

Session 2 – the non-road and data centre journey

Stationary and NRMM legislation

Joachim Demuynck • AECC



Rising concerns about data centre expansion

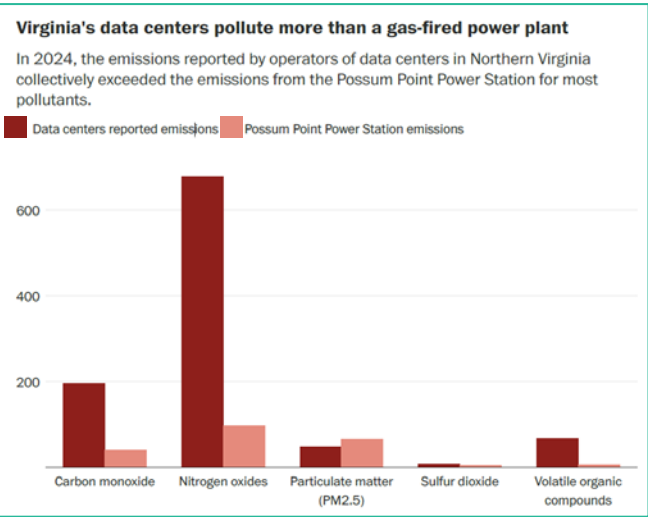
Pollutant emissions start to be noted ... affecting urban air quality

See where diesel-powered data center generators are polluting Virginia

Pollution from generators at data centers could cause respiratory symptoms and deaths in the region, an analysis for The Washington Post found.

May 28, 2026

The Washington Post



[Politics](#)

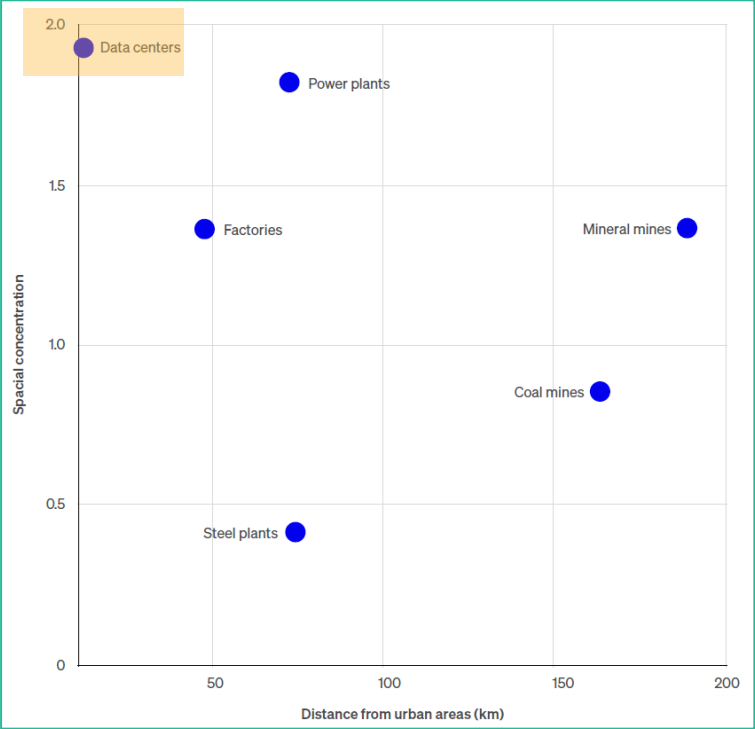
Virginia fines a Microsoft data center for emissions violations

By [Natalie Brand](#)

