HNO INTERNATIONAL

Testing, Data Analysis for HNOI’s Hydrogen Carbon Cleaner (HCC) Results, & Engine Component Performance on 2013 International Box Truck

THE CARBON PROBLEM

Carbon buildup in engines is a persistent challenge that adversely affects performance, fuel efficiency, and compliance with emissions standards. For fleets, the cumulative effects of these issues can significantly impact profitability, operational efficiency, and brand reputation.

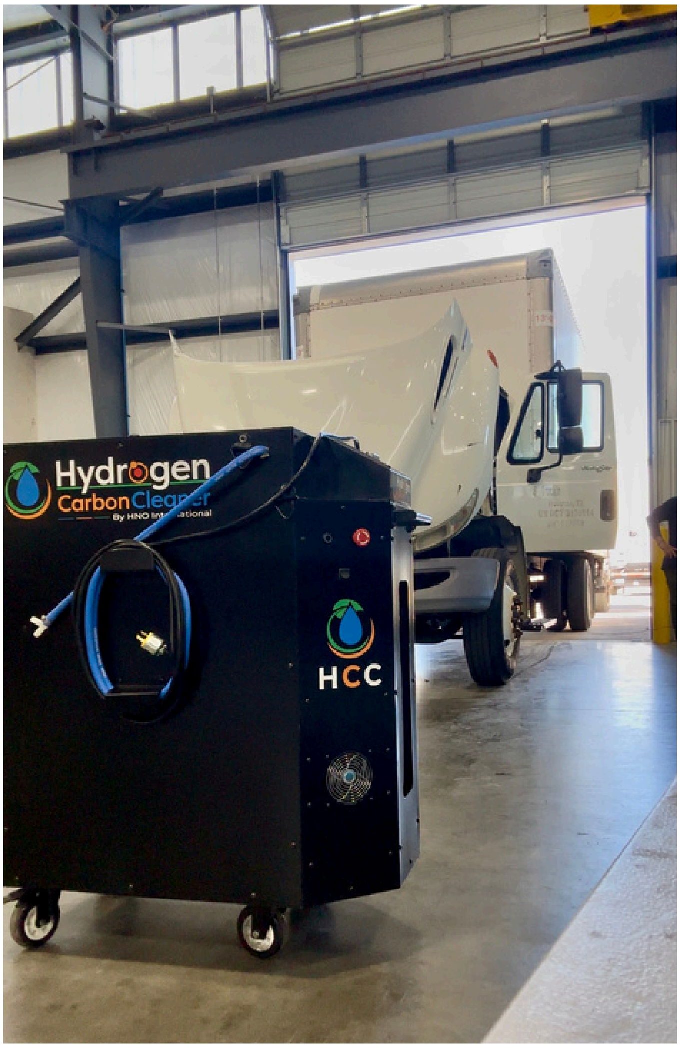
Modern engines are precision machines that rely on the efficient combustion of fuel to deliver optimal performance. However, over time, carbon deposits form on critical engine components such as intake valves, fuel injectors, and combustion chambers. These deposits are the byproduct of incomplete fuel combustion, which disrupts the engine's efficiency, and can lead to significant operational and financial consequences, especially for fleet operators.

For fleet operators, the impact of carbon buildup is particularly pronounced. Higher operating costs arise from increased fuel consumption and more frequent maintenance. Reduced vehicle reliability disrupts schedules and impacts customer satisfaction. Accelerated wear and tear shortens engine lifespans, necessitating earlier replacements, while non-compliance with emissions standards risks fines and investment capital losses. Collectively, these issues hinder operational efficiency and profitability.

TESTING & OBJECTIVE SUMMARY

Thank you for your interest in our technology!

The objective of the Hydrogen Carbon Cleaner (HCC) test was to evaluate its impact on key engine component performance parameters, including Injection Control Pressure (ICP), engine oil temperature, engine load, after-treatment hydrocarbon doser temperature, and overall fuel rate. The goal was to determine whether the HCC could enhance engine efficiency, reduce fuel consumption, improve combustion, and lower emissions to benefit fleet operators through operational efficiency and cost savings.



