

**Section 6**  
**GLOSSARY**

A/F ratio	air-fuel ratio: the ratio of air to fuel, on a mass basis, entering an engine
acetaldehyde	toxic compound in engine exhaust gases; produced from combustion of all fossil fuels—ethanol combustion typically creates higher concentrations because acetaldehyde is an ethanol combustion reaction intermediate
acid rain	rainwater, snow, fog, and other forms of precipitation that contain mild solutions of sulfuric and nitric acids from burning fossil fuels
AFDC	Alternative Fuels Data Center: an on-line service that provides information on a variety of alternative fuel projects, operated by the National Renewable Energy Laboratory for the U.S. DOE
aftermarket	components designed by someone other than the vehicle's manufacturer (see also conversion, conversion kit, conversion shop, downfit, OEM, QVM, retrofit, and upfit)
AFV	alternative fuel vehicle
AFV-FDP	Alternative Fuels for Vehicles Fleet Demonstration Program
AGA	American Gas Association
AGAL	American Gas Association Laboratories
air toxics	see TAP
ALAPCO	Association of Local Air Pollution Control Officials
alcohol	organic compounds whose molecules are similar to simple hydrocarbons but also contain oxygen atoms. The primary and most common alcohols are ethanol and methanol; alcohols and ethers are typically used as oxygenates and octane boosters

for blending with gasoline. (see also oxygenate and oxygenated fuel)

aldehyde	compounds, including toxic compounds such as acetaldehyde and formaldehyde, that may be produced by partial combustion (i.e., partial oxidation) of alcohols. The partial combustion can also convert the alcohol molecules into ketones; acetaldehyde and formaldehyde are often present in vehicle exhaust, especially from vehicles using alcohol fuels such as ethanol and methanol. (see also TAP)
all-composite	a component made of multiple layers of different materials, usually substituting for metal. In the case of CNG storage cylinders, all-composite construction is used to reduce weight and corrosion and entails substitution of materials having extremely high strength-to-weight ratios, such as carbon fibers and Kevlar®, in place of steel and aluminum. (see also composite)
AMFA	Alternative Motor Fuels Act of 1988. U.S. law that, among other things, provides automakers with CAFE credits for producing AFVs; also requires or encourages AFV demonstrations and purchases of AFVs by federal agencies.
AMI	American Methanol Institute
ANGI	Automotive Natural Gas, Inc.: manufacturer of CNG station and vehicle conversion equipment, now owned by EDO Corporation
ANSI	American National Standards Institute
aromatics	members of the benzene family of hydrocarbons that are ring-structured with the general formula $C_nH_{2n-6}$ . Aromatics have high octane numbers, high density, high solvency power (dissolve or swell gaskets), and burn sooty (the reason “clean diesel” has limits on aromatics). Benzene is defined by EPA as a toxic compound.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials

ASTM D1835	ASTM specification often used to define the properties of LPG/propane being purchased for use as engine fuel. (see also HD-5 propane)
autoignition temperature	temperature at which a fuel will spontaneously ignite when mixed with air
Avocet®	methanol ignition improver
AVTC	Advanced Vehicle Technology Center (Rome, NY)
B20	blend of 20-volume-percent vegetable oil or animal fat ester and 80-volume-percent diesel fuel (see biodiesel)
battery-electric vehicle	usually, a vehicle whose sole means of propulsion consists of electric motors that receive all their power from onboard, rechargeable storage batteries; abbreviation: BEV or, more commonly, EV. The batteries are recharged by connection to a stationary electric power source; e.g., the grid that distributes electricity generated at electric power plants. (see also EZEV, HEV, and ZEV)
BC Transit	Broome County Transit: transit authority serving Binghamton, NY and environs
benzene	an aromatic hydrocarbon that is considered to be toxic; chemical formula: C <sub>6</sub> H <sub>6</sub> (see also aromatics and TAP)
Berlin Mandate	international agreement, adopted in 1995, governing reductions in greenhouse gases (see also global warming, IPCC, and Rio Treaty)
bifuel	vehicles with two fuel systems, of which only one can be used at a time
biodiesel	fuel made from vegetable oils or animal fats and used in diesel engines, typically in a blend (e.g., B20) with conventional diesel fuel
biomass	materials produced from biological sources, including agricultural crops, crop residue, wood, forest residue, and cellulosic (e.g., paper, wood) components of municipal solid waste

