



Purify Fuel Solution Improves Hydraulic Fracking Customer's Performance up to 8%

While Reducing Emissions for a Healthier Workplace & Environment

Background Information

The customer evaluated in this case study is a \$2B Oil Field Services company specializing in hydraulic fracturing or "fracking." This customer is one of the most profitable companies in the fracking space due to its strong commitment to shareholder value and worker retention. The company consumes over 100 million gallons of diesel per year, which represents one of its biggest operating costs. **The goal of our project is to improve fuel efficiency while reducing carbon monoxide (CO) and oxides of nitrogen (NOx) to achieve a safer workplace and healthier air for the local community.**

Engine & Workload Analysis

Although the drilling rigs capable of horizontal drilling are quite impressive, the heavy work on the pad is performed by the pumping trucks pictured above. They insert fracking fluid into the drill holes and remove the initial oil and/or gas to get the production flowing. This site utilized pumping trucks with 50-liter Cummins engines capable of 2400 horsepower. The test evaluates four relatively new units with 12,000 to 20,000 hours of operation. In workload analysis we estimated that these units spent a **considerable amount of time operating between 60% and 70% of maximum capacity, with short periods in excess of 90% of maximum engine load.** These high loads put extreme stress on the equipment, resulting in incomplete combustion which creates black smoke.

Purify’s Custom Configured Solution

Purify Fuel patented nanO₂ Combustion Catalyst leverages nanotechnology-driven governor with a cetane improver and detergent and lubricity agents to achieve a more complete combustion of diesel fuel to help our customers **save money, increase engine power and reduce emissions**. These agents work together to initiate combustion sooner and then donate billions of molecules of oxygen in the final stage of combustion to burn a higher percentage of the fuel during the power stroke while protecting the heavy-duty engine. This customer was purchasing “pipeline” ultra-low sulfur diesel for use in large, high speed engines operating at heavy workloads. We created a custom 750:1 concentrated solution designed to improve fuel lubricity by 40%, increase cetane number by 6, and carefully balance the oxidation catalyst to maximize fuel efficiency without increasing NOx.

Proof of Performance Testing Platform

Purify Fuel has developed an automated Proof of Performance (PoP) platform that leverages technologies including remotely monitored fuel flow meters, temperature gauges and amp meters to provide laboratory-class data in real-world work environments. In previous trials, this technology allowed us to calculate the grams of fuel consumed per kilowatt hour of work performed. In addition to calculating fuel consumption by gram, several new components were added to provide RPM data as well as pump pressure. This allowed us to remotely calculate grams of fuel consumed per hydraulic horsepower hour of work performed. In addition, combustion emission tests were performed over the course of the program to measure NOx, CO and particulate matter (unburned hydrocarbons) in the exhaust.

Chemically Improved Fuel Consumption

Based on an analysis of the POP data, Purify Fuel was able to demonstrate to both the local operating teams and corporate management savings of 5.5% to 10.1%. As the chart depicts, fuel savings are sensitive to engine workloads. Overall, the chemically-improved energy harvest averaged 6.2%.

Gear	RPM	Raw Fuel	Treated	Diff	Overall
1	1600	14.85	13.32	10.3%	10.1%
	1900	12.80	11.54	9.9%	
2	1600	10.57	9.80	7.3%	7.8%
	1900	9.37	8.58	8.4%	
3	1600	7.98	7.50	6.0%	5.5%
	1900	6.83	6.51	4.8%	
Overall		10.27	9.64	6.2%	6.2%

Increased Power Boosts Mechanical Output

After 250,000 pump hours of operation, the customer performed an audit and believes that the extra power generated by the nanO₂ Combustion Catalyst allows them to operate at a higher gear more often—providing them with an additional 2% to 3% of fuel savings.

Field Test	Cummins, 4 Pumps		
	Pre	Post	Change
Temperature (F)	574	378	-34%
Oxygen (%)	9.5%	15.7%	65%
CO (PPM)	332	144	-57%
UHC (g/hphr)	0.11	0.06	-45%
NOX (PPM)	303	142	-53%

Harmful Emissions Reduce 45% to 57%

The initial test utilizing a handheld portable emissions tester showed reductions in CO and NOx of 57% and 53%. It also indicated a total elimination of unburned hydrocarbons. Since that is not possible, we have substituted UT lab data in the chart and are running a new test with a digital opacity meter. Overall, the customer is happy with the visual elimination of black smoke and 50%+ reduction in harmful emissions.

Potential Annual Savings in Excess of \$12 Million US

Our customer consumed 101 million gallons of fuel in 2018. The cost of fuel is budgeted at an average cost of \$2.50/gallon. Factoring out anticipated growth in 2019, their fuel expense would be about a quarter-billion dollars (US\$252M). If we only consider the 6.2% fuel savings measured by our scientifically-proven POP technology, the gross savings will be \$15.6M. The full-year cost for the nanO₂ Combustion Catalyst is \$8M, allowing the customer to save more than \$7.5M this year.

If we include the customer’s own internal audit results that found the equipment could be run more often at a higher gear to save more fuel, then the savings could increase more than 8% to drive \$12.5M to the bottom line.

Annualized Cost Savings (US\$)

Gallons - US\$	Chemical Only	+ Mechanical
Annual Consumption	101,000,000	101,000,000
Annual Fuel Cost	\$252,000,000	\$252,000,000
Chemical-Related Fuel Savings	6.2%	6.2%
Mechanical-Related Fuel Savings	N/A	2.0%
Gross Savings	\$15,655,000	\$20,705,000
NanO ₂ Product Cost	\$8,080,000	\$8,080,000
Net Cost Savings	\$7,575,000	\$12,625,000
Return on Expenditure	94%	156%

Conclusion

The Proof of Performance evaluation performed on frack pumps, before and after treating the fuel with custom-blended nanO₂ Combustion Catalyst, demonstrated a significant reduction in fuel consumption of 6.2% despite engines operating at very heavy engine workloads. The more complete combustion also caused a 57% and 53% reduction in carbon monoxide and oxides of nitrogen, along with a virtual elimination of black smoke, creating a healthier environment for the workforce and the communities near the fracking pads. The product was rolled out in early 2019 and the customer performed their own internal audit after 250,000 pump hours of operation with nanO₂ that indicated the incremental power being harvested results in equipment running at a higher gear more often, which they believe is generating an additional 2% to 3% in cost-savings. Purify Fuel continues to monitor fuel savings and emissions data to improve the accuracy of our analysis and will continue to update all case studies on our website.

About Purify Fuel



Purify Fuel is a greener energy company that uses its patented nanO₂ Combustion Catalysts® to save money, increase power and reduce emissions without the need to modify engines or replace current fleets. Purify Fuel believes nanO₂ is an important transition technology that should be implemented in every diesel engine in operation to immediately conserve our precious resources while saving money.

Purify Fuel provides solutions to very large consumers of diesel fuel in the Fracking, Mining, and Rail markets in 2019. We are working to expand capacity to help customers in Power Generation, Marine and Military Markets by 2020.