



Emissol is Emission Solutions!

# *Ultra-Low NOx Solution for Mining Operations*

*Emissol LLC*



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# NOx Toxicity in Mining Environments

- **On Respiratory System**

- **Short term:** Coughing, wheezing, shortness of breath
- **Long term:** Chronic bronchitis, asthma, lung function ↓



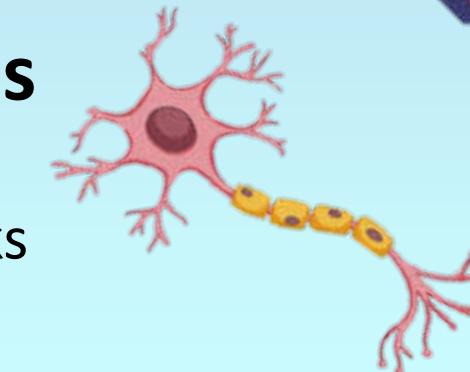
- **On Cardiovascular System**

- Blood pressure ↑, arterial inflammation
- Long-term exposure: ↑ risk of heart disease
- Pulmonary edema (likely delayed)



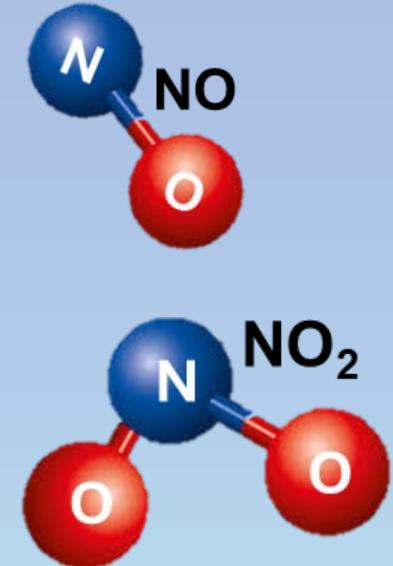
- **On Neurological Symptoms**

- Headaches, dizziness, fatigue
- ↓ alertness and ↑ accident risks



- **Others Long-term exposure**

- Spasms, swelled tissues, fatal in severe cases



- **Higher Risk Mining Conditions**

- Confined/ underground spaces
- Poor ventilation systems
- Using older diesel-powered machinery

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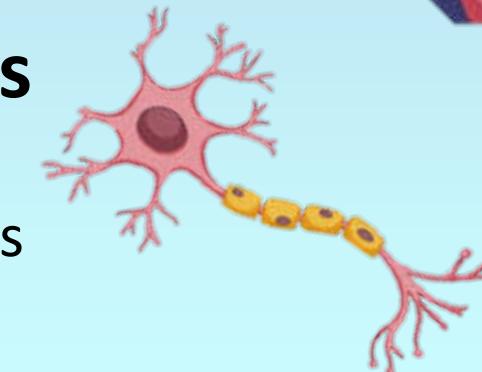
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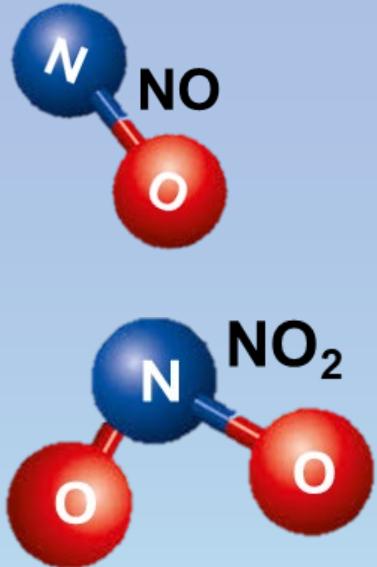


