Evaluating the Efficiency of Diesel Injector & DPF Flush and Diesel Kleen +Cetane Boost on Fuel Economy and Exhaust Aftertreatment Efficiency in Modern Light-Duty Diesel Fleet Vehicles

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EVALUATING THE EFFICIENCY OF DIESEL INJECTOR & DPF FLUSH AND DIESEL KLEEN + CETANE BOOST ON FUEL ECONOMY AND EXHAUST AFTERTREATMENT EFFICIENCY IN MODERN LIGHT-DUTY DIESEL FLEET VEHICLES

Abstract

Modern light-duty diesel platforms equipped with High Pressure Common Rail (HPCR) injection and integrated exhaust aftertreatment systems are susceptible to internal and external injector deposit formation. These deposits impair atomization, leading to incomplete combustion, increased soot and NO_x generation, frequent active Diesel Particulate Filter (DPF) regenerations, and excessive Diesel Exhaust Fluid (DEF) consumption.

A field trial was conducted across two 2025 and two 2026 GMC Sierra 1500 pickup trucks, equipped with 3.0L Duramax turbo-diesel engines, over a consecutive 20-tank operating sequence. Vehicles established a 10-tank baseline on untreated commercial pump diesel, followed by a 10-tank treatment phase consisting of a one-tank restorative cleanup using Power Service Diesel Injector & DPF Flush (Tank 11) and nine subsequent maintenance tanks treated with Power Service Diesel Kleen +Cetane Boost (Tanks 12–20).

Following the dual additive treatment, fleet-average fuel economy improved by **11.53%** (increasing from 24.81 MPG to 27.63 MPG), with individual truck improvements ranging between **+4.29% and +16.35%.** Additionally, fleet-average DEF efficiency improved by **60.20%** (increasing from 778.73 miles per gallon of DEF to 1,197.96 miles per gallon of DEF). This improved efficiency allows the range of a standard 5.4 gallon DEF tank to increase from approximately 2,000 miles to well over 4,000 miles. These results demonstrate that combining a targeted restorative detergent flush with continuous performance improving maintenance chemistry restores spray patterns, optimizes combustion efficiency, and meaningfully reduces DEF consumption.

Materials and Methods

TEST VEHICLES

The evaluation utilized four commercial fleet pickup trucks:

- **Make/Model:** 2025 and 2026 GMC Sierra 1500
- **Powertrain:** 3.0L Inline-6 Turbo-Diesel Duramax
- **Fuel Injection System:** High Pressure Common Rail (HPCR) with multi-hole solenoid injectors
- **Aftertreatment System:** Diesel Oxidation Catalyst (DOC), Diesel Particulate Filter (DPF), and Selective Catalytic Reduction (SCR) with DEF injection
- **Operating Conditions:** Vehicles operated in approximately 60% highway driving and 40% local/urban service with typical payload conditions.
- **Baseline Starting Odometers:**
  - Unit 1: 4,680 miles
  - Unit 2: 44,502 miles
  - Unit 3: 4,531 miles
  - Unit 4: 32,831 miles

DIESEL FUEL ADDITIVES

1. Power Service Diesel Injector & DPF Flush used at a 1:500 treatment ratio.
2. Power Service Diesel Kleen +Cetane Boost used at a 1:500 treatment ratio.

TEST PROTOCOL

The field study evaluated 20 consecutive fuel fills per vehicle under normal operational duty cycles:

- **Phase I — Untreated Baseline (Tanks 1–10):** All units were fueled with unadditized, commercially available #2 ultra low sulfur diesel (ULSD).
- **Phase II — Diesel Injector & DPF Flush (Tank 11):** Each vehicle was treated with one bottle of Power Service Diesel Injector & DPF Flush added to the tank prior to fueling at a 1:500 treatment ratio.
- **Phase III — Diesel Kleen +Cetane Boost (Tanks 12–20):** Vehicles received continuous treatment of Power Service Diesel Kleen +Cetane Boost for the final nine consecutive tanks at a 1:500 treatment ratio.

DATA ACQUISITION AND METRICS

For each fuel event, drivers recorded starting odometer mileage, ending odometer mileage, and fuel volume delivered (gallons). DEF was filled to capacity at the start and end of both the baseline phase (Tanks 1–10) and the treated phase (Tanks 11–20), with total gallons consumed tracked over the respective distances.