Updated on: September 16, 2026 / 4:39 PM EDT / CBS News

CBS NEWS

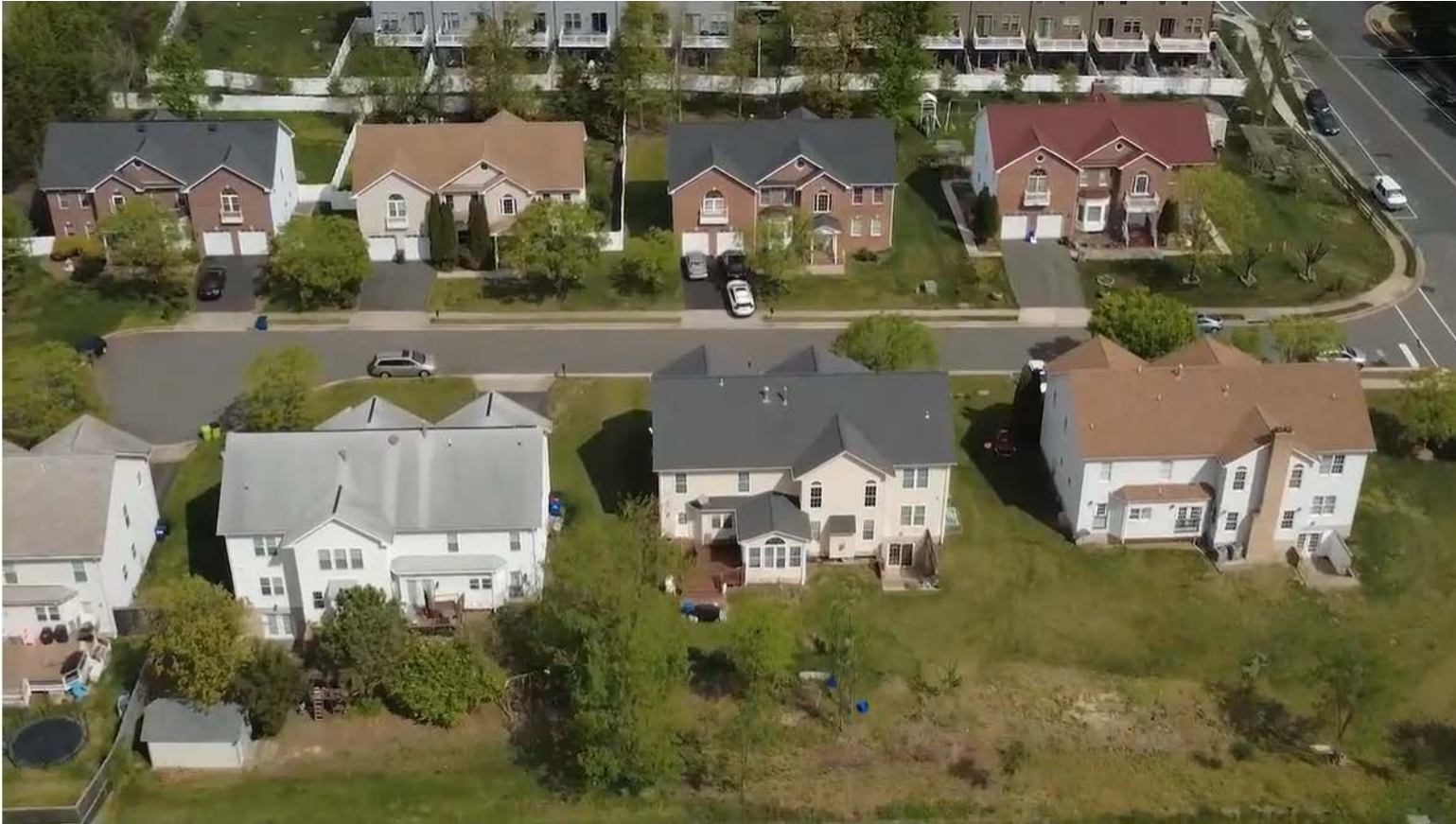
The notice [published online](#) details an event in June of 2025 when the Microsoft facility in Leesburg, Virginia, reported a failure of an electrical substation and had to operate 62 emergency engines for a seven-day period, according to the Department of Environmental Quality. The state says the facility exceeded its permitted fuel emissions limits for pollutants including CO, VOC, PM10 and PM2.5 during that time.



