Smart Emissions Reducer

Test Results

Testing Performed by:

Roush Industries, Inc

Livonia, MI

Vehicles Tested:

2005 Chevrolet Silverado 2500

2005 Dodge Ram 2500 HD

2004 Ford Passenger Van E-150

Testing Data Interpreted and Prepared for Extreme Energy Solutions by:

Ecosceptor, LLC

Mountain View, CA

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November 7, 2012

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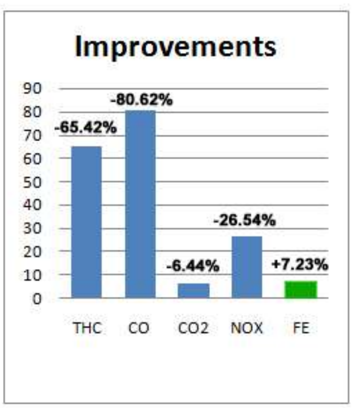
At a Glance

Testing of the Smart Emissions Reducer was conducted at Roush Industries in Livonia, Michigan in September, and again in October/November of 2012 to establish emissions and fuel economy benefits from a credible third party source. The testing was performed in 4 segments; Stock, Modified, Modified with 3.8k to 5.4k miles, and Stock again. This would be A_1, B_1, pause, B_2, A_2 testing. Each test constituted a cold start, city drive cycle, hot start, and highway drive cycle. Testing was performed on a 2005 Chevrolet Silverado 2500 4X4 regular cab truck with the 6.0 liter V-8, 2005 Dodge Ram 2500 utility body truck with the 5.7 liter Hemi V-8, and a 2004 Ford E-150 passenger van with the 4.6 liter V-8.

Roush Industries is a certified emissions and fuel economy testing lab recognized by US EPA, CARB, and EU. The documentation provided by Roush is deemed to be the most scientifically accurate data available within the protocol limits of the tests. Roush followed EPA FTP75, and Highway Emissions and Fuel Economy testing protocol and procedures (explained in more in the main body of the report).

The full report represents a comprehensive evaluation of the test data provided by Roush. At a glance, the testing suggests the potential of:

- **Up to 65.42% reduction in Total Hydrocarbons (THC)**[1]
- **Up to 80.62% reduction in Carbon Monoxide (CO)**[1]
- **Up to 6.44% reduction in Carbon Dioxide (CO_2)**[1]
- **Up to 26.54% reduction in Oxides of Nitrogen (NO_X)**[1]
- **Up to 7.23% increase in fuel economy (MPG)**[1]



Graph 1 *Potential Emissions Reduction & Fuel Economy Improvements.*

There were no Diagnostic Trouble Codes caused by the installation of the Smart Emissions Reducer on any of the test vehicles. No other modifications were made to the vehicles (outside normal maintenance and an emergency repair on the Chevy). The full report shall break down each of the test segments and test phases for each vehicle, cumulative results, and large scale projections.

This Report with test data represents third party testing and evaluation of the emissions and fuel economy potential for the Smart Emissions Reducer.

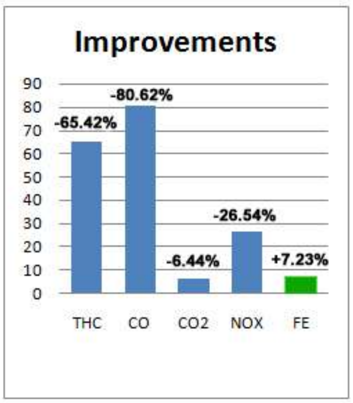
[1] Numbers used in these claims are highlighted in blue in the Full Report Charts.

General Overview

Disclaimer

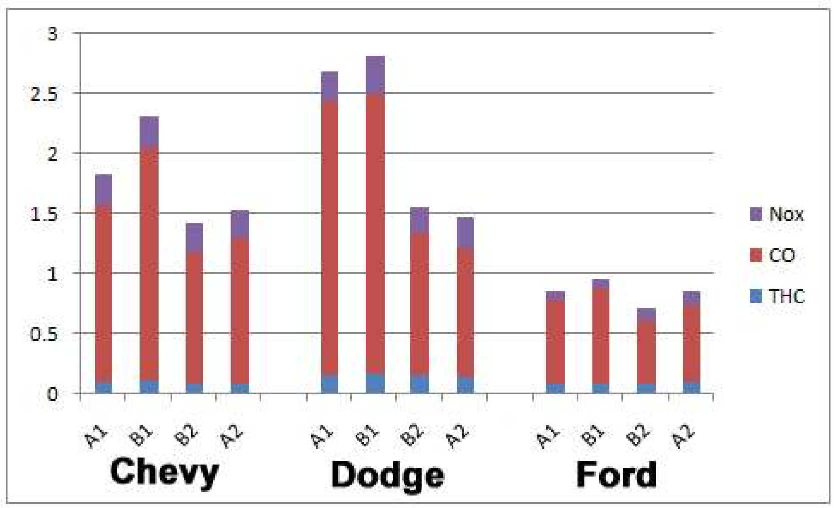
The General Overview constitutes a quick-glance summary of 77 pages of data. It is by no means a comprehensive review of the entire test regiment, and should be viewed with that perspective.

SMART Emissions Reducer Potential



Graph 1 *Emisisons and fuel economy potential.*

Graph 1 illustrates the potential of the Smart Emissions Reducer. Posted numbers are taken from the Roush reports from the various vehicles under varying conditions. It clearly indicates the potential for dramatic reduction in regulated emissions (THC, CO, and NO_X) with favorable carbon dioxide and fuel economy trends.

