

FUEL CAT LTD

t/a

ECS

REPORT

EVALUATION OF FUEL CAT/ ECS

EMISSION REDUCTION/FUEL SAVING
SYSTEM.

A Joint Cooperation study with

THE PHILADELPHIA COCA COLA

BOTTLING company

725 EAST ERIE AVENUE

PHILADELPHIA

U.S.A.

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OBJECTIVE

To evaluate emission reductions and fuel saving using the E.S.C. system a joint co-operation program with The Philadelphia Coca Cola Bottling Co.

For the program 20 trucks of varying ages in regular daily use were chosen from the Coca Cola Pool of trucks by Mr. Al Anderson. 10 would be fitted with E.S.C. the other 10 would remain as standard. All 20 trucks would then run their normal work.

The program to date covers 3 months, April, May and June 1998.

During this period all 20 trucks would be tested for opacity, (black smoke) and very closely monitored for their fuel consumption and mileage.

By the end of 3 months a clear indication of the E.C.S. capability of reducing opacity and improving fuel consumption on the 10 trucks fitted with E.C.S. will be shown compared to the 10 trucks not fitted.

TEST METHOD

OPACITY (BLACK SMOKE)

1. The chosen 20 trucks were all tested for Opacity to establish a baseline, readings taken and recorded by Mr Pete Krauski.
2. April 1998 10 of the trucks were fitted with E.C.S. Coca Cola Engineers carried out the fitting in the Philadelphia depot.
3. The remaining 10 trucks would remain as standard.
4. The 20 trucks 10 fitted E.C.S. and 10 standard continued to operate their normal daily runs and continued to do so throughout the program.
5. It is a requirement of E.C.S. a run in period of a minimum of 500 miles be achieved before E.C.S. achieves it's optimum effect. Therefore, when all 20 trucks had exceeded the 500 mile minimum, a second opacity (black smoke) test took place. Pete Krauski returned to Philadelphia to perform the operation.
6. From the baseline readings it is now possible to compare the 10 trucks not fitted with the 10 trucks fitted with E.C.S.

M.P.G.

1. Mr Al Anderson extracted from Coca Cola's computer, 6 months m.p.g. data directly previous to April 1998 relative to the 20 trucks. This data established the baseline.
2. The figures for the control period after fitting E.C.S. April, May and June were provided on the same basis.