BOCA	Building Officials and Code Administrators (see also ICBO, IMC, and SBCCI)
Btu	British thermal unit, the energy needed to raise one pound of water one °F
CAA	Clean Air Act. U.S. law governing control of air pollution. Enacted in 1963, and expanded in 1970 to include motor vehicle emission standards. For automobiles, the CAA required a 90 percent reduction in CO and HC emissions by 1975 and a 90 percent reduction in NO <sub>x</sub> by 1976; deadlines were later relaxed to 1981. (see also CAAA, OTC, and SIP)
CAAA	Clean Air Act Amendments of 1990
CAAA90	See CAAA
CAFE	corporate average fuel economy: for a vehicle manufacturer, the average fuel economy (mpg) of all the passenger cars sold by that manufacturer in the U.S. in a given model year. A separate CAFE is also calculated for each manufacturer's light truck production. (see also AMFA and CAFE standards)
CAFE standards	standards for fuel economy authorized in 1975 as part of the U.S. Energy Policy and Conservation Act (EPCA). The standards, one for passenger cars and another for light trucks, are subject to adjustments by NHTSA and are legally enforceable goals for vehicle manufacturers to achieve for the purpose of reducing petroleum consumption. (see also AMFA)
California LEV Program	program requiring vehicle manufacturers to meet an increasingly strict set of emissions standards for vehicles sold in California (see also CARB 2 RFG and CARB vehicle emission standards)
CARB	California Air Resources Board
CARB 2 RFG	gasoline meeting CARB's Phase 2 specifications. This "reformulated gasoline" was required to be produced by refiners serving the California market, starting in early 1996, and to be the only gasoline used in California by June 1, 1996, and is required by CARB for use in conjunction with the California Low Emission

Vehicle Program. Compared to federal specifications for reformulated gasoline, CARB 2 requires lower sulfur content, lower vapor pressure, and other modifications. (see also CARB vehicle emission standards)

CARB vehicle  
emissions standards

standards that define emissions certification levels attained by vehicles assigned to various categories for regulation under California's laws, specifically the California Low Emission Vehicle (LEV) Program. The categories are TLEV (transitional low-emission vehicle), LEV (low-emission vehicle), ULEV (ultra low-emission vehicle), and ZEV (zero-emission vehicle). ILEV (inherently low-emission vehicle) are those vehicles that meet TLEV (or better) levels and emit no evaporative emissions (usually assumed to be limited to natural gas, propane, and neat alcohol vehicles). California may adopt an EZEV standard, which would allow vehicles to emit the same amount as the equivalent electricity production emissions in California for recharging EVs. Vehicles that might meet the EZEV standard include hybrids and hydrogen powered vehicles. To help attain the emissions standards, gasoline vehicles in California are required to use CARB 2 gasoline.

carbon fiber

a type of manmade fiber having a high strength-to-weight ratio and which is used as a reinforcing element in composite materials. CNG tanks sometimes are made using carbon fibers, allowing a reduction in weight as compared to metal tanks. Carbon fibers are also used to reinforce metal tanks.

carbon dioxide

colorless, odorless, nonpoisonous gas produced by combustion of carbon-based fuels and by biologic processes (e.g., animal and human respiration). Chemical formula: CO<sub>2</sub>. Traditionally thought to be harmless, and indeed necessary for growth of plant life, CO<sub>2</sub> has in recent years become a concern because it is a greenhouse gas and its concentration in the atmosphere has been increasing, presumably because of the growing use of fossil fuels. (see also global warming and oxygenated fuel)

carbon monoxide

colorless, odorless, poisonous gas that can be produced by incomplete combustion of carbon-based fuels. Chemical formula: CO. When inhaled, CO is absorbed into the bloodstream and reduces the blood's ability to carry oxygen. In low concentrations, this impairs mental and muscular function; in higher

concentrations, death can result. CO is a criteria pollutant under the CAA and CAAA. (see also CARB vehicle emissions standards, catalytic converter, reformulated gasoline, and three-way catalyst)

**cascade** at a CNG fueling station, the high-pressure storage vessels, plus associated supports, enclosures, and interconnecting piping and valves, used for bulk storage of CNG. The primary purpose of a cascade is to serve as a buffer to meet peak demand requirements, allowing use of a smaller, less-expensive compressor that is sized to meet average demand. Note that it is also possible to use an LNG system as a substitute for a traditional cascade at a CNG station; such an arrangement is called an L-CNG system.

**catalyst** substance that assists a chemical reaction to start or continue, without itself being consumed in the reaction. In vehicles, catalysts are often placed in engine exhaust systems to facilitate chemical reactions that decrease harmful exhaust emissions. The use of catalysts in this way allows the desired reactions to start at a lower temperature than would otherwise be required and to proceed more rapidly. Noble (nonreactive) metals such as platinum (Pt), palladium (Pd), and rhodium (Rh) are commonly used as catalysts in vehicle exhaust systems, with Pt being especially good at oxidizing HC and Rh being very effective at reducing NO<sub>x</sub>. Catalysts can become poisoned or lose their effectiveness by exposure to lead, sulfur and other trace elements in exhaust gases. (see catalytic converter)

**catalytic converter** device installed in an engine's exhaust system to bring exhaust gases into contact with catalysts that help initiate and sustain chemical reactions to oxidize hydrocarbons and carbon monoxide to carbon dioxide (these catalysts are called "oxidation" catalysts). Some catalysts can reduce NO<sub>x</sub> emissions (creating nitrogen and oxygen) in addition, and are called "3-way" catalysts.

