ECO Fuel Systems, LLC

ECOFuelMax.com

(866) 374-0002

ECO Systems Fuel Enhancer
ECOFUELMAX

Independent
Test Results

ECO Fuel Systems, LLC

ECOFuelMax.com

(866) 374-0002

How the ECO Works

- ECO Systems Fuel Enhancers work by breaking up the Hydrocarbon chains of molecules and increasing the Reid Vapor Pressure in fuel. The results are a more combustible cleaner burning fuel.
    - Diesel RVP +/-6% to +/- 1%
    - Gasoline RVP +/-7.4% to +/-8.2%
- The ECO System only treats fuel, not an engine. No warranty issues.
- This process helps reduce Black Smoke and Carbon Pollution.
- Works on Gasoline, Diesel, Propane, Biofuels, Ethanol Blends, and Natural Gas.
- A more complete burn means increased horsepower, fuel efficiency & fewer Hydrocarbons released into the atmosphere.
- Reduce Diesel Particulate Matter, 40% to 70%+. Less DPF maintenance.
- Savings in fuel consumption, with a cleaner burning fuel can increase MPG 6% to 24%+, an average of 10%. Call it profit!
- Installed on 38,000+ School Buses, see *Who is Using It*.
- Products & Pricing

90 Day No Risk Money Back Satisfaction Guarantee

Any questions call or email us.

Cary Nagdeman, Director

ECOFuelMax.com
Cary@ECOFuelMax.com
(866) 374-0002

Fleet Fuel/ Regen Data 10/28/14

EMS (DuraMax)

Ecosytem unit

Unit #	Mileage	Hours	HSLR	GSLR	MSLR	Regen completed	Avg MPG	Reg/Dif.	Mileage	Hours	HSLR
70	211196	21751	9.9	9.5	44	1499	7.2	**15.8**	217042	22399	9.6
54	142092	14568	16.4	19.3	126	1066	7.5	**25.1**	15272	15272	1.8
38	199449	20288	9.7	5.8	43	126	8	**16**	206147	20976	9.6
24	19773	2022	7.13	7.9	66	158	8.1	**13.6**	26682	2690	23.16
26	159157	16385	8.3	9.5	101	1127	7	**13.68**	166025	17124	3
39	128011	12904	1.86	2.4	13	1189	6.6	**11.74**	134413	13585	0.6
58	148367	14999	1.02	1.3	15	1622	6.8	**6.45**	153908	15586	0.47
56	2096	74	11.86	11.6	98	14	8	**17.7**	6629	729	14.46
29	151455	15524	1.5	1.1	11	1170	7.4	**13.76**	157168	16116	2.3
36	582	38	2.33	2.4	14	13	5.4	**21.83**	4213	431	11.87

AVG MPG 7.2

Average 15.5 Hour/ Regens

72% Reduction in Regens

Non-Ecosystem unit

Unit #	Mileage	Hours	HSLR	GSLR	MSLR	Regen completed	Avg MPG	Reg/Dif	Mileage	Hours	HSLR
34	186449	19084	7.6	10	63	1178	6.8	**0.96**	191563	19594	6.9
60	119648	12225	2.11	2.1	6	1118	6.3	**9.75**	126489	12976	3.28
601	70320	4408	7.4	8.4	101	127	6	**1.92**	74120	4819	9.4
37	233603	23947	7.6	7.1	78	1580	6.4	**15.48**	140525	24675	14.5
23	46156	4355	0.26	0.3	0	242	7.6	**21.23**	51568	4907	17.02
55	147198	14880	1.97	2.4	28	1603	6.3	**0.94**	155711	15291	6.1
28	156821	16816	12.07	15.3	117	380	6.9	**15.6**	167771	16910	18
57	194076	19839	2.5	3.2	29	1358	7.4	**15.42**	200664	20564	4.6
74	214243	21964	1.1	1.8	27	2301	7.1	**7.5**	220006	22586	3.6
31	157145	16132	9.22	15.8	135	124	7.2	**1.27**	163682	16859	1.9

AVG MPG 6.8

Average 9 Hour / Regens

Final Download 12/15/14

GSLR	MSLR	Regen completed	Avg MPG
10.16	119	1540	**9.4**
1.8	13	1094	**8.2**
13.9	127	169	**8.5**
26.9	235	207	**8.6**
3.2	26	1181	**8.1**
0.5	1	1247	**6.7**
0.5	4	1713	**7.9**
19.7	179	51	**8.3**
2.1	9	1213	**7.6**
11.9	165	31	**8.1**

AVG MPG 8.14

13% Increase in Fuel Economy

GSLR	MSLR	Regen completed	Avg MPG
9	99	1709	**6.9**
5.3	41	1195	**6.7**
11.9	88	341	**7.6**
18.2	174	1627	**6.4**
21.1	184	268	**7.5**
6.1	47	2037	**7.5**
8	89	386	**7.2**
4	44	1405	**7.5**
5.8	87	2384	**6.1**
2.1	12	695	**7.1**

AVG MPG 7.05

Operating Principles of ECO Systems Fuel Enhancer

by
Richard Carlson
smogboss@aol.com

Objective:

Many tests have been conducted on the ECO Systems family of products. These tests have consistently shown improved fuel efficiency in a variety of engines and fuels types. The objective of this study is to establish how the device produces the observed improvements in combustion and how they relate to natural gas fuel engines and burning equipment.

Device Description:

The ECO Systems device consists of a steel tube containing a series of copper disks with a center hold and holes formed between the disks and the inside of the steel tube. The device does not contain magnets, consume chemicals, or use external electrical power. The device is produced in several sizes. The same device design is used for liquid fuels and for natural gas. The design promotes turbulent flow and extensive metal to fluid (liquid or gas) surface contact. The device is installed inline to an existing pipeline by cutting out a section, threading the ends and using pipe unions to attach the device. The device is manufactured by Emissions Technology, Inc., (ETI) of Tulsa, OK. The product is labeled ECO-x where x is the product model (size).

ECO Systems Sponsored Tests:

ETI has sponsored several tests to establish the fuel efficiency and emission reduction benefits plus any physical-chemical changes in the treated fuel. Teeter (1), determined that there was no significant effect on surface tension or chemical composition of diesel fuel, although vapor pressure was increased and pour point temperature was lower in the treated fuel compared to untreated fuel. Johnson (2) evaluated the vapor pressure changes due to the device in diesel fuel and gasoline and believed they were significant (not quantified) and related to improved combustion. A test conducted by SGS US Testing Co. (3) on a natural gas burner showed a 1.8% increase in combustion gas temperature at constant methane and air supply when using the ECO System fuel enhancer. A test conducted for the Texas Commission for Environmental Quality (4) showed an average reduction in HC and NOx emissions of 6-7% and 1% in fuel consumption from 4 high-mileage gasoline vehicles when using the ECO-System device.

Suggested Mechanism:

Based on the device description, several possible mechanisms (magnetic force, chemical reactivity or compositional changes, flow restriction or line pressure modulation) cannot occur. However, extensive laboratory and field research has established (5) that low conductivity flowing fluids can generate electrostatic charges on pipes and hoses. An equal and opposing charge occurs within low conductivity fluids, a process called flow electrification and the resulting current is usually referred to as a streaming current. The electrostatic charge density (Coulombs/kg) of a fluid in a duct or tube increases with increased flow velocity and decreases with increased mass flow density. This is basically related to the frequency of molecular collisions of the fluid with the duct surfaces.

Independent Research Reports:

Gasoline, diesel fuel, and natural gas have low electrical conductivity. This phenomenon results in well known transportation and handling risk because the electrostatic charge can cause a sudden spark that can ignite the fuel. Parameters causing increased levels of electrostatic potential include (5):

- Decreasing fluid conductivity
- Increasing flow velocity
- Increasing turbulence due to bends, constrictions, etc
- Increasing temperature of the fluid
- Decreasing humidity of the fluid.

Many technical papers discuss the beneficial effects of electrostatic charge on fuel atomization and distribution in liquid fuels. Leuteritz (6) reported that induced electrostatic charge of diesel fuel affected the core of the fuel spray such that additional waves were produced causing earlier breakup of the spray leading to smaller droplet diameters and larger spray angles. DiSalvo (7) expanded on this by showing that electrostatic energy improved atomization of diesel fuel yielding a significant improvement in combustion uniformity and efficiency. Parsons (8) determined that a negative charge induced in liquid flowing fuel survives through the injector orifice because the fuel is electrically insulating. The resulting spray pattern is better atomized and dispersed due to the electrostatic forces. Allen (9) reported data on an induced electrostatic charge in the fuel which resulted in improved atomization of diesel fuel. The paper reports that the physical mechanism is to reduce the inherent surface tension of the droplet surface. Reducing surface tension will generally increase the observed vapor pressure of liquid fuels which has been a commonly reported effect of the ECO-System device.

The above reports support the conclusion that liquid fuels are electrostatically charged by turbulent flow caused by impact of fuel droplets with the metallic surface; and that, once charged, retain that charge long into the engine, where the effect can be seen in improved dispersion and more rapid cylinder pressure rise.

Application of ECO Systems Fuel Enhancer to Natural Gas Engines and Gas Burners:

The data reported above was based on electrostatic properties in liquid fuels. However, natural gas also is non-conductive and is predominately methane. Lu (10) reported a generalized model for determining the entraining electrostatic charge in flowing compressed natural gas, generally referred to as the streaming current. Natural gas flowing through the ECO-System device accumulates electrostatic charge due to gas/surface collisions which is enhanced by the turbulence inherent in the device design. Mattheson Tri-Gas (11) reported that electrostatic charges are generated by flowing methane and they may be sufficiently high to cause explosive discharge in the presence of gas leaks. Methane is a non-polar molecule with strong covalent bonds between carbon and hydrogen atoms. This makes the molecules resistant to magnetic forces but still susceptible to electrostatic charging.

The Gas Research Institute has studied the effects of electrostatic charging on piping failures and gas explosions. Ersoy (12) reported that friction of high velocity flowing natural gas in a pipe will generate an electrostatic charge. Any obstacles in the flow path increase turbulence and friction and in turn increase the generation of static charge on the pipe and in the flowing gas.

Field Tests of ECO System Fuel Enhancer:

Tests were conducted on a natural gas engine and boiler plant operating in the San Joaquin Valley. These tests consistently showed a 2% reduction in fuel used for the same work output.

Grimmway Farms Pump PE185 (02-18-2009)	Baseline	ECO-GAS	% Change
Gas Input (cu.ft./hr)	1469.39	1440.00	-2.00
Energy Input (Therms/hr)	15.16	14.86	-1.98
Work (Acre-ft/hr)	0.145	0.145	0.00
Therms/Acre-ft	104.85	102.75	-2.00
Langer Farms Miura 7.9MBTU Boiler (05-5-2009)			
Low Load Gas Input (cu.ft.)	2434	2391	-1.77
High Load Gas Input (cu.ft.)	6462	6308	-2.38

Residential Gas Appliance Tests of ECO Systems Fuel Enhancer:

Tests were run on a residential stove/oven by measuring the time required to raise water in a sauce pan and to heat the oven a fixed number of degrees. An ECO-5 gas unit was installed on the gas line entering the stove. The heating time was reduced 2-3%.

Boil Water Test (7-10-2009)	Baseline	ECO-GAS	% Change
Starting air temperature (F)	70	70	0.00
Starting water temperature (F)	64	64	0.00
Amount of water (oz)	128	128	0.00
Time to reach 200F (seconds)	1,291	1,253	-2.94

Oven Pre-heating Test (7-10-2009)	Baseline	ECO-GAS	% Change
Starting oven wall temperature (F)	67	67	0.00
Time to reach 350F (seconds)	471	459	-2.55

Discussion:

The data collected from tests of the ECO Systems Fuel Enhancer has shown consistent 2% energy efficiencies in natural gas fueled engines, a boiler, and residential appliances. The principal of operation has been shown to be electrostatic charging of the fuel by the Fuel Enhancer, because other principals of operation (chemical reaction, magnetic charge, catalytic reforming of the fuel, external electrical charging or plasma) are not embodied in the Fuel Enhancer. Technical literature supports that fuel, once charged, retains the charge for the time required to travel from the Fuel Enhancer into the engine or gas burner due to the low electrical conductivity of natural gas. The electrostatically charged gas molecules promote more complete fuel/air mixing which results in more complete combustion and the observed energy saving. This electrostatic charge effect is small compared to the inherent energy of the fuel molecule and is insufficient to reach an explosive discharge potential.

Conclusions:

1) The ECO-System Fuel Enhancer design promotes electrostatically charging of flowing fluids, including natural gas.
2) Natural gas fuels are electrostatically charged by flowing through the Fuel Enhancer.
3) Electrostatically charged fuel retains its charge during the time required to transit the fuel delivery system into the engine or burner.
4) Electrostatically charged fuel mixes with air and burns more efficiently than uncharged fuel resulting in reduced fuel consumption for the same work performed.
5) Electrostatically charged fuel from the Fuel Enhancer has provided a reproducible 2% energy savings in a number of tests.

References:

1. Teeters, Dale, "Preliminary Physical and Chemical Evaluation of Fuel Treated by ETI's Fuel Conditioning Device," University of Tulsa, 1991.
2. Johnson, Kent, "Personal correspondence," 1991.
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4. Thomason, J.W., "Emissions Reducing Benefits of the ECO-Systems Retrofit Device," Final Report, TCEQ Contract No. 02-R01-27G, January, 2005
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6. U. Leuteritz, "A Novel Injection System for Combustion Engines Based on Electrostatic Fuel Atomization", SAE Paper 2000-01-2041, June 2000.
7. Di Salvo, R., et al, "Electrostatic Atomization Insertion into Compression Ignition Engines, SAE Paper 2002-01-3053, June 2002.
8. Parsons, M, et al, "Electrospray for Fuel Injection", SAE Paper 972987, October, 1997
9. Allen, J., et al. "Experimental Test Results from a Novel Low Power Electrostatic Port Fuel Injector for Small Engines," SAE Paper 2005-32-0090, October 2005.
10. Lu, Z.Y., H. Fox, "New Numerical Algorithm on Electric Streaming Currents in Turbulent Flow," American Institute of Aeronautics and Astronautics, 1996
11. Material Safety Data Sheet, Methane, Matheson Tri-Gas, Copyright 2009
12. Ersoy, D. "Static Discharge Failure of PE Pipe," Gas Technology Institute Report #GRI 05/147, 2003, page 7.

Credentials of Richard Carlson:

1. Master of Science degree in Environmental Engineering from UCLA.
2. Member - Society of Automotive Engineers for over 15 years.
3. 25 years performing and managing emission and performance tests at independent vehicle and engine testing laboratories in Southern California for government and corporate clients.
4. 12 years developing, testing, and certifying catalytic converters for major aftermarket catalytic converter manufacturer.
5. 5 years developing, testing, and certifying diesel emission control systems such as particulate filters, selective catalytic systems, and lean NOx traps.

United States Testing Company, Inc.

