



## CASE STUDY

## Paradigm of New York: Reactor Performance Evaluation

Paradigm of New York, LLC (Paradigm) is a Rochester, NY based company that designs and manufactures control systems, targeting improvements in operating efficiency and emissions for power generation systems. Among other benefits, Paradigm's new "Reactor" technology is designed to reduce emission constituents from engines and power plants.

### Challenge

Paradigm's market research indicates that the US currently uses over 12 million medium & heavy-duty diesel engines, comprising a large percentage of power plants used for the transportation and power generation industries. The global market for diesel engines is three times that of the US, offering Paradigm the opportunity to have a significant impact on global emissions and fuel savings (fuel efficiency was not investigated by RIT). Paradigm requested NYSP2I at the Rochester Institute of Technology (RIT) to independently quantify their system's benefits for emissions reduction as applied to diesel engines and power generation.



The goal of this project was to evaluate the performance of Paradigm's "Reactor" in the exhaust stream of a medium duty diesel engine by measuring exhaust gas emissions with and without the reactor present.

### Solution

Under the GTAC program, NYSP2I applied Paradigm's V-4 Reactor to the exhaust system of a medium duty Cummins™ ISC-240 diesel engine in RIT's engine dynamometer lab. Measurements of PM, NO, NO<sub>2</sub>, CO and O<sub>2</sub> were made over two test sequences, including emissions sampling with and without the "Reactor" in place. Each test sequence consisted of five load conditions to simulate the operation of a diesel power plant. Analysis of Variance (ANOVA) was used to determine the magnitude and significance of the results.

### Results

Over the two test sequences on RIT's engine dynamometer, the Paradigm V-4 "Reactor" demonstrated statistically significant particulate matter (PM) reductions of 42.6% and 38.3% across a range of test conditions, as compared to the baseline system without the reactor in place.

- Individual measurements at the 1800 RPM, 450 lb\*ft test point showed changes in particulate matter ranging from a 78% decrease to a 15% increase
- No significant changes in other exhaust constituents (NO, NO<sub>2</sub>, CO, O<sub>2</sub>) were detected
- Paradigm is forecasting up to 73 NY State jobs to be created over the next three years to support this system's manufacturing and commercialization

### Testimonial

*"Teaming with NYSP2I under the GTAC program enabled an independent performance evaluation of our new "reactor", designed to reduce pollutants in exhaust emissions for diesel engine applications. NYSP2I used an engine dynamometer and applied statistical analysis to measure changes in PM and other gases. The collaboration with NYSP2I proved very successful and will greatly assist Paradigm in further product optimization and commercialization. We sincerely appreciate this support and are forecasting the creation of 73 jobs over the next 3 years as a result of this team effort."*

- John Erbland, CEO, Paradigm of NY, LLC.

### CHALLENGE

- Evaluate the performance of Paradigm's emission reducing "Reactor" by measuring exhaust gas emissions with & without the reactor present

### SOLUTION

- NYSP2I measured particulate matter (PM), NO, NO<sub>2</sub>, CO & O<sub>2</sub> emissions with & without the "Reactor"

### RESULTS

- Paradigm's V-4 reactor reduced particulate matter (42.6% & 38.3%) in strategically relevant engine testing
- No significant changes in exhaust (NO, NO<sub>2</sub>, CO, O<sub>2</sub>)

## NYSP2I PARTNERS



10 Regional Technology Development Centers

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