**CBD** central business district: Used to describe vehicle emissions test cycles characterized by much stop-and-go driving and engine idling

**CENTRO** common name for the Central New York Regional Transportation Authority (CNYRTA), the transit authority serving Syracuse and environs.

cetane number	a measure of a fuel's ignition quality; i.e., the ability of a fuel to ignite spontaneously when injected into hot air, with minimal ignition lag (time between the start of fuel injection and the start of ignition). Used to rate suitability of fuels for use in diesel engines. A fuel with a high cetane number (CN) starts a cold engine more quickly and burns more smoothly, as compared to a fuel having a low CN. CN ranges from zero to 100. Analogous to octane number for spark ignition engine fuels.
cetane rating	the cetane number of a fuel
cetane	a hydrocarbon found in petroleum. Chemical formula: $C_{16}H_{34}$ . (also called n-hexadecane, see also cetane number)
CFFP	Clean Fuels Fleet Program: established by CAAA, this covers centrally fueled fleets of 10 or more vehicles in 22 nonattainment areas and requires that 30% of new purchases meet LEV standards, starting in 1998, later ramping to 70%. (see also CFV)
cfm	cubic feet per minute, a measure of gas volume flow rate; also written CFM. When corrected to standard conditions, expressed as scfm.
CFV	clean fuel vehicle: EPA classification denoting a vehicle certified as meeting CFV emissions standards, including durability requirements, under provisions of the CAAA and CFFP. Clean fuels include alternative fuels, reformulated gasoline, and clean diesel fuel.
chassis dynamometer	a stationary device used to subject a motor vehicle to simulated driving cycles. In one arrangement, the vehicle is positioned such that its drive wheels rest on rollers, and flywheels of varying weights are coupled to the rollers to simulate vehicle inertia. A water brake or other resistance device can be used to simulate the effects of aerodynamic drag, rolling resistance and hill climbing. Sometimes called a treadmill.
clean fuel	reformulated gasoline, clean diesel, or alternative fuels (see CAAA, CFFP, and CFV)

clean diesel	generally, a diesel fuel that has been modified to achieve lower exhaust emissions. As compared to conventional diesel, clean diesel fuels have reduced sulfur content (e.g., 0.05 weight percent or less) and may also have reduced aromatic content and other modifications.
Clean Air Act Amendments	see CAAA
Clean Cities	U.S. Department of Energy program to assist cities in purchasing and using AFVs
Clean Air Act	see CAA
closed-loop	emission control system that adjusts engine operation based on exhaust-gas composition
CMAQ	Congestion Mitigation and Air Quality Improvement (Federal Highway Administration program)
CMSA	Consolidated Metropolitan Statistical Area
CNG	compressed natural gas
CO	carbon monoxide (exhaust emission caused by incomplete combustion)
CO <sub>2</sub>	carbon dioxide (a major greenhouse gas produced from combustion of carbon-containing fuels)
composite	denotes type of construction used to make certain components (e.g., certain types of CNG storage cylinders), where different materials are layered and bound together by application of pressure, heat, adhesives, etc. to form an integral unit. Popular materials used in composite parts include carbon fibers, aluminum, and plastics, including plastic fibers such as Kevlar®, and other so-called engineering plastics. (see also all-composite)

compressed natural gas	see CNG
compression ratio	in a piston engine, the ratio between the volume of the cylinder when the piston is at bottom dead center and the volume of the cylinder when the piston is at top dead center, or the displacement plus clearance volume divided by the clearance volume. Higher compression ratios generally allow more powerful and efficient engines but require higher quality fuels (abbreviation: CR).
compression ignition	ignition technique used in diesel engines whereby the heat required to ignite the fuel-air mix is created solely by compressing the incoming air
conventional fuel	gasoline, diesel fuel, and other fuels derived from crude oil
conversion	when applied to an AFV, denotes a vehicle converted to run on an alternative fuel after the vehicle was sold to the end user (see also aftermarket, conversion kit, conversion shop, downfit, OEM, QVM, retrofit, and upfit)
conversion kit	when applied to an AFV, denotes equipment used to convert a vehicle to alternative fuel operation (see also aftermarket, conversion, conversion shop, downfit, OEM, QVM, retrofit, and upfit)
conversion shop	facility used for converting vehicles to alternative fuel; sometimes also refers to organization performing the conversion work (see also aftermarket, conversion, conversion kit, downfit, OEM, QVM, retrofit, and upfit)
CR	compression ratio
criteria pollutant	pollutant that per provisions of the CAA and later amendments has been determined by EPA to be hazardous to human health and is subject to EPA regulations
cryogenic	adjective referring to extremely low temperature. There is no generally accepted temperature reading that constitutes the upper limit of the cryogenic range; the upper limit has been assumed by various writers to be as low as 216 degrees R