Tulsa Division

1341 NO. 108th EAST AVENUE TULSA, OKLAHOMA 74116
TELEPHONE: AREA CODE 918-437-8333

REPORT OF TEST

NUMBER
91-0047
3/4/91

CLIENT: Emissions Technology Inc.
P.O. Box 471916
Tulsa, OK 74147-1916

Attn: Alex Collin

SUBJECT:

Testing of diesel fuel samples for vapor pressure by the Reid mehtod.

SAMPLE IDENTIFICATION

Two jars of diesel fuel marked "Treated Diesel 2-20-91" and "Untreated Diesel 2/20/91".

RESULTS

	Treated	Untreated
Vapor Pressure, psig	1.0	0.6

The Reid vapor pressure is a measurement of the stabilized pressure exerted by a volume of liquid fuel at 100°F. The test is an indirect measurement of combustion characteristics. When more liquid volatilizes into the pressure chamber the vapor pressure increases. Higher fuel volatility indicates hotter burning characteristics. Therefore, higher vapor pressure indicates a hotter, consequently cleaner, burning fuel.

Mart V. Dean Ramy
March 17, 1992

SIGNED FOR THE COMPANY
C. Richard Finley
Mgr/Laboratory Services

United States Testing Company, Inc.

Tulsa Division

1341 NO. 108th EAST AVENUE TULSA, OKLAHOMA 74116

TELEPHONE: AREA CODE 918-437-8333

REPORT OF TEST

NUMBER

91-0073

3/22/91

CLIENT: Emissions Technology Inc.
P. O. Box 471916
Tulsa, OK 74147-1916

Attn: Alex Collin

SUBJECT: Testing of unleaded gasoline for Reid Vapor Pressure.

SAMPLE IDENTIFICATION

Two samples of regular unleaded gasoline, one untreated, one treated with Ecolizer.

TEST RESULTS

Untreated Sample	7.6 lbs.
Treated W/Ecolizer	8.4 lbs.

The Reid vapor pressure is a measurement of the stablized pressure exerted by a volume of liquid fuel at 100°F. The test is an indirect measurement of combustion characteristics. When more liquid volatilizes into the pressure chamber the vapor pressure increases. Higher fuel volatility indicates hotter burning characteristics. Therefore, higher vapor pressure indicates a hotter, consequently cleaner, burning fuel.

NOTARY PUBLIC

notary
Dean Raney
Exp. March 17, 92

SIGNED FOR THE COMPANY

C. Richard Finley, Manager
Laboratory Services

SGS U.S. Testing Company Inc.

1341 North 106th East Avenue • Tulsa, OK 74116 • Tel: 918-437-8333 • Fax: 918-437-8487

CLIENT: Emissions Technology Inc.
P.O. Box 471918
Tulsa, OK 74147-1916

Attn: Clark Daywalt

Test Report No:	162482	Date:	November 2, 2001

SUBJECT: Pressure Tests.

REFERENCE: Letter.

SAMPLE ID: Two (2) samples identified as "ECO Units" were received from the client on 10/29/01. The samples received were ¼" NPT by 8" in length. The samples were received in good condition.

PROCEDURE: The samples were evaluated by gradually applying a 10,000 psi hydrostatic pressure for 1 minute or until failure. No revisions to this report will be allowed after 90 days of the report date.

RESULTS: Sample: ¼" NPT by 8" length
Both samples held 10,000 psi for one minute without failure.

TEST DATE: 11/1/01.

SIGNED FOR AND ON BEHALF OF
SGS U.S. TESTING COMPANY INC.

Simmons
Dept. Manager/Product Evaluation

Dale E. Holloway
Tulsa Branch Director

Eco-2 Vapor Pressure Enhancer Study

Prepared by

Wallace Environmental Testing Laboratories, Inc.
2140 Wirtcrest
Houston, TX 77055

FINAL REPORT

Prepared for

Emissions Technology of Texas

October 2004

Introduction

The purpose of this study was to determine the effectiveness of the Eco-2 Vapor Pressure Enhancer in reducing emissions and increasing fuel economy. The method used for such determination was a comparison of emissions and fuel economy test results obtained prior to device installation with those achieved after the device was installed. To stabilize the vehicle prior to testing, forty miles were accumulated prior to each test series. For each vehicle a series of three EPA-75 FTPs and three Highway Fuel Economy Tests (HWFET) were performed without the device installed. After the device was installed, each vehicle was subject to another series of three EPA-75 FTPs and three HWFETs.

All testing for this study was performed at Wallace Environmental Testing Laboratories, Inc. using the guidelines of 40CFR86.

Test Procedures

Four late model trucks were tested under dynamometer conditions. Emissions Technology of Texas provided the trucks for this study. The test selection consisted of 1996-1998 and 2000 model year trucks (See Table 1 for a complete list of test vehicles). The starting mileage on the trucks ranged from 99,814 to 130,890 miles.

All testing and mileage accumulation was performed using 87-octane, commercially available fuel.

Each truck's emission levels were tested using the three phase, EPA-75 Federal Test Procedure, as outlined in *Code of Federal Regulations, Title 40, Part 86*. A Clayton model ECE-50 dynamometer with direct-drive variable inertia flywheel system was used for testing. The inertia system on this dynamometer can simulate vehicle weights from 1,000-5,750 lbs. in 125-lb increments. A 5,000 cfm cooling fan in front of each test vehicles provided air flow during all tests. During soak periods, the fan was turned off. Wallace Environmental Testing Laboratories' Constant Volume Sampler, a Horiba Instruments CVS, was used for collecting vehicle emissions samples.

All of the Light Duty Trucks were equipped with an OBD II system. This system enables the vehicle control module to determine if all exhaust emission related systems are functioning properly. The module can monitor systems which could adversely effect engine emissions. (i.e. Engine misfire, incorrect fuel mixture, ignition timing problems, etc.) At the request of Emissions Technology of Texas, a laptop computer was used to collect data from the OBD II system. The laptop utilized commercially available software, CarCode©, which logged all data available through the OBD II socket.

Table 1. Test Vehicles

Description	Classification	Engine Size	Starting Mileage	Appendix Location
1998 Dodge Ram 1500	Light Duty Truck	3.9 L, V-6	99,814 miles	A
1996 GMC Safari	Light Duty Truck	4.3 L, V-6	109,780 miles	B
2000 Chevrolet 1500	Light Duty Truck	4.3 L, V-8	130,637 miles	C
1997 Ford F350	Heavy Duty Truck	5.8 L, V-8	130,890 miles	D

The EPA-75 Federal Test Procedure consists of three phases. The first phase is approximately 505 seconds, the second phase is approximately 870 seconds, and the third phase is 505 seconds. Between the second and third phase is a 540 second soak period. The HWFET consists of one-765 second phase.

Prior to testing, all fuel was drained. 87-octane, commercially available fuel was added to the vehicle. One three-phase city driving cycle and one one-phase driving cycle were driven to accumulate 20 miles on the vehicle. The vehicle was then taken on the road for 4 heavy throttle accelerations. One three-phase city driving cycle and one one-phase driving cycle were driven to accumulate 20 miles on the vehicle. Three EPA-75 FTPs and Three HWFET were then performed without the device.

The device was then added to the vehicle under the instruction of Emissions Technology of Texas. Again, the fuel was drained and fuel from the same batch of commercially available, 87-octane fuel was added. One three-phase city driving cycle and one one-phase driving cycle were driven to accumulate 20 miles on the vehicle. The vehicle was then taken on the road for 4 heavy throttle accelerations. One three-phase city driving cycle and one one-phase driving cycle were driven to accumulate 20 miles on the vehicle. Three EPA-75 FTPs and Three HWFET were then performed with the device installed.

For each EPA-75 FTP and HWFET, except those performed on the 1998 Dodge Ram 1500, the amount of fuel added to the vehicle prior to testing was measured into an external fuel tank. After each test the remaining fuel was drained and measured. The volumetric fuel economy was calculated by dividing the amount of fuel consumed during testing by the mileage accumulated during the test.

Test Results

EPA-75 Testing

The effect of adding the Eco-2 Vapor Pressure Enhancer was found in all instances to reduce most regulated emissions. Emission of hydrocarbon (HC), carbon monoxide (CO) and oxides of nitrogen (NO_x) were all reduced on the 1996 GMC Safari. The other three vehicles' emissions were reduced in two of three of the regulated emissions (See Table 2).

Table 2. Effect of Eco-2 Vapor Pressure Enhancer on Regulated Emissions

Vehicle	HC	CO	NO_x
1998 Dodge Ram 1500	0.693 %*	-2.712 %	-6.515 %
1996 GMC Safari	-13.136 %	-1.387 %	-4.534 %
2000 Chevrolet 1500	-4.307 %	9.184 %	-17.210 %
1997 Ford F350	-9.029 %	-2.415 %	1.530 %

*Positive values indicate an increase in emissions levels.

The greatest decrease in HC was found when the device was installed on the 1996 GMC Safari. The 1998 Dodge Ram 1500 had the greatest decrease in CO with the device installed. The 2000 Chevrolet 1500 had the largest decrease in NO_x of the vehicles tested. A graphical representation of regulated emissions effect on each vehicle is provided in Chart 1.

Chart 1. **Graphical Representation of Eco-2 Vapor Pressure Enhancer on Regulated Emissions**

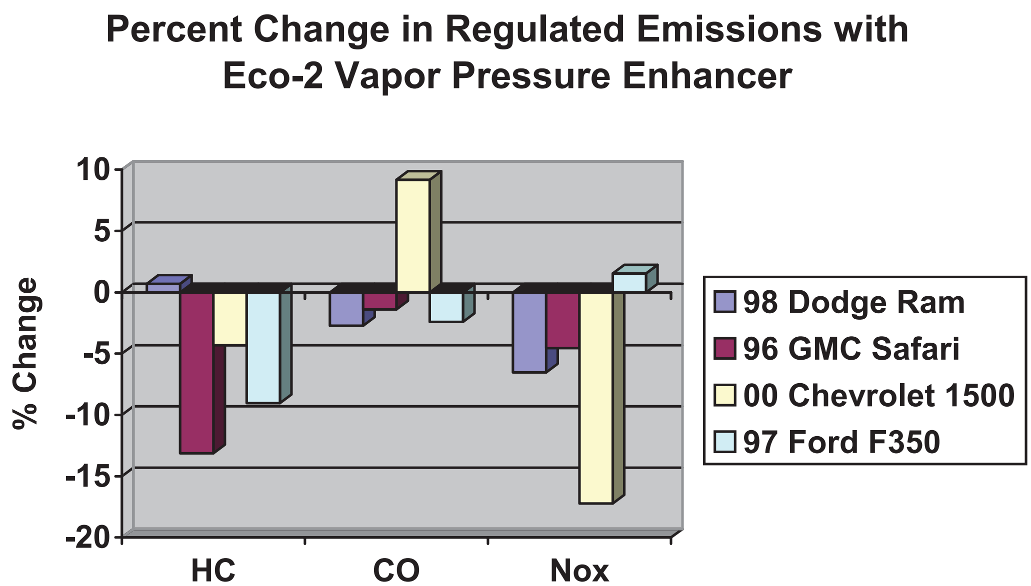

Table 3 shows the average effect on emissions over all vehicles.

Table 3. **Average Effect of Eco-2 Vapor Pressure Enhancer on Regulated Emissions**

HC	CO	NO_x
-6.445 %	0.668 %	-6.682 %

HWFET and Volumetric Fuel Economy

The HWFET calculates fuel economy based on HC emissions. Volumetric fuel economy calculations are based upon the fuel consumed during the test. Table 4 provides an overview of the effect of the addition of the device on fuel economy.

Table 4. Effect of Eco-2 Vapor Pressure Enhancer on Fuel Economy

Vehicle	HWFET fuel economy	Volumetric fuel economy
1998 Ram 1500	1.37 %	N/A[t]
1996 GMC Safari	-0.094 %*	1.46 %
2000 Chevrolet 1500	0.15 %	-0.14 %
1997 Ford F350	1.17 %	2.44 %

*A negative value indicates a decrease in fuel economy.
[t] No volumetric fuel economy calculations were performed on the Ram 1500.

The 1998 Dodge Ram 1500 was unable to be tested using the volumetric fuel economy method as the Dodge was not factory equipped with a fuel return line.

The 1997 Ford F350 had the greatest increase in fuel economy, both as measured by the HWFET and the volumetric methods. A graphical representation of the fuel economy measurement results can be found in Chart 2, on the following page.

Chart 2. Percent Change in Fuel Economy with Eco-2 Vapor Pressure Enhancer

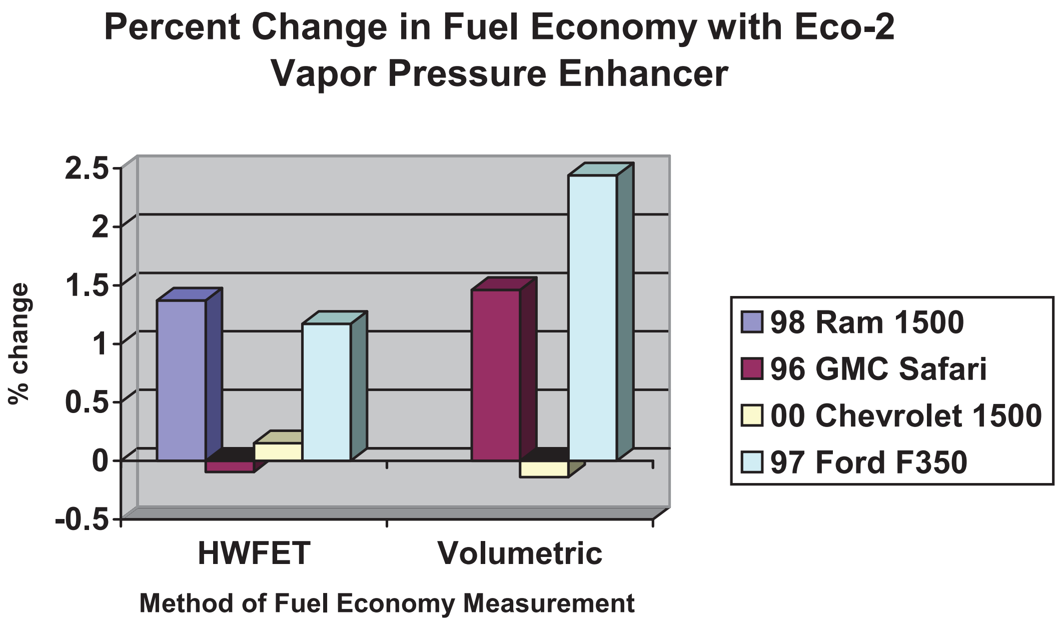

Table 5 shows the average effect on fuel economy over all vehicles.

Table 5. Average Effect of Eco-2 Vapor Pressure Enhancer on Fuel Economy

HWFET fuel economy	Volumetric fuel economy
0.649 %	1.253 %

OBD II monitoring

Of the four vehicles tested, three were equipped with an On Board Diagnostic system level II. Of the parameters monitored, Emissions Technology of Texas requested that the percent change of rpm, speed and throttle percent be calculated. Table 6 shows the average percent change in each of these parameters over the three vehicles that were monitored.

Table 6. Average percent change of monitored parameters with device installed.