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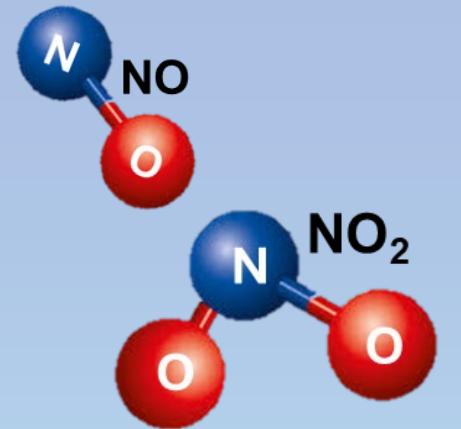
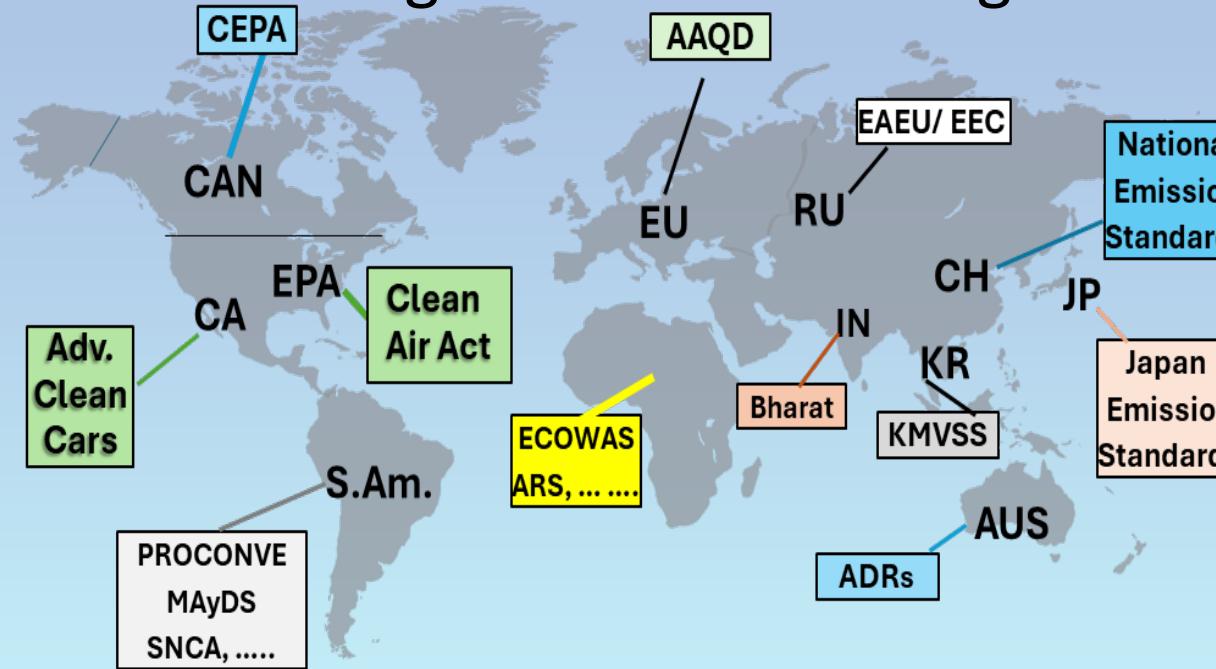


**Emissol**

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# Global NOx Rules.... Regulatory Fines

- Worldwide Regulations for Mining Machineries, Non-road, On-road, others



## Examples of Regulatory Fines

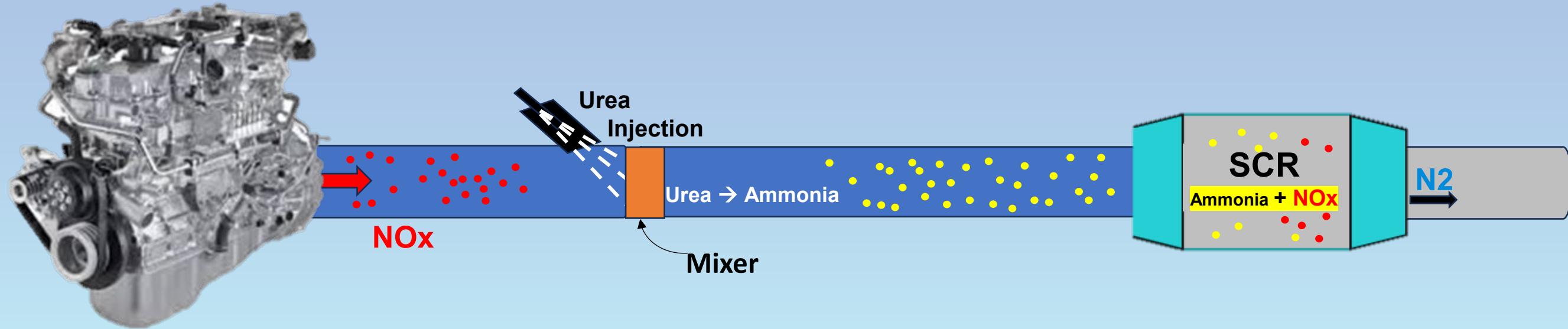
### Suppliers to Mining Industry

- Manitowoc: \$42.6 M (2024)
- Fayat Group: \$11 M (2025)
- Hyundai Heavy Ind. \$47 M (2011)
- .....