(120 degrees K; minus 244 degrees F) and as high as 396 degrees R (220 degrees K; minus 64 degrees F). (see also cryogenic fuels)

cryogenic fuels	fuels stored at cryogenic conditions. Normally these are fuels, such as hydrogen and natural gas, that are gases at room temperature but that have been liquefied and stored at cryogenic temperatures. Liquefaction is desirable because it greatly reduces the size and weight of tanks needed to store a given mass of fuel; however, significant amounts of energy must be expended to run the necessary refrigeration equipment, and sophisticated storage tanks, usually double-walled, vacuum-insulated vessels called dewars, must be used to keep the fuels from warming up until they are needed. Modern systems are capable of keeping cryogenic fuels cold, and avoiding any need for pressure relief, for a week or more. (see also LH <sub>2</sub> and LNG)
Cummins	Cummins Engine Company (manufacturer of diesel and alternative-fuel engines)
curb weight	the weight of a vehicle with standard equipment and fuel, oil, and coolant
cylinder	high-pressure storage container for gases
DDC	Detroit Diesel Corporation (manufacturer of diesel and alternative-fuel engines)
DEC	New York State Department of Environmental Conservation; also NYSDEC
dedicated vehicle	vehicle that has only one fuel system; e.g., a dedicated CNG vehicle can only use CNG
denaturant	toxic, foul-tasting, or foul-smelling additive to make ethanol unfit for human consumption
denature	to alter a substance by adding another substance that imparts a repugnant odor and/or taste for the purpose of discouraging human ingestion. For example, at a facility producing ethanol for use in motor vehicles, 5 volume percent of gasoline is added to the final product to give it a repulsive odor/taste and thereby discourage the ethanol from being diverted for use in alcoholic beverages.

DEP	NYC Department of Environmental Protection
DER	discrete emission reduction (credit) (see also ERC)
deterioration factor	a factor, determined by testing, used to predict the increase in per-mile emissions over the life of a vehicle
diesel fuel	generally, any fuel capable of being used in a diesel (i.e., compression-ignition) engine
diesel engine	a compression-ignition piston engine that employs the Diesel thermodynamic cycle; named after Rudolph Diesel, the cycle's inventor
diurnal	refers to evaporative emissions caused by the typical rise and fall of temperature over a 24-hour period
DME	dimethyl ether: an alternative fuel made from natural gas and used in diesel engines; has physical properties similar to propane
DMV	New York State Department of Motor Vehicles
DOE	U.S. Department of Energy
domestic	non-imported; also called indigenous. For example, natural gas used in the U.S. is generally considered to be a domestic resource because it comes predominantly from gas wells inside the U.S.
DOT	U.S. Department of Transportation (see also NYSDOT)
DOT cylinder	cylindrical pressure vessel (tank) that meets U.S. DOT specifications. DOT cylinders are often selected for use in storing CNG.

downfit	to convert an AFV to conventional fuel operation; e.g., to remove the CNG components from a bifuel NGV (see also aftermarket, conversion, conversion kit, conversion shop, OEM, QVM, retrofit, and upfit)
dual fuel vehicle	vehicle having the ability to use two fuels simultaneously; e.g., a diesel-engine truck that is equipped with a diesel fuel tank, but that also has CNG cylinders and equipment for delivering both fuels to the engine such that they are mixed together and burned simultaneously (see also pilot injection)
dynamometer	a device for measuring mechanical power (see also chassis dynamometer and engine dynamometer)
E10	a blend of 10 volume percent ethanol and 90 volume percent gasoline
E22	a blend of 22 volume percent ethanol and 78 volume percent gasoline used extensively in Brazilian AFV market (see also E85, E100, flexible fuel vehicle, and gasohol)
E85	a blend of 85 volume percent ethanol and 15 volume percent gasoline
E100	neat (pure or 100%) ethanol (see also E10, E22, E85, and gasohol)
EHV	electric-hybrid vehicle (see hybrid-electric vehicle)
electric vehicle	vehicle having an electric propulsion system (abbreviation: EV). Usually denotes a “battery-electric” vehicle, e.g., a highway vehicle that derives all its power from onboard, rechargeable electric storage batteries. (see also EZEV, HEV, and ZEV)
engine dynamometer	device for measuring the power output of an engine. Typically, the engine is mounted on a test stand and its output shaft is connected to a power absorbing device like a water brake.
EPA	U.S. Environmental Protection Agency

