FACT SHEET

GMC Sierra

Bi-Fuel CNG Pickup

For the 1998 model year, General Motors has equipped its line of Sierra pickups with an optional 5.7L V8 bi-fuel compressed natural gas/gasoline engine. General Motors has teamed with IMPCO to produce and sell this bi-fuel vehicle. The vehicle has a KL5-gaseous fuel ready engine and is delivered to the dealer with the natural gas system installed. Modifications to the engine for gaseous fuel compatibility include exhaust valve seat inserts, hardened intake valves and seats, and an increased capacity oil pan. A bi-fuel vehicle allows for flexibility in refueling. Using both fuels gives the pickup an estimated range of 550 miles (150 on CNG and 400 on gasoline). The Sierra is designed to operate primarily on CNG, but will automatically switch to gasoline operation if the CNG tank pressure falls below a set limit. Safety features include automatic shutoff of the CNG flow when the engine is not operating on CNG or if a significant leak in the system should occur.

The GM bi-fuel CNG lineup includes the GMC Sierra 2500 and the Chevrolet C/K 2500 pickups.

The U.S. Department of Energy (DOE) is promoting the use of alternative fuels and alternative fuel vehicles (AFVs). To support this activity, DOE has directed the National Renewable Energy Laboratory (NREL) to conduct projects to evaluate the performance and acceptability of light-duty AFVs. We tested a pair of 1998 GM pickups: one bi-fuel CNG and a gasoline model as closely matched as possible. Each vehicle was run through a series of tests, explained briefly below. The bi-fuel was tested on both CNG and gasoline. Each of these procedures has a page, on the vehicle evaluation web pages, with detailed descriptions.

Acceleration: Three tests performed: (1) elapsed time from a standstill to 60 mph at wide open throttle, loaded and unloaded; (2) elapsed time from 40 to 60 mph at wide open throttle (passing simulation); (3) elapsed time and maximum speed at a quarter mile. Values are the average of six measurements.

Braking: Dry surface is concrete, wet surface is low friction Jennite pad. Minimum stopping distance from 62 mph (100 km/h) on dry surface, and from 31 mph (50 km/h) on wet surface with no wheels locked. Panic stops are minimum measured distance from 31 mph (50 km/h) on wet and dry surfaces at maximum pedal pressure with no attempt to steer. Values are average of six stops.

Fuel Economy: City fuel economy determined using an urban driving cycle—a distance of 2 miles with 8 stops. Highway fuel economy used a 70 mph average driving cycle with no stops. The 150 mile trip alternated between urban and highway cycles until 150 miles was reached. Results are reported in 70% highway driving for total trip.

Cold Start: Vehicle placed in a temperature-controlled room at -20°F for first test (minimum soak time 12 hr*). Crank time and idle rating recorded. If start successful, procedure repeated at -20°F for confirmation. If start unsuccessful, procedure repeated at higher temperature until minimum temperature is determined.

Driveability and Handling: Four different drivers rated each aspect of the vehicles; final rating is average of the four.

Emissions: Duplicate tests performed on each vehicle using EPA's Federal Test Procedure. The bi-fuel pickup was tested on both CNG and RF-A (industry average gasoline), and the gasoline pickup was tested on RF-A.

*Soak time allows the vehicle to stabilize at a given temperature

General Description

	CNG Bi-fuel GM	Gasoline GM
Engine:		
Displacement	5.7 liter	5.7 liter
Configuration	V8	V8
Transmission	4-speed automatic	4-speed automatic
Fuel System	SFI-gasoline TBI-CNG	SFI
Engine Family Code	WTJXT05.7187	WGMXH05.7582
Compression Ratio	9.4:1	9.4:1
Capacities:		
Fuel	34 gal. gasoline/ 13 eq. gal. CNG @ 3600 psi	34 gal.
Passengers	3 front	3 front
Dimensions:		
Length	213.4 in	213.4 in
Width	77.0 in	77.0 in
GVWR*	8600	8600

*gross vehicle weight rating

Other Options: Both vehicles were regular cab, rear wheel drive, long bed trucks equipped with air conditioning, power steering, power brakes, tilt wheel, ABS, and cruise control. **Note:** Due to the added weight of the CNG fuel system, it is estimated that the pay- load for the bi-fuel pickup is approximately 500 lbs less than that of the gasoline pickup.