### On-road:

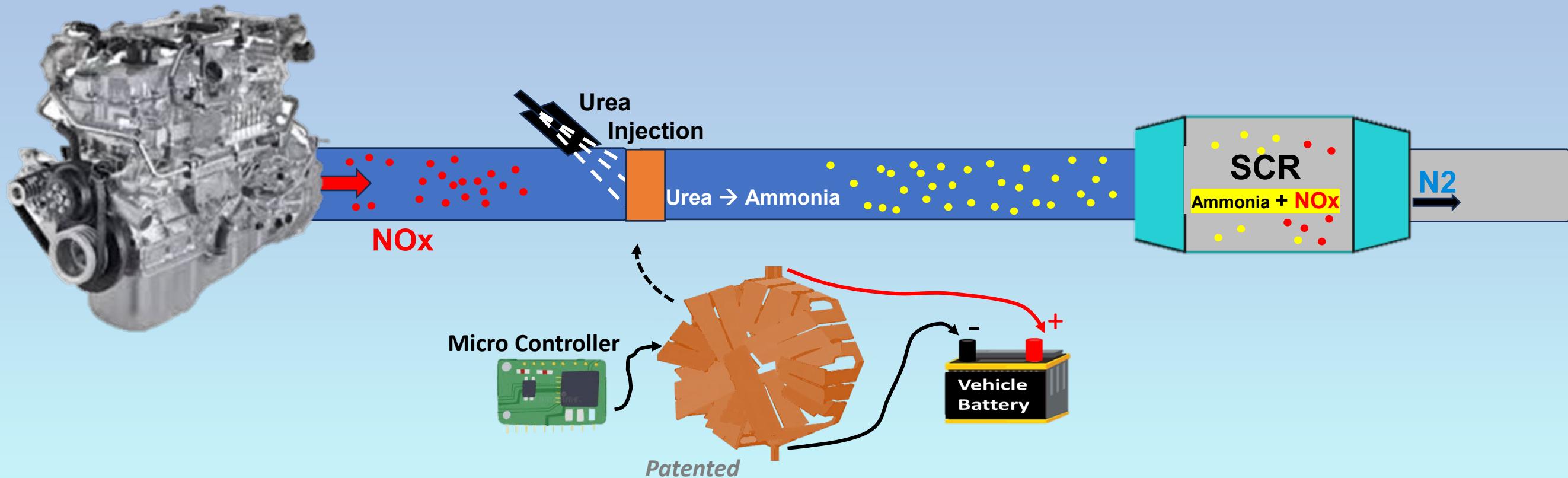
- Chrysler: \$305 M (2019)
- Cummins: \$1.6 B (2025)
- Hino: \$1.6 B (2025)
- Volkswagen: \$18 B (2016)
- BMW, Daimler \$1 B (2021)

# NOx Treatment Challenges



- **Poor NOx Reduction** *in Low-Load Cycles: Idling, Stop-n-Go, Local Driving, ...*
- **In-Use Compliance** *(regulatory fines, public image, ...)*
- **Downtime** *(due to urea deposit, ...)*
- **Warranty Costs**