Fuel economy and DEF efficiency were calculated as follows:

$$\text{Fuel MPG} = \frac{\Delta \text{ Miles}}{\text{Gallons of Diesel Consumed}}$$

$$\text{DEF MPG} = \frac{\Delta \text{ Miles}}{\text{Gallons of DEF Consumed}}$$

$$\text{Improvement (\%)} = \left(\frac{\text{Treated Metric} - \text{Baseline Metric}}{\text{Baseline Metric}} \right) \times 100$$

Results and Discussion

FUEL ECONOMY

Baseline fleet fuel economy averaged 24.81 MPG across the initial 10 tanks. Following the restorative cleanup in Tank 11 and subsequent Diesel Kleen maintenance, fleet-average fuel economy increased to 27.63 MPG, representing a net improvement of **+11.53% (+2.81MPG).**

SUMMARY OF FUEL ECONOMY PERFORMANCE

Vehicle ID	Starting Mileage	Baseline Fuel MPG (Tanks 1–10)	Treated Fuel MPG (Tanks 11–20)	Δ MPG	Improvement (%)
Unit 1	4,680 mi	21.67	24.35	+2.68	**+12.33%**
Unit 2	44,502 mi	24.67	28.71	+4.04	**+16.35%**
Unit 3	4,531 mi	25.65	29.01	+3.36	**+13.13%**
Unit 4	32,831 mi	27.26	28.43	+1.17	**+4.29%**
Fleet Average	—	**24.81**	**27.63**	**+2.82**	**+11.53%**

Unit 2 (starting at 44,502 miles) exhibited the largest individual fuel economy gain at **+16.35%.** Higher-mileage platforms accumulate greater deposit burdens over extended duty cycles, resulting in more pronounced recovery when treated with Diesel Injector & DPF Flush. Units

1 and 3, despite beginning the evaluation with under 5,000 miles, also realized double-digit improvements (+12.33% and +13.13%, respectively), demonstrating that injector fouling and spray pattern disruption occur early in the life cycle of modern HPCR platforms operating on unadditized commercial fuel.

EXHAUST AFTERTREATMENT & DEF CONSUMPTION

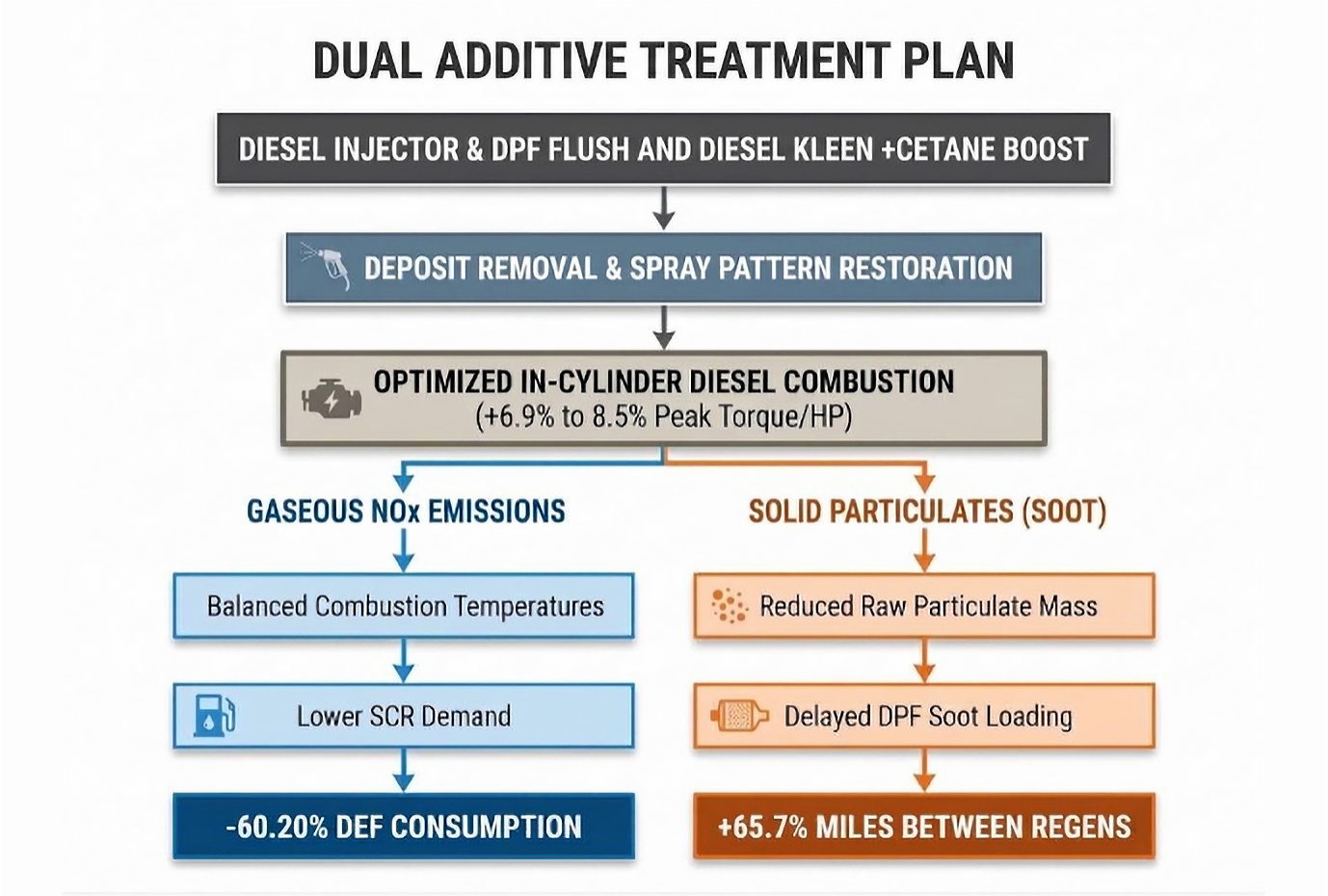
The reduction in Diesel Exhaust Fluid consumption was the most notable outcome of the trial. Across the four units, DEF efficiency increased by an average of **+60.20%**, extending DEF range from 778.73 miles per gallon of DEF to 1,197.96 miles per gallon of DEF. This effectively increased the range of the DEF tank, allowing for less time spent refilling the tank.