TESTING METHODOLGY

Date: October 24, 2024

**Equipment & Vehicle: HNOI's Hydrogen Carbon Cleaner (HCC)
2013 International Box Truck with 318,933 miles.**

Location: The test was performed at our partner's Pneumatic & Hydraulic'site in Katy, Texas.

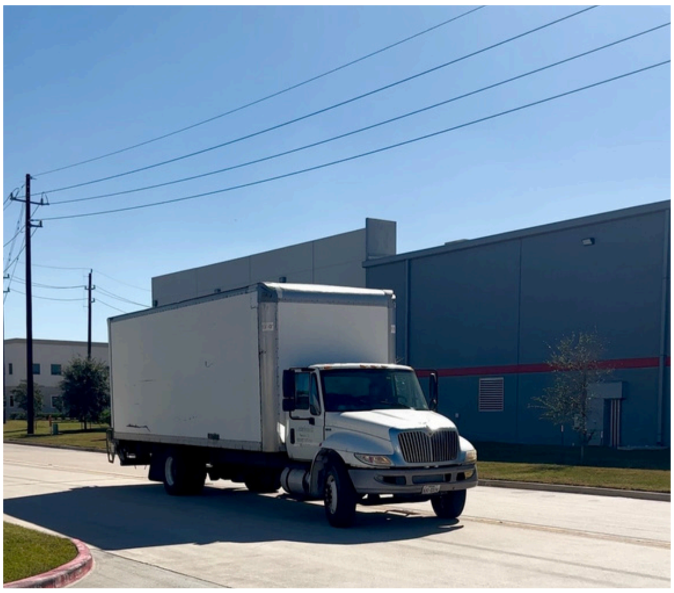
Testing Conditions: Environmental temperature was 98 degrees Fahrenheit.

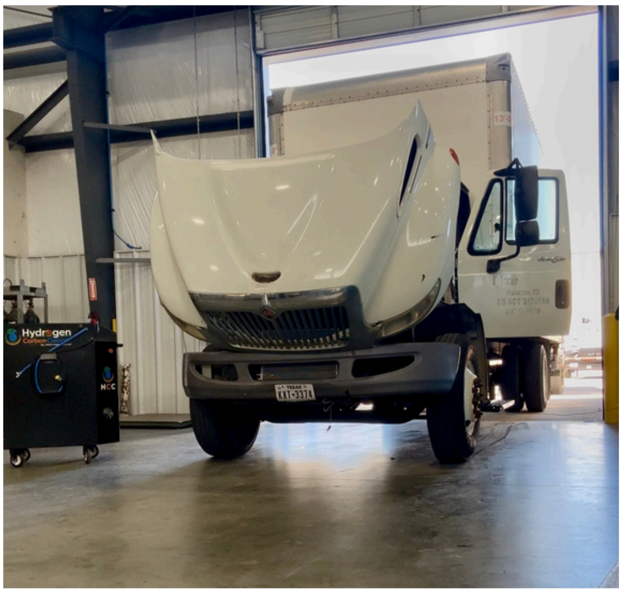
Data Collection Protocols: JPRO Commercial Vehicle Diagnostic Software

Baseline: To establish a engine component parameter baseline, the 2013 Intl. Box Truck ran at idle RPM for 30 minutes before injecting hydrogen into the engine.

HCC Hydrogen Injection: The HCC hydrogen hose was connected to the air intake of the vehicle, and injected hydrogen into the engine for 2 hours while running at idle RPM . The hydrogen output during the test was between 9-11L of hydrogen per minute.

References: E & J Fleet Services, Pneumatic & Hydraulic.





