

# WHITE PAPER: Meeting Tighter Emissions Limits While Improving Diesel Engine Efficiency

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## Summary

New environmental legislation has created an engineering challenge for heavy-duty diesel engines. CO<sub>2</sub> and NO<sub>x</sub> emissions must fall below stricter standards; at the same time greater engine efficiency has resulted in a corresponding loss of exhaust gas temperature, leading to lower catalytic activity. This is particularly concerning when it comes to NO<sub>x</sub> emissions for Cold Start and Low Load Cycles, as there is a lot of thermal inertia in the aftertreatment system.

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Meeting Tighter Emissions Limits While Improving Diesel Engine Efficiency

New environmental legislation has created an engineering challenge for heavy-duty diesel engines. CO<sub>2</sub> and NO<sub>x</sub> emissions must fall below stricter standards; at the same time, greater engine efficiency has resulted in a corresponding loss of exhaust gas temperature, leading to lower catalytic activity. This is particularly concerning when it comes to NO<sub>x</sub> emissions for Cold Start and Low Load Cycles, as there is a lot of thermal inertia in the aftertreatment system.

Many of the solutions put forward to meet these stricter standards are engine-based. While they have been important contributions, it might be that we are reaching the limit of what these can do in terms of NO<sub>x</sub> emissions reduction. To achieve the newer, stricter standards, automobiles and trucks will need to look at other elements of the system—specifically, adding heat to exhaust to increase catalytic activity.

Such an advanced heating strategy has already been shown to be the most efficient means of meeting these NO<sub>x</sub> emissions standards. In fact, a small heater placed at the intake of the aftertreatment system enables its rapid and efficient heating, even during cold start and low load operating conditions. Having a practical means to power and control such a heater has been a barrier for implementation, however.

More recent testing has shown that a small heating element, using only conventional alternator or battery power, can be effectively used to heat the exhaust and meet emissions standards in vehicles typically operated in a city (road sweeper and city bus). Integrating these heaters into new designs might be the final piece of the puzzle in bringing diesel engines into compliance with the current laws—and an innovative way to make them more efficient as well.

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