EPA I	RFG meeting EPA Phase I regulations for years 1998-1999
EPA II	RFG meeting EPA Phase II regulations for year 2000 and beyond
EPACT	Energy Policy Act of 1992
EPCA	Energy Policy and Conservation Act: U.S. law that, among other things, authorized CAFE standards
ERC	emissions reduction credit (see also DER)
ETBE	ethyl tertiary butyl ether: a fuel additive typically made from ethanol and sometimes used to increase the octane rating of gasoline, or to increase the oxygen content of gasoline to comply with emissions requirements.
ethanol	an alcohol, sometimes referred to as grain alcohol or ethyl alcohol; chemical formula: $C_2H_5OH$ (also expressed as $CH_3CH_2OH$ ); sometimes written EtOH. Commonly made by fermenting agricultural crops (fermentation ethanol), but can also be made by the catalytic hydration of ethylene (synthetic ethanol). Work is on-going to develop processes to produce ethanol from wood, paper waste, or other cellulose-based resources (cellulosic ethanol). As a motor fuel, ethanol can be used as a nearly direct substitute for gasoline, or as a blending agent to increase the octane rating and oxygen content of gasoline, or as a feedstock for making ETBE, an oxygenate that can be blended with gasoline. (see also E85, E100, ETBE, E22, flexible fuel vehicle, gasohol, oxygenate, and oxygenated fuel)
ethers	organic compounds similar to simple hydrocarbons, but also containing oxygen. Ethers such as DME, ETBE, MTBE, and TAME are used as substitutes for and additives to gasoline and diesel fuel. Ethers and alcohols are typically used as oxygenates and octane boosters for blending gasoline. (see also oxygenate and oxygenated fuel)
EtOH	ethanol
EV	electric vehicle

EV1	General Motors' production electric vehicle																		
evaporative emissions	emission of air pollutants from a vehicle's fuel system, or from refueling or other equipment, as the result of evaporation of fuel and subsequent escape of the fuel vapors into the atmosphere																		
EZEV	equivalent zero-emission vehicle: vehicle meeting CARB's EZEV emissions standard, set at a level corresponding to the in-basin central power plant NO <sub>x</sub> and ROG emissions caused by recharging a battery-electric vehicle; proposed standard: 0.02 grams/mile NO <sub>x</sub> and 0.004 gpm NMOG. (see also ZEV)																		
fast-fill	refueling a CNG vehicles in the same amount of time as it would take to refuel an equivalent conventional-fuel vehicle																		
FFV	flexible-fuel vehicle (vehicle able to use alcohol fuels or gasoline, or any blend of alcohol and gasoline)																		
flammability limits	for a combustible gas in air, the minimum and maximum concentrations below and above which flame will not propagate. Expressed as volume percentages. Examples: <table border="0" style="margin-left: 40px;"> <tr> <td colspan="3" style="text-align: center;">Lower and Upper Flammability Limits in Air (Volume %)</td> </tr> <tr> <td></td> <td style="text-align: center;">Lower</td> <td style="text-align: center;">Upper</td> </tr> <tr> <td style="text-align: center;"><u>Gas</u></td> <td style="text-align: center;"><u>(LFL)</u></td> <td style="text-align: center;"><u>(UFL)</u></td> </tr> <tr> <td>Propane</td> <td style="text-align: center;">2.2</td> <td style="text-align: center;">9.5</td> </tr> <tr> <td>Hydrogen</td> <td style="text-align: center;">4.0</td> <td style="text-align: center;">74.2</td> </tr> <tr> <td>Natural Gas (typical)</td> <td style="text-align: center;">4.8</td> <td style="text-align: center;">13.5</td> </tr> </table>	Lower and Upper Flammability Limits in Air (Volume %)				Lower	Upper	<u>Gas</u>	<u>(LFL)</u>	<u>(UFL)</u>	Propane	2.2	9.5	Hydrogen	4.0	74.2	Natural Gas (typical)	4.8	13.5
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flash point	temperature at and above which a fuel will spontaneously generate, if exposed to air, a vapor-air mixture that is ignitable by a spark or other ignition source																		
flex-fuel vehicle	flexible fuel vehicle																		
flexible fuel vehicle	vehicle having a single fuel tank, in which an alcohol fuel (either methanol or ethanol) and gasoline can be mixed in any ratio. The terms "methanol FFV" and "ethanol FFV" refer to flexible fuel vehicles (FFVs) optimized to use																		

methanol/gasoline blends and ethanol/gasoline blends, respectively; sometimes referred to as a VFV (variable fuel vehicle). (see also E85, gasohol, and M85)