% change	EPA-75 FTP	HWFET
rpm	- 0.3 %	- 0.367 %
Speed	- 2.267 %	- 0.133 %
Throttle %	1.067 %	2.833 %

Emissions Reducing Benefits of the ECO-Systems Retrofit Device

FINAL REPORT

Texas Council on Environmental Technology (TCET)
Emissions Reducing Grant
Contract Number 02-R01-27G

Prepared by
J. Wade Thomason II
On behalf of
Emissions Technology of Texas, L.L.C.

For the
Texas Commission on Environmental Quality
New Technology, Research & Development Program
January 2005

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Tables and Graphs

Preface

This report is being submitted as required by Texas Commission on Environmental Quality (TCEQ) Contract Number 02-R01-27G. It was prepared by J. Wade Thomason II, President and Principal; J. Wade Thomason II Public Affairs on behalf of the grant recipient Emissions Technology of Texas, L.L.C.

Introduction

This is the final report for the TCET (Texas Council on Environmental Technology) grant funded project that was awarded in 2003 to Emissions Technology of Texas, L.L.C., distributor of the ECO-System (Emission Control Optimizer), a retrofit fuel line device designed to decrease tailpipe emissions. The purpose of the project was to test the ECO-System device for its effectiveness in reducing tailpipe emissions from gasoline engines, particularly nitrogen oxides and hydrocarbons, the two main components of ground level ozone. This was done in an EPA approved laboratory on a treadmill using an emissions gas analyzer and other equipment, as per EPA Federal Test Procedures (FTP). Test vehicles were targeted that research has shown are major emitters of these emissions among on-road vehicles in the Dallas-Ft. Worth and Houston-Galveston ozone nonattainment areas, which are also the largest metropolitan areas in Texas. The purpose of this strategy was to demonstrate the potential for the technology to reduce the contribution to ozone formation made by these high emitting vehicles, if it were to be deployed in sufficient magnitude in the two largest and worst ozone nonattainment areas in Texas.

The original intent of the testing was to use the data gathered to pursue EPA Verification. Receiving EPA Verification would qualify the technology for eligibility as a strategy to be used in the SIP (State Implementation Plan) for nonattainment areas and in the EAC (Early Action Compact) of near nonattainment areas opting for that plan.

History of the Project

The Texas Council on Environmental Technology (TCET) was created by the Texas Legislature in 2001 to promote the development of technology designed to improve air quality that could be deployed in areas of Texas that are not meeting federal air quality standards. The council came into being on September 1, 2001 and over the next year the structure for creating and implementing an environmental technology grant program was put into place. Subsequently, a request for proposals (RFP No. 02-R01) was issued in 2002 and a grant for $81,700 was awarded to Emissions Technology of Texas, L.L.C. However, approximately another year went by as TCET requested further information which was provided in correspondence dated July 24, 2003, July 31, 2003, August 8, 2003, and August 31, 2003. Finally, a grant agreement was signed that provided an eight month contract period beginning on August 1, 2003 and terminating on March 30, 2004. By this point in time (2003), the Texas Legislature was again in session and at the behest of Governor Perry, TCET was dissolved and its responsibilities were transferred to the Texas Commission on Environmental Quality (TCEQ), where it became the New Technology Research and Development (NTRD) program.

Due to the transition of the program to a new home and issues involving the grant recipient, Emissions Technology of Texas, L.L.C., and their consultant, Good Company Associates, grant activities were not initiated and no funds were expended. Rather than lose the grant, in February 2004, the grant recipient requested a six month extension of the grant contract. Two changes to the agreement were also requested. These were the transfer of project management responsibilities from Good Company Associates to J. Wade Thomason II Public Affairs and changing the emissions testing facility from Southwest Research Institute to Wallace Environmental Testing Laboratories, Inc. (WETL, Inc.). These requests were granted and a six month contract extension was initiated that began on April 1, 2004 and terminated on September 30, 2004. Due to their inability to complete all the tasks in the work plan, the grantee requested and received another contract extension of four months beginning on October 1, 2004 and ending on January 31, 2005.

Description of the Technology

The housing of the ECO-System retrofit fuel line device consists of a steel tube with threaded fittings on each end. The fittings are used to install the unit on the fuel line after the fuel filter and before the carburetor or fuel injectors. The core of the unit is composed of a series of copper discs that are punched out and bent in a concave direction. These copper discs are packed tightly within the steel tube.

As the fuel passes through the device, it is agitated. This creates a reaction that breaks up the hydrocarbon bonds in the fuel and increases its volatility or Reid Vapor Pressure (RFP), as well as increasing the vaporization of the fuel by the injectors or carburetor. This vaporization causes the fuel to combust more completely, resulting in a more uniform and even burn. Burning the fuel more completely reduces emissions of HC and CO, while burning the fuel more evenly reduces the NOx emissions. By causing the fuel to burn more completely, there are less evaporative emissions; more power is derived from the fuel which causes an increase in performance, and fuel economy is realized as less fuel is needed to do the same job.

Goals of the Project

The original primary goal of the project was to use the test data for verification testing. However, over time it became apparent that this was not going to be feasible, for a number of reasons. Almost two years passed from the time the grant application was approved and the grant activities were finally initiated. Cost estimates used in the grant proposal were dated by the time the grant activities actually took place. Significant changes also took place over that time period including the government entity responsible for the program and the project management. Over this period of time and with significant personnel changes, things are sometimes lost due to a lack of continuity and institutional memory. Nonetheless, the original intent of demonstrating the effectiveness of the technology in reducing ozone causing tailpipe pollutants remained. Therefore, it was determined that the testing would be conducted at WETL, Inc. and the test results would be used to determine the viability of the technology to pursue EPA Verification, not to actually conduct verification testing, which was to have taken place at Southwest Research Institute in San Antonio.

In terms of demonstrating its ability to reduce regulated tailpipe emissions, the ECO-System device performed well, as was demonstrated by the test results. WETL, Inc. stated in their FINAL REPORT that **"the effect of adding the Eco-2 Vapor Pressure Enhancer was found in all instances to reduce most regulated emissions."** These emissions test results, fuel economy tests, and other aspects of the technology that may not be represented well in the test results, will be discussed later in this report. Whether the technology will eventually be subjected to verification testing will also be discussed in the *Conclusions and Recommendations* section of this report.

Summary of the Project Activities

Three contractors were responsible for completion of the project activities. Their areas of responsibility were as follows:

CONTRACTOR	RESPONSIBILITIES
1. J. Wade Thomason II Public Affairs	Project management & liaison to TCEQ, Administrative duties including reporting requirements and financial affairs
2. Charles Edwin "Ed" Martin Jr.	Technical adviser on selection of test vehicles, test procedures and test results
3. Wallace Environmental Testing Laboratories, Inc	Test four selected vehicles for emissions and fuel economy in a laboratory setting following Federal Test Procedures (FTP) and reporting the test results to TCEQ

The grant recipient, Ben Talamantez with Emissions Technology of Texas, was also closely involved with the project. He provided several in-kind services. These included furnishing the ECO-System devices for the testing and providing expertise on installing them, as well as his personal expenses for traveling to Houston and time spent there, time away from his business, and other project associated costs.

Because the purpose of the project changed while it was already underway, some effort was made initially toward working with EPA/ETV at Research Triangle Institute to determine a prudent plan that would lead to verification. Once it was determined that the test data would not be considered for verification purposes, the tasks related to EPA involvement in the original Updated Scope of Work, Schedule, and Deliverables became obsolete. Therefore, during the process of receiving a second contract extension in October 2004, the Updated Scope of Work, Schedule, and Deliverables (2^{nd} Contract Extension) was revised accordingly. Comments are provided under each item listed below to summarize activities and evaluate contractor's performance.

Updated Scope of Work, Schedule, and Deliverables
(2^{nd} Contract Extension)

To carry out the proposed project, Emissions Technology of Texas and/or its consultant will:

1. Contract with TCEQ for this project (April 1, 2004 or sooner).

A contract extension was granted and signed by TCEQ on March 30, 2004. A second contract extension was signed in September 2004 that extends the contract period until January 31, 2005.

2. Contract with J. Wade Thomason II, consultant, to manage the project and be TCEQ's primary contact throughout the project (April 1, 2004 or sooner).

J. Wade Thomason II Public Affairs was hired on April 1, 2004 and has been responsible for project management and administration, including acting as liaison for Emissions Technology of Texas to all involved parties, including TCEQ.

3. Begin dialogue with EPA/ETV Program at Research Triangle Institute to determine the most expeditious verification plan (April 1, 2004 or sooner).

Contact was made via telephone on April 8, 2004 with Mr. Drew Trenholm/EPA Environmental Technology Verification (ETV) program at Research Triangle Institute, Research Triangle Park, North Carolina. Verification issues were discussed as they pertained to Eco-System's pursuit of EPA Verification. A follow up letter and project information were sent for his perusal and comment on April 28, 2004. In discussions with EPA, it was determined that further testing beyond this project would be needed to pursue verification. This led to the conclusion that the testing done during the project will not be considered for verification purposes, but will be considered pre-verification testing to demonstrate the effectiveness of the technology and its potential for pursuing a verification plan.

4. In consultation with TCEQ, determine the appropriate testing design and protocol (April 15, 2004).

As part of granting the first contract extension, TCEQ approved the submitted testing plan, which had been developed during the original grant period and followed federal testing protocol. Southwest Research Institute and Wallace Laboratories concurred prior to the project that the testing plan met all requirements for Federal Test Procedures (FTP) and Highway Fuel Economy Tests (HFET).

5. Based on availability and cost effectiveness, designate an EPA approved emissions testing facility to conduct testing of the retrofit device, consistent with Federal Test Procedures (FTP). Wallace Laboratories of Houston is the first choice. (April 30, 2004)

Wallace Environmental Testing Laboratories, Inc. (WETL, Inc.) in Houston was approved by TCEQ as part of the contract extension. Wallace submitted a testing plan that was used as the basis for approval. Because of their requirement for payment prior to testing, payment of $54,000.00 was made and a contract was signed on June 15, 2004. Testing began in June and concluded at the end of July, 2004.

6. Determine through research, the best candidate vehicles for retrofit devices, based upon their contribution to the pollutants that form ground level ozone (NOx and HC) in the major Texas urban nonattainment areas. Confirm findings and conclusions with TCEQ. (April 30, 2004)

Ed Martin worked with the Mobile Source staff at TCEQ and analyzed data provided by them. Records of emissions testing conducted by his company in the Dallas-Ft.Worth area were also reviewed. Because of his involvement in the design of the Air Check Texas program, he has expertise in knowing which vehicles perform badly and why. During the first contract extension period, Wade Thomason and Ed Martin conducted a work session at Ed's office in Plano on April 30th. From that work session, they were able to cull down the candidate vehicles to the list presented during the May 6th conference call of the project team. After some further paring down from that list, they were able to choose the four vehicles to be tested from those available in the Port of Houston Authority motor pool. Ben Talamantez and Thomason physically inspected the vehicles at the POHA motor pool lot to ensure compliance with the established selection criteria. TCEQ was kept aware of developments as they occurred through progress reports submitted on a monthly basis, as well as phone calls and emails as needed.

7. Ed Martin will perform preliminary tests on the vehicles identified as best candidates for the retrofit devices, using a 5-gas analyzer and chassis dynamometer. (April 30, 2004)

These tests were performed in Plano on vehicles that fit the general profile criteria prior to selection of the actual test vehicles. These test data were used in determining which vehicles were chosen for testing.
Ed reviewed and approved the vehicles selected from the motor pool lot by Thomason and Talamantez.
He traveled to Houston on June 14th to examine the test vehicles prior to testing and confer with the project team, including the staff at Wallace Environmental Testing Laboratories.

8. Conduct initial vehicle testing. (Emissions Technology and/or consultant to be present at all times during testing.) (May 31, 2004)

Testing on the first vehicle (1999 V-6 3.9L Dodge Magnum Pick Up) began the week of June 14th and concluded the last week of June. A representative of Emissions Technology and/or the Project Manager was present at all times during the testing.

9. Review the preliminary results of the initial tests. Identify, if any, problems or unexpected issues that may arise. If adjustments need to be made to the testing procedure, those will only be made with approval from TCEQ, or the testing facility. (May 31, 2004)

Initial test results were examined and discussed by the grant recipient, consultants, and Wallace Laboratories staff. No significant changes were made to the testing procedures. Unexpected problems were encountered with the fuel system (fuel regulator in tank, no return fuel line) causing the volumetric fuel economy test to be very difficult to conduct and it was decided that it would not be done. None of the other vehicles had this type of fuel system, so it was not a problem for the rest of the testing.

10. Test the remainder of the designated vehicle types. (May 31, 2004)

The vehicle testing concluded on July 16, 2004.

11. Receive the lab report. (October 10, 2004)

The Final Report and Individual Vehicle Reports for each of the four test vehicles were submitted in hard copy form by WETL, Inc. to TCEQ in early October. The grant recipient was furnished with the same documentation.

12. Review the report and send a copy to TCEQ. (October 15, 2004)

TCEQ received hard copies of all the supporting testing documentation, in addition to the Final Report and Individual Vehicle Reports in October directly from Wallace Labs. These have been available for review since mid October. Thomason has also sent electronic copies of the Final Report and Individual Report to TCEQ/NTRD.

13. Review test results with TCEQ. (November 15, 2004)

Wade Thomason met with TCEQ/NTRD staff on behalf of Emissions Technology in September to discuss issues related to the grant project. However, a fruitful discussion of the test results between TCEQ and the grant recipient cannot take place prior to TCEQ reviewing the final project report, due to information presented in the report regarding the testing.

14. Submit draft final report to TCEQ. (November 30, 2004)

Submitted on January 7, 2005.

15. Submit final report to TCEQ. (December 20, 2004)

Submitted on January 18, 2005.

16. TCEQ accepts final report. (January 31, 2005 or sooner)

Test Vehicles

As stated previously, four test vehicles were chosen based on research conducted by Ed Martin to determine the types of gasoline fueled on-road vehicles that are major emitters and have significant numbers among vehicle populations in the Houston-Galveston and Dallas-Ft. Worth ozone nonattainment areas. Fleets, as well as the general vehicle population, were included. It was determined that the target vehicles would be light-duty pick up trucks from the years 1996-1998. However, one heavy-duty truck and one 2000 model vehicle were chosen due to availability issues. Both of these were good test vehicles because they fit the profile for mileage, engine size, fuel use, and other factors. While all efforts were made to keep the test vehicles within the target parameters, limited availability of vehicles due to the lack of a budget for vehicle procurement was a factor in the eventual selection of the test vehicles. The logistical issues involving getting the vehicles to the test facility were also not addressed in the inherited work plan.

Without the assistance of the Port of Houston Authority (POHA), finding and obtaining vehicles that fit the needed criteria for the project may have been difficult without incurring further costs. The POHA provided vehicles from their motor pool and delivered them to the test facility. Due to their support, the project team was able to resolve the issues of obtaining test vehicles that met the desired criteria and getting them to the test site in a safe and timely manner.