Source: IEA, 2025 as reported by Politico

Rising concerns about data centre expansion

Pollutant emissions start to be noted ... affecting urban air quality



Source: Washington Post, May 2026

Rising concerns about data centre expansion

Pollutant emissions start to be noted ... affecting urban air quality



Source: "[Internet, un géant très vulnérable](#)" (26:10-26:43), arte, 2025

EU data centre permit examples

Illustrating market fragmentation for available emission control technologies

• Location	Berlin	Frankfurt	Frankfurt
• Permit issued	<u>2021</u>	<u>2024</u>	<u>2024</u>
• Limits			
• NOx	1700 mg/Nm ³	1000 mg/Nm ³	200 mg/Nm ³
• CO	265 mg/Nm ³	650 mg/Nm ³	100 mg/Nm ³
• Dust	-	50 mg/Nm ³	50 mg/Nm ³
• Back-up gensets			
• Total Power	180 MW	170 MW	140 MW
• Engine Power	32x 6.5 MW	23x 7.2 MW	19x 7.7 MW
• Emission controls	DPF	SCR	DOC + SCR

Initial EU legislative initiatives

- Medium Combustion Plant Directive
 - Combustion plants of 1 MW to < 50 MW
 - Emission Limit Values for SO₂, NO_x & Dust depending on fuel type, technology, size, new/existing
 - Back-up power derogation: no limits < 500 h / year
 - Member State or local authorities might add requirements
 - General review expected by 2027
- Environment Omnibus
 - Establishes link with Non-Road Mobile Machinery Stage V for new data centres > 20 MW
 - [AECC supports](#) this, but calls for Stage V review to address e.g. NO_x and PN gaps

Table 2

Emission limit values (mg/Nm³) for new engines and gas turbines

Pollutant	Type of medium combustion plant	Gas oil	Liquid fuels other than gas oil	Natural gas	Gaseous fuels other than natural gas
SO ₂	Engines and gas turbines	—	120 ⁽¹⁾	—	15 ⁽²⁾
NO _x	Engines ⁽³⁾ ⁽⁴⁾	190 ⁽⁵⁾	190 ⁽⁵⁾ ⁽⁶⁾	95 ⁽⁷⁾	190
	Gas turbines ⁽⁸⁾	75	75 ⁽⁹⁾	50	75
Dust	Engines and gas turbines	—	10 ⁽¹⁰⁾ ⁽¹¹⁾	—	—

Table II-2: Stage V emission limits for engine category NRG defined in point (2) of Article 4(1)

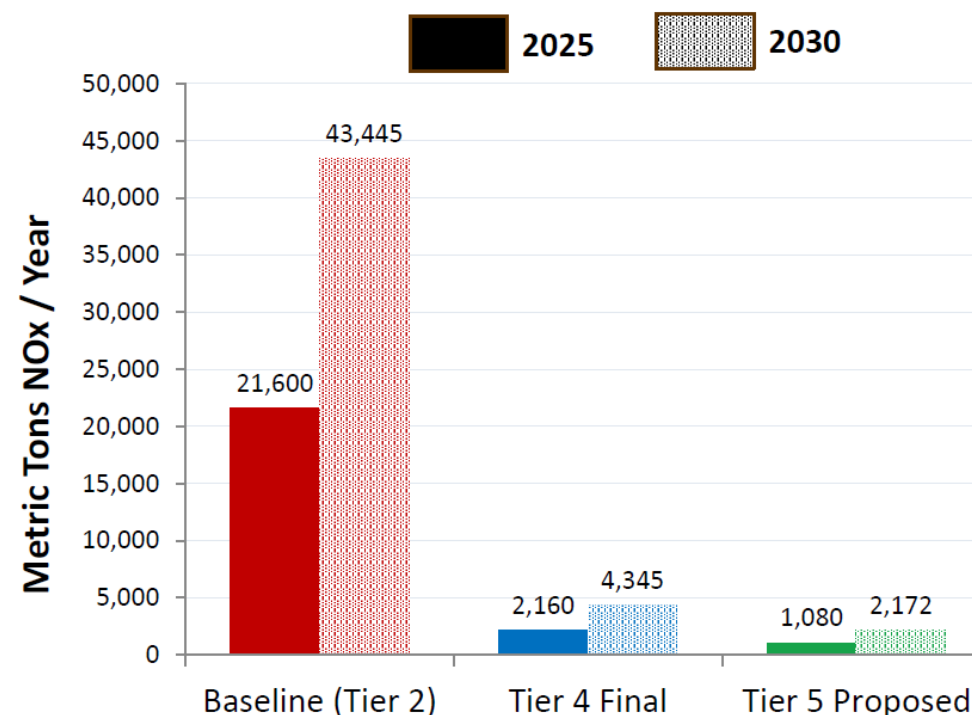
Emission stage	Engine sub-category	Power range	Ignition type	CO	HC	NO _x	PM mass	PN
		kW		g/kWh	g/kWh	g/kWh	g/kWh	#/kWh
Stage V	NRG-v-1 NRG-c-1	P > 560	all	3,50	0,19	0,67	0,035	—