FMVSS	Federal Motor Vehicle Safety Standard
formaldehyde	toxic compound in exhaust gases; produced from combustion of all fossil fuels—methanol combustion typically creates higher concentrations because formaldehyde is a methanol combustion reaction intermediate
four-stroke	refers to the internal combustion engine that uses intake, compression, power, and exhaust strokes. All vehicles sold in the U.S. that use gasoline have four-stroke spark ignition engines.
ft <sup>3</sup>	cubic foot; also written cf or cu ft
FTA	U.S. Federal Transit Administration: formerly, U.S. Urban Mass Transit Administration (UMTA)
FTP	Federal Test Procedure: the driving cycle used by EPA to certify light-duty vehicles for emissions
fuel cell	energy-conversion device that produces electricity from hydrogen or fuels that contain hydrogen
Fuelmaker	See VRA
full fuel cycle	tracking all inputs and outputs of fuel production and use from resource through combustion
g	gram; also written gm: metric unit of mass generally treated as equivalent of 0.03527 ounces, or 1/454th of a pound
gal	gallon

gallon	unit of volume equal to 231 cubic inches or 0.1337 cubic feet or 3.785 liters; abbreviation: gal
gaseous fuel vehicle	a vehicle fueled by CNG, propane, or other fuel that is normally in a gaseous state at room temperature and atmospheric pressure; abbreviation: GFV
gasohol	a blend of 10-volume-percent ethanol in gasoline
gasoline	a mixture of liquid hydrocarbons refined from crude oil, with properties that meet specifications for use as a motor fuel
gasoline engine	generally, a spark-ignited piston engine that uses gasoline for fuel (see also diesel engine, four-stroke, Otto cycle, and spark-ignited engine)
gasoline-gallon equivalent	an amount of fuel that equals the energy in one gallon of gasoline; abbreviation: gge
GFI	GFI Control Systems, Inc: Canadian manufacturer of CNG vehicle fuel control systems
GFV	gaseous fuel vehicle
gge	gasoline-gallon equivalent; also written GGE
global warming	theory that the average temperature of the earth's atmosphere is increasing (see also Berlin Mandate, greenhouse gases, IPCC, and Rio Treaty)
glow plug	electric-resistance heating device installed in the combustion chamber of a diesel engine for the purpose of assisting in engine starting, especially in cold weather; also written glowplug or glow-plug
gm	gram; also written g
gpm	gallons per minute

GPV	gasoline powered vehicle
gram	metric unit of mass generally treated as equivalent of 0.03527 ounces, or 1/454th of a pound; abbreviation: g or gm
greenhouse effect	phenomenon whereby certain gases in the earth's atmosphere allow solar radiation to penetrate the atmosphere more easily than they allow the outward (infrared, i.e., longwave) radiation of energy from the earth's surface to outer space, thus trapping energy in the earth's atmosphere. Some scientists point to the greenhouse effect as the primary mechanism in the theory of global warming. (see also greenhouse gases)
greenhouse gases	gases in the atmosphere, such as carbon dioxide, that trap solar radiation and contribute to global warming
GRI	Gas Research Institute
GRT	gross receipts tax or gross revenue tax
GVW	gross vehicle weight: the maximum allowable loaded weight of a vehicle, including the vehicle, its cargo, passengers, driver, fuel, etc; also called gross vehicle weight rating (GVWR) (for comparison, see curb weight)
GVWR	gross vehicle weight rating (see GVW)
H	hydrogen, the lightest element; normally occurs in diatomic form: H <sub>2</sub> .
HAP	hazardous air pollutant
HC	hydrocarbon emissions; vehicles emit HC from their tailpipes (because of incomplete combustion) and from their fuel systems (because of evaporation)

HCFC	hydrochlorofluorocarbon: type of molecule containing hydrogen, chlorine, fluorine, and carbon atoms. To reduce depletion of the ozone layer in the upper atmosphere, HCFCs have been deployed to replace CFCs as working fluids in air conditioners and in other applications. When CFCs escape into the air, they migrate to the upper atmosphere and there engage in reactions that deplete ozone and thereby reduce the atmosphere's ability to absorb cancer-causing ultraviolet rays. HCFCs also cause this kind of damage, although to a lesser extent, and production of HCFCs is being limited under the terms of a worldwide treaty
HD	heavy-duty; also written heavy duty
HD-5 propane	NPGA specification often used to define the properties of LPG/propane being purchased for use as engine fuel. HD-5 requires that the fuel contain at least 90 volume percent propane and no more than 5 volume percent propylene. (see also ASTM D1835, LPG, NGL, and propane)
HDE	heavy-duty engine
HDT	heavy-duty truck
HDV	heavy-duty vehicle
HEV	hybrid-electric vehicle
HFL	higher flammability limit
HHV	higher heating value (see lower heating value)
horsepower	unit of power equal to 550 ft-lb per second; Also equal to 0.7457 kW, or 0.1781 kcal/s, or 0.7068 Btu/s; also written hp
hp	horsepower
HVAC	heating, ventilation, and air conditioning

hybrid vehicle usually denotes a hybrid-electric vehicle

hybrid-electric vehicle usually denotes a vehicle that incorporates propulsion system components from both a battery-electric vehicle and a conventional vehicle; abbreviation: HEV. Many drivetrain configurations are possible within series and parallel types. Most employ a downsized engine (as compared to that on a conventional vehicle) that may be set up to run at a continuous speed or intermittently or in some other mode that reduces the amount of fuel burned, and with an energy storage device (e.g., electric battery, flywheel) and electric drive system providing supplemental power for acceleration, hill-climbing and other high-power situations. As compared to conventional vehicles, hybrids have the potential to greatly reduce fuel consumption and emissions, while overcoming range and performance limitations normally associated with battery-electric vehicles. (see also EV, EZEV, and ZEV)

hydrate a solid phase complex of water and light hydrocarbons that can form when mixtures of water vapor and light hydrocarbons are subjected to high pressures (e.g., above 100 psia) at low temperatures (e.g., below 60 degrees F). In CNG systems, hydrates are a concern because they can restrict or stop gas flow. The primary preventive measure is removal of water (moisture) from the natural gas, preferably before it enters the CNG compressor.