SUMMARY OF DEF CONSUMPTION PERFORMANCE

Vehicle ID	Baseline Distance & DEF Volume	Baseline DEF MPG	Treated Distance & DEF Volume	Treated DEF MPG	DEF Efficiency Gain (%)
Unit 1	4,450 mi / 7.302 gal	609.42	4,982 mi / 4.512 gal	1,104.17	**+81.18%**
Unit 2	5,189 mi / 7.500 gal	691.87	5,417 mi / 5.000 gal	1,083.40	**+56.59%**
Unit 3	4,818 mi / 7.400 gal	651.08	5,845 mi / 5.000 gal	1,169.00	**+79.55%**
Unit 4	5,586 mi / 4.805 gal	1,162.54	5,975 mi / 4.163 gal	1,435.26	**+23.46%**
Fleet Average	—	**778.73**	—	**1,197.96**	**+60.20%**

MECHANISM OF ACTION

The substantial drop in DEF consumption and recovery of fuel economy can be attributed to three mechanical and chemical mechanisms:



1. **Restoration of Spray Patterns:** High pressure common rail injectors require tight cone angles and uniform fuel atomization. Deposit buildup distorts these patterns, creating fuel-rich pockets that increase soot and unburned hydrocarbons, alongside thermal hotspots that elevate NO_x emissions. Eliminating internal carboxylates and external nozzle coking during Tank 11 restored factory spray geometry, returning in-cylinder combustion to designed operating parameters.

2. **Mitigation of Active DPF Regenerations:** In the 3.0L Duramax, soot accumulation in the DPF triggers late-combustion post-injections of raw fuel to elevate catalytic exhaust temperatures. Improving primary combustion efficiency minimizes the rate of soot accumulation, lengthening passive intervals and significantly cutting post-injection fuel usage.

3. **SCR Dosing Reduction:** Because NO_x generation is a direct function of combustion stability, uniform spray patterns enabled by restored injection timing and improved cetane numbers lower NO_x. As a result, the SCR system requires significantly less DEF to keep tailpipe emissions within compliance.

Conclusion

1. **Dual Additive Performance:** Implementing a two-stage additive program yielded significant efficiency improvements across all four light-duty diesel pickups. Starting with a cleanup dose of Power Service Diesel Injector & DPF Flush and continuing with regular Power Service Diesel Kleen +Cetane Boost maintenance resulted in an 11.53% fuel economy improvement and a 60.20% increase in DEF range. The range of a 5.4 gallon tank of DEF increased by over 2,000 miles.
2. **Aftertreatment Life Extension:** The notable drop in DEF consumption directly correlates with lower emissions and reduced active regeneration cycles, mitigating DPF clogging, and extending aftertreatment component lifespan.
3. **Fleet Protocol Execution:** To maximize fuel savings and reduce emissions-related downtime, the following maintenance schedule is recommended for diesel fleets:
    - **Restorative Treatment:** 1 tank treated with Power Service Diesel Injector & DPF Flush monthly or as needed.
    - **Preventive Dosing:** Power Service Diesel Kleen +Cetane Boost treated at every fill-up to ensure continuous deposit prevention, lubricity protection, and consistent emissions compliance.