The test vehicles selected were as follows:

Table 1. Test Vehicles

Test Vehicle	Classification	Engine Size	Mileage
1998 Dodge Ram 1500	Light Duty Truck	3.9L, V-6	99,814 miles
1996 GMC Safari Van	Light Duty Truck	4.3L, V-6	109,780 miles
2000 Chevrolet 1500	Light Duty Truck	5.0L, V-8	130,637 miles
1997 Ford F350	Heavy Duty Truck	5.8L, V-8	130,890 miles

Test Procedures

In order to determine the effectiveness of the ECO-System technology, a comparison of emissions and fuel economy was conducted before and after installing the device. For each vehicle a series of three EPA-75 Federal Test Procedures (FTP) and three Highway Fuel Economy Tests (HWFET) were performed without the device installed. After the device was installed, each vehicle was given another series of three EPA-75 FTPs and three HWFETs. All testing was performed at Wallace Environmental Testing Laboratories, Inc. using the guidelines of 40CFR86.

The EPA Federal Test Procedure consists of three phases. The first phase is approximately 505 seconds, the second phase is approximately 870 seconds, and the third phase is 505 seconds. Between the second and third phase is a 540 second soak period. The HWFET consists of one phase that is 765 seconds.

Prior to testing, all fuel was drained. Commercially available, unleaded gasoline with an 87 octane rating was added to the vehicle. The fuel used in all the test vehicles was taken from the same batch to ensure consistency. One three-phase city driving cycle and one one-phase driving cycle were driven to accumulate 20 miles on the vehicle. The vehicle was then taken on the road for 4 heavy throttle accelerations. One three-phase city driving cycle and one one-phase driving cycle were driven to accumulate 20 miles on the vehicle. Three EPA-75 FTPs and three HWFET were then performed without the device.

The device was then installed on the vehicle's fuel line under the instruction of Emissions Technology of Texas. The fuel was drained again and fuel from the same batch of commercially available 87 octane fuel was added. One three-phase city driving cycle and one one-phase driving cycle were driven to accumulate 20 miles on the vehicle. The vehicle was then taken on the road for 4 heavy throttle accelerations. One three-phase city driving cycle and one one-phase driving cycle were driven to accumulate 20 miles on the vehicle. Three EPA-75 FTPs and three HWFET were then performed with the device installed.

For each EPA-75 FTP and HWFET, except those performed on the 1998 Dodge Ram 1500, the amount of fuel added to the vehicle prior to testing was measured into an external fuel tank. After each test the remaining fuel was drained and measured. The volumetric fuel economy was calculated by dividing the amount of fuel consumed during testing by the mileage accumulated during the test.

Test Results

As seen in Table 2. WETL, Inc. concluded that "the effect of adding the ECO-2 Vapor Pressure Enhancer was found in all instances to reduce most regulated emissions." More importantly, ozone precursors NOx and HC were reduced significantly in 75% of the test vehicles. Three of the vehicles had three-test average NOx reductions of -4.5%, -6.5%, and -17.2%, all significant average reductions. Three of the vehicles had three-test average HC reductions of -4.3%, -9.0%, and -13.1%, again, all significant average reductions.

Table 2. Test Results: EPA-75 Testing

Vehicle	HC	CO	NOx
1998 Dodge Ram 1500	**0.693%***	**-2.712%**	**-6.515%**
1996 GMC Safari	**-13.136%**	**-1.387%**	**-4.534%**
2000 Chevrolet 1500	**-4.307%**	**9.184%**	**-17.210%**
1997 Ford F350	**-9.029%**	**-2.415%**	**1.530%**

*Positive values indicate an increase in emissions levels.

However, if you look at the range of reductions, rather than the average or mean of three tests, as is called for in federal testing protocol, you get a truer sense of the potential for actual reductions that could be obtained. In Table 2. the 1997 Ford F350 has a three-test average of a 1.530% increase in NOx. In Table 3. the range of NOx reduction is -4.6%. This is derived by subtracting the lowest NOx result after installation of the device from the highest NOx result before installation of the device. Similarly, the three vehicles that fared well in reducing NOx on the three-test average, have a range of reduction of -9.8%, -19.8%, and -23.4%, indicating the strong potential to increase the measured level of NOx reduction if a longer term study were conducted under real world application.

Table 3. Test Results: Range of Reductions for Nitrogen Oxides (NOx)

Vehicle	Highest NOx Pre-Installation	Lowest NOx Post-Installation	Range of Reduction
1998 Ram 1500	.960 ppm*	.770 ppm	-19.8%
1996 GMC Safari	.669 ppm	.604 ppm	-9.8%
2000 Chevrolet 1500	.960 ppm	.736 ppm	-23.4%
1997 Ford F350	3.669 ppm	3.502 ppm	-4.6%

***Parts per million**

Table 4. reflects the range of reductions of hydrocarbons for each test vehicle follows a similar pattern as that for NOx. For example, the Dodge Ram 1500 has a three-test average of a .693% (less than 1%) increase in HC emissions. However, the range of reduction of HC for this vehicle is a -2.4% decrease. Looking at the three vehicles that fared well for reducing HC emissions on the three-test average, they show a range of reduction of -11.3%, -17.5%, and -22%, all significant increases over their three-test average. Again, this points up the potential for greater emissions reductions than are reflected in the three-test average.

Table 4. Test Results: Range of Reductions for Hydrocarbons (HC)

Vehicle	Highest HC Pre-Installation	Lowest HC Post-Installation	Range of Reduction
1998 Ram 1500	.632 ppm	.617 ppm	-2.4%
1996 GMC Safari	.346 ppm	.270 ppm	-22%
2000 Chevrolet 1500	.444 ppm	.394 ppm	-11.3%
1997 Ford F350	.836 ppm	.690 ppm	-17.5%

The issues of appropriate testing protocol and interpretation of results are crucial when attempting to demonstrate the effectiveness of this technology in reducing ozone precursors from mobile sources. Because the technology is already being used in the field with good results, it behooves us to go a little deeper than just evaluating the technology based on the three-test average method. A longer term assessment of the technology's effectiveness is warranted when attempting to quantify its benefits. One that would better reflect use under real world conditions, accumulating more road mileage and testing again at specified mileage intervals, would be more accurate in determining its actual emissions reduction benefits.

This is true for the fuel economy tests as well. Table 5. illustrates the results of the HWFET and volumetric fuel economy tests conducted by WETL, Inc. Again, the results are a three-test average taken before and after the device was installed. Before each series of tests, the vehicle was driven through two twenty mile drive cycles. While the device showed an improvement in fuel economy in 3 out of 4 vehicles using the HWFET method and in 2 out of 3 vehicles using the volumetric method, the overall results ranged from a -0.14% decrease in fuel economy to a 2.44% increase in fuel economy. Although overall the results were positive, it is felt that to get a truer picture of the technology's effectiveness in increasing fuel economy; a more long term test would be needed. This rationale is based on the fact that the technology enhances the combustion of the fuel without altering any of the components of the engine. Therefore, the impact of fuel economy benefits derived from increased efficiency will not be seen immediately, but rather will occur incrementally as the technology begins to reverse the build up of carbon in the engine. As this clean up process occurs over time, the fuel is now being combusted more completely, the engine is cleaner and running more efficiently and less fuel is needed to accomplish the same task.

Table 5. Test Results: Fuel Economy Tests

Vehicle	HWFET Fuel Economy	Volumetric Fuel Economy
1998 Ram 1500	1.37%	N/A#
1996 GMC Safari	-0.094%*	1.46%
2000 Chevrolet 1500	0.15%	-0.14%
1997 Ford F350	1.17%	2.44%

*A negative value indicates a decrease in fuel economy
#No volumetric fuel economy calculations were performed on the Dodge Ram 1500

The HWFET calculates fuel economy based on HC emissions. For the ECO-System technology, this method is problematic because you are working with a very short drive cycle that doesn't allow the technology to realize its full potential. All the test vehicles had accumulated mileage of approximately 100,000 to 130,000 miles. Operating the vehicle for 40 miles after installation of the device, prior to testing, is not adequate to fully evaluate the fuel economy benefit of the technology.

Volumetric fuel economy calculations are based upon the fuel consumed during the test. The volumetric method measures the leftover fuel in the gas tank, in this case, usually the 2-3 gallons remaining after driving the two 20 mile drive cycles and doing the FTP and HWFET testing. Because all the technology's benefits are not all realized immediately after installation, it would be prudent to have follow up testing done after the test vehicles have accumulated some mileage with the device installed. Repeating the FTP and HWFET testing at 500 miles, 1,000 miles, and 1,500 miles after installation would be a fairer assessment of the technology's capabilities. However, this was not possible for this project due to logistics, financial issues, and other limitations.

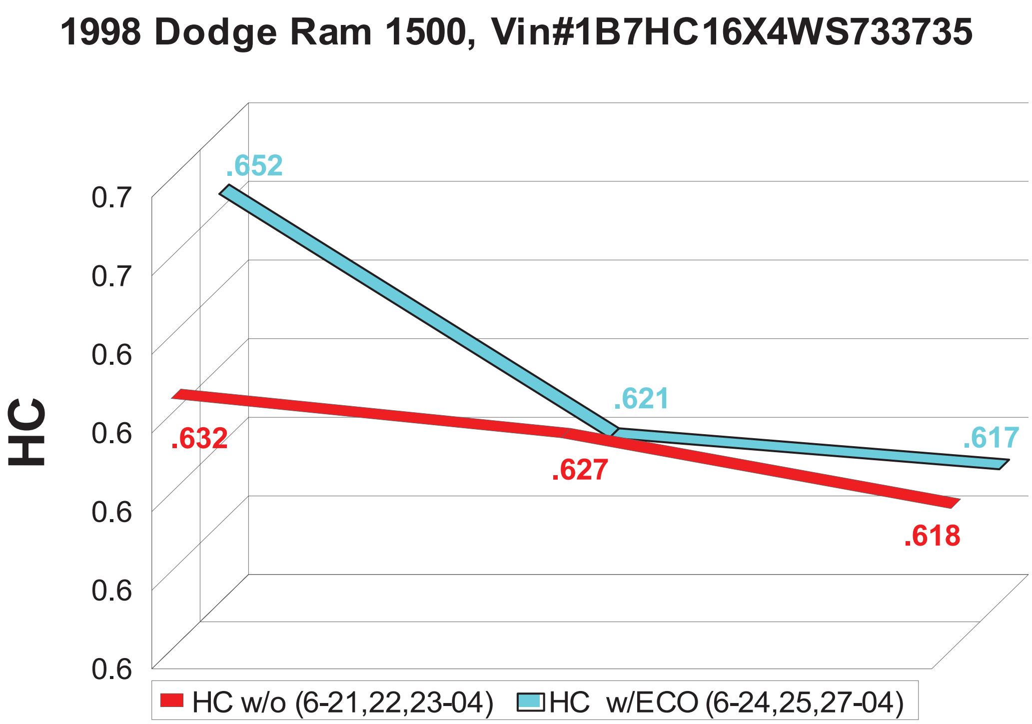
Understanding the Technology

To gain a better understanding of how the technology works, it is important to look again at the vehicle tests. All of the test vehicles had approximately 100,000 miles or more on them. Even with good maintenance there will be a considerable amount of carbon build up on the valves and piston heads, as well as varnish or paraffin in the fuel system. The ECO-System device not only increases the vapor pressure of the fuel, but also begins dissolving the varnish and carbon deposits. The emissions tests calculate the total emissions in the exhaust gas. HC is the fuel that is partially or completely unburned. Varnish is also HC based. As the technology dissolves these deposits, they are being added to the fuel. Therefore, it is not unrealistic to see the HC go up initially until these deposits are gone. This can create an unfair disadvantage in measuring fuel economy using the HWFET method because it is based on total HC emissions.

Two of the test vehicles experienced spikes in some emissions gases during the first test after the installation of the device. The 1998 Dodge Ram had its highest measured levels of HC (.652) and NOx (.994) during the first test after installation of the device. NOx is a gas created from heat and oxygen. Because the dissolved deposits are adding fuel to the system, they could easily increase combustion temperatures until they are removed. By the third after test, the vehicle measured its lowest levels for HC (.617) and NOx (.770). However, because of the three-test average method of evaluation, the initial spike skewed the averages for these emissions gases and the actual emissions reducing potential was not well reflected in the test results. The emissions for the three before and after tests for HC and NOx are shown in Graphs 1. and 2.

Graph 1. HC Emissions Tests

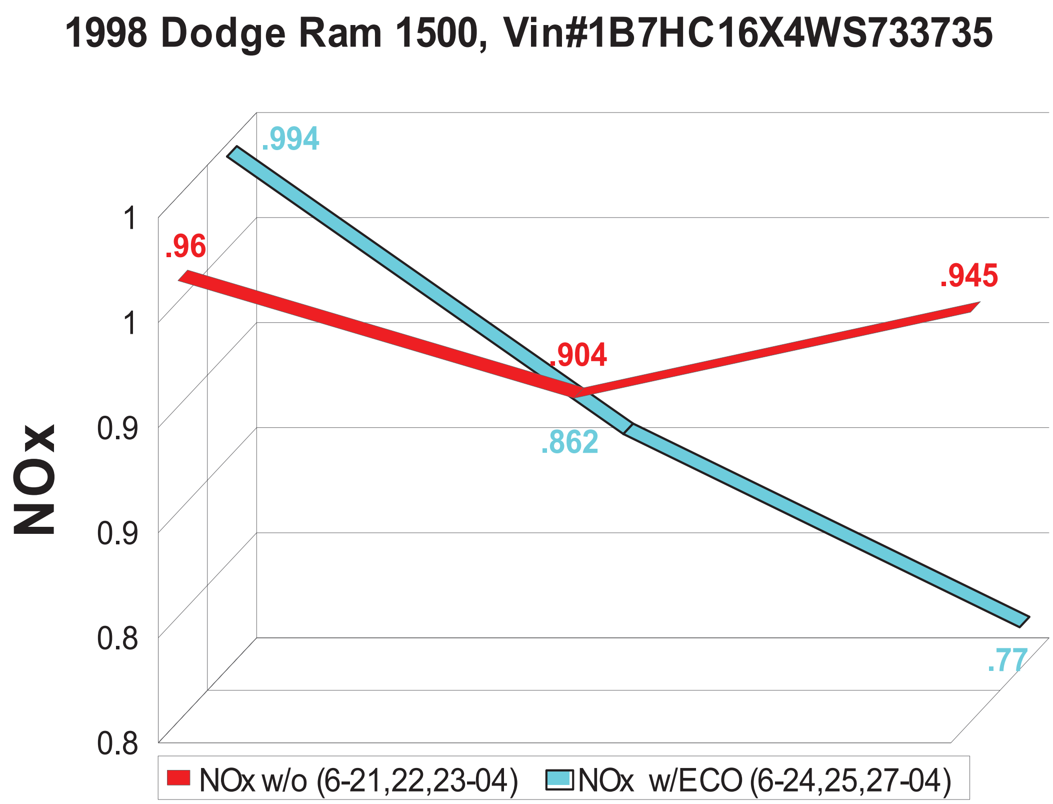
Wallace Environmental Testing Laboratories, Inc.
Houston, TX



Emissions Technology of Texas (210) 842-0703
Emissions Technology Inc., Tulsa, OK
(918) 663-2220

Graph 2. NOx Emissions Tests

Wallace Environmental Testing Laboratories, Inc.
Houston, TX



Emissions Technology of Texas **(210) 842-0703**
Emissions Technology Inc., Tulsa, OK
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Conclusions and Recommendations

The ECO-System technology fared well overall during emissions testing conducted during the summer of 2004 in Houston by Wallace Environmental Testing Laboratories, Inc. In particular, in most cases, ozone precursors NOx and HC were reduced significantly.

