Energy Value of Fuels and Variations in Efficiency

Adam Goldstein

Chief Technology and Compliance Officer

STAG

Alternative Fuel Solutions USA

Fuel	Energy Content*	Quantity of Fuel in 1 GGE	Quantity of Fuel in 1 DGE
Gasoline	116,090 Btu/gallon	1.00 gallon	1.11 gallon
Low Sulfur Diesel	128,488 Btu/gallon	0.90 gallon	1.00 gallon
Biodiesel (B20)	126,700 Btu/gallon	0.92 gallon	1.01 gallon
Biodiesel (B100)	119,550 Btu/gallon	0.97 gallon	1.07 gallon
Compressed Natural Gas (CNG)	923 Btu/cubic foot (ft^3) or 20,160 Btu/lb	125.77 ft^3 or 5.76 lb	139.21 ft^3 or 6.37 lb
Liquefied Natural Gas	21,240 Btu/lb	5.47 lb	6.05 lb
Ethanol (E100)	76,330 Btu/gallon	1.52 gallon	1.68 gallon
Ethanol (E85)**	88,258 Btu/gallon	1.32 gallon	1.46 gallon
Electricity***	3,414 Btu/kilowatt hour (kWh)	34.00 kWh	37.64 kWh
Propane	84,250 Btu/gallon	1.38 gallon	1.53 gallon
Hydrogen	288.88 Btu/ft^3 or 51,585 Btu/lb	401.86 ft^3 or 2.25 lb	444.78 ft^3 or 2.49 lb

Tier 2 Emission standards, FTP 75, g/mi

Bin#	Intermediate life (5 years / 50,000 mi)					Full useful life				
	NMOG*	CO	NOx	PM	HCHO	NMOG*	CO	NOx†	PM	HCHO
Temporary Bins										
11 MDPV[c]						0.280	7.3	0.9	0.12	0.032
10[a,b,d,f]	0.125 (0.160)	3.4 (4.4)	0.4	-	0.015 (0.018)	0.156 (0.230)	4.2 (6.4)	0.6	0.08	0.018 (0.027)
9[a,b,e,f]	0.075 (0.140)	3.4	0.2	-	0.015	0.090 (0.180)	4.2	0.3	0.06	0.018
Permanent Bins										
8[b]	0.100 (0.125)	3.4	0.14	-	0.015	0.125 (0.156)	4.2	0.20	0.02	0.018
7	0.075	3.4	0.11	-	0.015	0.090	4.2	0.15	0.02	0.018
6	0.075	3.4	0.08	-	0.015	0.090	4.2	0.10	0.01	0.018
5	0.075	3.4	0.05	-	0.015	0.090	4.2	0.07	0.01	0.018
4	-	-	-	-	-	0.070	2.1	0.04	0.01	0.011
3	-	-	-	-	-	0.055	2.1	0.03	0.01	0.011
2	-	-	-	-	-	0.010	2.1	0.02	0.01	0.004
1	-	-	-	-	-	0.000	0.0	0.00	0.00	0.000

* for diesel fueled vehicle, NMOG (non-methane organic gases) means NMHC (non-methane hydrocarbons)
† average manufacturer fleet NOx standard is 0.07 g/mi for Tier 2 vehicles

a - Bin deleted at end of 2006 model year (2008 for HLDTs)
b - The higher temporary NMOG, CO and HCHO values apply only to HLDTs and MDPVs and expire after 2008
c - An additional temporary bin restricted to MDPVs, expires after model year 2008
d - Optional temporary NMOG standard of 0.195 g/mi (50,000) and 0.280 g/mi (full useful life) applies for qualifying LDT4s and MDPVs only
e - Optional temporary NMOG standard of 0.100 g/mi (50,000) and 0.130 g/mi (full useful life) applies for qualifying LDT2s only
f - 50,000 mile standard optional for diesels certified to bins 9 or 10