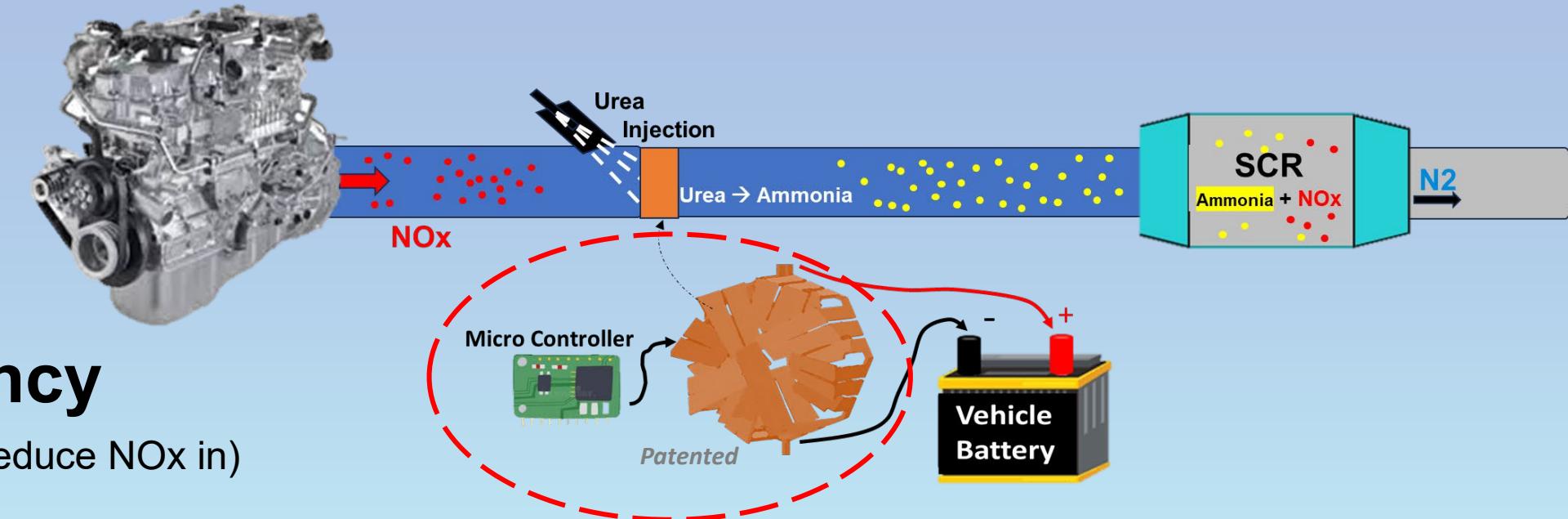
# Achieving Ultra-Low NOx with Relative Simplicity



- **Very small unit**
- **Low cost**
- **Low pressure drop**

- **Low Power** compared to other solutions
- **Durable** (withstands thermal shocks, DPF regen, ...)
- **Easy fit** (replacement for static mixer)