While test results for fuel economy were not as impressive, test procedures were felt to be inadequate to provide an accurate measurement for this technology due to a number of factors. These included too short of a drive cycle to allow the technology to fully function at its peak performance level, the potential for excess HC from the clean up process in the emissions gases that would impact the fuel economy negatively using the HWFET method, and the potential for error in measurement and calculations when dealing with such short drive cycles and small amounts of fuel as when using the volumetric method. A more long-term test plan is reasonable in this case to get a more accurate picture of the fuel economy benefit.

The future for the technology is good. As it is already in use in the field and has documented success with fuel economy and other benefits among several fleets, this laboratory emissions testing only strengthens the validity of the assertions of the manufacturer regarding its effectiveness at reducing emissions.

Truly, the technology holds great promise as an ozone reduction and fuel economy strategy that can be deployed cost-effectively on a large scale. In particular, high mileage fleets could be identified and targeted. Due to the financial constraints of this small business, however; it is unlikely that the manufacturer will pursue EPA Verification at this time without financial assistance and government support. It is an important goal of the manufacturer to keep the cost of the device as affordable as possible, making it accessible to all, including the less fortunate on the socioeconomic scale. The only feasible way for them to do this is to keep production costs low and outside expenses to a minimum. In today's economy that is the reality of economic survival for most small businesses.

Leander ISD Vehicle Report, Installation was March 19, 2009

Leander I.S.D. 2009
Eco System - Evaluation

Bus#	Feb-09	Mar-09	Apr-09	May-09	% of Fuel Savings	Fuel Used
	MPG					
43	7.5	8.7	8.5	8.5	13%	1619.3
213	7.0	8.0	8.0	8.2	17%	1077.0
224	6.6	6.4	7.4	7.6	15%	882.5
229	6.4	8.3	8.3	8.5	33%	803.6
252	6.6	6.9	7.2	7.0	5%	1205.3
263	4.1	5.8	6.0	5.9	45%	593.2
275	4.5	6.5	6.5	6.4	43%	605.5
287	5.6	7.7	7.5	7.9	40%	1045.6

FUEL ENHANCER

Leander Independent School District
2009 evaluation

ECO Fuel Systems, LLC.
(866) 347-0002

Average Fuel Savings for 8 buses 26% **Total 7,832**
Average Fuel Used per bus, per week. 61.2 Gallons

Fuel Savings

For 8 buses, each using on average 61.2 gallons of fuel per week, at $1.98 per gallon, with a 26% reduction in fuel consumption, you will save $252/week, $1,084/month, and $13,008/Year.

Carbon Emissions

With a 26% reduction in fuel consumption for the 8 buses, your total carbon[1] emissions would be reduced by 67 metric tons/year for diesel.

FYI: 200 bus scenario

Fuel Savings

For 200 buses, each using on average 61.2 gallons of fuel per week, at $1.98 per gallon, with a 26% reduction in fuel consumption, you will save $6,301/week, $27,094/month, and $325,128/year.

Carbon Emissions

With a 26% reduction in fuel consumption for the 200 vehicles, your total carbon[1] emissions would be reduced by 1,667 metric tons/year for diesel.

carbon[1] emissions - These are based only on the reduced fuel use, and don't include emissions reductions our product offers.

Leander I.S.D. 2009
Eco System - Evaluation

	MPG				% of Fuel	Fuel Used
Vehicle#	Feb-09	Mar-09	Apr-09	May-09	Savings	Fuel Used
45T	9.6	15.3	16.2	14.2	**47%**	489.9

Average Fuel Used per week. 30.6 Gallons

Fuel Savings

For 1 vehicle, using on average 30.6 gallons of fuel per week, at $1.98 per gallon, with a 47% reduction in fuel consumption, you will save $28/week, $120/month, and $1,440/year.

Carbon Emissions

With a 47% reduction in fuel consumption for the 1 vehicles, your total carbon[1] emissions would be reduced by 6.58 metric tons/year for gasoline.

FYI: 25 vehicle scenario

Fuel Savings

For 25 vehicles, using on average 30.6 gallons of fuel per week, at $1.98 per gallon, with a 47% reduction in fuel consumption, you will save $712/week, $3,062/month, and $36,744/year.

Carbon Emissions

With a 47% reduction in fuel consumption for the 25 vehicles, your total carbon[1] emissions would be reduced by 165 metric tons/year for gasoline.

Carbon[1] emissions - These are based only on the reduced fuel use, and don't include emissions reductions our product offers.

Leander I.S.D. 2009
Eco System - Evaluation

Vehicle#	Date	Mileage	Gallons	MPG
45T	Feb. 1	215580		
	Feb. 28	216913		
		1333	138.4	9.6
	1-Mar	216913		
	31-Mar	218304		
		1391	91.2	15.3
	1-Apr	218304		
	30-Apr	220187		
		1883	116.2	16.2
	1-May	220187		
	31-May	222232		
		2045	144.1	14.2
			489.9	

Bus#	Date	Mileage	Gallons	MPG
43	Feb. 1	56505		
	Feb. 28	59249		
		2744	365.5	7.5
	1-Mar	59249		
	31-Mar	62360		
		3111	355.6	8.7
	1-Apr	62360		
	30-Apr	66100		
		3740	440	8.5
	1-May	66100		
	30-May	69980		
		3880	458.2	8.5
			1619.3	

Bus#	Date	Mileage	Gallons	MPG
213	Feb. 1	195886		
	Feb. 28	197650		
		1764	250.8	7.0
	1-Mar	197650		
	31-Mar	199502		
		1852	231.7	8.0
	1-Apr	199502		
	30-Apr	202105		
		2603	324.6	8.0
	1-May	202105		
	30-May	204317		
		2212	269.9	8.2
			1077.0	

Bus#	Date	Mileage	Gallons	MPG
224	Feb. 1	196276		
	Feb. 28	197474		
		1198	181.3	6.6
	1-Mar	197474		
	31-Mar	199046		
		1572	246.4	6.4
	1-Apr	199046		
	30-Apr	200783		
		1737	236.1	7.4
	1-May	200783		
	30-May	202445		
		1662	218.7	7.6
			882.5	

Bus#	Date	Mileage	Gallons	MPG
229	Feb. 1	19008		
	Feb. 28	19853		
		845	132.5	6.4
	1-Mar	19853		
	31-Mar	21604		
		1751	209.9	8.3
	1-Apr	21604		
	30-Apr	23514		
		1910	231.2	8.3
	1-May	23514		
	30-May	25458		
		1944	230	8.5
			803.6	

Bus#	Date	Mileage	Gallons	MPG
252	Feb. 1	82810		
	Feb. 28	84560		
		1750	263.2	6.6
	1-Mar	84560		
	31-Mar	86719		
		2159	312.8	6.9
	1-Apr	86719		
	30-Apr	88911		
		2192	304.5	7.2
	1-May	88911		
	30-May	91187		
		2276	324.8	7.0
			1205.3	

PRELIMINARY PHYSICAL AND CHEMICAL EVALUATION OF FUEL TREATED BY ETI'S FUEL CONDITIONING DEVICE

for

EMISSIONS TECHNOLOGY, INC.

by

Dale Teeters, Ph.D.

THE UNIVERSITY OF TULSA

Dale Teeters, Ph.D.
Associate Professor of Chemistry
College of Engineering and Applied Sciences

600 South College Avenue • Tulsa, Oklahoma 74104-[illegible]

PRELIMINARY PHYSICAL AND CHEMICAL EVALUATION OF FUEL TREATED BY ETI'S FUEL CONDITIONING DEVICE

INTRODUCTION

Fuel that had been subjected to ETI's fuel conditioning device was the object of several tests. Surface tension studies were done on gasoline and diesel before and after exposure (called untreated and treated fuels, respectively in this report) to ETI's device. Gas-chromatograph/mass spectrometry (GCMS) runs were made on gasoline before and after exposure. Vapor pressure data from United States Testing Company, Inc. and cloud point, pour point, and distillation data from Southwest Laboratory of Oklahoma were also considered in this discussion.

CONCLUSIONS

1. There is no significant change in surface tension between treated and untreated samples.

2. Vapor pressure and distillation data seem to indicate that the fuel is more volatile after exposure to ETI's device.

3. Pour point data seems to indicate that lower molecular weight materials are being formed.

4. Within the limits of the detection capability of GCMS experiments, there appears to be no new chemical compounds generated.

5. Considering the physical changes in the fuel listed in points 2 and 3 above and the fact that there appears to be little new compound formation as mentioned in item 4, there may be a further breakdown of the fuel into components already present in the untreated fuel. The treated fuel could thus have a higher concentration of these components than the untreated fuel. This hypothesis needs to be tested with further work.

6. A much more complete and elaborate study in needed to fully understand ETI's fuel conditioning device.

DISCUSSION

At the request of ETI, surface tension for treated and untreated diesel and gasoline provided by ETI were determined using the time-tested Wilhelmy hanging plate technique. The Wilhelmy technique is based on the force pulling down on a plate that is in contact with the liquid of interest. The force on the plate is measured by a microbalance and this value is changed to a surface tension reading. The values for untreated and treated gasoline are 21.3 and 21.5 dynes/cm respectively while the untreated and treated diesel values were 28.4 and 28.3 dynes/cm. The difference between the untreated and treated samples is viewed to be insignificant in both cases and provides little information concerning the system.

Test were made on methanol which was run through the ETI device to see if there was significant breakdown of methanol. These values were inconclusive.

GCMS runs were made on untreated and treated diesel provided by ETI. These runs were made on a Hewlett Packard 5890/5970 GCMS. Data from this technique are in the form of mass spectra where "peaks" in the various spectrum indicated a specific chemical compound. As expected, the spectrum of both untreated and treated diesel are very complicated. However, upon close inspection, there was no significant difference observed between the two samples. This tends to indicate that no new chemical compounds have been made.

The pour point values (from Southwest Laboratory of Oklahoma) are lower for the treated diesel which could indicate that lower molecular weight material is being formed. The cloud point data is inconclusive. Vapor pressure data (from United States Testing Company) shows that the treated diesel has a higher vapor pressure (1.0 psig) than the untreated sample (0.6 psig). Distillation data (Southwest Laboratory of Oklahoma) indicates that the treated sample was completely distilled at a lower temperature. Thus pour point data, distillation data and vapor pressure data could be interpreted as indicating more volatiles in the treated diesel. Since the GCMS data indicate no new compounds have been formed, one possible explanation for the increase in the volatility of the treated sample could be the break down of components in the diesel to form more of components originally present. This is only a hypothesis and much further work would be needed to confirm these ideas.

Dale Teeters

Dale Teeters, Ph.D.

Notarized By: Pamela Kay Jacob
Date: March 22, 1991
Commission Expires: June 21, 1993

Horry County Fleet Service
4457 Privetts Road
Conway, South Carolina 29526

Horry County
SOUTH CAROLINA

Telephone: (843) 915-5200
Fax: (843) 365-0064

	Fuel Put In/gal	Odometer	Miles Driven	MPG
AUGUST				
5-Aug	15.206	33701		
11-Aug	14.952	33959	258	17.26
18-Aug	15.454	34264	305	19.75
22-Aug	14.133	34514	250	17.69
29-Aug	15.146	34820	306	20.21
SEPT				
8-Sep	15.367	35104	284	18.46
17-Sep	15.391	35409	305	19.82
24-Sep	15.821	35754	345	21.81
OCT				
1-Oct	15.431	36070	316	20.48
9-Oct	15.643	36402	332	21.23
15-Oct	15.963	36758	356	22.31

The information reflects the vehicle fuel usage prior to installation of the device for 5 weeks, and then after installation of the device for 5 weeks on Asset# 32329.

Prior to installation the vehicle was getting an average of 18.67 mpg. After installation of the device the vehicle was getting an average of 21.13 mpg. This is an increase (savings) of 2.46 mpg per each refueling of the vehicle.

ECO SYSTEMS FUEL ENHANCER
PRODUCT TESTING REPORT

ROAD AND BRIDGE EQUIPMENT
FABENS WAREHOUSE

October 25th — November 30th 2007

To All Interested Parties:

I had the pleasure of meeting an individual by the name of Jay Bennet from ECO Systems Fuel Enhancers. This individual was referred to me by Piti Vasquez of the Purchasers office.

We authorized this individual to install the product on several different vehicles to perform a study in order to prove or disprove his claims that the product would increase fuel economy, add horsepower, and clean the emissions of all the vehicles in which it was installed. We had Installed the product on five (5) different vehicles which are as Follows: 1994 Chevrolet C-1500 Flatbed pick-up, 1999 Chevrolet C-3500 Field Service vehicle, 2000 Freightliner FL-60 our Field Mechanic vehicle, 2004 Sterling Truck/Tractor, and a 2005 Komatsu Loader.

On the 1994 Chevrolet Flatbed pick-up we were having problems *with the* vehicle emissions, we had completed a full service and tune-up, and this vehicle could not pass the emissions inspection. After we had installed the device and drove the vehicle for approximately one hundred (100) miles we checked the vehicle with a gas analyzer. All of the readings for emissions had vastly improved and the vehicle passed the test. The readings are as follows:

Testing area	Before	After
CO – Carbon Monoxide	.80	.25
HC – Hydrocarbons	38	16
CO2 – Carbon Dioxide	7.9	7.0
02 -- Oxygen	0.1	0.1

As indicated above there were significant reductions in the harmful emissions of this vehicle. The mileage of the vehicle also increased from 12 miles per gallon to over 15 miles per gallon. This will give a cost efficiency savings of approximately 25 % on this vehicle.

We had also placed the device on a 1999 Chevrolet pickup that the hydrocarbons were reading in the 1000 range and it too would not pass inspection. After using the device the emissions have steadily decreased, in fact this vehicle is *now ready for* inspection.

On the 1999 Chevrolet C-3500 which is used as our field service vehicle. There was a longer starting period in the mornings and it had hard starts throughout the day. There was also a lack of horsepower and fuel economy. After installation of the device, starts were more easily obtained and an increase in horsepower was very noticeable. We also had an increase of 2 more miles per gallon.

The 2000 Freightliner FL-60 had an increase of horsepower. This vehicle is sometimes used for pulling equipment that has broken down and needs to be moved from the roadway, the operator says it has more power and pulls the equipment easier since the add-on of this product and it too has had an increase in fuel economy.