Similar debate ongoing in US

Replacing Tier 2 gensets with Tier 4 can save up to ~ 20,000 tons of NOx in VA

Further savings as market grows, and with introduction of Tier 5

Parameter	2025	2030
Total Genset Capacity	27 GW	54.3 GW (15% CAGR)
Annual Operating Hours	100 hrs	
Baseline NOx (Tier 2)	8.0 g/kWh	
Tier 4 Final NOx	0.8 g/kWh	
Tier 5 Proposed NOx	0.4 g/kWh	



Source: "A review of emissions from gensets for data center applications", Ameya Joshi, Off-highway & Power Generation USA, May 2026

Summary data centres

- Rising concerns about rapid expansion including urban air quality impact
- Existing permitting requirements vary significantly across EU, creating **market fragmentation**
- Environment Omnibus provides first elements which are to be further discussed under upcoming Medium Combustion Plant Directive review
- Emission control technologies are available to achieve **low back-up power pollutant emissions**



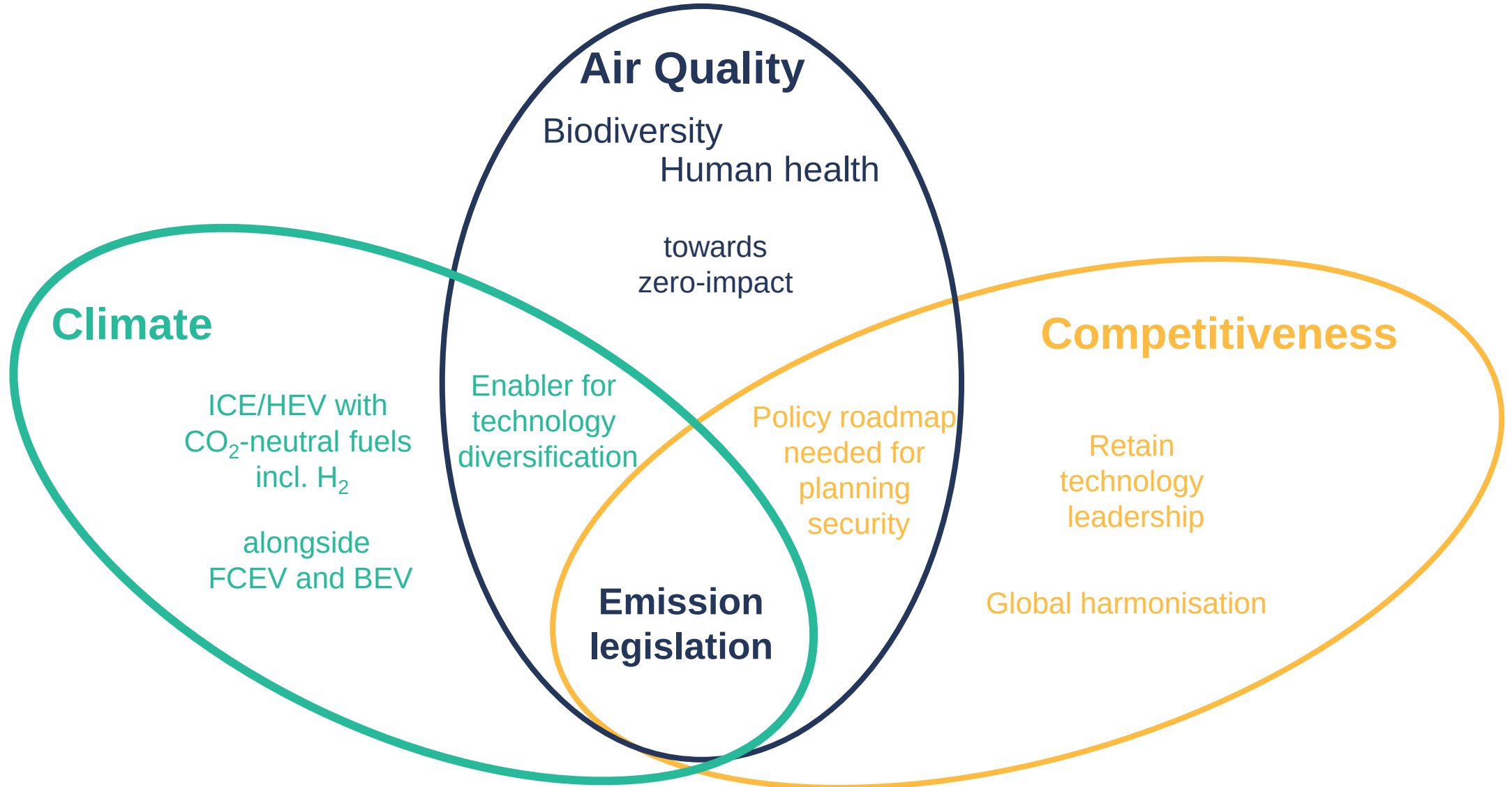
Session 2 – the non-road and data centre journey

