across Delhi-NCR is proposed as follows:

Vehicle Category	Delhi	HVD NCR	Rest of NCR	Fuel Type
3-Wheelers	01.01.2027	01.01.2028	01.01.2029	EV

Impact of EV Mandate

Transitioning to 100% EV in new 3W sales would result in:

Direct Emissions Impact	System-Level Benefits
• Elimination of ~5.5 tonnes of PM_{2.5} annually from new 3W additions • Over a vehicle lifetime (10-15 years): ○ ~55 - 83 tonnes of PM_{2.5} avoided per year of intervention	• Immediate air quality improvement (no tailpipe emissions) • Lower operating costs for drivers (fuel + maintenance savings) • Reduced noise pollution in urban areas • Energy security benefits through reduced fossil fuel dependence.

Each year of delay results in avoidable emissions being permanently added to the NCR airshed.

Implementation Considerations

- **OEM and Market Readiness** - The EV 3-wheeler market is supported by a strong presence of established original equipment manufacturers (OEMs) with proven capabilities in both passenger and goods segments. More than 10 OEMs sold more than 10,000 EV vehicles in 2025. Supply chains are mature, ensuring consistent product availability, and vehicles have demonstrated reliable performance under Indian operating conditions. This foundation reduces implementation risk and facilitates rapid scaling of EV adoption.
- **Charging and Swapping Ecosystem** - Most 3Ws operate on short, intra-city routes, making them well-suited for electrification. Battery swapping models are increasingly operational in key cities, minimizing downtime and reducing dependence on fixed charging infrastructure. This flexibility allows operators to maintain high daily utilization while avoiding large upfront investment in charging stations. Delhi-NCR currently hosts ~50 battery swapping stations, of which a significant proportion—estimated at 70–80% utilization—is driven by 3-wheeler segments. Dedicated 3W-enabled swapping infrastructure is present across at least 30–40+ key locations, including DMRC sites and private operator hubs
- **Financing and Adoption Support** - Financing solutions for EV 3Ws are evolving, with banks, NBFCs, and OEM-linked credit models offering structured loans and lease options. Targeted incentives and support mechanisms, especially in lagging regions, can accelerate fleet electrification by lowering upfront costs and encouraging adoption among smaller fleet operators.

Conclusion

The 3W segment represents a “low-regret, high-impact” opportunity for immediate intervention. The market has already initiated the transition; a regulatory mandate would formalise and accelerate this shift, ensuring that residual ICE/CNG adoption does not lock in avoidable emissions.

In doing so, the Commission for Air Quality Management can enable the 3W segment to become the first fully electrified vehicle category in Delhi-NCR, delivering early and measurable air quality gains.

Annexure 1: Why CNG vehicles will NOT solve the transport PM problem in Delhi

CNG vehicles are a major source of NO_x

Compressed Natural Gas (CNG) burns cleaner than diesel in terms of particulate matter and sulphur, but its **high combustion temperatures generate significant nitrogen oxides (NO_x)** — particularly NO and NO₂.

- CNG engines operate at lean air-fuel ratios and high flame temperatures (>1,300°C), the principal condition for thermal NO_x (Zeldovich mechanism) formation.
- Studies by ARAI (Automotive Research Association of India) show CNG buses emit 0.8–2.0 g/km of NO_x — comparable to Euro-III diesel and exceeding Euro-VI diesel standards.
- A 2019 study found that CNG auto-rickshaws in Delhi emitted NO_x levels 3–5× higher than petrol equivalents under real-world driving conditions.

CNG led NO_x-to-Secondary PM_{2.5} emissions

In Delhi's atmosphere — rich in sunlight, volatile organic compounds (VOCs), and ammonia — it undergoes rapid photochemical and heterogeneous reactions to form **secondary inorganic aerosols (SIA)**, the dominant form of secondary PM_{2.5}.

- $\text{NO}_2 + \text{OH} \rightarrow \text{HNO}_3$, which condenses with NH₃ (abundant from agricultural and waste sources in NCR) to form ammonium nitrate (NH₄NO₃) — a key PM_{2.5} component.
- NO_x also participates in ozone formation (O₃), which further oxidises SO₂ and VOCs to form sulphate and organic aerosol particles — all sub-2.5 micron in size.
- SAFAR (IITM Pune) data shows secondary aerosols peak in winter in Delhi, precisely when photolysis is lower but NO_x-NH₃ chemistry intensifies in cold, stagnant air.

CAQM Finding	The Commission for Air Quality Management (CAQM) meta-analysis report identifies secondary particulate matter as contributing 27 per cent of PM _{2.5} in Delhi NCR — making it the single largest identified source category, ahead of dust, biomass burning, and industry.
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Why CNG Does Not Solve the PM_{2.5} Problem

By substituting diesel with CNG without addressing NO_x, policymakers are **trading primary PM for secondary PM** — shifting the pollution upstream in the chemical chain, not eliminating it.