hydrocarbons substances whose molecules are comprised entirely of hydrogen and carbon; abbreviation: HC. Examples of hydrocarbons include:

methane (CH <sub>4</sub> )		benzene (C <sub>6</sub> H <sub>6</sub> )	
ethane (C <sub>2</sub> H <sub>6</sub> )		octane (C <sub>8</sub> H <sub>18</sub> )	
propane (C <sub>3</sub> H <sub>8</sub> )		acetylene (C <sub>2</sub> H <sub>2</sub> )	
butane (C <sub>4</sub> H <sub>10</sub> )		ethylene (C <sub>2</sub> H <sub>4</sub> )	
pentane (C <sub>5</sub> H <sub>12</sub> )		propylene (C <sub>3</sub> H <sub>6</sub> )	

Hydrocarbons contribute to formation of ground level ozone, and as a group are a criteria pollutant under the CAA and CAAA. Hydrocarbons also include toxic chemicals that are separately regulated as criteria pollutants under the CAA and CAAA. (see also CARB vehicle emissions standards, catalytic converter, NMHC,

NMOG, OMHCE, reactivity, reformulated gasoline, TAP, and three-way catalyst)

hydrogen

the lightest element; chemical symbol: H. In its elemental form hydrogen is normally diatomic; i.e., occurs as a molecule composed of two hydrogen atoms (chemical formula: H<sub>2</sub>) and is a gas; it can be liquefied, but only at extremely low temperatures (-423 degrees F). Hydrogen presently is made commercially by a reaction process between natural gas and steam, but can also be made by electrolysis of water. In transportation, use of hydrogen has been limited by its high cost and unusual storage and handling requirements. (see also cryogenic fuels, fuel cell, [word has been intentionally omitted], and LH<sub>2</sub>)

[words have been intentionally omitted]

I/M

inspection/maintenance

I/R

inspection and repair; also written IR or I&R

IAS

International Approval Services

ICBO

International Conference of Building Officials: major issuer of building codes covering, among other things, aspects of building design that may be affected by the presence of vehicles, vehicle fuel systems, and vehicle fueling equipment. Other building codes organizations include BOCA and SBCCI. BOCA, ICBO, and SBCCI are trying to consolidate their efforts by participating in the International Code Council (ICC). (see also IMC)

ICC

1. International Code Council: organization seeking to unify building codes covering, among other things, aspects of building design that may be affected by the presence of vehicles, vehicle fuel systems, and vehicle fueling equipment. Has issued draft (as of 1995) International Mechanical Code (IMC). (see also BOCA, ICBO, and SBCCI)
2. Formerly, U.S. Interstate Commerce Commission; abolished 1995, with

remaining functions transferred to U.S. DOT and the U.S. Justice Department.

ICE	internal combustion engine
ignition lag	in a diesel engine combustion chamber, the time between the start of fuel injection and the start of ignition
IGT	Institute of Gas Technology
ILEV	inherently low-emission vehicle: per a voluntary standard written by EPA, an ILEV must meet CARB's TLEV certification requirements and also emit no evaporative emissions. Dedicated CNG, propane, and neat alcohol vehicles are capable of meeting the ILEV standard, based on their inherent lack of evaporative emissions.
IMC	International Mechanical Code: issued by the International Code Council (ICC), this draft (as of 1995) code covers, among other things, aspects of building design that may be affected by the presence of vehicles, vehicle fuel systems, and vehicle fueling equipment. May supersede existing codes issued by BOCA, ICBO, and SBCCI. (see also SBC, UBC, and UMC)
IMPCO	IMPCO Technologies, Inc: manufacturer of fuel systems for AFVs and other vehicles
indigenous	non-imported; also called domestic. For example, natural gas used in the U.S. is generally considered to be an indigenous resource because it comes predominantly from gas wells inside the U.S.
Indolene	trademark name of a gasoline manufactured by Amoco to meet specifications set forth in CFR Part 86. Must be used by manufacturers to certify vehicles for emissions.
internal combustion engine	generally, a gasoline or diesel engine