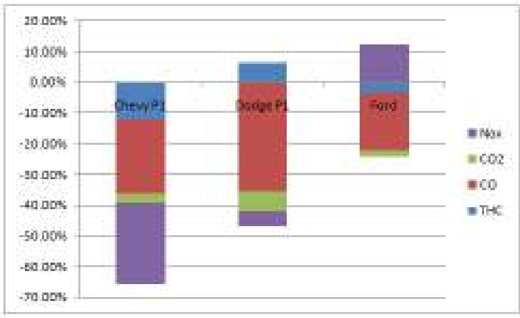


Graph 3 *Regulated toxic emissions trends from stock (A_1), immediate installation (B_1), after mileage accumulation (B_2), and back to stock again (A_2).*

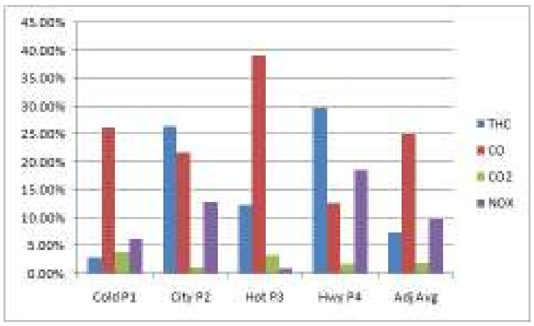
Graph 3 shows the trends in regulated toxic emissions starting with the stock baseline (A_1), immediately after the SER installation (B_1), after accumulating 3.8k to 5.4k miles (to allow the SER time to clean out the engine) (B_2), then again with the SER removed (A_2). In all cases the recorded emissions went up immediately after installing the SER. However, after the SER had an opportunity to systematically remove residual carbon from engine internals, the emissions stabilized at significantly lower levels. The residual effects of this cleaning can be noted by comparing the "first" stock test (A_1) to the "after" stock test (A_2), where pollution levels are lower than before the installation of the SER.

Cold Start Conditions

The engine and emissions control systems operate most efficiently with the engine at normal operating temperature. Ergo, there is typically more pollution released to the atmosphere in the first 10 minutes than for the following 2 hours. Even small percentages (%) of pollution reduction in the cold start phase



Graph 4 *Reduction in pollutants during Cold Start Cycle.*



Graph 5 *[Modified] Average Emissions Reductions*[2]

can equate to large volumes (kilograms) of pollutants not emitted into the atmosphere and environment over the course of a year.

As can be seen in Graph 4, total emissions are reduced by a significant percentage overall during cold start driving. This graph also suggests that emissions reductions begin with the SER even before the normal OEM emissions systems come online. This data suggests substantial improvements in emissions, especially with vehicles that don't accumulate many miles, but experience frequent cold starts.

Averages

Graph 5 shows the adjusted[2] average reductions ($B_2 - A_1$) of all 3 vehicles through all of the phases of testing. In scientific nomenclature, the term "significant" means ≥4%. As can be seen in Graph 5, there are significant decreases in THC, CO, and NO_X emissions throughout most of the phases of testing, with quite impressive reductions under certain conditions.

Chevy	**THC**	**CO**	**CO2**	**Nox**	**Fuel Gal.**
10k	140 g	3.7 kg	173 kg	130 g	15.08
25k	350 g	9.25 kg	432.5 kg	325 g	37.7
50k	700 g	18.5 kg	865 kg	650 g	75.4
100k	1.4 kg	37.0 kg	1.73 Ton	1.3 kg	150.8
Dodge					
10k	40 g	11 kg	182 kg	310 g	20.15
25k	100 g	27.5 kg	455 kg	775 g	50.38
50k	200 g	55 kg	910 kg	1.55 kg	100.75
100k	400 g	110 kg	1.82 Ton	3.1 kg	201.5
Ford					
10k	50 g	1.7 kg	113 kg	NA	10.12
25k	125 g	4.25 kg	282.5 kg	NA	25.3
50k	250 g	8.5 kg	565 kg	NA	50.6
100k	500 g	17 kg	1.13 Ton	NA	101.2

Chart 8 *Emissions reductions and fuel savings for 10k, 25k, 50k, and 100k miles driven.*

Chart 8 illustrates the impact each vehicle will have over the course of a year based on mileage (10k – 100k). Contrast this with Graph 5 to see how the Smart Emissions Reducer can have a substantial impact on the environment and air quality.

Take note to the potential tonnage of carbon emissions (THC, CO, and CO_2) that can be removed from exhaust emissions, thus reducing the Greenhouse Gas (GHG) Effect. With Carbon Cap & Trade coming online, there could be potential value in the

[2] Suspect data removed from posted averages. See full Report for details.

carbon emissions alone with the Chevy and Dodge showing a reduction of almost 2 metric tons, and the Ford a reduction of over 1 metric ton of carbon from the exhaust per 100k miles driven.

Big Picture

Fleet	10	50	100	500	1000
Pollutant	569 kg	2845 kg	5690 kg	28,450 kg	56,900 kg
Carbon	1.615 ton	80.77 ton	161.5 ton	807.72 ton	1,615.43 ton
Fuel	1511 gal	7555 gal	15,110 gal	75,550 gal	151,100 gal

Chart 9 *Pollution reduction and fuel savings for fleets per 100k miles (ton = metric ton).*

It is assumed that a typical US fleet consists of GM, Dodge, and Ford vehicles, as well as Toyota, Honda, Mazda, and other makes. It is also assumed that emissions from a Toyota or Honda would be lower than for a Dodge or GM truck. However, it is also assumed that many fleet vehicles will be loaded with trailers and payload beyond the scope of the Roush test vehicles. Therefore, the numbers represented in Chart 9[3] are averages of the 3 test vehicles [(Chevy + Dodge + Ford) ÷ 3], and should be valued accordingly. Pollutants are the combination of regulated toxic emissions (THC + CO + NO_X) and are designated in kilograms (kg), and Carbon is the combination of all carbon-based emissions (THC + CO + CO_2), and is designated in metric tons. Fuel savings is based on (100k miles divided by fuel economy test A_1) minus (100k miles divided by fuel economy test B_2). Fleet size is designated in increments of 10, 50, 100, 500, and 1000 vehicles.