# Achieving Virtual Zero NOx Emission



- **Yields Peak SCR Efficiency**

- In Low-Load Cycles (hard to reduce NOx in)
- In Cold Environments

- **Enables**

- **Maximum ammonia/ HNCO (reductants)**
- **Very High Uniformity**

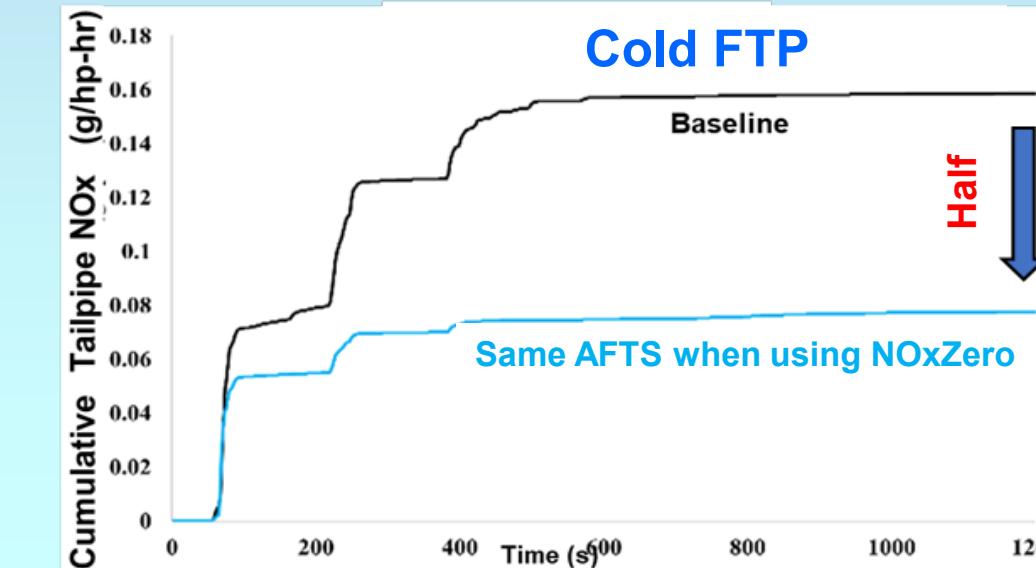
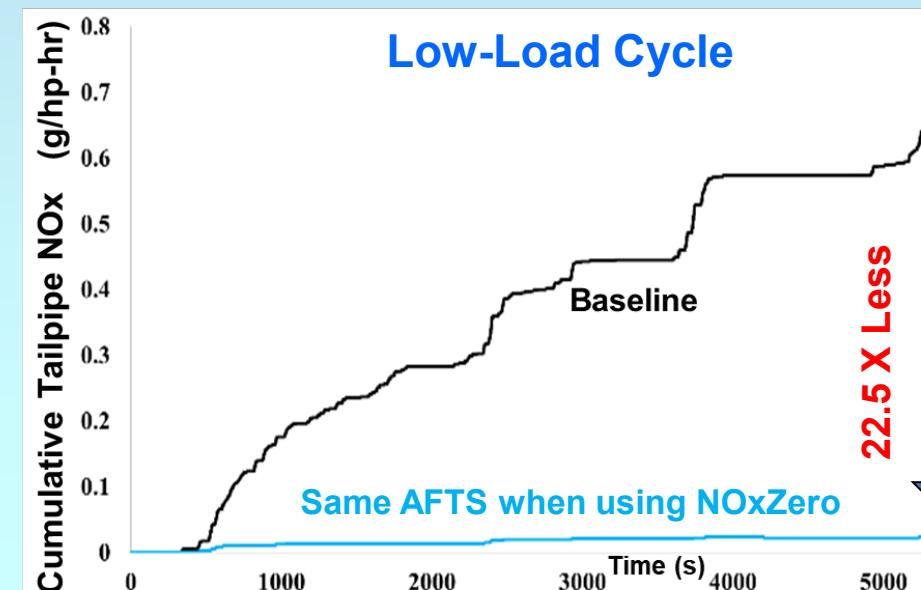
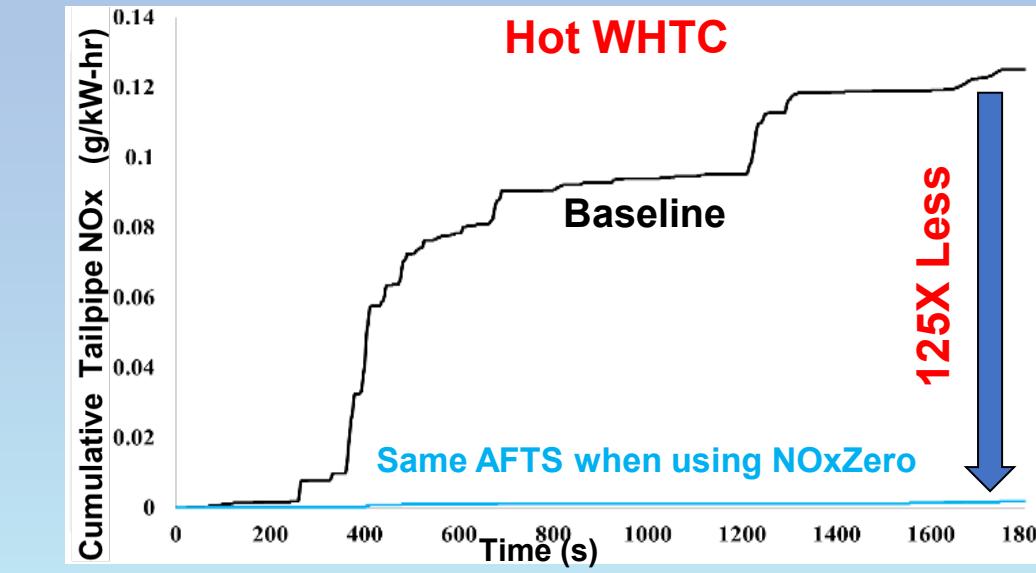
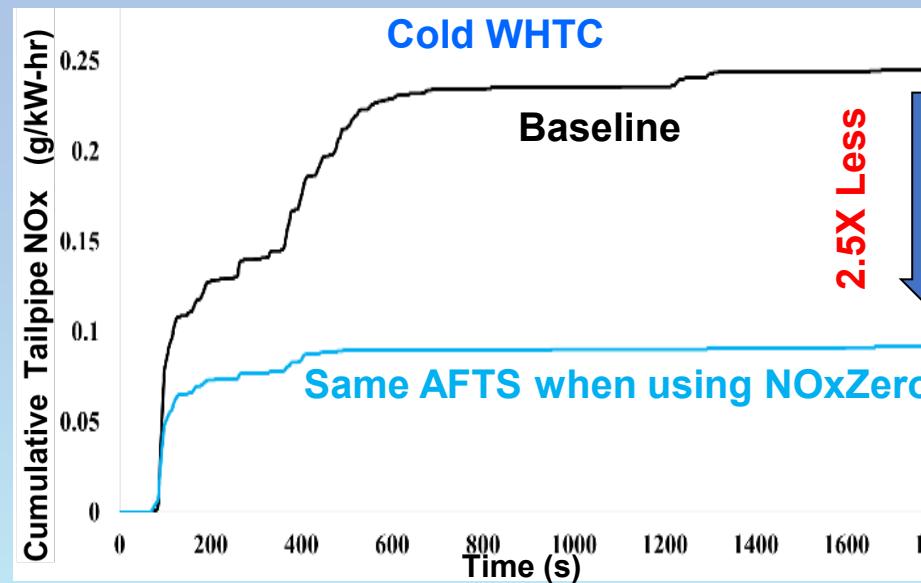
- **Additional Benefits: Enables**