Impacts on efficiency

Injector precision

Thermodynamics

Timing

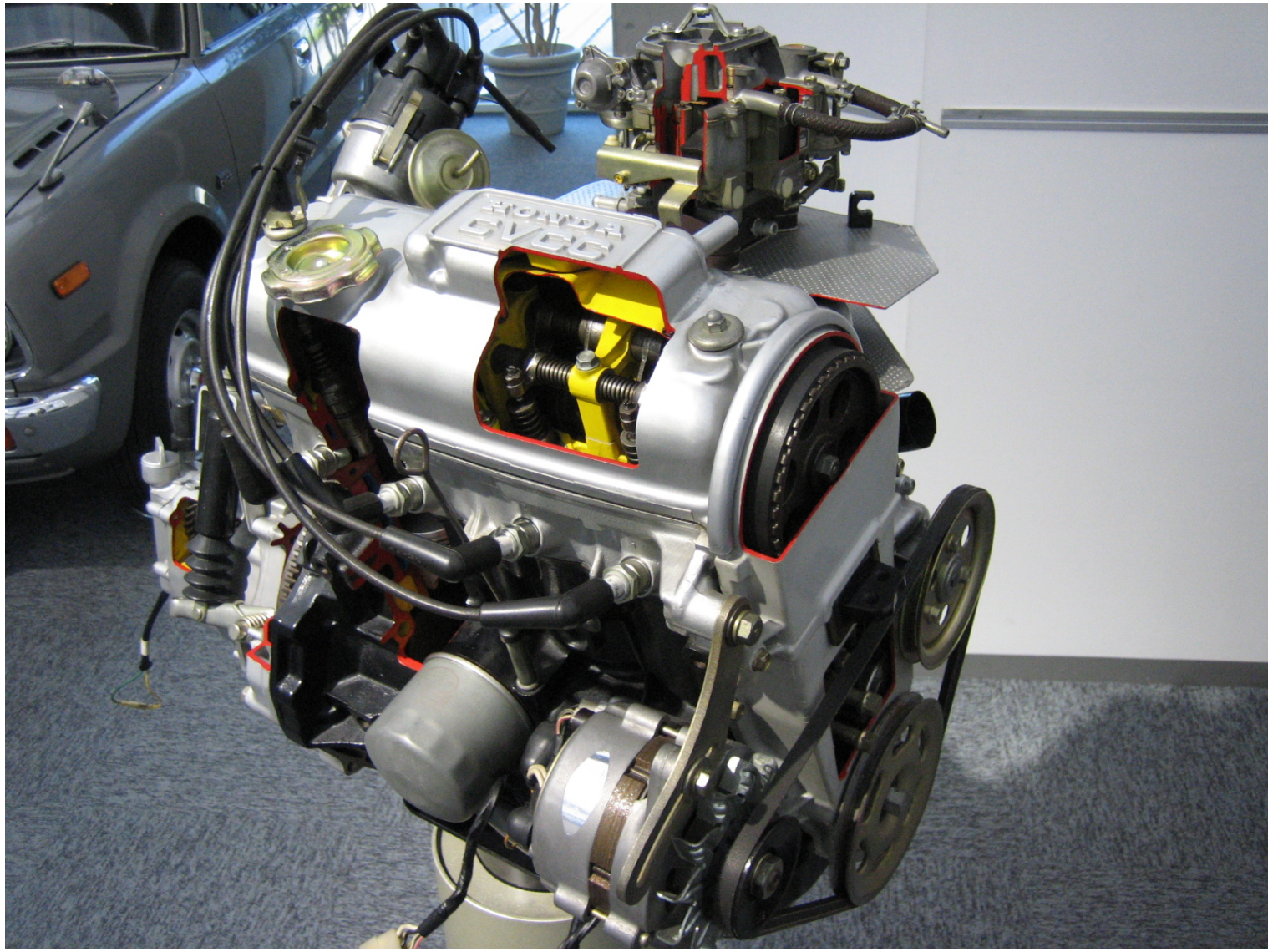
Octane rating

Stoichiometric uniformity across all cylinders

Emission controls

Soichiro Honda

Compound Vortex Controlled Combustion




IMPALA

TABLE III

Comparison Steady State Emissions
350 CID CVCC Impala vs. A Stock 1973 350 CID Impala

	HC		CO		NOx		CO_2		Fuel Economy (mpg)	
	350 CVCC	Stock 350	350 CVCC	Stock 350	350 CVCC	Stock 350	350 CVCC	Stock 350	350 CVCC	Stock 350
Idle (gm/5 min)	0.50	N/A	2.04	N/A	0.21	N/A	424.32	N/A	*	N/A
15 mph (gm/mi)	0.16	0.60	3.30	7.26	0.37	0.52	662.68	620.32	13.3	14.0
30 mph (gm/mi)	0.00	1.22	0.65	9.98	0.53	0.37	542.49	443.44	16.3	19.2
45 mph (gm/mi)	0.00	0.51	0.19	4.71	1.00	0.93	604.73	451.89	14.7	19.3
60 mph (gm/mi)	0.01	0.32	0.53	2.48	3.00	1.78	557.75	487.24	15.9	18.0

NOTE: a) CVCC data - - rear axle ratio: 3.08
- - loading characteristic is per belt-driven Clayton
Dynamometer set at 14.7 rear wheel Hp at 50 mph

b) Stock data - - rear axle ratio: 2.73
- - loading characteristic is per belt-driven Clayton
Dynamometer set at 14.0 rear wheel Hp at 50 mph

* 350 CID CVCC Idle Fuel Consumption: 0.58 gal/hr

Why do some fleets report fuel mileage on alternative fuels that does not mathematically equate to energy content?


STAG
CHEVROLET

How do you, as a fleet operator, know what systems will maximize you savings as it relates to energy content of fuel?

Empirical Data!

Don’t trust me. Or any other system manufacturer.

Talk to other fleet operators who deploy identical vehicles to yours.

Run a test of a system for four weeks.

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