Total Impact

There is an estimated 300 million vehicles on the road in the United States alone. Based on the average data from Chart 9, and assuming an annual accumulation of 20k miles, if only 1% of these vehicles were retrofitted with the Smart Emissions Reducer the impact would be:

- **34,140 metric tons of regulated pollutants (THC + CO + NO_X) will not be emitted into the air**
- **969,000 metric tons of carbon (THC + CO + CO_2) will not be emitted into the air**
- **90.66 million gallons of fuel will be conserved**
- **At $4.00 per gallon, US consumers will save $362.6 Million**

The total impact becomes staggering when these numbers are considered. With more companies and governmental agencies finding it beneficial to “Go Green”, the Smart Emissions Reducer represents a cost effective way to make a substantial impact on the environmental concerns shared by everyone.

[3] Based on unmodified Roush data.

Full Report

Objectives

The purpose of testing is to establish typical values for emissions reduction and fuel economy improvements for the Smart Emissions Reducer. Utilizing the certified Roush test facility in Livonia, Michigan, and executing industry standard FTP75 and Highway testing protocols, results were acquired that show improvements in both emissions and fuel economy across the board.

The Report from Roush

An addendum to this document constitutes the results of the 12 tests. Testing was done in an “A_1 – B_1, pause, B_2 – A_2” fashion, whereas “A” means stock condition and “B” means retrofitted with the test apparatus; the Smart Emissions Reducer. This equates to 12 tests total. During the “pause”, 3.8k to 5.4k miles were accumulated to allow the Smart Emissions Reducer to reach equilibrium with the engine and stabilize readings. Each individual Roush test encompasses 4 pages of data with information about the test. These addendums were supplied by Roush Industries and are the foundation upon which this Roush/Ecosceptor/Extreme Energy Solutions Report is built.

- **Page 1** of the Roush Test shows vehicle information, dynamometer information, driver’s name, operator’s name, time and miles driven, fuel type and specifications, as well as the test date and time.
- **Page 2** of the Report shows the test data. Each test comprises 4 Phases with a cumulative average. Phases 1 and 3 are identical in the driving protocol.
    - Phase 1 shows cold start conditions.
    - Phase 2 equates to the EPA FTP75 City Drive Cycle
    - Phase 3 repeats Phase 1, but after a 10 minute hot soak
    - Phase 4 equates to the Highway Drive Cycle
- **Page 3** of the report shows calibration and span specifics for each phase of the test.
- **Page 4** of the report shows the driver’s performance as far as errors (no errors reported).

The Actual Test

Prior to testing, the Horiba emissions testing equipment is calibrated and spanned to ensure accuracy. Temperature and humidity in the test cell are manipulated within EPA FTP75 test specifications. The vehicle is drained of all pump gas and filled to 40% capacity with test fuel (EEE). The vehicle is then pushed onto the dyno rollers and

Figure 1 *Drive Cycle screen for driver.*

strapped down. Each test takes 2 days. Day 1 is a preparation cycle, where the vehicle's ECU adaptive strategies are allowed to adapt to the laboratory fuel. No emissions or fuel economy data is collected during this test cycle. The vehicle is then pushed off the dyno and allowed to sit overnight to stabilize engine temperature (a thermal cycle). Day 2 of testing constitutes the data reflected in the report. Testing begins with the turn of the ignition key. Emissions data is collected from the first moment of engine rotation.

The driver follows a screen that mandates vehicle speed. There is a tolerance of +/- 2 mph. The screen shows a column on the left that encompasses the entire test. The main portion of the screen shows required speed with high resolution (see Figure 1). The driver is to keep the yellow "X on a circle (¤)" directly over the white line. The speed cannot exceed beyond either of the red lines.

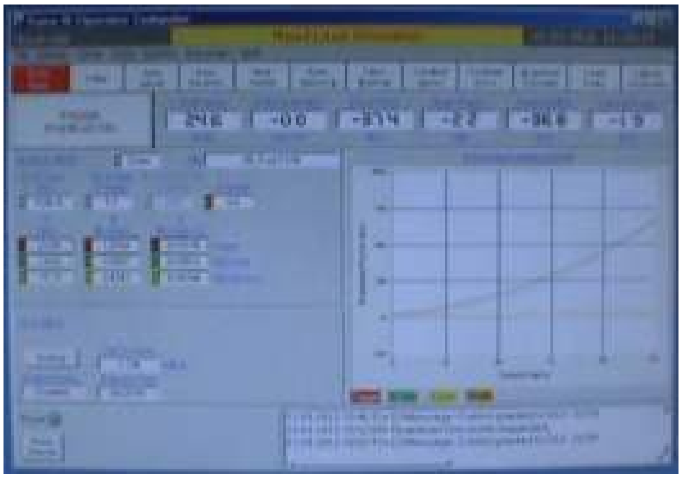


Figure 2 *Dynamometer load screen.*

The dynamometer load is calibrated to accurately represent real world conditions. For the Smart Emissions Reducer testing, the load calibration information was used from the OEM-provided files on the specific vehicles. That screen is shown in Figure 2.