Urea Injection in < 130 °C exhaust for optimal NH<sub>3</sub> storage

Urea Injection in ~ 130 - 200 °C exhaust for additional SCR efficiency

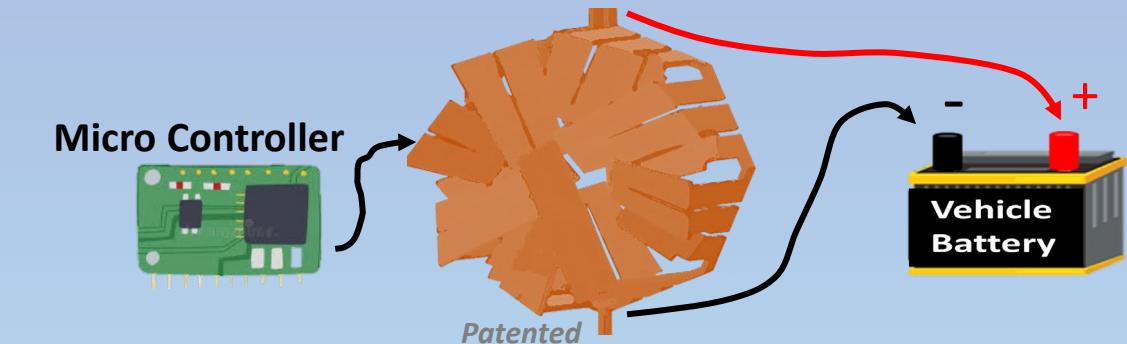
# Examples: 2.5X to 125X Lower Tailpipe NOx (compared to standard systems)

- On *fully-aged aftertreatment system*; Cummins engine.



# Examples

- Test Results
- 3- to 22-Fold *Additional* NOx Reduction\*\*



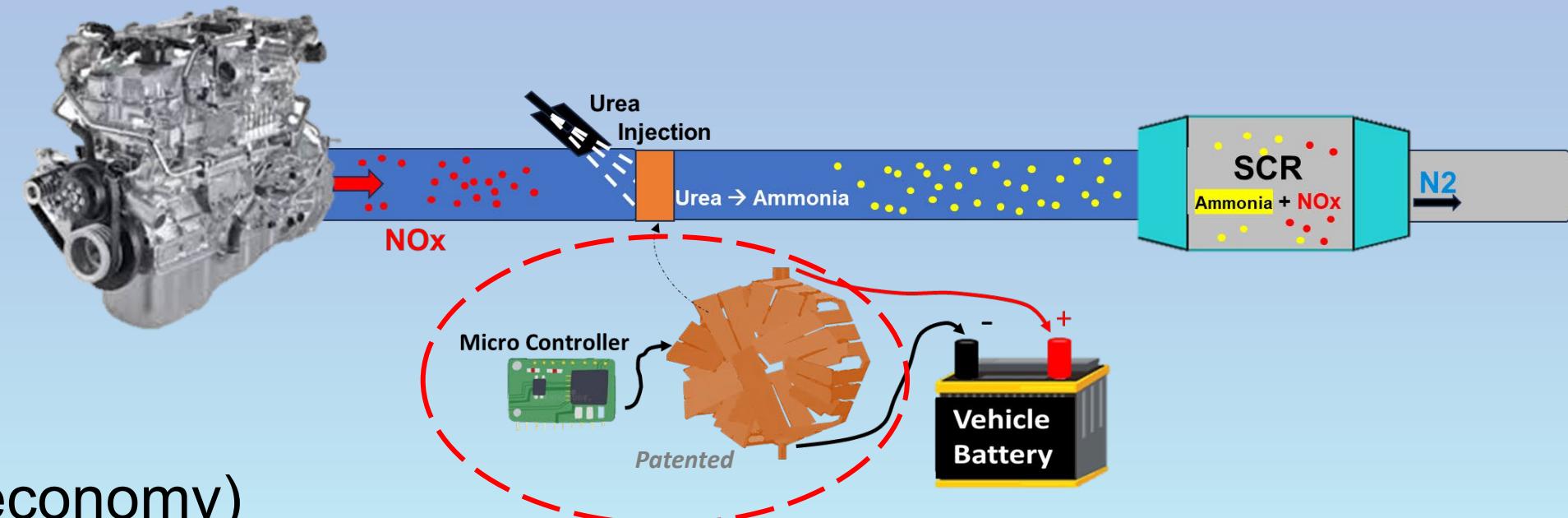
All Cycles on Fully Aged Aftertreatment System