The 2004 Sterling Truck/Tractor is used with a belly dump trailer for hauling material wherever needed. This vehicle started with an average MPG of 5.3 mpg and has increased to between 7.5 – 7.8 miles per gallon. The operator also says he has noticed an easier take-off when loaded than before. The vehicle fuel economy has increased with and without loads. He also says the engine is running smoother than before.

The 2005 Komatsu loader was being re-fueled on a daily basis. Since the addition of the device we have had on average a half day longer working period between fueling and there has also been an increase of horsepower noticed as well. Being that this vehicle is constantly in use it will show a great decrease in fuel consumption.

The overall rating of this product has been a success. There is a great benefit in having this product added to our equipment. Not only in the fuel savings but in the emissions that will be reduced from all of our equipment which will cause less pollutants being emitted into the atmosphere. The increase in horsepower means less effort for the equipment doing the same job so efficiency will be improved.

This advantage of a cleaner running vehicle will decrease the amount of oil products used in the scheduled maintenance of all our equipment. This will result in less frequent services being required because the oil *in the* equipment will last longer and still perform at its maximum efficiency. Being that this device can be installed on most of our gasoline and diesel equipment, there will be a cost savings all around.

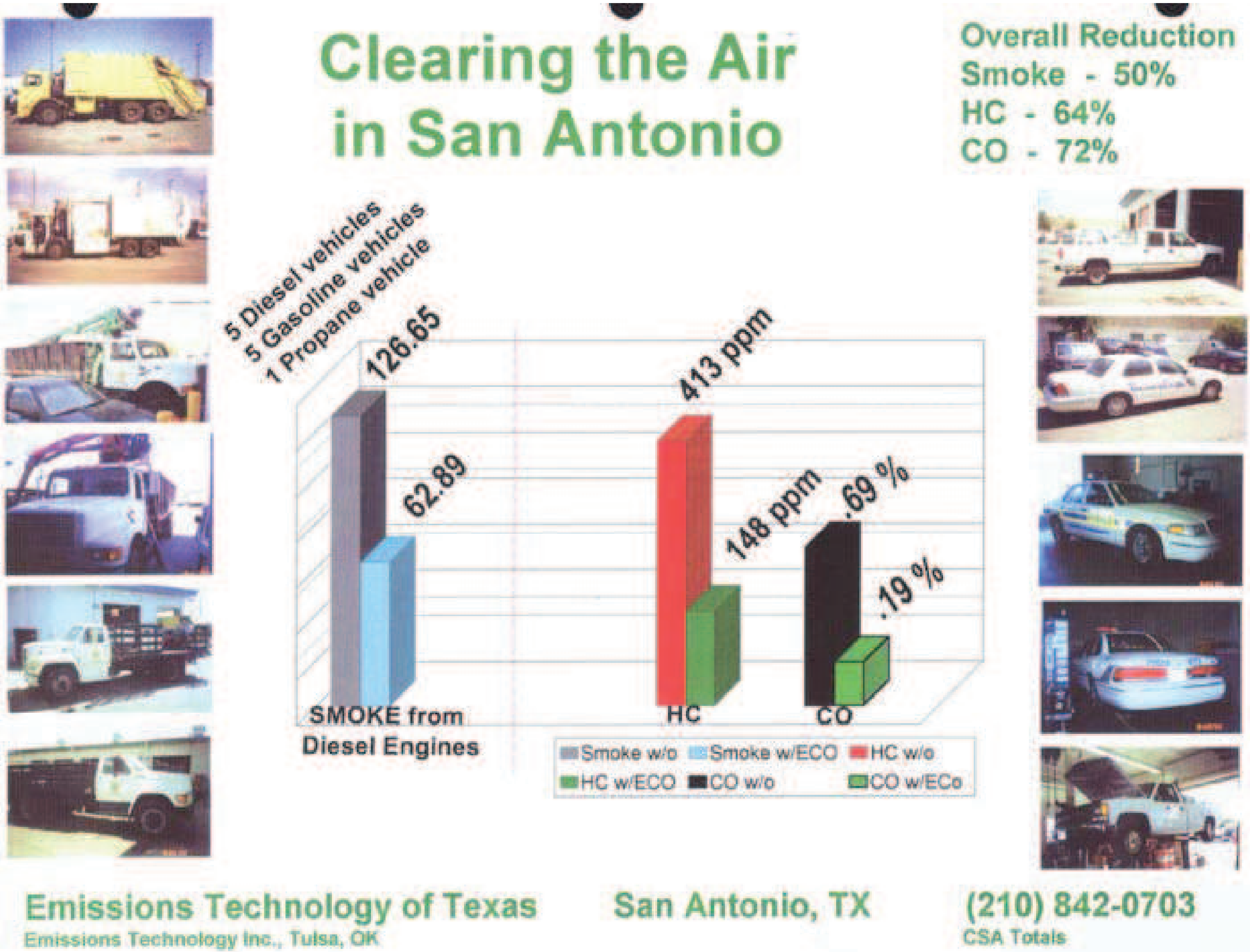
It's my opinion that the Road and Bridge department will benefit considerably from the addition of this *product on its equipment.* It has proved to be productive in the fuel economy improvements, power enhancements and emission reductions. It should *be considered for* placement in all Road and Bridge equipment.

This product may need to be further tested on other types of vehicles. The equipment here at the road and bridge sees a limited type of usage, than other department s within the county. A wider based testing may need to be required possibly by the sheriffs department where the vehicles are used more vigorously during emergency and other type situations. Further testing will ensure that it is beneficial to the county. This will also ensure that there is a need for this device within the county as a whole.

Mark S. Macias

Equip. Maint, Foreman

Road & Bridge Dept.


Clearing the Air
in San Antonio
Overall Reduction
Smoke - 50%
HC - 64%
CO - 72%
5 Diesel vehicles
5 Gasoline vehicles
1 Propane vehicle
126.65
62.89
413 ppm
148 ppm
.69 %
.19 %
SMOKE from
Diesel Engines
HC
CO
Smoke w/o
Smoke w/ECO
HC w/o
HC w/ECO
CO w/o
CO w/ECo
Emissions Technology of Texas
Emissions Technology Inc., Tulsa, OK
San Antonio, TX
(210) 842-0703
CSA Totals

January 4, 2008

TO: ECO Systems
Brad Danches/Jack Jameson, Jr.

FROM: Stephen Sopko, II
Orlando, FL

SUBJECT: ECO System Comments – Highly Impressed

I previously owned a 1997 Chevrolet Suburban 5.7 L and mileage was 15.5 mpg in-town/hwy average. I recently bought a new Chevrolet Tahoe 5.3 L and wanted better mileage than the 16 mpg/21 mpg window sticker averages. My friend, (Alternative Fuels Mgr.) at Kennedy Space Center, recommended trying the ECO System in my new SUV. As a retired Shuttle Program Quality Assurance Division Chief, I was both skeptical, but enthusiastic for better mileage than factory estimates.

The first 3 months my in-town mileage was about 14.2 mpg. The best highway mileage was 17.9, this was at 70 mph.

I then installed the ECO System and at first really didn't see a fast increase. Over the second three months, especially the past 6 weeks, my in-town mileage jumped to 17.7 (approx) and my holiday trip (1200 miles) mpg jumped to 21.5. When my wife was driving the highways, her average was 20.5. I have to assume this was a difference in braking/accelerator pedal usage, (which I've known for a long time).

In closing, as a retired federal employee, I cannot endorse the ECO system, but personally I can say I'm highly impressed with ECO, as I've seen a great improvement from my factory gas mileages. I've got a 27 mpg (hwy) Cadillac Deville that I'm ready to ECO equip to save more at the pumps! (I wish this system was available for my old '97 Suburban!)

Thanks to your ECO staff for the install assistance and support overall.

Respectfully,

Stephen Sopko, II

KENT A. JOHNSON
8149 S. 77th East Avenue, #103
Tulsa, OK 74133

March 27, 1991

Clark Daywalt
8266 E. 41st
Tulsa, OK 74145

Clark Daywalt:

It is my opinion that the recently performed Reid Vapor Test ("R.V.P.") is the most significant and meaningful test demonstrating the effects of the ecolizer. Vapor pressure is a measure of the ability of a liquid to dissociate into the gaseous state. In a fixed volume of space, a liquid will exhibit an equilibrium of evaporation and condensation at a specific pressure and temperature. Hydrocarbon liquids display a specific vapor pressure correspondent to their chemical make-up when this equilibrium is obtained. Short chain hydrocarbons exert higher vapor pressures than do longer chain heavier components. Molecular dissociation is effected by molecular forces, charge, surface tension, surface area, and structure.

The distillation of crude oil at the refinery breaks the original feed stock into fractions characterized by Vapor pressures and corresponding molecular weights. The diesel component is fractionated at a higher temperature than gasoline due the longer carbon chain structures typical to that fluid. Therefore, diesel exhibits a lower vapor pressure than does gasoline. Generally speaking, each addition of a carbon atom in the hydrocarbon structure increases the resistance of that liquid to exert a vapor pressure.

The combustion reaction is defined as the combination of a hydrocarbon, oxygen and an initial input of energy yielding water (H2O), carbon dioxide (CO2), and a positive net heat of reaction value (Q). The heat value is converted to power in an engine through the pressure of thermal expansion against a piston. <u>In order for the hydrocarbon and oxygen to combine the hydrocarbon must exist in the Vapor state</u>. The heat associated in the combustion chamber of this reaction is often high enough to vaporize the majority of incoming fuel. However, as the quality of the fuel degrades (longer carbon chain structures), the ability for the entire amount to vaporize diminishes. Thus, unburnt hydrocarbons are produced in the emissions or product side of the combustion equation.

The black diesel exhaust is visable evidence of the lack of diesel fuel to vaporize in the combustion process. If the combustion process was 100% efficient the only product would be water and carbon dioxide. A higher vapor pressure fuel will interact and burn to a greater degree of completeness while generating less unburnt byproducts. The amount of thermal pressure will consequently increase and cause a greater amount of work performed per unit of fuel within an engine.

The test results you have forwarded to myself indicate an initial vapor pressure for untreated diesel of .6 psi R.V.P. and a treated diesel of 1.0 psi R.V.P. This is of great significance for identifying the physical mechanism which accounts for both the observed differences in driving a vehicle with an ecolizer and the reduction in hydrocarbon emissions. The gasoline test indicated a change in R.V.P. from 7.6 psi untreated to 8.4 psi for the treated sample. Although the magnitude is not quite as large as observed with diesel, the result is very significant. The government has recently imposed restrictions on gasoline at the pump limiting the R.V.P. to 7 psi. This is effective only during the summer months due to the volatile nature of gasoline during warmer temperatures. The restrictions were created to control the amount of vapors escaping and coming in contact with humans. Therefore, the octane rating of the gasoline must be achieved through alternative means other than through the high vapor pressure components. The installation of an ecolizer becomes of even greater significance during these periods because the fuel can be treated to increase its volatility while on a direct path to the engine and not hinder the health of individuals.

Vapor Pressure Analysis is a very positive step in the description of effects caused by the product. There are additional areas of investigation which will break down the academic analysis of the effects but quantitatively the vapor pressure analysis is an easily repeatable, recognizable by the industry, and inexpensive test of high validity.

Pursuant to your request concerning my education and interest, I have a B.S. in petroleum Engineering from the University of Tulsa, a background in organic geochemistry (chemistry of oil), interest in a refinery.

Kent A. Johnson
Kent A. Johnson

daywalt.let

State of Oklahoma
County of Tulsa

Patricia Diane Fowler
Notary Public

My commission expires Nov. 19, 1991

United States Testing Company, Inc.

Tulsa Division

1341 NO. 108th EAST AVENUE TULSA, OKLAHOMA 74116

TELEPHONE: AREA CODE 918-437-8333

REPORT OF TEST

NUMBER

91-0047

3/4/91

CLIENT: Emissions Technology Inc.
P.O. Box 471916
Tulsa, OK 74147-1916

Attn: Alex Collin

SUBJECT:

Testing of diesel fuel samples for vapor pressure by the Reid mehtod.

SAMPLE IDENTIFICATION

Two jars of diesel fuel marked "Treated Diesel 2-20-91" and "Untreated Diesel 2/20/91".

RESULTS

	Treated	Untreated
Vapor Pressure, psig	1.0	0.6

The Reid vapor pressure is a measurement of the stabilized pressure exerted by a volume of liquid fuel at 100°F.
The test is an indirect measurement of combustion characteristics. When more liquid volatilizes into the pressure chamber the vapor pressure increases. Higher fuel volatility indicates hotter burning characteristics. Therefore, higher vapor pressure indicates a hotter, consequently cleaner, burning fuel.

March 17, 1992

SIGNED FOR THE COMPANY

C. Richard Finley
Mgr/Laboratory Services

United States Testing Company, Inc.

Tulsa Division

1341 NO. 108th EAST AVENUE   TULSA, OKLAHOMA 74116
TELEPHONE: AREA CODE 918-437-8333

SGS

REPORT OF TEST

NUMBER
91-0073
3/22/91

CLIENT: Emissions Technology Inc.
P. O. Box 471916
Tulsa, OK 74147-1916

Attn: Alex Collin

SUBJECT: Testing of unleaded gasoline for Reid Vapor Pressure.

SAMPLE IDENTIFICATION

Two samples of regular unleaded gasoline, one untreated, one treated with Ecolizer.

TEST RESULTS

Untreated Sample	7.6 lbs.
Treated W/Ecolizer	8.4 lbs.

The Reid vapor pressure is a measurement of the stablized pressure exerted by a volume of liquid fuel at 100°F. The test is an indirect measurement of combustion characteristics. When more liquid volatilizes into the pressure chamber the vapor pressure increases. Higher fuel volatility indicates hotter burning characteristics. Therefore, higher vapor pressure indicates a hotter, consequently cleaner, burning fuel.

NOTARY PUBLIC ... OKLAHOMA

notary
[signature]
Exp March 17, 92

SIGNED FOR THE COMPANY
[signature]
C. Richard Finley, Manager
Laboratory Services

Laboratories in: New York • Chicago • Los Angeles • Houston • Tulsa • Memphis • Reading • R

SGS® SGS U.S. Testing Company Inc.

1341 North 108th East Avenue • Tulsa, OK 74116 • Tel. 918-437-8333 • Fax. 918-437-8487

CLIENT: Emissions Technology Inc.
P.O. Box 471918
Tulsa, OK 74147-1918

Attn: Clark Daywalt

Test Report No:	162482	**Date:**	November 2, 2001

SUBJECT: Pressure Tests.

REFERENCE: Letter.

SAMPLE ID: Two (2) samples idenbfied as "ECO Units" were received from the client on 10/29/01. The samples received were ¼" NPT by 8" in length. The samples were received in good condition.

PROCEDURE: The samples were evaluated by gradually applying a 10,000 psi hydrostatic pressure for 1 minute or until failure. No revisions to this report will be allowed after 90 days of the report date.

RESULTS: Sample: ¼" NPT by 8" length
Both samples held 10,000 psi for one minute without failure.

TEST DATE: 11/1/01.

SIGNED FOR AND ON BEHALF OF
SGS U.S. TESTING COMPANY INC.

Jeff Simmons
Dept. Manager/Product Evaluation

Dale E. Holloway
Tulsa Branch Director

REPORT OF TEST

SGS U.S. Testing Company Inc.