Emissions data is not represented as a *percentage* of total exhaust, but in grams per mile. Fuel Economy is calculated by "counting the carbon atoms in the exhaust". This is possible only if the fuel used has a known carbon count per volume. This is the reason EEE test fuel is used instead of pump fuel. Furthermore, variations possible with various grades and brands of pump fuel could have a dramatic effect on end results for both emissions and fuel economy.

Pages 3 and 4 of each Roush's test reports are included only as a validation process, and are not referenced in this report.

Disclaimer

EPA and CARB certifications require a minimum of 5 of each test to account for variables and odd circumstances. Test data is then averaged over the 5 tests. This report reflects one test and may include anomalies which can skew final results from real world, long term averages. There are a couple of sections where such anomalies are suspected. These sections will be pointed out later in the report.

Testing Protocol

Three vehicles were chosen to represent the light duty truck market;

- 2005 Dodge Ram 2500 Utility Body truck with the 5.7 liter Hemi V-8 engine
- 2005 Chevrolet Silverado 2500 4X4 with the 6.0 liter V-8 engine
- 2004 Ford Econoline E-150 Passenger Van with the 4.6 liter V-8 engine

The test vehicles represent vehicles of age and condition typical of what would be found in the real world. The Ford was tested with 11k miles, the Chevy with 66k miles, and the Dodge with 28.5k miles. Between B_1 and B_2 tests, each vehicle was driven over several thermal cycles to accumulate miles:

- Dodge accumulated 3796 miles
- Chevy accumulated 4396 miles
- Ford accumulated 5404 miles

Prior to Phase 1 of the testing (A_1 and B_1 tests), the vehicles were inspected for overall condition. Each vehicle received a new air filter and an oil change using Motorcraft Synthetic Blend Motor Oil. As it is approximately 600 miles from Extreme Energy Solutions' building in Ogdensburg, New Jersey and Roush Industries testing facility in Livonia, Michigan, 600 is approximately the number of miles accumulated on the fresh oil prior to Phase 1 testing.

Prior to Phase 2 testing (B_2 and A_2 tests), the vehicles received another oil change using the same brand and viscosity oil and filters. This was to keep consistency between the Phases, as far as emissions data is concerned. The Smart Emissions Reducers were cleaned as per Smart Air Fuel Saver Cleaning Protocol prior to departure for Phase 2 testing. The original protocol specified that no modifications or repairs be performed on the vehicles between testing phases (excepting safety and legal related repairs). Original Protocol is included as an addendum.

Special Notes

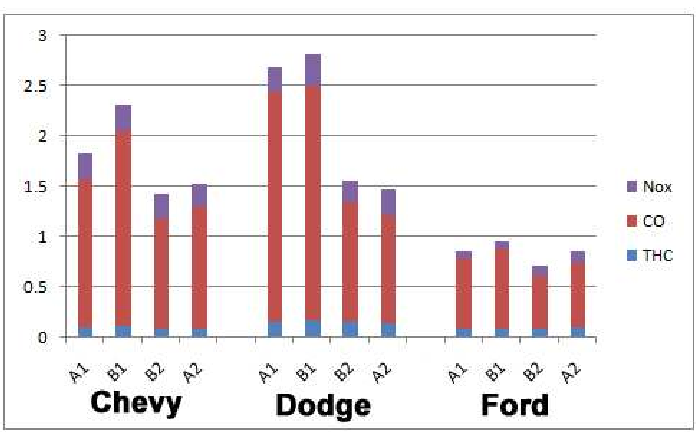
The Chevy and Ford received Smart Emissions Reducers in the primary (vacuum side) PCV hose, while the Dodge received the device in the breather (secondary) side hose. Although the Dodge and Ford vehicles performed flawlessly throughout the entire testing procedure, the Chevy experienced a P-0300 emissions code for "Random engine misfires". The diagnosis showed an electrical arcing between the boots of the secondary ignition wires and the ignition coil bases (not related to the Smart Emissions Reducer installation). The spark plugs were replaced with AC Delco factory replacement Iridium spark plugs, the ignition wires were replaced with AC Delco factory replacement versions, and all 8 ignition coils were replaced with GM original equipment versions. In addition, the engine-to-firewall ground connection was cleaned, and an additional ground wire was added to the driver's side of the engine. The P-0300 code was still present during Phase 2 testing. The problem only manifested after 120+ miles of driving; most likely a thermal break-down issue. It was decided to proceed with Phase 2 testing on the Chevy despite the presence of the code.

Data Representation

Industry standard testing protocol requires A-B-A testing, where the vehicle is tested in stock condition, the modification is made and retested, then the vehicle is returned to stock and tested again. Since the Smart Emissions Reducer works to remove carbon from the intake runners, valves, and combustion chambers, emissions and fuel economy readings would not show favorably immediately after the installation. This report reflects these assumptions with the A_1 and B_1 test data. As suspected, emissions were slightly elevated and fuel economy suffered by an insignificant amount. After the accumulation of 3.8k to 5.4k miles, emissions and fuel economy had indeed improved. This is shown in the B_2 test data (Chart 1 and Graph 2). Therefore, the majority of this report uses the A_1 (stock) and B_2 (modified) test reports for the comparisons and claims. Where the term "significant" is used, this represents a change of ≥ 4%.