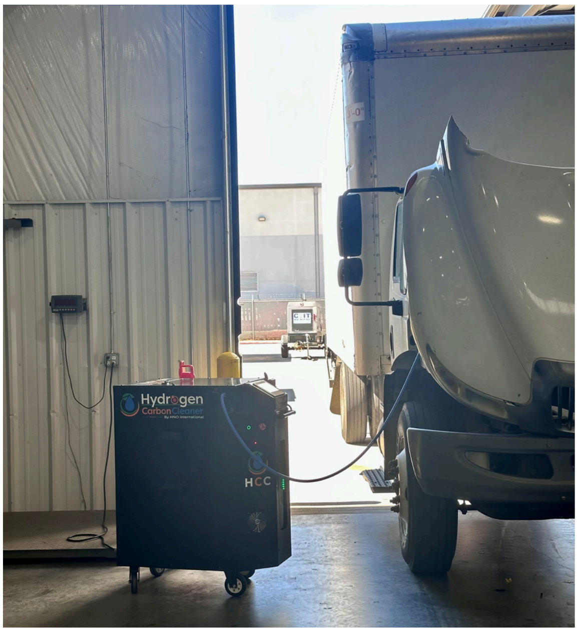
THE HCC IMPACT ON CARBON

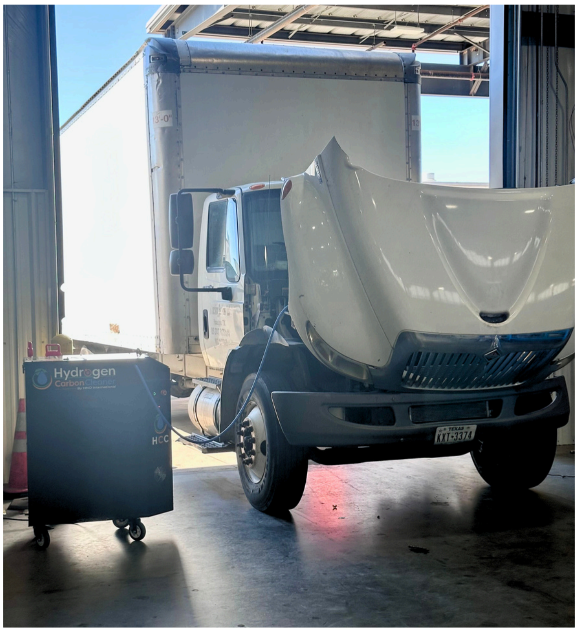
HNOI's Hydrogen Carbon Cleaner is the safest, most advanced, and most accessible hydrogen carbon cleaner system in the world.

A high impact carbon removal technology that enhances diesel, gasoline and natural gas engines using the power of clean non pressurized hydrogen.

The Hydrogen Carbon Cleaner (HCC) provides a powerful solution to these pressing challenges, consistent optimal engine performance, engine component longevity, fuel costs, and costly maintenance. By removing harmful carbon deposits, the HCC revitalizes the engine's efficiency, increases power output, and minimizes wear on critical engine components—delivering a smoother operation and significantly optimizing engine life.

For fleet operators, this means fewer breakdowns, reduced downtime, and better control over operating expenses, resulting in a healthier bottom line. Discover the HCC advantage: a cleaner, more efficient engine, reliable performance, and substantial savings—unlock the full potential of your fleet with the most advanced hydrogen carbon cleaner on the market.





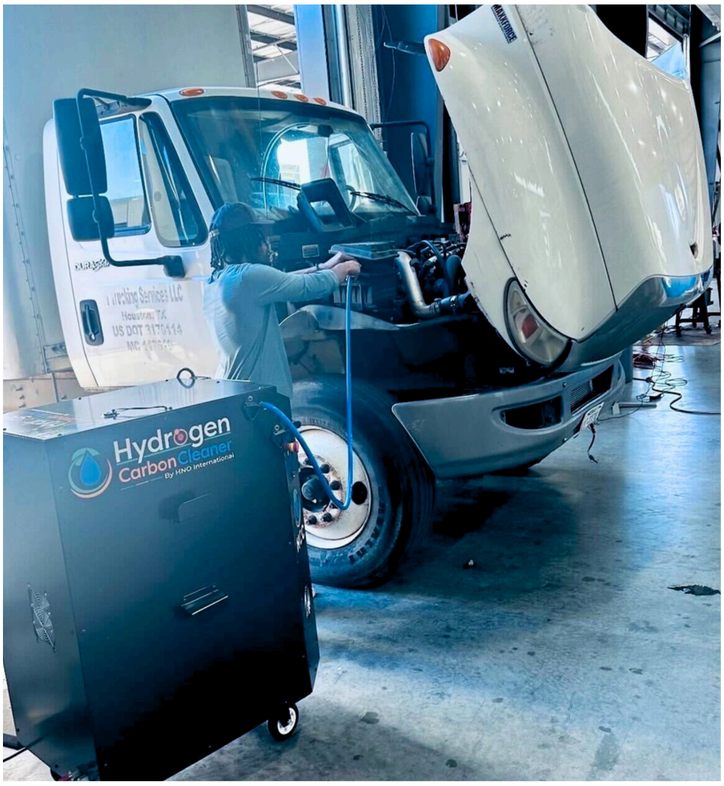
SEAMLESS OPERATION, NO DISASSEMBLY REQUIRED