1341 North 108th East Avenue
Tulsa, OK 74116
Tel: 918-437-8333
Fax: 918-437-8487

Report No.: FT97-0030
Date: 4/22/97

CLIENT: Emissions Technology, Inc.
P.O. Box 471916
Tulsa, OK 74174

Attn: Clark Daywalt

SUBJECT: Efficiency testing of ECO Systems by use of a propane source.

REFERENCE: Verbal 4/15/97.

SAMPLE ID: Client refers to the sample as "ECO System, Model ECO-2".

PROCEDURE: The testing procedure used a flow meter, monitoring propane flow, to measure the temperature of a gas brooder. With a thermal couple located in the brooder, the temperature of the flame was evaluated in comparison to propane flow. Tests were recorded with and without the sample ECO System in line with the brooder.

RESULTS: The results are on the following pages.

TEST DATE: 4/17/97.

Signed for the Company

Eric Hundley, Engineer

Dale E. Holloway
Tulsa Branch Director

bk

Member of the SGS Group

ANALYTICAL SERVICES • PERFORMANCE TESTING • STANDARDS EVALUATION • CERTIFICATION SERVICES

SGS U.S. Testing Company Inc.

REPORT OF TEST

Client: Emissions Technology, Inc.

RESULTS:

Brooder Temperature Test Standard Installation

Sample Number	Measurement (mm)	Temperature (^0C)	Flow Rate (ft^3/min)	Flow Rate (BTU/hr)
1	5	1049	0.0435	6495
2	10	1095	0.0869	12970
3	15	1120	0.1300	19400
4	20	1142	0.1730	25825
5	24.5	1150	0.2097	31310

Brooder Temperature Test With ECO System

Sample Number	Measurement (mm)	Temperature (^0C)	Flow Rate (ft^3/min)	Flow Rate (BTU/hr)	
1	5	1065	0.0435	6495	
2	10	1109	0.0869	12970	
3	15	1140	0.1300	19400	
4	20	1165	0.1730	25825	
5	24.5	1191	0.2097	31310	(Extrapolated)

REPORT OF TEST

SGS U.S. Testing Company Inc.

Client: Emissions Technology, Inc.

CONCLUSION:

Three temperature points were evaluated for flow differences made with the ECO System and without. These points are evaluated in terms of flow difference and percent efficiency difference.

EVALUATED TEMPERATURE POINTS

Sample	Temperature (^{0}C)	Flow Difference (ft^3/min / BTU/hr)	Efficiency Difference (%)
1	1065	.0151 / 2253	25.8
2	1095	.0138 / 2060	15.9
3	1125	.0306 / 4568	17.7
		AVERAGE - 2960 BTU/hr	**19.8%**

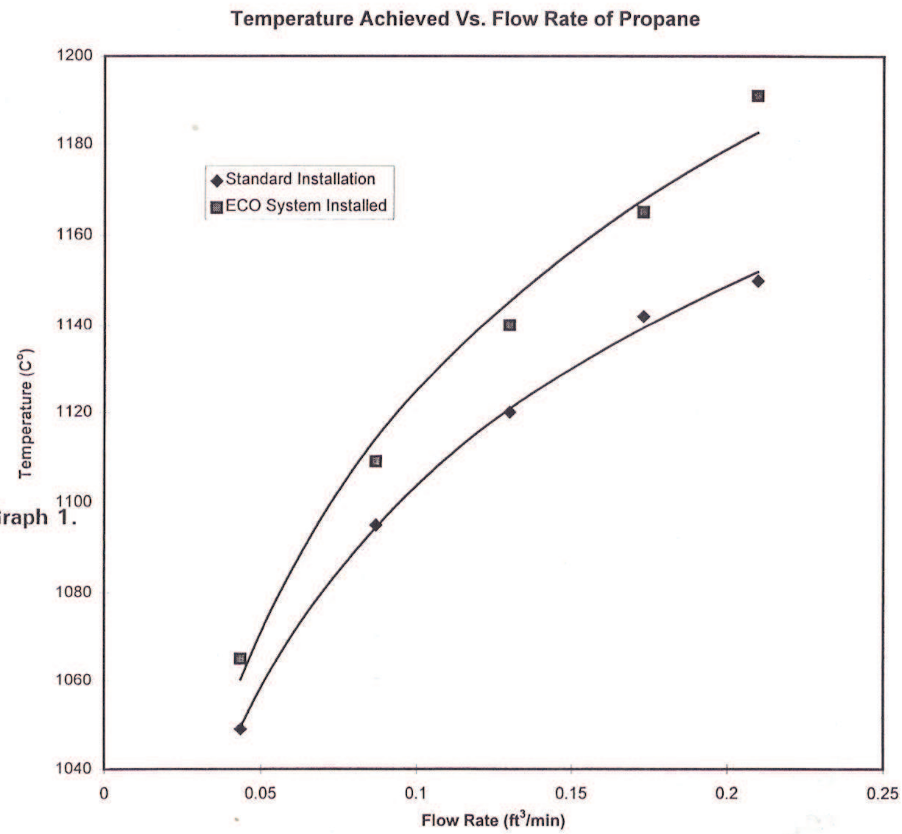
****END OF REPORT****

REPORT OF TEST

SGS U.S. Testing Company Inc.

Client: Emissions Technology, Inc.

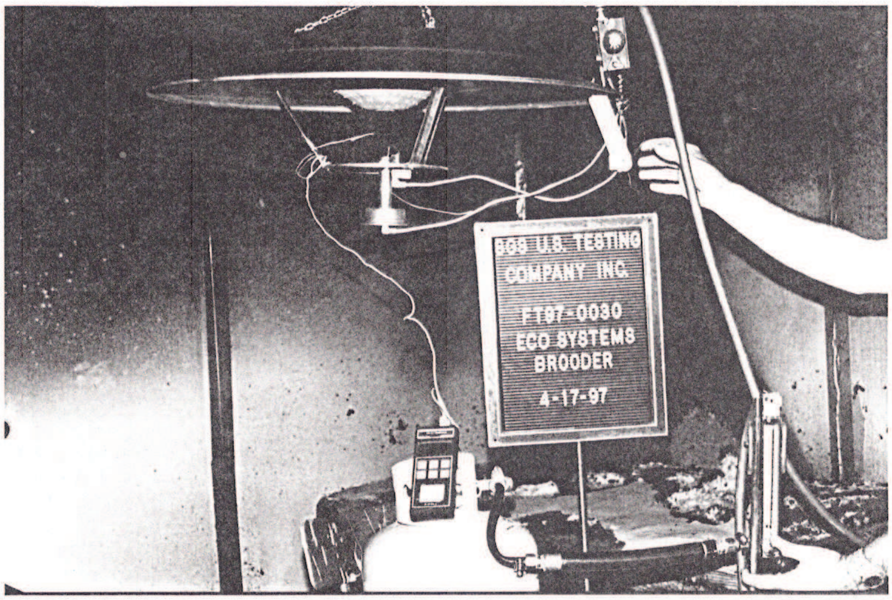
Graph 1.



REPORT OF TEST

SGS U.S. Testing Company Inc.

Client: Emissions Technology, Inc.

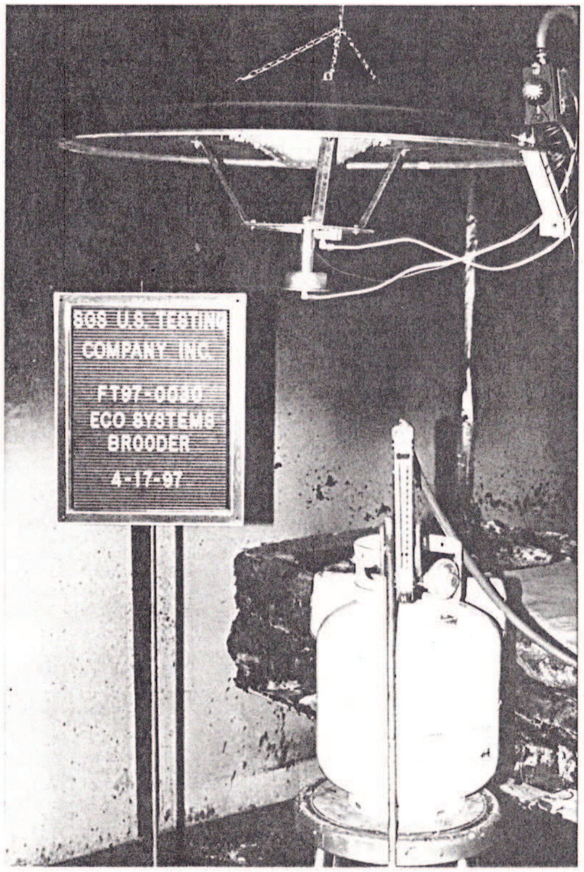


Systems Brooder with ECO System Installed

REPORT OF TEST

SGS U.S. Testing Company Inc.

Client: Emissions Technology, Inc.



Standard Brooder without Set-up

REPORT OF TEST

SGS U.S. Testing Company Inc.
1341 North 108th East Avenue
Tulsa, OK 74116
Tel: 918-437-8333
Fax: 918-437-8487

CLIENT: Emissions Technology, Inc.
P.O. Box 471916
Tulsa, OK 74174

Attn: Clark Daywalt

SUBJECT: Efficiency testing of ECO Systems by use of a methane source.

REFERENCE: Verbal 5/2/97.

SAMPLE ID: Client refers to the sample as "ECO System, Model ECO-2".

PROCEDURE: The testing procedure used a flow meter, monitoring methane flow, to measure the temperature of a gas brooder. With a thermal couple located in the brooder, the temperature of the flame was evaluated in comparison to methane flow. Tests were recorded with and without the sample ECO System in line with the brooder.

RESULTS: The results are on the following pages.

TEST DATE: 5/06/97.

Eric Hundley, Engineer

Signed for the Company
Dale E. Holloway
Tulsa Branch Director

bk

REPORT OF TEST

SGS U.S. Testing Company Inc.

Client: Emissions Technology, Inc.

Report No.: FT97-0033
Date: 6/2/97

RESULTS:

Brooder Temperature Test Standard Installation

Sample Number	Measurement (SCFH air)	Temperature (°C)	Flow Rate (ft^3/min)	Flow Rate (BTU/hr)
1	6.0	900	0.134	8840
2	10.0	1050	0.224	14800
3	14.0	1110	0.313	20600
4	18.0	1145	0.403	26600

Brooder Temperature Test With ECO System

Sample Number	Measurement (SCFH air)	Temperature (°C)	Flow Rate (ft^3/min)	Flow Rate (BTU/hr)
1	6.0	925	0.134	8840
2	10.0	1060	0.224	14800
3	14.0	1135	0.313	20600
4	18.0	1160	0.403	26600

SGS® SGS U.S. Testing Company Inc.

REPORT OF TEST

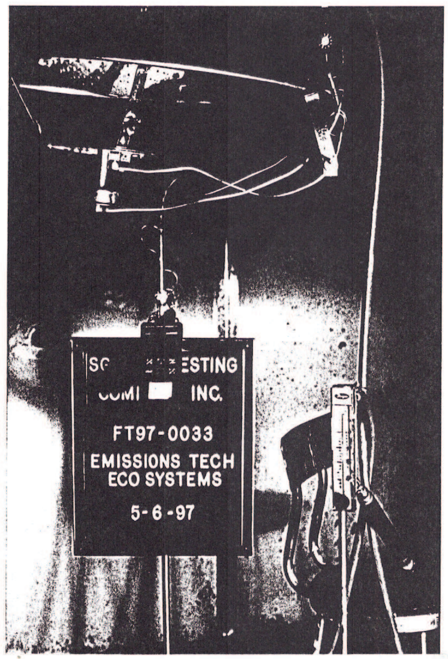
Client: Emissions Technology, Inc.

CONCLUSION:

Three temperature points were evaluated for flow differences made with the ECO System and without. These points are evaluated in terms of flow difference and percent efficiency difference.

EVALUATED TEMPERATURE POINTS

Sample	Temperature (°C)	Flow Difference (ft^3/min / BTU/hr)	Efficiency Difference (%)
1	925	.0150 / 990	11.2
2	1110	.0298 / 1967	9.6
3	1150	.0530 / 3490	12.7
		AVERAGE - 2150 BTU/hr	11.2 %

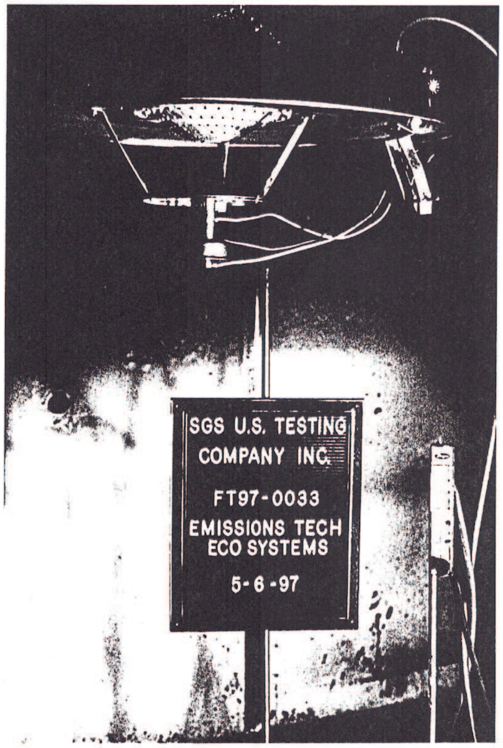


Standard Brooder with ECO System Installed

REPORT OF TEST

SGS U.S. Testing Company Inc.

Client: Emissions Technology, Inc.



Standard Brooder without ECO Set-up

****END OF REPORT****

STCC
South Texas Community College
Automotive Technology Program
3700 W. Military Hwy. • McAllen, Texas 78503

P.O. Box 9701
McAllen, TX 78502-9701

(956) 992-6200
Fax: (956) 992-6169

May 9, 2002

Dear Sir or Madam:

We were introduced to the Eco-System, Fuel Vapor Enhancer a few months ago. When we were told that this device could lower emissions, increase performance, save fuel, and lower maintenance cost, I was interested but very skeptical. We conducted a series of before and after emission tests on the following two vehicles:

- 1995 Chevrolet 1500 P.U. 5.7L
- 1997 Chevrolet S-10 P.U.

The above tests were conducted using an OTC Five Gas Analyzer, as well as the Vetronix Five Gas. These tests were also done at different engine speeds, @ idle, 1500 RPM, 2500 RPM, and highway driving conditions. To our surprise, the overall emission levels dropped, after the completion of the tests. NOx levels dropped 29% on the S-10 and 40% on the Chevrolet 1500.