TEST APPARATUS

PLATE NO.	YEAR	MAKE	MODEL	VIN	REG. NO.	REG. STATE
1000	1971	Ford	Ford LTD 3000	8D0 301100	200 072	PA
1001	1971	Ford	Ford LTD 3000	8D0 301100	200 074	PA
OPACITY (BLACK SMOKE)						
1002	1971	Ford	Ford LTD 3000	8D0 301100	200 076	PA
1003	1971	Ford	Ford LTD 3000	8D0 301100	200 078	PA
1004	1971	Ford	Ford LTD 3000	8D0 301100	200 080	PA
1005	1971	Ford	Ford LTD 3000	8D0 301100	200 082	PA
1006	1971	Ford	Ford LTD 3000	8D0 301100	200 084	PA
1007	1971	Ford	Ford LTD 3000	8D0 301100	200 086	PA
1008	1971	Ford	Ford LTD 3000	8D0 301100	200 088	PA
1009	1971	Ford	Ford LTD 3000	8D0 301100	200 090	PA
1010	1971	Ford	Ford LTD 3000	8D0 301100	200 092	PA
1011	1971	Ford	Ford LTD 3000	8D0 301100	200 094	PA
1012	1971	Ford	Ford LTD 3000	8D0 301100	200 096	PA
1013	1971	Ford	Ford LTD 3000	8D0 301100	200 098	PA
1014	1971	Ford	Ford LTD 3000	8D0 301100	200 100	PA
1015	1971	Ford	Ford LTD 3000	8D0 301100	200 102	PA
1016	1971	Ford	Ford LTD 3000	8D0 301100	200 104	PA
1017	1971	Ford	Ford LTD 3000	8D0 301100	200 106	PA
1018	1971	Ford	Ford LTD 3000	8D0 301100	200 108	PA
1019	1971	Ford	Ford LTD 3000	8D0 301100	200 110	PA
1020	1971	Ford	Ford LTD 3000	8D0 301100	200 112	PA
1021	1971	Ford	Ford LTD 3000	8D0 301100	200 114	PA
1022	1971	Ford	Ford LTD 3000	8D0 301100	200 116	PA
1023	1971	Ford	Ford LTD 3000	8D0 301100	200 118	PA
1024	1971	Ford	Ford LTD 3000	8D0 301100	200 120	PA
1025	1971	Ford	Ford LTD 3000	8D0 301100	200 122	PA
1026	1971	Ford	Ford LTD 3000	8D0 301100	200 124	PA
1027	1971	Ford	Ford LTD 3000	8D0 301100	200 126	PA
1028	1971	Ford	Ford LTD 3000	8D0 301100	200 128	PA
1029	1971	Ford	Ford LTD 3000	8D0 301100	200 130	PA
1030	1971	Ford	Ford LTD 3000	8D0 301100	200 132	PA
1031	1971	Ford	Ford LTD 3000	8D0 301100	200 134	PA
1032	1971	Ford	Ford LTD 3000	8D0 301100	200 136	PA
1033	1971	Ford	Ford LTD 3000	8D0 301100	200 138	PA
1034	1971	Ford	Ford LTD 3000	8D0 301100	200 140	PA
1035	1971	Ford	Ford LTD 3000	8D0 301100	200 142	PA
1036	1971	Ford	Ford LTD 3000	8D0 301100	200 144	PA
1037	1971	Ford	Ford LTD 3000	8D0 301100	200 146	PA
1038	1971	Ford	Ford LTD 3000	8D0 301100	200 148	PA
1039	1971	Ford	Ford LTD 3000	8D0 301100	200 150	PA
1040	1971	Ford	Ford LTD 3000	8D0 301100	200 152	PA
1041	1971	Ford	Ford LTD 3000	8D0 301100	200 154	PA
1042	1971	Ford	Ford LTD 3000	8D0 301100	200 156	PA
1043	1971	Ford	Ford LTD 3000	8D0 301100	200 158	PA
1044	1971	Ford	Ford LTD 3000	8D0 301100	200 160	PA
1045	1971	Ford	Ford LTD 3000	8D0 301100	200 162	PA
1046	1971	Ford	Ford LTD 3000	8D0 301100	200 164	PA
1047	1971	Ford	Ford LTD 3000	8D0 301100	200 166	PA
1048	1971	Ford	Ford LTD 3000	8D0 301100	200 168	PA
1049	1971	Ford	Ford LTD 3000	8D0 301100	200 170	PA
1050	1971	Ford	Ford LTD 3000	8D0 301100	200 172	PA
1051	1971	Ford	Ford LTD 3000	8D0 301100	200 174	PA
1052	1971	Ford	Ford LTD 3000	8D0 301100	200 176	PA
1053	1971	Ford	Ford LTD 3000	8D0 301100	200 178	PA
1054	1971	Ford	Ford LTD 3000	8D0 301100	200 180	PA
1055	1971	Ford	Ford LTD 3000	8D0 301100	200 182	PA
1056	1971	Ford	Ford LTD 3000	8D0 301100	200 184	PA
1057	1971	Ford	Ford LTD 3000	8D0 301100	200 186	PA
1058	1971	Ford	Ford LTD 3000	8D0 301100	200 188	PA
1059	1971	Ford	Ford LTD 3000	8D0 301100	200 190	PA
1060	1971	Ford	Ford LTD 3000	8D0 301100	200 192	PA
1061	1971	Ford	Ford LTD 3000	8D0 301100	200 194	PA
1062	1971	Ford	Ford LTD 3000	8D0 301100	200 196	PA
1063	1971	Ford	Ford LTD 3000	8D0 301100	200 198	PA
1064	1971	Ford	Ford LTD 3000	8D0 301100	200 200	PA
1065	1971	Ford	Ford LTD 3000	8D0 301100	200 202	PA
1066	1971	Ford	Ford LTD 3000	8D0 301100	200 204	PA
1067	1971	Ford	Ford LTD 3000	8D0 301100	200 206	PA
1068	1971	Ford	Ford LTD 3000	8D0 301100	200 208	PA
1069	1971	Ford	Ford LTD 3000	8D0 301100	200 210	PA
1070	1971	Ford	Ford LTD 3000	8D0 301100	200 212	PA
1071	1971	Ford	Ford LTD 3000	8D0 301100	200 214	PA
1072	1971	Ford	Ford LTD 3000	8D0 301100	200 216	PA
1073	1971	Ford	Ford LTD 3000	8D0 301100	200 218	PA
1074	1971	Ford	Ford LTD 3000	8D0 301100	200 220	PA
1075	1971	Ford	Ford LTD 3000	8D0 301100	200 222	PA
1076	1971	Ford	Ford LTD 3000	8D0 301100	200 224	PA
1077	1971	Ford	Ford LTD 3000	8D0 301100	200 226	PA
1078	1971	Ford	Ford LTD 3000	8D0 301100	200 228	PA
1079	1971	Ford	Ford LTD 3000	8D0 301100	200 230	PA
1080	1971	Ford	Ford LTD 3000	8D0 301100	200 232	PA
1081	1971	Ford	Ford LTD 3000	8D0 301100	200 234	PA
1082	1971	Ford	Ford LTD 3000	8D0 301100	200 236	PA
1083	1971	Ford	Ford LTD 3000	8D0 301100	200 238	PA
1084	1971	Ford	Ford LTD 3000	8D0 301100	200 240	PA
1085	1971	Ford	Ford LTD 3000	8D0 301100	200 242	PA
1086	1971	Ford	Ford LTD 3000	8D0 301100	200 244	PA
1087	1971	Ford	Ford LTD 3000	8D0 301100	200 246	PA
1088	1971	Ford	Ford LTD 3000	8D0 301100	200 248	PA
1089	1971	Ford	Ford LTD 3000	8D0 301100	200 250	PA
1090	1971	Ford	Ford LTD 3000	8D0 301100	200 252	PA
1091	1971	Ford	Ford LTD 3000	8D0 301100	200 254	PA
1092	1971	Ford	Ford LTD 3000	8D0 301100	200 256	PA
1093	1971	Ford	Ford LTD 3000	8D0 301100	200 258	PA
1094	1971	Ford	Ford LTD 3000	8D0 301100	200 260	PA
1095	1971	Ford	Ford LTD 3000	8D0 301100	200 262	PA
1096	1971	Ford	Ford LTD 3000	8D0 301100	200 264	PA
1097	1971	Ford	Ford LTD 3000	8D0 301100	200 266	PA
1098	1971	Ford	Ford LTD 3000	8D0 301100	200 268	PA
1099	1971	Ford	Ford LTD 3000	8D0 301100	200 270	PA
1100	1971	Ford	Ford LTD 3000	8D0 301100	200 272	PA