Traditional methods like chemical additives, manual disassembly, and walnut blasting each have drawbacks: chemical additives can leave residues and often miss deep deposits; manual disassembly is costly and time-consuming; and walnut blasting risks abrasive damage and requires specialized equipment. Hydrogen carbon cleaning, is non-invasive, efficient, and eco-friendly, thoroughly clearing deposits without residues or risks, boosting performance, and reducing downtime in a way traditional methods can't match.

The HCC is a simple four step cleaning process:

1. **HCC connects to engine's air intake.**
2. **Hydrogen enriched gas enters the engine's cylinders at idle RPM.**
3. **The hydrogen enriched gas reacts with carbon deposits.**
4. **Carbon deposits are extracted and expelled through the exhaust.**

The Hydrogen Carbon Cleaner (HCC) provides a seamless, efficient cleaning process that minimizes downtime, delivering thorough preventative engine maintenance without disassembly or disruption.



INITIAL 7 KEY ENGINE COMPONENT PARAMETERS

- **Fuel Rate**
- **Engine Load**
- **Injection Control Pressure (ICP)**
- **Engine Oil Temperature**
- **Primary & Secondary Brake Pressure**
- **After treatment Hydrocarbon Doser Temperature**
- **Mass Air Flow (MAF)**

REAL WORLD DATA ANALYSIS

Monitoring and analyzing engine parameters for the impact of Hydrogen Carbon Cleaner (HCC) is crucial to understanding its effectiveness and validating its benefits. Key engine parameters such as Injection Control Pressure (ICP), fuel rate, engine oil temperature, engine load, primary brake pressure, and after-treatment hydrocarbon doser temperature, provide a comprehensive picture of engine health and performance. By assessing these metrics, fleet operators and consumers can measure the extent to which HCC improves fuel efficiency, enhances combustion, reduces emissions, and decreases engine stress.

The positive impact of HCC, supported by comprehensive engine data analysis, positions the HCC as a valuable tool in the commercial and consumer markets. For fleet operators these benefits mean significant long-term cost savings through reduced fuel consumption and maintenance expenses, alongside increased vehicle uptime. The HCC provides a means to improve vehicle performance, optimize engine life, and promote eco-friendly practices through lower emissions. This positions the HCC as not just an operational enhancement but a sustainable solution that aligns with modern regulatory standards and environmental expectations. The data-backed evidence of HCC's efficacy fosters confidence and can drive adoption in both commercial fleets and individual vehicles, amplifying its market reach and impact.

FUEL RATE (AT IDLE RPM)

- ### Data from 2013 International Box Truck Test:
  - **Baseline Fuel Consumption: .**67 gallons per hour (gph)
  - **Observed Reduction:** Dropped to .59 gph after 2 hours cleaning, indicating a significant 7.94% improvement.
- ### Analysis:
  - **Fuel Savings and Efficiency:** The 7.94% reduction in fuel rate observed here translates directly to savings in fuel costs. Over extensive use, such as in fleet applications, this reduction would yield hundreds of thousands of gallons saved annually across multiple vehicles.
  - **Cost Benefits:** For fleet operations,improvements in fuel economy lead to substantial savings across multiple vehicles, especially in high-mileage applications.
  - **Environmental Impact:** Improved fuel efficiency leads to lower overall fuel consumption, reducing the vehicle's carbon footprint and aiding in corporate sustainability efforts.