Chevy	THC	CO	CO2	Nox	FE
A1	0.101	1.47	925.6	0.257	11.13
B1	0.115	1.94	921.5	0.264	11.20
B2	0.087	1.10	908.3	0.244	11.32
A2	0.088	1.21	907.4	0.236	11.37
Dodge					
A1	0.157	2.28	854.6	0.249	12.25
B1	0.173	2.33	868.2	0.306	12.08
B2	0.161	1.18	836.4	0.218	12.56
A2	0.149	1.07	852.3	0.255	12.31
Ford					
A1	0.088	0.70	575.3	0.075	17.89
B1	0.085	0.80	575.5	0.072	17.79
B2	0.083	0.53	564.0	0.101	18.22
A2	0.094	0.65	568.2	0.111	18.05

Chart 1 *Compilation of averages from all 4 tests*



Graph 2 *Regulated pollutants for the 4 tests.*

Chart 1 and Graph 2 represent the averages from all 4 tests, whereas A_1 is the first stock test results taken on September 19th for the Ford and Dodge, and September 20th for the Chevy (there was a test malfunction during the September 19th test on the Chevy). Test B_1 is the results for the vehicles immediately after installing the Smart Emissions Reducer, and were taken on September 20th (September 21st for the Chevy). Test B_2 is the modified results after the accumulation of miles, taken on October 31st. Test A_2 is the results after the Smart Emissions Reducer was removed, taken on November 1st.

THC represents total hydrocarbons in grams per mile. The Roush data, page 2 of each report, shows NMHC (non-methane hydrocarbons) and CH_4 (methane) values which are not present in this report, as NMHC + CH_4 ≈ THC. **CO** represents carbon monoxide in grams per mile. **CO_2** represents carbon dioxide in grams per mile. **NO_X** represents oxides of nitrogen (NO + NO_2) in grams per mile. **FE** represents fuel economy in miles per gallon.

The trend represented by Chart 1 and Graph 2 is a slight increase in emissions and reduction in fuel economy between tests A_1 and B_1, then a more dramatic reduction in emissions and a slight increase in fuel economy between tests B_1 and B_2. The comparison between tests B_2 and A_2 show an emissions increase and a slight fuel economy decrease, and serves as a final base line. *An interesting note is that the A_2 results show an improvement over the A_1 results, suggesting the engines were cleaner after having the Smart Emissions Reducer installed over a period of time.*

It should be noted that since fuel economy is determined by "counting the carbon atoms in the exhaust" and not the volume of fuel consumed, there have been claims of inaccuracies from parties dissatisfied with FTP75 test results. Several unofficial claims suggest discrepancies in fuel economy in the range of 1.5X to 3X; whereas a reported gain during FTP75 testing of 5% equates to a minimum real-world gain of 7.5% > <15%. As preparer of this report, I have seen extremely accurate results from the FTP75 testing process from Roush, with the most extreme discrepancy of < 12% (test results versus measured real-world fuel economy). This is mentioned specifically due to the nature of the Smart Emissions Reducer and its inherent tendency to remove carbon build-up from the engine's internal parts. This additional carbon could show up as reduced fuel economy (or increased carbon-based emissions) in the FTP75 reports.

Another note is that the various tests reflect 4 different drivers. Driving style may have an impact on recorded results. Total mileage for the test is around 21 miles. Individual test phases may vary by +/- 1% from test to test. Stabs of the throttle will affect emissions; one driver may stab hard then let off, while another driver may ease on the throttle more gradually. Additionally, a few tests followed 20° F tests where the dyno roller was wet from condensation. Initial cold start testing experienced lost traction on hard acceleration (for 2 tests total).

Chevy Silverado

Chevy A1	THC	CO	CO2	Nox	FE
P1	0.39255	6.01565	957.7493	0.47136	9.17
P2	0.01981	0.26987	948.7295	0.09903	9.36
P3	0.03307	0.30380	857.6397	0.39360	10.35
P4	0.01216	0.13607	639.3908	0.04607	13.89
Avg	0.101	1.47	925.6	0.257	11.13
Chevy B2					
P1	0.34480	4.56476	928.6899	0.34628	9.48
P2	0.01325	0.17234	935.1095	0.09707	9.49
P3	0.02929	0.22336	842.4453	0.44372	10.53
P4	0.00896	0.15886	630.1581	0.03773	14.08
Avg	0.087	1.1	908.3	0.244	11.32
Change					
P1	0.04775	1.45089	29.0594	0.12508	0.31
P2	0.00656	0.09753	13.6200	0.00196	0.13
P3	0.00378	0.08044	15.1945	0.05012	0.18
P4	0.00032	0.02279	9.23267	0.00834	0.19
Avg	-0.014	-0.37	-17.3	-0.013	0.19
Percent					
P1	-12.16%	-24.12%	-3.03%	-26.54%	3.38%
P2	-33.11%	-36.14%	-1.44%	-1.98%	1.39%
P3	-11.43%	-26.48%	-1.77%	12.73%	1.74%
P4	-2.63%	16.75%	-1.44%	-18.10%	1.37%
Avg	-13.86%	-25.17%	-1.87%	-5.06%	1.70%

Chart 2 *Individual tests for the Chevy. Numbers in red indicate increases. Underlined number suspect. Number in blue used in Page 3 of this report.*

The P_1 row shows cold start information. The P_2 row represents the City Drive Cycle. The P_3 row represents a hot start after a 10 minute hot soak, with the actual test being identical to that of the P_1 row. The P_4 row represents the Highway Drive Cycle, with a maximum speed of 60 mph.