Stationary and NRMM legislation

Joachim Demuynck • AECC



Key pillars for NRMM compatibility with 2050 targets

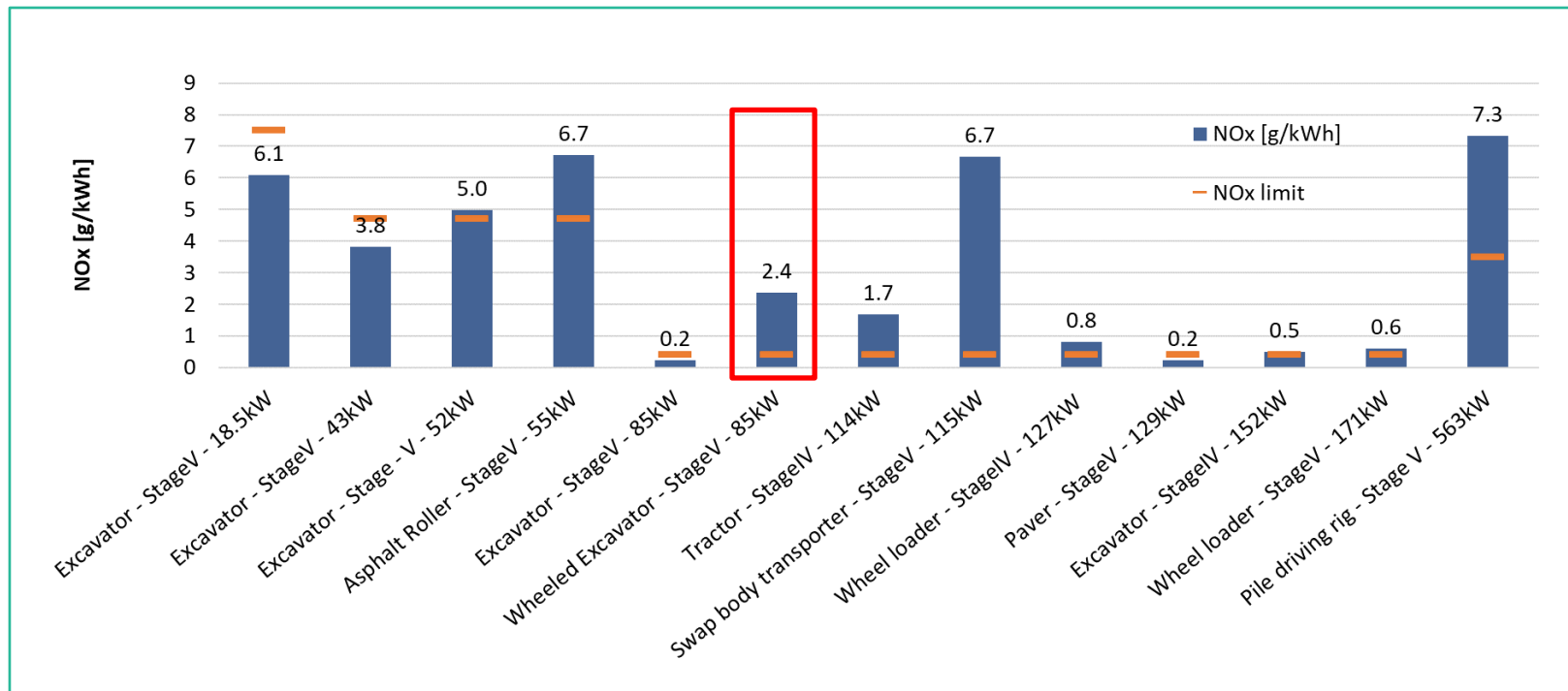
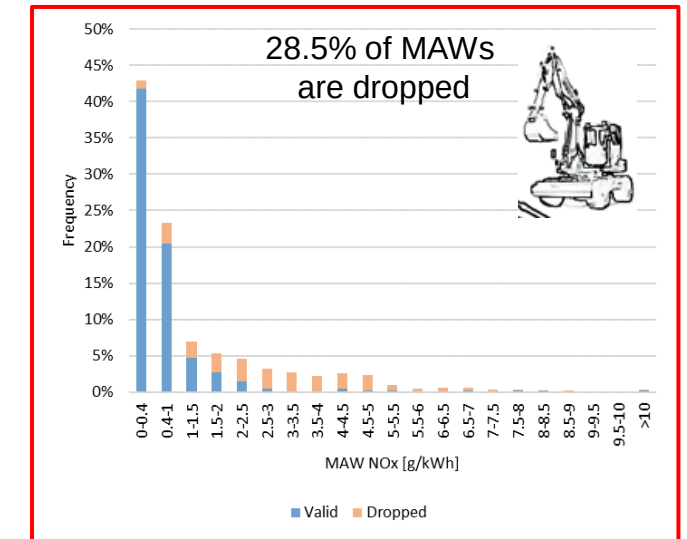