ENGINE OIL TEMPERATURE

- ### Data from 2013 International Box Truck Test:
  - **Baseline Temperature**: 172.50°F
  - **Observed Reduction:** Dropped to 170.50°F after 2 hours of HCC cleaning.
- ### Analysis:
  - **Significance of Temperature Drop:** A reduction of 2°F indicates lower friction and better heat dissipation within the engine. Reducing carbon build-up on key components.
  - **Impact on Engine Efficiency:** Lower engine oil temperature enhances engine durability by reducing thermal stress on parts, such as pistons and cylinders. Reduced friction also allows the engine to work with greater mechanical efficiency.
  - **Fuel Benefit:** Lower engine oil temperatures reduce friction within the engine, improving mechanical efficiency. This reduced friction can contribute to lower fuel consumption, potentially leading to a savings of around 0.5-1%. For a large fleet, this reduction in fuel rate adds up over long distances, providing a cumulative financial benefit in reduced fuel expenses.
  - **Benefits for Maintenance:** Over time, lower operating temperatures can contribute to longer oil life and extend maintenance intervals, reducing downtime and costs.

ENGINE LOAD

- ## Data from 2013 International Box Truck Test:
  - **Initial Load:** 26%
  - **Observed Reduction:** Dropped to 25% post-HCC cleaning.
- ## Analysis:
  - **Impact of Reduced Load**: A reduction in engine load means the engine is experiencing less resistance or friction during operation. This is attributed to HCC's removal of carbon deposits on moving components, allowing for smoother operation.
  - **Benefits for Fuel Economy and Performance**: A lower engine load means the engine expends less energy, consuming less fuel under similar operating conditions. This can potentially translate to fuel savings of approximately .5-1%, as observed in this test. Over a year, these savings would result in hundreds of gallons of fuel preserved per vehicle, offering substantial cost reductions for fleet operators.
  - **Long-term Benefits**: Reduced load decreases wear on the engine, contributing to optimal engine life and potentially reducing the likelihood of premature engine failure.

INJECTION CONTROL PRESSURE (ICP)

- ## Data from 2013 International Box Truck Test:
  - **Baseline ICP:** 853.23 psi
  - **Observations:**
    - ICP increased to 859.46 psi after 25 minutes of HCC cleaning.
    - By the end of 2 hours, ICP stabilized slightly lower at 855 psi.
- ## Analysis:
  - **Significance of ICP Increase:** An increase in ICP indicates a more efficient fuel injection process. Higher ICP levels suggest that the injectors are better able to atomize the fuel, creating a finer mist that enhances combustion efficiency. The initial rise followed by stabilization implies that the HCC cleaning process cleared carbon deposits in the injectors, allowing for an unrestricted fuel flow.
  - **Benefits for Engine Performance:** This increased efficiency in fuel atomization directly impacts combustion, resulting in a more complete burn, reduced emissions, and better fuel economy.
  - **Fuel Benefit:** The increase in ICP gives a more efficient fuel injection process, directly improving combustion efficiency. With better atomization, the fuel burns more completely, reducing unburned fuel waste and resulting in potential fuel savings of approximately 1.5% over time.
  - **Long-term Benefits:** Consistent ICP after cleaning would lead to fewer injection-related issues, enhancing the longevity and reliability of the fuel injection system.