Examples of Full Cycles	Tailpipe NOx WITHOUT NOxZero™ (g/hp-hr)	Tailpipe NOx WITH NOxZero™ (g/hp-hr)	Additional Reduction
FTP Cycle	0.06	0.018	3 X ↓
Low-Load Cycle	0.716	0.032	22 X ↓
WHTC Cycle (in g/kw-hr)	0.142	0.014	10 X ↓

Looking for Mining/ Non-Road Demonstration Partner  
for: NRTC, Non-Road Steady Cycle (NRSC), Other Cycles

\*\* Frontiers | Meeting future NOX emission regulations by adding an electrically heated mixer ([frontiersin.org](http://frontiersin.org))

# Next: Fuel savings with NOxZero™



- **Fuel savings** (fuel economy)
  - **Lower CO<sub>2</sub>**  
(via higher engine-out NOx strategy)
- **with AI for ~ 0 ppm tailpipe NOx**  
(team formed)

# For Global Powertrains

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- NOxZero works with all Diesel engine utilizing SCR
- Also retrofit



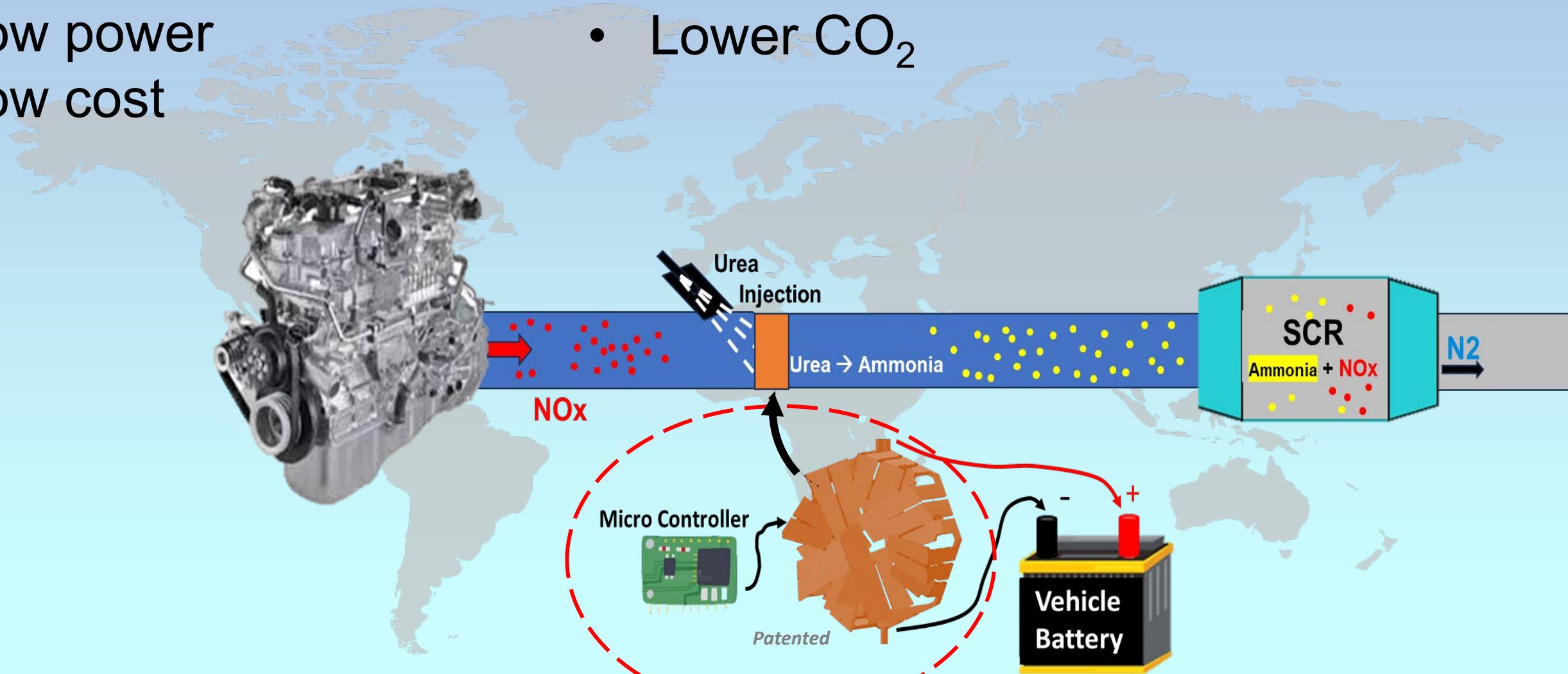
Data Centers



# Summary

- NOxZero™ : Novel solution for Ultra-Low NOx emission
- Low-effort packaging
- Low power
- Low cost

- Lower fuel consumption
- Lower CO<sub>2</sub>



# Awards: US, EU & Global

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**SAE Create the Future**  
(Finalist, global contest 2025)



**SAE Johnson Award**  
(2024)



**R&D-100 Finalist**  
(2022)



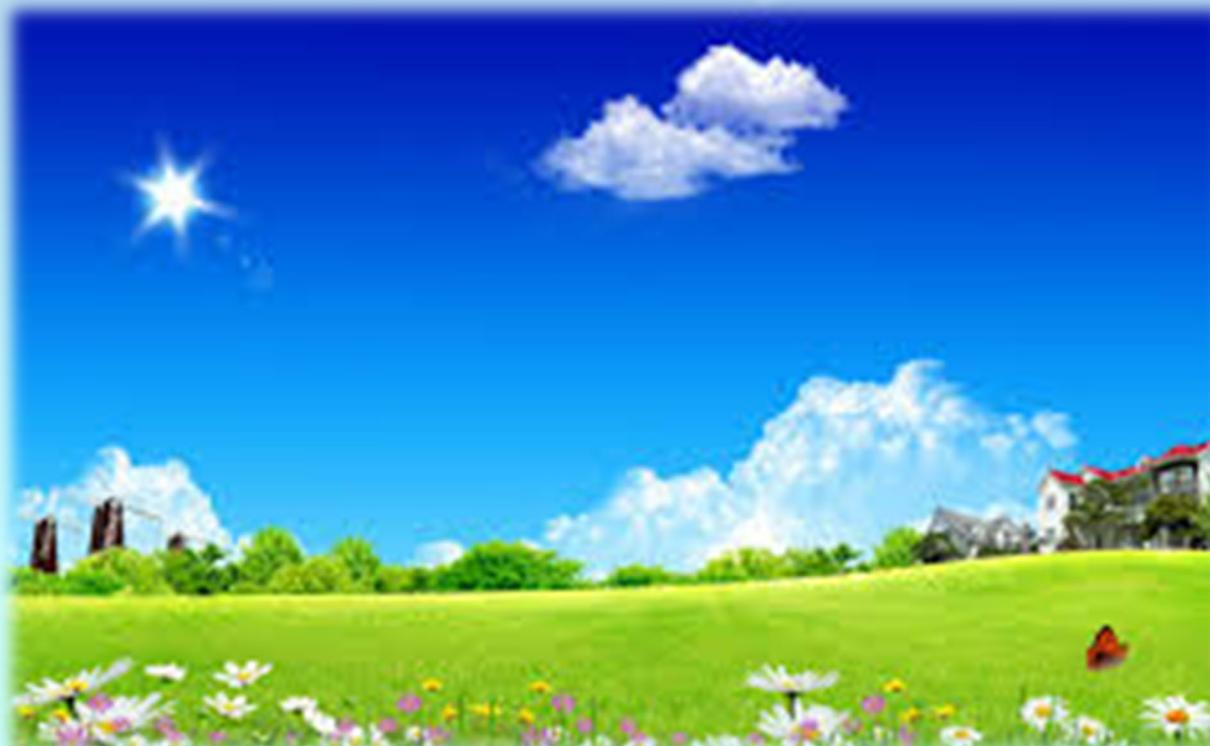
**German Innovation Award**  
(2023)



**Featured CLEPA Innovation (2025)**

*European Association of Automotive Suppliers*

# For Cleaner Air!



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# Backup slides