- Primary PM (exhaust soot) is reduced by CNG — this is visible and politically legible.
- Secondary PM formation, driven by NO_x + NH₃ chemistry, is invisible, delayed, and occurs kilometres downwind of the emission source.
- Delhi's ambient NH₃ burden (from agriculture in Haryana/Punjab, waste burning, and livestock) provides an abundant precursor for NO_x to convert to nitrate aerosol. CNG vehicles continuously 'feed' this system.
- A TERI analysis (2022) estimated that vehicular NO_x accounts for 18–22 per cent of total NO_x load in the NCR airshed and CNG fleets being a substantial share of this.

International Evidence: NO_x-PM Link Is Well-Established

Region	Finding	Source
Beijing, China	Post-CNG bus transition, NO _x -driven secondary nitrate aerosol became the dominant PM _{2.5} fraction in winter; primary PM fell but PM _{2.5} averages did not improve proportionally.	<i>Zhang et al., Atmos. Environ. (2015)</i>
London, UK	After Euro-VI diesel transition reduced primary PM, secondary PM from NO _x remained high;	<i>RCP Report: Every Breath We Take (2018)</i>
Po Valley, Italy	High NH ₃ from agriculture + NO _x from transport created severe ammonium nitrate PM _{2.5} episodes.	<i>EMEP/EEA Emission Inventory Guidebook (2019)</i>

The Policy Implication: What Needs to Change

The CNG transition was a necessary first step in the 1990s–2000s. But in the context of Delhi's current PM_{2.5} crisis, it is an incomplete solution.

- Emission Standards for CNG vehicles must be tightened to Bharat Stage VI equivalents with real-world driving emission (RDE) testing — current BS-VI norms are lab based engine-bench tested only.
- **Selective Catalytic Reduction (SCR) retrofits on high-emitting CNG buses — proven in Europe and the US — can cut NO_x by 80–90 per cent.**
- The 27 per cent secondary PM share demands a dual-pronged NO_x + NH₃ control strategy: **cutting vehicle NO_x by reducing CNG new vehicle sales**; must be accompanied by agricultural ammonia controls (fertiliser management in Punjab/Haryana).
- Accelerating transition to zero-tailpipe emissions vehicles (ZTEs) — which emit no NO_x — is the only way to **structurally decouple mobility from secondary PM formation.**

Annexure 2: Calculations on the basis of 2026 EFs

Table 1: Active + fitness approved vehicle stock as on 31st Dec 2025 and their respective PM2.5 emissions.

Segment	Delhi NCT		HVD		Rest of NCR		Delhi + NCR (Combined)	
	Active stock	Emission % (2026 EFs)	Active stock	Emission % (2026 EFs)	Active stock	Emission % (2026 EFs)	Active stock	Emission % (2026 EFs)
2Ws	58,47,589	46.8	33,52,920	18.8	62,33,001	27.8	1,54,33,510	27.4
Private 4Ws	22,74,861	20.6	15,81,271	9.4	11,90,650	6.2	50,46,782	9.3
Taxi	48,203	1.2	1,25,374	0.7	36,791	0.3	2,10,368	0.6
3Ws	1,67,670	13.9	77,410	4.2	28,941	0.4	2,45,872	3.6
Buses	11,073	2.0	17,705	5.3	20,574	11.1	49,352	7.9
LGV	1,43,893	10.1	68,782	2.8	98,323	3.4	3,10,998	4.1
MHGV	21,613	5.3	1,12,848	58.8	86,754	50.8	2,21,215	47.2
Total	84,86,753		53,36,310		76,95,034		2,15,18,097	

Source: VAHAN database and ARAI 2026 EFs

Table 2: Segment wise New registration in 2025 and their respective share in incremental PM emissions

Segment	Delhi NCT		HVD		Rest of NCR		Delhi + NCR (Combined)	
	New Sales in 2025	Emission % (2026 EFs)	New Sales in 2025	Emission % (2026 EFs)	New Sales in 2025	Emission % (2026 EFs)	New Sales in 2025	Emission % (2026 EFs)
2Ws	5,29,100	38.7	2,77,312	7.0	6,22,178	16.9	14,28,590	15.6
Private 4Ws	1,83,080	2.4	1,46,080	0.7	2,30,333	1.0	5,59,493	1.1
Taxi	3,318	0.04	37,258	0.4	12,340	0.3	52,916	0.3
3Ws	15,960	36.9	23,791	19.8	8,554	10.6	48,305	18.6
Buses	1,952	4.7	2,677	6.8	2,743	10.8	7,372	8.1
LGV	17,700	2.0	13,931	0.7	15,810	1.1	47,441	1.0
MHGV	2,416	15.3	18,683	64.7	14,024	59.3	35,123	55.3
Total	7,53,526		5,19,732		9,05,982		21,79,240	

Source: VAHAN database and ARAI 2026 EFs

Figure 1: Fuel mix of Active fleet and New registrations of 3Ws across Delhi NCR.