PRIMARY & SECONDARY BRAKE PRESSURE

- ## Data from 2013 International Box Truck Test:
  - **Baseline Pressure:** 103.27 psi
  - **Increase After Cleaning:** Reached 111.97 psi in the first 25 min of HCC cleaning, and stabilized at 113.13 psi after 2 hours.
- ## Analysis:
  - **Relevance of Brake Pressure Increase:** An increase in brake pressure indicates more responsive and effective braking performance. The HCC cleaning results improved engine performance and power output, which can support braking systems that rely on engine-generated vacuum or compressed air.
  - **Safety Benefits:** Improved braking responsiveness is critical for vehicle safety, especially in commercial vehicles with heavier loads. Higher brake pressure leads to better stopping power, reducing the risk of brake fade and increasing driver control.
  - **Fuel Benefit**: Improved brake pressure indirectly benefits fuel economy. With optimal brake function, vehicles avoid excessive use of the engine brake or retarder, reducing fuel load demands. This can result in a potential fuel savings (estimated around 0.2-0.5%) due to smoother braking and acceleration transitions, ultimately supporting better fuel economy.
  - **Long-term Benefits:** With more effective braking response, drivers will experience safer operation, which is particularly important for fleet management and driver satisfaction.

AFTERTREATMENT HYDROCARBON DOSER TEMPERATURE

- ## Data from 2013 International Box Truck Test:
  - **Baseline Doser Temperature:** 132.8°F
  - **Decrease After Cleaning:** Stabilized at 127.4°F by the end of the test.
- ## Analysis:
  - **Meaning of Temperature Reduction:** A decrease in the doser temperature translates to a reduction in hydrocarbon buildup, due to improved combustion efficiency from HCC cleaning. Lower doser temperatures indicate that the aftertreatment system is not needing to work as hard to manage emissions.
  - **Benefits for Emissions and Compliance:** Reduced doser temperature enhances the durability and efficiency of aftertreatment components, which are essential for emissions compliance. This helps the vehicle maintain regulatory standards more easily.
  - **Fuel Benefit:** Lower doser temperatures indicate improved aftertreatment efficiency, which reduces backpressure on the engine. With reduced backpressure, the engine can operate more efficiently, potentially saving 0.5-1% in fuel consumption. For high-mileage vehicles, this contributes to lower fuel expenses and improved compliance with emissions standards without sacrificing fuel efficiency.
  - **Cost Savings in Aftertreatment Maintenance:** Lower stress on the aftertreatment system will reduce the frequency of required cleaning or replacement of components, lowering long-term maintenance costs.

MASS AIR FLOW (MAF)

- ## Data from 2013 International Box Truck Test:
  - **Baseline MAF:** 95.20 g/s (grams per second)
  - **Changes During Testing:**
    - MAF rose to 98.47 g/s within 30 minutes of HCC cleaning.
    - Stabilized at 97.90 g/s by the end of the 2-hour cleaning period.
- ## Analysis:
  - **Interpretation of Increased MAF:** The rise in MAF is an improvement in the engine's breathing capabilities, due to the cleaning effect of HCC. A higher MAF indicates that air is flowing into the engine with reduced restriction, due to the removal of carbon buildup in the intake manifold and on intake valves.
  - **Benefits for Combustion:** Enhanced air intake directly supports a cleaner and more efficient combustion process. The improved MAF can also contribute to better throttle response, as the engine can now pull in more air when required.
  - **Fuel Benefit:** The increased MAF allows for a more complete and efficient combustion process. By optimizing air intake, fuel use becomes more efficient, potentially saving 1-2% in fuel consumption over time. For commercial applications, this efficiency would result in significant savings on fuel costs, especially for high-mileage vehicles that consume hundreds of gallons per month.
  - **Emissions Reduction:** With increased MAF, the engine would produce fewer hydrocarbons and particulate matter due to a more complete combustion cycle, leading to improved emissions compliance and reduced aftertreatment burden.

PERCENTAGE PERFORMANCE/FUEL SAVINGS FOR EACH PARAMETER

Based on the tests:

1. **Fuel Rate:** 7.94%
2. **Engine Load:** 1.5%
3. **Injection Control Pressure (ICP):** 1.5%
4. **Engine Oil Temperature:** 1%
5. **Primary & Secondary Brake Pressure:** 0.5%
6. **Aftertreatment Hydrocarbon Doser Temperature:** 0.5%
7. **Mass Air Flow (MAF):** 1.5%

The **total percentage performance/fuel savings for a fleet** by implementing HCC across these measured parameters is approximately **14.94%.** This detailed analysis highlights the specific mechanisms by which HCC improves each parameter. The HCC provides a clear picture of its immediate impact and value for optimal engine performance, engine component longevity, fuel savings, emissions reduction and ultimately providing significant cost savings for fleets. In addition, this observed data has the potential to have massive operational and economic benefits.