Sincerely,

Guillermo Lopez
Program Chair, Transportation Technology

South Texas Community College

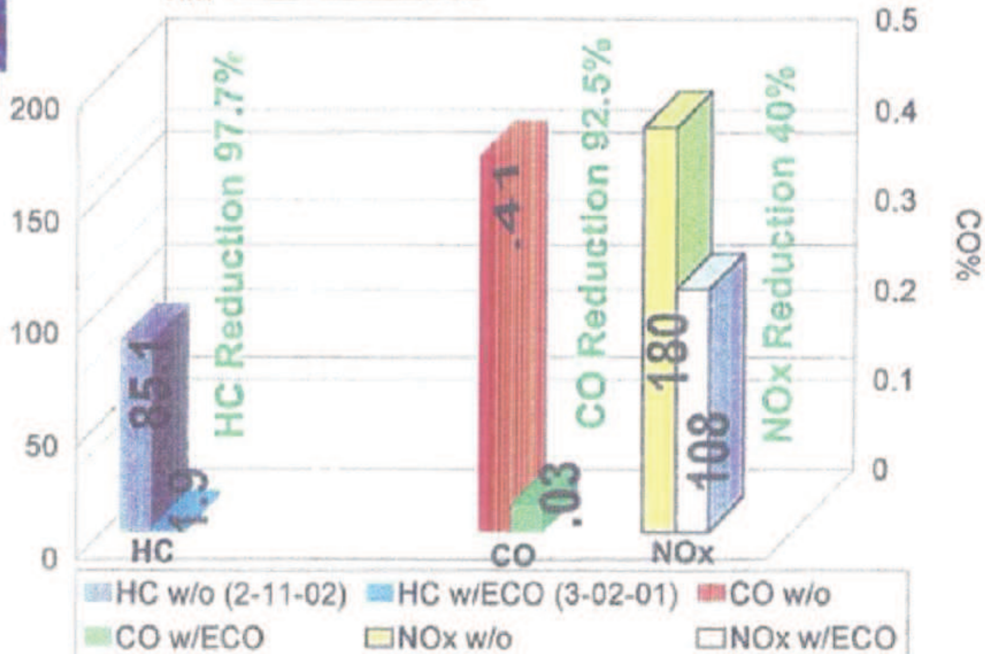
Guillermo Lopez, Transportation Technology Program Chair

Clearing the Air in Texas

ECO-2 Installation

1995 Chevrolet 1500 P.U. 5.7L 104,331 miles

Vin# [redacted]



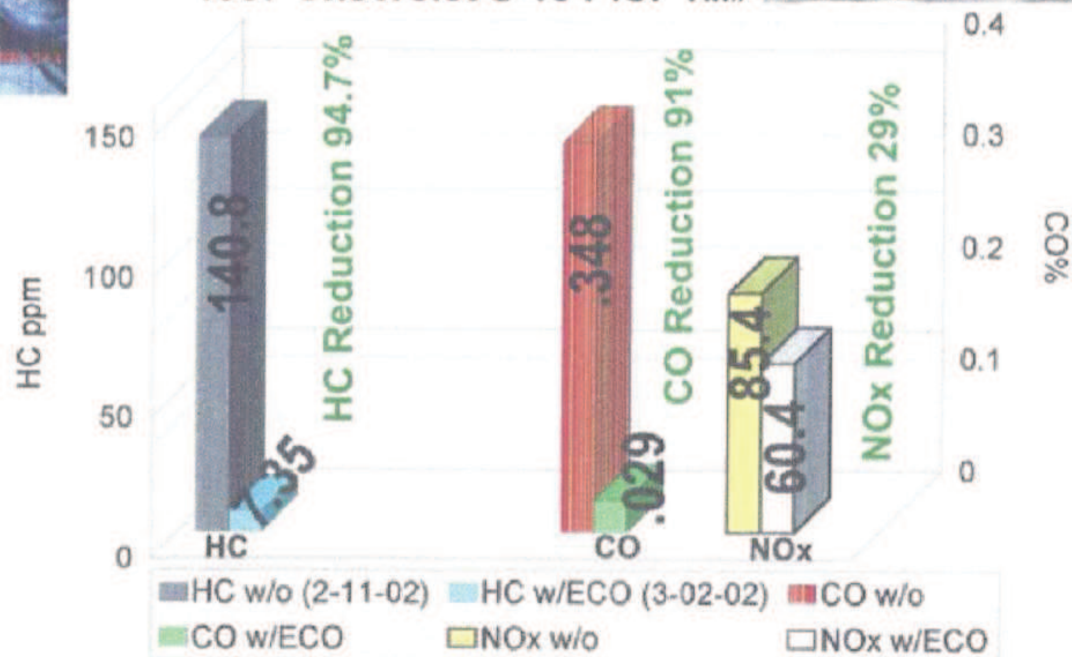
80 frames before and after installation of ECO System
<u>Tested under load</u>

South Texas Community College

Guillermo Lopez, Transportation Technology Program Chair

Clearing the Air in Texas

1997 Chevrolet S-10 P.U. Vin# [redacted]



Motorcycle
Dyno Test Results

Tested 1-16-06

Test performed at

HOG ALLEY
Georgetown, Texas
(512) 930-5475

2003 Harley Davidson - Heritage Softail Classic – 1550

Max Power Increase	2.7 hp
Max Torque Increase	2.3 (ft-lbs)

	Before	**After**
Horse Power	92.0	94.7
Torque	94.7	98.1

EMISSIONS:

CO2 - Carbon Dioxide

Idle	1200	1196
70 mph	1180	1156

CO - Carbon Monoxide

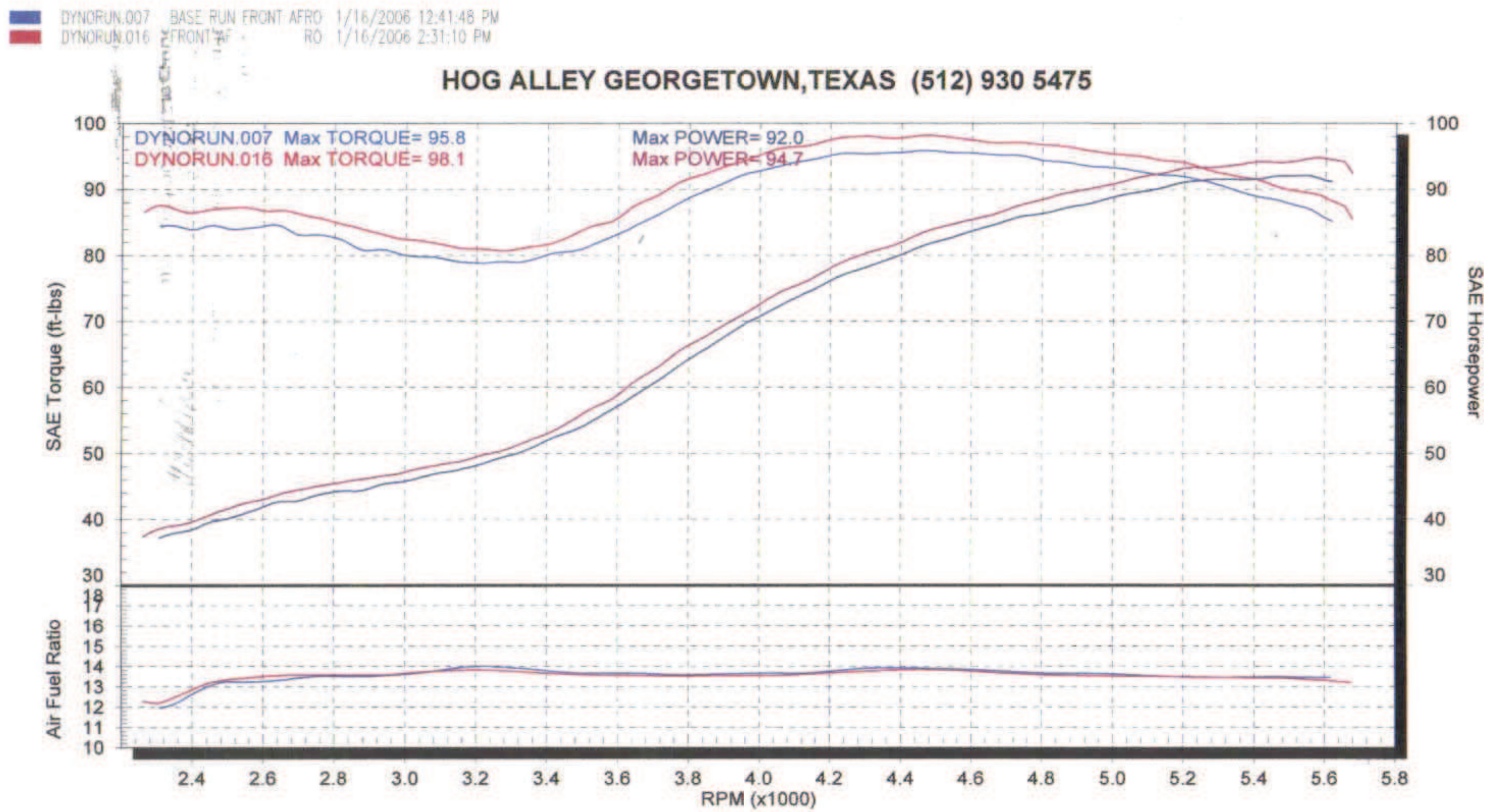
Idle	3.13	3.04
70 mph	6.12	5.55

HC - Hydro Carbons

Idle	1050	700
70 mph	590	482

AFR - Air Fuel Ratio

Idle	13.97	14.11
70 mph	12.05	12.79



DYNORUN.007 BASE RUN FRONT AF RO 1/16/2006 12:41:48 PM
WALTER KIMBER, 2003 FLSTCI, 95 CI
V + H BIG SHOTS WITH STOCK BAFFLES, SE HIGH FLOW
HQ CYCLONE KIT

DYNORUN.016 FRONT AF RO 1/16/2006 2:31:10 PM
WALTER KIMBER, 2003 FLSTCI, 95 CI
V + H BIG SHOTS WITH STOCK BAFFLES, SE HIGH FLOW
HQ CYCLONE KIT
ECO SYSTEMS FUEL VAPOR PRESSURE ENHANCER
AFTER 20 MILE TEST RIDE


16 1:45PM


16 2:09PM


16 1:33PM


16 3:23PM

328 eo Frio
San Antonio, TX 78207

(210)207-6303
746-1414pg.
Email: gwilborn@ci.sat.us.tx

George Wilborn Jr.

Special Projects

Conducted many Evaluations on Additives and Devices for use within the Fleet Maintenance and Operations Division of the City of San Antonio. The Evaluations of devices have ranged from Secondary Ignition Enhancement to the usage of Mono-pole Magnets on sub-systems on engines. I have also tested for other Governmental and outside entities on their equipment the before- tests and after- tests, with the City of San Antonio SIS 904Engine Analyzer and with our Diesel Opacity No-smoke Testers. At present we are undergoing a possible Pilot Program with Bio-diesel, we are reviewing all the Pros and Cons of this product and its possible usage within our fleet. I am also continuing the evaluation of a very promising product that can be used on the entire City of San Antonio Fleet vehicles to include Off-Road vehicles this product is the ECO-Systems. I have also had this product installed on a number of our dedicated propane vehicles and have personally witnessed, the reduction of Hydrocarbons and Carbon- Monoxides on an already Low Emission emitting Alternative Fueled vehicle. The ECO-System is being used on several City of San Antonio vehicles from Administrative to Police vehicles to Garbage Trucks and to include Central Parts Forklift. The City of San Antonio Fire Department has been using this Device since 1996 and will have completed the installations of their entire Fleet of Fire Trucks and EMS units in the next few months. In addition to the installations to complete the City of San Antonio Fire Department Fleet they have taken steps on the spec. Of this Device on all future Equipment purchases. The City of San Antonio Environmental Services Division along with the Fleet Maintenance and Operations Division have purchased though monies allocated by the City of San Antonio, twenty eight additional ECO-System Devices to be utilized in our continued effort in finding a solution to the reduction of harmful emission pollutants. All of the test results on all vehicles tested showed a reduction of emissions and no long-term adverse effects on the vehicles Fuel Distribution system to the Emission Control Systems to include the vehicles On Board Computer Control Systems.

Experience

1999–Present   City of San Antonio   San Antonio, TX

Fleet Maintenance Instructor/Safety Coordinator

- Conducts and coordinates Automotive and Truck safety, First Aid and other related training programs. Coordinated Training on FASTER, Fleet Maintenance Tracking Software Program for entire Division.
- Developed a technical support database for division.
- Develops, implements and directs systems trouble shooting procedures for all Fleet vehicles and equipment. As well as electrical systems schematics and circuit testing, digital volt ohm meter training.
- Developed complete safety program and implemented within the division.
- Conducts ASE prep-course training for all Technical staff in order to

ECO Fuel Systems, LLC

ECOFuelMax.com
(866) 374-0002

UPHILL Fueltech Private Limited

ECO Systems Fuel Saving Project for Locomotives

Pilot Project Report

Project start date - April 15, 2015

Project by UPHILL Fueltech Private Limited, Delhi

Raigarh location has 15 locomotives. Each locomotive runs approximate 5,000 hours annually and consumes approximately 50,000 liters of diesel annually. Coal is transported at Raipur facility by network of Rail system comprising of 15 Locomotives with Cummins engines. All these engines run on diesel fuel. Based on three months of testing, fuel savings were 7.18% and smoke was reduced almost 50%.

Based on the pilot test, here is the summary for LOCO#13

- Fuel savings 7.18%
- Fuel savings for LOCO #13 Rs.1,59,000 annually
- Payback time for investment 8.34 months
- Return on investments 144%
- Engine performance will be improved
- It will extend life of Locomotive
- 8,100 Kg of Carbon emissions reduced annually.

UPHILL Fueltech Technology

ECO System technology is patented and proven US technology which has been in existence since 2000 and has been even approved by USA federal government agencies thru GSA. ECO systems technology helps in reducing fuel consumption 5%-12% and reduces carbon emissions up to 50% depending upon the engine type and other variable factors such as fuel type, age, condition of engine, load and driving conditions. Eco Systems work with Diesel, petrol and natural gas.

ECO Fuel Systems, LLC

ECOFuelMax.com

(866) 374-0002

ECO Fuel Enhancer Pricing

The ECO Fuel Enhancer product line is a proven affordable solution to reducing Pollution and Fuel consumption. Each and every vehicle has different results, some save 6.5% and some save as much as 26+%. The big savings is in the reduction of Maintenance, Fuel Injection, Oil & Diesel Regeneration Cycles, 40% to over 70%. Reduction of DPF maintenance can save thousands of dollars annually per vehicle.

Why are you paying +/-10% more for fuel and spending thousands per year in maintenance that you don't have to pay?

With our 90 Day full refund Guarantee you have nothing to lose, in many instances the ROI of the unit can be paid for within the first 90 - 180 days.

ECO 2 Gasoline & Small Diesel **Engines <5 ltrs**
Warehouse Price $270.00*

ECO 4 Diesel **Engines <400 HP**
Warehouse Price $390.00*

ECO 5 Diesel **Engines >400 HP**
Warehouse Price 450.00*

ECO 7 Gas Natural Gas-Propane
Warehouse Price $975.00-$1,500.00*

*Pricing does not include installation kits, supplies or installation charges.

To Order go On-line or Call:

ECOFuelMax.com

(866) 374-0022