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Appendix: Comprehensive Field Trial Data Tables

Appendix A: Unit 1 Raw Data Log (Starting Odometer: 4,680)

FUEL ECONOMY

Phase	Tank	Starting Mileage	Ending Mileage	Gallons of Fuel	MPG Calculated
No Additives	Tank 1	4,680	5,162	20.412	23.61
	Tank 2	5,162	5,432	12.248	22.04
	Tank 3	5,432	5,863	20.562	20.96
	Tank 4	5,863	6,324	20.695	22.28
	Tank 5	6,324	6,687	19.188	18.92
	Tank 6	6,687	7,173	21.523	22.58
	Tank 7	7,173	7,624	22.499	20.05
	Tank 8	7,624	8,132	21.779	23.33
	Tank 9	8,132	8,637	23.714	21.30
	Tank 10	8,637	9,130	22.730	21.69
DIDF	Tank 11	9,130	9,608	21.926	21.80
Diesel Kleen	Tank 12	9,608	10,107	20.227	24.67
	Tank 13	10,107	10,723	23.657	26.04
	Tank 14	10,723	11,248	22.609	23.22
	Tank 15	11,248	11,676	16.818	25.45
	Tank 16	11,676	12,156	19.368	24.78
	Tank 17	12,156	12,515	16.810	21.36
	Tank 18	12,515	13,093	22.682	25.48
	Tank 19	13,093	13,621	20.365	25.93
	Tank 20	13,621	14,112	19.842	24.75

- **Average Untreated (Tanks 1–10):** 21.67 MPG
- **Average Treated (Tanks 11–20):** 24.35 MPG
- **Fuel Economy Improvement:** 12.33%

DEF USAGE

Treatment Status	Starting Mileage	Ending Mileage	Gallons of DEF	DEF MPG Calculated	DEF Improvement (%)
Untreated	4,680	9,130	7.302	609.42	—
Treated	9,130	14,112	4.512	1,104.17	**81.18%**

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Appendix B: Unit 2 Raw Data Log (Starting Odometer: 44,502)

FUEL ECONOMY

Phase	Tank	Starting Mileage	Ending Mileage	Gallons of Fuel	MPG Calculated
No Additives	Tank 1	44,502	45,000	20.760	23.99
	Tank 2	45,000	45,478	20.567	23.24
	Tank 3	45,478	45,993	20.614	24.98
	Tank 4	45,993	46,436	21.323	20.78
	Tank 5	46,436	47,003	20.988	27.02
	Tank 6	47,003	47,471	21.300	21.97
	Tank 7	47,471	48,046	22.284	25.80
	Tank 8	48,046	48,589	20.722	26.20
	Tank 9	48,589	49,126	20.739	25.89
	Tank 10	49,126	49,691	21.036	26.86
DIDF	Tank 11	49,691	50,224	22.604	23.58
Diesel Kleen	Tank 12	50,224	50,856	10.002	63.19
	Tank 13	50,856	51,113	21.382	12.02
	Tank 14	51,113	51,670	21.963	25.36
	Tank 15	51,670	52,255	21.364	27.38
	Tank 16	52,255	52,799	20.780	26.18
	Tank 17	52,799	53,344	20.824	26.17
	Tank 18	53,344	53,959	20.967	29.33
	Tank 19	53,959	54,531	20.910	27.36
	Tank 20	54,531	55,108	21.768	26.51

- **Average Untreated (Tanks 1–10):** 24.67 MPG
- **Average Treated (Tanks 11–20):** 28.71 MPG
- **Fuel Economy Improvement:** 16.35%
- **Note:** Fills 12 and 13 represent a premature pump auto-shutoff / partial fill (10.002 gal) followed by a full top-off (21.382 gal). Over the combined 889 miles and 31.384 gallons consumed, the combined interval fuel economy was 28.33 MPG, consistent with adjacent maintenance tanks.