There was an increase in carbon monoxide during the highway drive cycle, and an increase in NO_X after a hot soak. Carbon monoxide numbers showed a significant decrease in all other cycles, with the Highway Drive Cycle showing up as an anomaly. It is possible the engine misfire condition may have had an effect on this portion of the testing. The increase in NO_X after the hot soak is probably accurately indicative.

Hydrocarbon emissions were dramatically reduced during the City Drive Cycle by 33.11%, and by 13.86% overall. Even with an increase in carbon monoxide during the Highway Drive Cycle, overall CO was reduced by a significant 25.17%. Reduction in Carbon Dioxide typically follows improvements in fuel economy, and by a close percentage. This is represented in Chart 2. The highest improvements in fuel economy were noted during the cold start cycle, at 3.38% (which is statistically insignificant). The cold start and highway cycles showed a significant decrease in NO_X (26.54% and 18.10% respectively), and even with an increase (of 12.73%) after a hot soak, overall NO_X emissions showed a 5.06% reduction, which is statistically deemed significant.

Dodge Ram

Dodge A1	THC	CO	CO2	Nox	FE
P1	0.59637	6.00187	906.0218	0.53569	9.68
P2	0.02851	0.33287	868.7609	0.11487	10.22
P3	0.06710	3.14055	788.9253	0.28404	11.19
P4	0.03652	0.36197	561.0983	0.14604	15.81
Avg	0.157	2.28	854.6	0.249	12.25
Dodge B2					
P1	0.63427	3.87158	847.6636	0.50957	10.38
P2	0.02466	0.40390	864.7906	0.08948	10.26
P3	0.06168	0.60869	774.2237	0.24223	11.45
P4	0.02882	0.30854	545.8349	0.12663	16.25
Avg	0.161	1.18	836.4	0.218	12.56
Change					
P1	0.03790	2.13029	58.3582	0.02612	0.70
P2	0.00385	0.07103	3.9703	0.02539	0.04
P3	0.00542	2.53186	44.7016	0.04181	0.26
P4	0.00770	0.05343	15.2634	0.01941	0.44
Avg	-0.004	-1.1	-18.2	-0.031	0.31
Percent					
P1	6.36%	-35.49%	-6.44%	-4.88%	7.23%
P2	-13.50%	21.34%	-0.46%	-22.10%	0.39%
P3	-8.08%	-80.62%	-5.67%	-14.72%	2.32%
P4	-21.08%	-14.76%	-2.72%	-13.29%	2.78%
Avg	-2.55%	-48.25%	-2.13%	-12.45%	2.53%

Chart 3 *Individual tests for the Dodge. Numbers in red indicate increases. Underlined numbers suspect. Numbers in blue used in Page 3 of this report.*

The P_1 row shows cold start information. The P_2 row represents the City Drive Cycle. The P_3 row represents a hot start after a 10 minute hot soak, with the actual test being identical to that of the P_1 row. The P_4 row represents the Highway Drive Cycle, with maximum speed of 60 mph.

There was a slight but significant increase in hydrocarbons during the cold start cycle. The chart shows a substantial increase in carbon monoxide during the City Drive Cycle, but this increase is inconsistent with the more dramatic decreases throughout the rest of the testing. This increase is suspect, and is not deemed representative of the performance of the vehicle. Also suspect is the 80.62% reduction in CO during Phase 3.

Even with the increase in hydrocarbons during cold start, overall hydrocarbons showed a 2.55% decrease, which is statistically insignificant. However, the reductions in hydrocarbon emissions during the City and Highway Cycles (13.50% and 21.08% respectively) are significant. Carbon monoxide reductions are dramatic in all but the City Cycle (which is suspect). Yet even with the suspected increase during the city cycle, overall carbon monoxide showed a dramatic 48.25% reduction. Overall NO_X reduction is a significant 12.45% with a more dramatic reduction during the City Cycle (22.10%).

Whereas carbon dioxide and fuel economy percentages usually follow each other, the fuel economy ***or*** carbon dioxide numbers during the Hot Soak test are suspect. The chart shows a significant decrease in carbon dioxide of 5.67%, but fuel economy only increased by 2.32%. It is suspected that either the carbon dioxide reduction is inaccurate, or the fuel economy increase is inaccurate. Fuel economy did show a significant increase during the cold start cycle of 7.23%. Overall fuel economy increase was an insignificant 2.53%.

Ford Van

Ford A1	THC	CO	CO2	Nox	FE
P1	0.36639	2.86036	586.6755	0.31525	15.00
P2	0.01314	0.07814	592.4000	0.01333	14.99
P3	0.02068	0.23172	534.4084	0.01148	16.61
P4	0.02736	0.05730	398.4883	0.00862	22.28
Avg	0.088	0.70	575.3	0.075	17.89
Ford B2					
P1	0.35468	2.31655	574.6961	0.35426	15.32
P2	0.00888	0.03864	583.1113	0.01684	15.22
P3	0.01713	0.11153	519.7368	0.07011	17.08
P4	0.00946	0.0511	392.4264	0.01087	22.62
Avg	0.083	0.53	564	0.101	18.22
Change					
P1	0.01171	0.54381	11.9795	0.00901	0.32
P2	0.00426	0.03950	9.2887	0.00351	0.23
P3	0.00355	0.12019	14.6717	0.05863	0.47
P4	0.01790	0.00620	6.0620	0.00225	0.34
Avg	-0.005	-0.17	-11.3	0.026	0.33
Percent					
P1	-3.19%	-19.01%	-2.04%	2.86%	2.13%
P2	-32.42%	-50.55%	-1.57%	26.33%	1.53%
P3	-17.17%	-51.87%	-2.75%	510.71%	2.83%
P4	-65.42%	-10.82%	-1.52%	26.10%	1.53%
Average	-5.68%	-24.26%	-1.96%	34.67%	1.84%

Chart 4 *Individual tests for the Ford. Numbers in red indicate increases. Underlined numbers are suspect. Number in blue is used in Page 3 of this report.*

The P_1 row shows cold start information. The P_2 row represents the City Drive Cycle. The P_3 row represents a hot start after a 10 minute hot soak, with the actual test being identical to that of the P_1 row. The P_4 row represents the Highway Drive Cycle, with maximum speed of 60 mph.