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Performance

	Bi-fuel CNG	Bi-fuel Gasoline	Conventional Gasoline
Acceleration			
0-60 mph loaded (sec)	19.2	15.6	14.7
0-60 mph unloaded (sec)	12.7	10.8	9.5
40 to 60 mph (sec)	6.7	6.3	4.9
1/4 mile time (sec)	19.2	18.0	17.2
1/4 mile speed (mph)	75.0	79.6	83.0
Fuel Economy (mpg)			
City	10.9	10.8	11.4
Highway	15.1	15.3	15.5
Combined City/Highway	13.4	13.6	14.1

Braking	Bi-fuel CNG		Bi-fuel Gasoline		Conventional Gasoline	
Effectiveness stops:	meters	feet	meters	feet	meters	feet
62 mph (100 kph) dry pavement	58.6	192.1	57.3	187.9	56.5	185.4
31 mph (50 kph) wet jenite	33.0	108.2	32.4	106.4	32.0	105.0
Panic stop						
31 mph (50 kph) dry pavement	17.0	55.7	16.4	53.7	16.3	53.4
31 mph (50 kph) wet jenite	33.6	110.1	33.7	110.4	31.7	104.1

Cold Start Temperature °F	Bi-fuel* CNG crank time	CNG idle rating	Gasoline crank time	Gasoline idle rating	Conventional Gasoline crank time	Conventional Gasoline idle rating
-20	did not start		4	9	4	7.5
+10	4	9	—	—	—	—

Idle ratings from 1 to 9, 1 being lowest rating
*vehicle designed to only start on gasoline below 10 degrees F

Subjective Ratings:

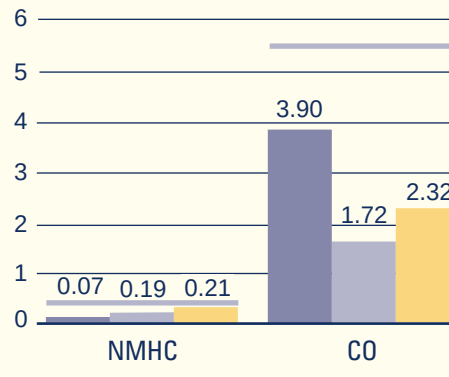
	Bi-fuel CNG	Bi-fuel Gasoline	Conventional Gasoline
Routine handling	★	★	★
Emergency handling	★	★	★
Acceleration	■	★	★
Braking	★	★	■
Ride; fully loaded	■	■	■
Ride; lightly loaded	★	★	■
Noise	★	★	★
Driving position	★	★	★
Seat comfort	★	★	★
Climate control	★	★	★
Access	★	★	★
Controls & displays	★	★	★
Cargo Area	■	■	★

★= Excellent ■= Good ● = Fair ❍= Poor ❒= Very Poor

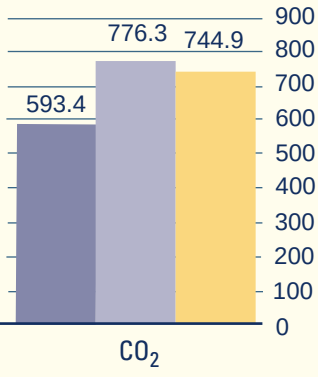
Emissions

Bi-CNG Bi-Gasoline Conventional Gasoline LEV

Regulated Exhaust Emissions (g/mi)



CO_2 Emissions (g/mi)



Clean Cities
Alternative Fuel Information Series

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Evaluation Summary

Evaluation results from a CNG bi-fuel GM pickup and a conventional gasoline GM pickup showed very little difference in fuel economy or driveability and handling. Braking results were slightly better for the conventional gasoline pickup, but at an average of 3% difference, this would hardly be noticeable to the driver. Comparison of the acceleration results for the bi-fuel pickup showed better results when operating on gasoline than when the truck was operating on CNG. The gasoline GM truck had better acceleration than the bi-fuel truck on either fuel. In the Cold start test, both trucks operating on gasoline started quickly at –20 degrees F. The owners manual for the bi-fuel pickup states that if the coolant temperature falls below 10 degrees F, the vehicle will default to gasoline operation. To confirm this, we tested the bi-fuel at –20 degrees F with the CNG tank full, and the gasoline tank empty. As expected, the engine attempted to start on gasoline, but was not successful. A subsequent test at 10 degrees on CNG was successful. Emissions tests run on the two vehicles showed reduced levels of NMHC and CO_2 for the CNG tests. CO emissions for the CNG tests were higher than both gasoline tests. NO_x levels for the bi-fuel truck on CNG were higher than the bi-fuel on gasoline, but lower than the conventional gasoline truck. Emissions of potency weighted toxics (including: benzene, 1,3-butadiene, formaldehyde, and acetaldehyde)* for the bi-fuel pickup operating on CNG were 83% lower than that of the gasoline pickup.

* For more information on the calculation of potency weighted toxic emissions see the section on emissions on the website (http://www.afdc.doe.gov/demoproj/ldv/nve).