DEF USAGE

Treatment Status	Starting Mileage	Ending Mileage	Gallons of DEF	DEF MPG Calculated	DEF Improvement (%)
Untreated	44,502	49,691	7.500	691.87	—
Treated	49,691	55,108	5.000	1,083.40	**56.59%**

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Appendix C: Unit 3 Raw Data Log (Starting Odometer: 4,531)

FUEL ECONOMY

Phase	Tank	Starting Mileage	Ending Mileage	Gallons of Fuel	MPG Calculated
No Additives	Tank 1	4,531	4,932	19.400	20.67
	Tank 2	4,932	5,346	18.900	21.90
	Tank 3	5,346	5,764	20.300	20.59
	Tank 4	5,764	6,205	21.200	20.80
	Tank 5	6,205	6,986	21.000	37.19
	Tank 6	6,986	7,534	17.900	30.61
	Tank 7	7,534	8,020	17.000	28.59
	Tank 8	8,020	8,462	14.100	31.35
	Tank 9	8,462	8,854	17.700	22.15
	Tank 10	8,854	9,349	21.900	22.60
DIDF	Tank 11	9,349	10,188	20.600	40.73
Diesel Kleen	Tank 12	10,188	11,105	19.400	47.27
	Tank 13	11,105	11,684	22.100	26.20
	Tank 14	11,684	12,226	22.400	24.20
	Tank 15	12,226	12,796	21.700	26.27
	Tank 16	12,796	13,323	21.100	24.98
	Tank 17	13,323	13,829	19.500	25.95
	Tank 18	13,829	14,320	19.700	24.92
	Tank 19	14,320	14,735	17.200	24.13
	Tank 20	14,735	15,194	18.000	25.50

- **Average Untreated (Tanks 1–10):** 25.65 MPG
- **Average Treated (Tanks 11–20):** 29.01 MPG
- **Fuel Economy Improvement:** 13.13%
- **Note:** Unit 3 operated extended continuous steady-state empty highway corridors during Tanks 11–12.

DEF USAGE

Treatment Status	Starting Mileage	Ending Mileage	Gallons of DEF	DEF MPG Calculated	DEF Improvement (%)
Untreated	4,531	9,349	7.400	651.08	—
Treated	9,349	15,194	5.000	1,169.00	**79.55%**

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Appendix D: Unit 4 Raw Data Log (Starting Odometer: 32,831)

FUEL ECONOMY

Phase	Tank	Starting Mileage	Ending Mileage	Gallons of Fuel	MPG Calculated
No Additives	Tank 1	32,831	33,399	19.727	28.79
	Tank 2	33,399	33,881	19.156	25.16
	Tank 3	33,881	34,450	21.201	26.84
	Tank 4	34,450	35,059	22.298	27.31
	Tank 5	35,059	35,493	16.724	25.95
	Tank 6	35,493	36,059	20.985	26.97
	Tank 7	36,059	36,644	20.604	28.39
	Tank 8	36,644	37,277	22.101	28.64
	Tank 9	37,277	37,822	20.291	26.86
	Tank 10	37,822	38,417	21.522	27.65
DIDF	Tank 11	38,417	38,995	21.472	26.92
Diesel Kleen	Tank 12	38,995	39,657	23.363	28.34
	Tank 13	39,657	40,257	21.158	28.36
	Tank 14	40,257	40,904	20.574	31.45
	Tank 15	40,904	41,530	20.559	30.45
	Tank 16	41,530	42,022	18.323	26.85
	Tank 17	42,022	42,596	19.945	28.78
	Tank 18	42,596	43,199	21.367	28.22
	Tank 19	43,199	43,829	22.906	27.50
	Tank 20	43,829	44,392	20.552	27.39

- **Average Untreated (Tanks 1–10):** 27.26 MPG
- **Average Treated (Tanks 11–20):** 28.43 MPG
- **Fuel Economy Improvement:** 4.29%

DEF USAGE

Treatment Status	Starting Mileage	Ending Mileage	Gallons of DEF	DEF MPG Calculated	DEF Improvement (%)
Untreated	32,831	38,417	4.805	1,162.54	—
Treated	38,417	44,392	4.163	1,435.26	**23.46%**

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ABOUT THE AUTHOR

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Jessica is the Director of Technical Services at Power Service Diesel Additives with 12 years of experience in fuel system performance and maintenance. By analyzing over 2,000 fuel samples annually, she provides unique, data-backed insights into real-world fuel quality and equipment longevity. An active member of ASTM Committee D02, she leverages her deep technical background to help fleet managers optimize fuel efficiency, reduce maintenance costs, and ensure reliability in varying regional fuel conditions.