Hydrocarbon emissions showed dramatic reductions throughout all but the cold start cycle. The numbers in the line labeled "Average" were provided as part of Roush's report.

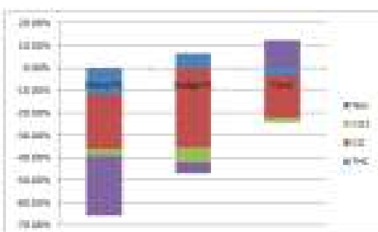
Suspect is the 510.71% increase in NO_X emissions represented in the hot soak cycle. Although NOX emissions showed a consistent increase (A_1 to B_2), this overly dramatic increase seems unreasonably excessive. It should be noted that the NO_X Compensation Factor for these 2 tests were 0.886 for A_1 and 0.919 for B_2 (page 2 of Roush report, top right of page). The higher the NO_X Compensation Factor, the more likely NO_X will form. This number is calculated taking into consideration ambient temperature, barometric pressure, and humidity levels. However, the difference between 0.886 and 0.919 cannot account for a 510% increase in NO_X.

Carbon monoxide levels were dramatically reduced during the City Cycle and Hot Soak Cycle (50.55% and 51.87% respectively), with an average reduction of 24.26%. Fuel economy showed an insignificant increase of 1.84% average.

Cold Start Benefits

Chevy P_1	**THC**	**CO**	**CO2**	**Nox**	**FE**
A_1	0.39255	6.01565	957.7493	0.47136	9.17
B_2	0.34480	4.56476	928.6899	0.34628	9.48
Change	0.04775	1.45089	29.0594	0.12508	0.31
Percentage	-12.16%	-24.12%	-3.03%	-26.54%	3.38%
Dodge P_1					
A_1	0.59637	6.00187	906.0218	0.53569	9.68
B_2	0.63427	3.87158	847.6636	0.50957	10.38
Change	0.03790	2.13029	58.3582	0.02612	0.7
Percentage	6.36%	-35.49%	-6.44%	-4.88%	7.23%
Ford P_1					
A_1	0.36639	2.86036	586.6755	0.31525	15.00
B_2	0.35468	2.31655	574.6961	0.35426	15.32
Change	0.01171	0.54381	11.9795	0.03901	0.32
Percentage	-3.20%	-19.01%	-2.04%	12.37%	2.13%

Chart 5 *Cold start emissions and fuel economy data. Numbers in red represent an increase. Number in blue used in Page 2 of this report.*



Graph 3 *Cold Start Improvements.*

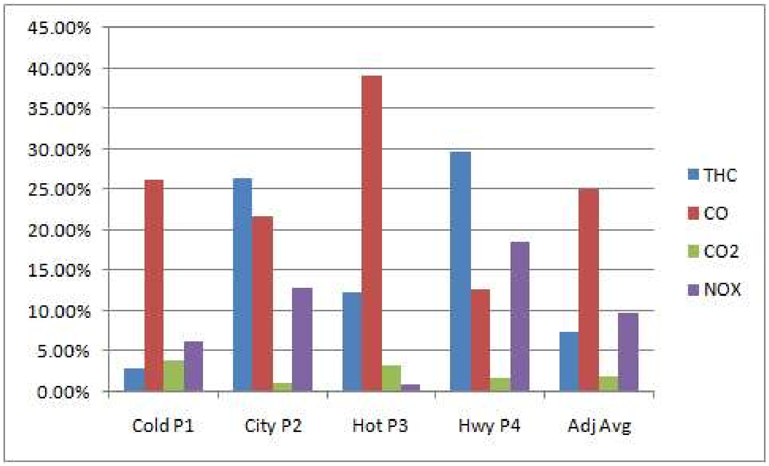
Since cold starts represent the highest emissions levels and the highest fuel consumption experienced during any drive cycle, comparing cold start data represents a significant contribution to air quality and fuel usage. The Chevy showed significant reductions in all monitored pollutants; THC -12.16%, CO -24.12%, and NO_X -26.54%. Fuel economy increased by an insignificant 3.38%. The Dodge showed an increase in THC of 6.36%, with significant reductions of CO -35.49%, CO_2 -6.44%, and NO_X -4.88%. Fuel economy increased by a significant 7.23%. The Ford showed a significant decrease in CO of -19.01%.

Overall Averages

Averages	**THC**	**CO**	**CO2**	**Nox**	**FE**
Cold (P_1)	-3.00%	-26.21%	-3.84%	-6.35%	4.25%
City (P_2)	-26.34%	-21.78%	-1.16%	0.75%	1.10%
Hwy (P_4)	-29.71%	-2.94%	-1.89%	-1.76%	1.89%
Total	-7.36%	-32.56%	-1.99%	5.72%	2.02%

Chart 6 *The values in the "Average" rows of the Roush reports were averaged between the 3 vehicles.*

Since 3 different vehicles were tested, some showing substantial reductions in certain emissions under certain conditions, and others showing increases in emissions under certain conditions, Chart 6 shows the average results from all the testing by category. THC emissions were reduced by an insignificant 3.00% during the cold start cycle. THC was reduced by a substantial 26.34% during the City Cycle and 29.71% during the Highway Cycle. Overall average THC reduction was a significant 7.36%.