Evolution of NRMM Stage V legislation is expected

- NRMM legislation is several steps behind on-road HDV legislation
 - PEMS monitoring instead of In-Service Conformity (ISC) and Real-Driving Emissions (RDE)
 - More data exclusions
 - Higher limits than Euro 7
- Global initiatives ongoing, but with some delay compared to original timelines
 - European Commission is preparing Stage V review
 - Report of Stage V PEMS monitoring data was originally expected end of 2025
 - EC DG-JRC needed more time due to data collection and quality issues
 - Internal review of report is ongoing, presentation expected at GEME expert working group on 5 November 2026
 - US CARB [Tier 5 proposal](#) includes 2-year delay, now for MY2031+
 - China is internally reviewing NRMM Stage V proposal, publication was expected mid-2026

A large variation is observed in real-world NOx emissions

- Depending on the use case and applicable limit as tested by TNO
- NRMM regulation does not consider a substantial share of the real working conditions



MAW: Moving Average Window

R. Vermeulen, et al.; *"Real-World NOx emissions of Stage V NRMM"*, Transport and Air Pollution Conference, 2023

NRMM project demonstrated future-proof ICE concepts

- NRMM engine

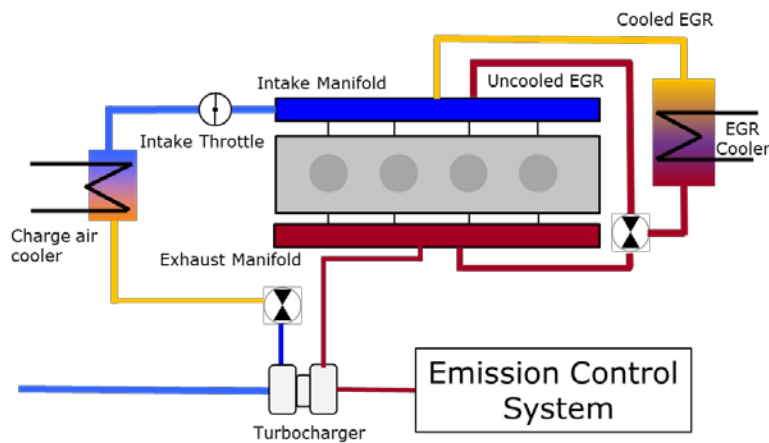
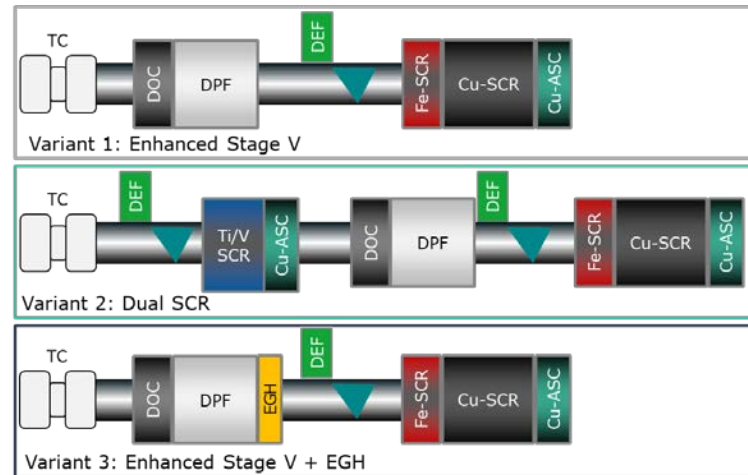
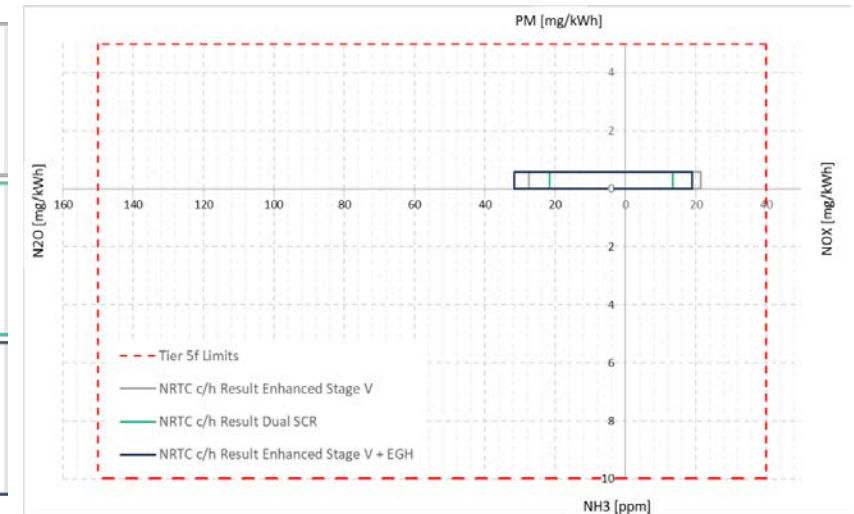
- 4l class
- ~ 100 kW rated power
- Cooled HP-EGR
 - ~ 4 g/kWh engine-out NO_x
- Uncooled EGR in low load

- Emission control systems

- Oven aged substrates (Hydrothermal)
- Modular approach to test 3 different variants

- Results

- Tier 5/Euro 7 emission level demonstrated on legislative cycles (NRTC c/h, RMC, LLC)
- Euro 7 emission level demonstrated on variety of in-use profiles



J. Demuyne, et al.; "Potential for Reduction in NRMM Real-World Emissions", 13th International engine congress, Baden-Baden, February 2026

Summary Non-Road Mobile Machinery

- Stage V evolution is expected, starting with presentation of In-Service Monitoring report by EC DG-GROW on 5 November
- A large variation is observed in real-world NOx emissions
- Emission control technologies are available to achieve **low NRMM pollutant emissions**
- Together with operation on **CO₂-neutral fuels** the ICE is a future-proof NRMM powertrain option