OPACITY (BLACK SMOKE)

Wager Model 6500
 SAE approved J1667
 Mobile opacity meter.

Operator Mr Peter Krazinski

M.P.G.

Courtesy of The Philadelphia Coca Cola Bottling Co.
 Computer records Mr Al Anderson

TRUCK DETAILS PRE INSTALLATION

TRUCK #	YEAR	MAKE & MODEL	ENGINE SPEC.	MILEAGE	BASELINE MPG
9062	1986	Ford LNT 9000	NTC 315 HP	205,575	3.39
9063	1986	Ford LNT 9000	NTC 315 HP	363,394	3.67
9064	1986	Ford LNT 9000	NTC 315 HP	284,929	5.48
9066	1986	Ford LNT 9000	NTC 315 HP	347,240	3.08
9067	1986	Ford LNT 9000	NTC 315 HP	227,776	5.05
9068	1986	Ford LNT 9000	NTC 315 HP	248,640	4.46
9073	1986	Ford LNT 9000	NTC 315 HP	242,075	3.73
9075	1987	Ford LNT 9000	NTC 315 HP	430,741	5.58
9077	1987	Ford LNT 9000	NTC 315 HP	263,263	2.24
9078	1987	Ford LNT 9000	NTC 315 HP	194,631	4.57
9079	1987	Ford LNT 9000	NTC 315 HP	164,627	4.83
9080	1987	Ford LNT 9000	NTC 315 HP	364,614	3.25
9082	1989	Ford LNT 9000	NTC 315 HP	296,227	3.41
9083	1989	Ford LNT 9000	NTC 315 HP	462,839	5.42
9084	1989	Ford LNT 9000	NTC 315 HP	410,904	4.03
9085	1989	Ford LNT 9000	NTC 315 HP	423,789	3.21
9089	1997	Freight Liner FL112	Cummins M11 350 HP	97,015	5.41
9092	1997	Freight Liner FL113	Cummins M11 350 HP	36,052	4.26
9090	1997	Freight Liner FL114	Cummins M11 350 HP	79,460	5.65
9094	1997	Freight Liner FL115	Cummins M11 350 HP	52,165	5.67

5. Opacity (Black Smoke).

SUMMARY OF OPACITY (BLACK SMOKE) READINGS

Trucks not fitted with E.C.S.:

Truck #	Wager Recorded #	Baseline Opacity %	Wager Recorded #	Opacity %	Opacity % change
** 9064	1158	7.80	1187	5.10	-34.62
** 9079	1163	41.70	1169	49.10	+17.75
** 9082	1151	27.10	1188	27.90	+2.95
** 9089	1150	9.40	1179	5.80	-38.30
** 9093	1148	2.70	1175	3.30	+22.22
Condition worse				Average Total % Change	+2.82

Trucks fitted with E.C.S.:

Truck #	Wager Recorded # before fitting E.C.S.	Baseline Opacity %	Wager Recorded # after fitting E.C.S.	Opacity % after fitting E.C.S.	Opacity % change
* 9063	1145	18.5	1171	3.2	-82.70
* 9066	1154	9.10	1170	6.10	-32.97
* 9068	1165	28.70	1181	1.30	-95.47
* 9075	1144	64.60	1177	16.80	-73.99
* 9077	1153	26.70	1182	7.30	-72.66
* 9084	1166	23.60	1190	2.00	-91.53
* 9085	1164	38.80	1178	10.70	-72.42
* 9092	1159	2.30	1185	0.70	-69.75
* 9094	1157	2.40	1189	0.90	-62.50
Condition better				Average Total % Change	-77.18

- * Equipment with E.C.S.
- ** Equipment without E.C.S.

Of the 20 trucks in the test program only the above 14 trucks were available for Opacity Smoke Testing on the same day after fitting E.C.S.

However it shows substantial Opacity (Black Smoke) reduction

6. 10 Trucks mpg without modification or change.

Baseline represents a total of 6 months average fuel consumption to March 1998.
Mpg April, May and June 1998.

Truck #	Baseline Mpg	April Miles	April Mpg	May Miles	May Mpg	June Miles	June Mpg
9062	3.39	1479	3.26	1356	3.93	1334	2.45
9064	5.48	1949	4.69	1993	4.78	1654	4.39
9067	5.05	2485	3.45	1934	3.67	1385	3.88
9073	3.73	2722	3.78	2380	4.19	2424	3.66
9078	4.57	1943	5.05	1974	3.71	1946	5.29
9079	4.83	3280	3.78	2184	3.54	1872	2.9
9082	3.41	3342	3.14	2074	3.5	1832	3.69
9083	5.42	1719	3.46	2088	3.71	2011	3.55
9089	5.41	2701	3.74	2424	3.59	5459	3.68
9093	5.65	4495	3.87	3481	3.16	3374	4.01
10 Truck Average	4.69	2601	3.82	2188	3.78	2329	3.75

7. 10 Trucks mpg fitted with E.C.S.

Baseline represents a total of 6 months average fuel consumption berfore fitting E.S.C.

Mpg April, May and June 1998

Truck #	Baseline Mpg	April Miles	April Mpg	May Miles	May Mpg	June Miles	June Mpg
9063	3.67	1756	2.93	2959	3.21	2578	3.01
9066	3.08	1156	3.53	1467	3.57	1784	3.66
9068	4.46	1363	3.82	1710	3.41	1885	3.53
9075	5.58	2170	5.02	1810	3.73	2139	4.63
9077	2.24	1604	3.25	1127	4.61	1562	3.75
9080	3.25	1483	3.13	2596	3.45	1904	5.01
9084	4.03	2313	3.41	3531	4.14	2833	4.25
9085	3.21	2496	3.74	1206	3.39	2109	4.1
9092	4.26	2410	3.54	1742	4.99	1583	3.96
9094	5.67	2986	3.67	1876	2.92	2426	5.43
10 Truck Average	3.95	1974	3.6	2002	3.74	2080	4.13

8. Mpg Analysis.

10 trucks not fitted E.C.S.:-

	mpg average	% +/- baseline
Baseline 6 months	4.69	
April 1998	3.87	-17.48 %
May 1998	3.78	-19.40 %
June 1998	3.75	-20.04 %

10 trucks fitted with E.C.S. (mid April 1998):-

	mpg average	% +/- baseline	Overall improvement
Baseline 6 months	3.95		
April 1998	3.6	-8.86 %	+8.62 %
May 1998	3.74	-5.31 %	+14.05 %
June 1998	4.13	+4.55 %	+24.59 %

Fuel saving based upon mileage of 10 trucks fitted with E.C.S.:-

	Mileage	Mpg Saving	Galons saved
April	19,740	8.62 %	473
May	20,020	14.05 %	752
June	20,800	24.59 %	1238

RESULTS

OPACITY (BLACK SMOKE)

Of the 20 trucks in the program, unfortunately on the day nominated for Peter Krusinski to complete the readings only 14 trucks were available. The other 6 trucks were still out of the depot working.

However the effect of E.C.S. was significant. A 77% reduction in opacity (black smoke).

M.P.G.

It was apparent even considering the wide age range of trucks used in the program in the optimum third month after fitting E.S.C. a 24% fuel saving was achieved.

Of the 10 trucks fitted with E.C.S. over the 3 months, there was an approximate fuel saving of 2,463 gal.

CONCLUSION

The concept of testing 20 trucks. 10 trucks fitted with E.C.S. and 10 trucks not fitted has shown that real world testing highlights the benefits of E.C.S.