Graph 7 With Chart 7, reductions in pollutants using modified Roush data.

Carbon monoxide was reduced by a substantial amount during all but the Highway Cycle. Cold start showed a reduction of 26.21%, City Cycle by 21.78%, with an overall average reduction of 32.56%. Fuel economy was improved by a significant 4.25% during the cold start cycle.

	THC	CO	CO2	NOX	FE
Cold P1	-3.00%	-26.21%	-3.84%	-6.35%	4.25%
City P2	-26.34%	-21.78%	-1.16%	0.75%	1.10%
Hot P3	-12.23%	-39.18%	-3.40%	-1.00%	2.30%
Hwy P4	-29.71%	-12.79%	-1.76%	-18.50%	1.89%
Adj Avg	-7.36%	-24.99%	-1.99%	-9.71%	2.02%

Chart 7 *Averages of 3 vehicles minus suspect data*

In an attempt to bring the numbers into a congruent consistency, Chart 7 and Graph 7 show the same data as Chart 6, except the suspect numbers have been removed. The following suspect values are not factored in Chart/Graph 7:

- Chevy P_4 CO (+16.75%)
- Dodge P_2 CO (+21.34%)
- Dodge P_3 CO (-80.62%)
- Ford P_3 NO_X (+510.71%)

Total Impact

Chevy	THC	CO	CO2	Nox	Fuel Gal.
10k	140 g	3.7 kg	173 kg	130 g	15.08
25k	350 g	9.25 kg	432.5 kg	325 g	37.7
50k	700 g	18.5 kg	865 kg	650 g	75.4
100k	1.4 kg	37.0 kg	1.73 tons	1.3 kg	150.8
Dodge					
10k	40 g	11 kg	182 kg	310 g	20.15
25k	100 g	27.5 kg	455 kg	775 g	50.38
50k	200 g	55 kg	910 kg	1.55 kg	100.75
100k	400 g	110 kg	1.82 tons	3.1 kg	201.5
Ford					
10k	50 g	1.7 kg	113 kg	NA	10.12
25k	125 g	4.25 kg	282.5 kg	NA	25.3
50k	250 g	8.5 kg	565 kg	NA	50.6
100k	500 g	17 kg	1.13 tons	NA	101.2

Chart 8 *Emissions reductions and fuel savings for 10k, 25k, 50k, and 100k miles driven.*

Chart 8 shows reduction in total pollutants and carbon footprint over the course of a year based on miles driven, and is derived from 100% of the Roush report data without adjustments. Fuel savings are calculated by (miles ÷ FE A_1) – (miles ÷ FE B_2). The total regulated pollution (THC + CO + NO_X) reduction equates to 39.7 kg for the Chevy, 113.5 kg for the Dodge, and 17.5 kg for the Ford per 100k miles driven. Total carbon footprint (THC + CO + CO_2) is reduced by 1768.4 kg (1.7684 metric tons) for the Chevy, 1930.4 kg (1.9304 metric tons) for the Dodge, and 1147.5 kg (1.1475 metric tons) for the Ford per 100k miles driven.

Average (of the 3 vehicles) regulated pollution reduction is 56.9 kg/100k miles. Average carbon footprint reduction is 1615.43 kg (1.6154 metric tons)/100k miles. Average fuel consumption reduction is 151.17 gallons/100k miles.

Big Picture

Fleet	10	50	100	500	1000
Pollutant	569 kg	2845	5690	28,450	56,900
Carbon	1.615 ton	80.77	161.5	807.72	1,615.43
Fuel gal	1511	7555	15,110	75,550	151,100

Chart 9 *Pollution reduction and fuel savings for fleets*

With individual numbers, fleet projections can be made. Chart 9 represents number of vehicles in a fleet driving 100k miles. For some fleets, this would be an annual cycle, for other fleets, this would be the lifetime of the vehicle. It becomes obvious that cumulatively, reductions in regulated pollutants, carbon footprint, and fuel usage add up to significant savings for fleets.

Considering there are approximately 300 million vehicles on the road in the United States in the private, government, and fleet sectors, installing the Smart Emissions Reducer on 1% of these vehicles (considering an average of 20k miles per year) would reduce:

- Regulated pollutants (THC, CO, and NO_X) by **34,140 metric tons per year**
- Carbon footprint (THC, CO, and CO_2) by **969,000 metric tons per year**
- Fuel consumption by **90.66 million gallons** (2.16 million barrels) per year
- Savings of **$362.6 Million** per year to consumers (at $4.00 per gallon)

These numbers are generated by averaging all 3 vehicles' pollution reduction, carbon reduction, and fuel savings at the 20k mile rate (100k numbers ÷ 5). For every additional percentage of total vehicle population retrofitted, multiply percent by numbers listed. For example, if 5% of vehicles were equipped with the Smart Emissions Reducer, savings to consumers would be over $1.8 Billion.

This report has been prepared by Mike Holler of Ecosceptor, LLC for Extreme Energy Solutions and represents testing for the Smart Emissions Reducer; a crankcase and exhaust emissions reduction device. This report may be used in part or in whole by EES. The Roush Industries documents at the end of this report are provided and backed by Roush Industries and constitute the foundation upon which this report is compiled. All charts, graphs, and claims outside of the Roush Industries documents are created by Ecosceptor, LLC. This report was submitted to EES on November 7, 2012.