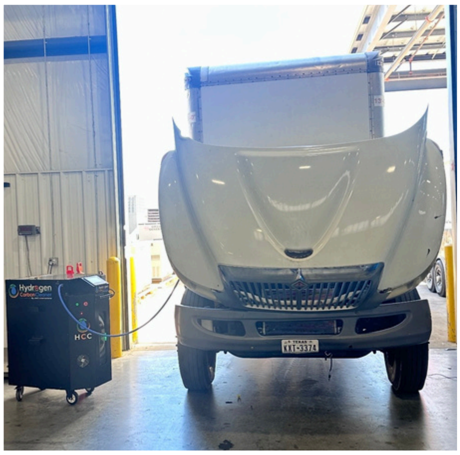
TESTING & DISCOVERIES

The trends observed across the Hydrogen Carbon Cleaner (HCC) test consistently highlight improvements in fuel efficiency, combustion, and optimal engine performance.

The positive effects of the Hydrogen Carbon Cleaner (HCC) observed across this test can be attributed to several mechanisms that improve overall engine performance and efficiency. One primary mechanism is the reduction of carbon buildup. Carbon deposits on engine components such as fuel injectors, intake valves, and combustion chambers impede fuel atomization, air intake, and the combustion process. The HCC helps break down and remove these carbon deposits, which restores optimal functioning of the engine's internal components. This leads to improved Injection Control Pressure (ICP) , enabling better fuel delivery and combustion efficiency.

Another benefit is the improvement in the air-fuel mixture. With cleaner engine components, air can flow more freely through the intake system, leading to a more balanced and efficient air-fuel ratio. This supports a more complete and efficient combustion process, reducing unburned fuel and enhancing fuel economy. This better air-fuel mixture also contributes to smoother engine operation and reduced engine load, minimizing stress on the engine and extending its operational life.(Mass Air Flow)

The HCC's effect on the after-treatment system performance is directly linked to cleaner combustion. Reduced carbon buildup means fewer hydrocarbons and particulates are generated during combustion, which lightens the load on the after-treatment system. The decrease in after-treatment hydrocarbon doser temperature observed in the test show the doser system working more efficiently, with less thermal and chemical stress. This leads to longer engine component life, improved emissions control, and better compliance with environmental regulations. Collectively, these benefits provide a comprehensive explanation for the improvements seen in engine efficiency, fuel consumption, and overall performance following the HCC application.



CONCLUSION AND OPPORTUNITY

The key findings from the Hydrogen Carbon Cleaner (HCC) test highlight its significant positive impact on various engine performance metrics and its potential for massive maintenance savings. Expanding testing to include vehicles that operate under different environmental conditions, such as extreme temperatures, high altitudes, and varied humidity levels, will offer more insight into how external factors affect the HCC's performance. In addition to testing the HCC in different environmental conditions, long-term field tests to evaluate the durability of the improvements observed, assess any cumulative benefits, and determine any potential side effects of prolonged use with the HCC. Additional tests and data collection from these diverse scenarios, a robust dataset can be established that will further supports HCC's efficacy across different vehicle categories and conditions. This comprehensive analysis will enhance credibility, making it easier to generalize the benefits and advocate for mass commercial and consumer market adoption.

Ultimately, with sufficient data collected from the test, a detailed cost-benefit analysis can be conducted to quantify the return on investment for fleet operators and businesses. This analysis would further highlight HCC's value proposition, facilitating strategic marketing and implementation plans aimed at a wider market. The comprehensive data set will also be instrumental in aligning with regulatory standards for emissions and fuel efficiency, positioning HCC as a potent solution that not only supports economic benefits but also contributes to environmental sustainability.