IPCC	Intergovernmental Panel on Climate Change: international body studying global warming (see also Berlin Mandate, greenhouse gases, and Rio Treaty)
IR	infrared
ketone	a volatile organic compound (VOC) that may be produced, along with aldehydes, by partial combustion of alcohols such as ethanol and methanol. Examples of ketones include acetone ( $\text{CH}_3\text{CH}_2\text{CO}$ ) and methyl ethyl ketone ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}$ ).
Kevlar®	an aramid fiber having an extremely high strength-to-weight ratio and which is used in bulletproof vests and as a reinforcing element in composite materials. CNG tanks are sometimes made by wrapping Kevlar® or other high-strength fibers around a metal tank, allowing a reduction in the metal wall thickness and reducing the weight of the overall structure. (see also carbon fiber)
kg	kilogram
kilogram	unit of mass equal to 1,000 grams or 2.205 lb; abbreviation: kg
knock	see octane number
kPa	kilopascal (unit of pressure equal to about 6.8 psi)
kW	kilowatt
kWh	kilowatt-hour: unit of energy equal to 3412 Btu, or 1.341 hp-hr, or $2.655 \times 10^6$ ft-lb
L	liter
L-CNG	liquefied-compressed natural gas: system for refueling CNG vehicles without using high-pressure compressors or cascades. Instead, the fuel is delivered to the station as LNG, or LNG is produced onsite from low-pressure natural gas. CNG is then produced on demand by allowing some of the LNG to warm up and vaporize in special equipment that controls the amount of expansion that occurs.

(see also cryogenic fuels)

lambda sensor	see oxygen sensor
latent heat of vaporization	the heat required to change a liquid into a vapor
lb	pound: force equal to 0.4536 kilograms (i.e., force required to support a 0.4536 kg mass at the standard locality) or 444,800 dynes or 32.17 poundals
LDT	light-duty truck
LDV	light-duty vehicle
lead	see leaded gasoline or tetraethyl lead
leaded gasoline	gasoline to which lead compounds have been added to increase octane ratings. Federal regulations required phase-out of leaded gasoline in the U.S. highway fuels market, starting in the 1970s, because of concern over environmental effects of lead. Use of lead in U.S. fuels is now prohibited. The most common additive used to add lead to gasoline has been tetraethyl lead ( $\text{Pb}(\text{C}_2\text{H}_5)_4$ ). (see also oxygenated fuel, tetraethyl lead, and unleaded gasoline)
LEV	low emission vehicle (California emission standard)
LFL	lower flammability limit: for a combustible gas in air, the minimum concentration below which flame will not propagate; expressed in terms of combustible gas volume percentage (see also flammability limits and UFL)
$\text{LH}_2$	liquefied hydrogen, also called liquid hydrogen (see also cryogenic and cryogenic fuels)
LHV	lower heating value

LIB	Long Island Bus: transit authority headquartered in Nassau County, New York; formerly Metropolitan-Suburban Bus Authority (MSBA)
liquefied petroleum gas	see LPG
liquefied natural gas	see LNG
liquid propane	see LPG
liter	unit of volume equal to 1000 cubic centimeters; also equal to 0.2642 U.S. gallons, or 61.0 cubic inches; abbreviation: l or L
LNG	liquefied natural gas (natural gas turned liquid by cooling to minus 260°F)
low-emission vehicle	Vehicle meeting emissions standards for a LEV (versus a TLEV, ULEV, or ZEV) under the California Low-Emission Vehicle Program, or that meets the emissions standards for a LEV under the federal CFV program (the Federal and California programs use numerically equal definitions for TLEV, LEV, ULEV, and ZEV); abbreviation: LEV (see also California LEV Program and CARB vehicle emission standards)
lower heating value	a measure of the energy released when fuel is burned in an engine. The primary difference between LHV (lower heating value) and HHV (higher heating value) is that HHV includes the energy that could be recovered by allowing water vapor in the exhaust gases to cool and condense into liquid. LHV is customarily used in calculations of engine efficiency, whereas HHV is more commonly used in efficiency calculations, and fuel specifications, for fuels burned in boilers and other non-engine applications.
LP gas	liquefied petroleum gas (see LPG)
LPG	liquefied petroleum gas, also called LP gas; a mixture of hydrocarbons that are gases at room temperature and pressure, but that condense to liquids when subjected to moderate pressure (under 300 psi) at room temperature. In the U.S.,

commercial LPG usually consists of a mix that is more than half propane, and in many locations the mixture is sold commercially as "propane" (see also HD-5 propane and NGL)

LPG/propane	LPG and/or propane; i.e., LPG, including product designated specifically as propane
LPGV	liquefied petroleum gas vehicle (see LPG)
M/A	methanol with Avocet® added as an ignition promoter, enabling this mixture to be used in standard diesel engines with minor modifications (primarily, larger-capacity fuel injectors). The volume percent methanol in the mix is sometimes denoted by trailing numerals; e.g., M/A 93 is a mixture of 93 volume percent methanol and 7 volume percent Avocet®.
M85	a blend of 85 volume percent methanol and 15 volume percent gasoline
M100	neat (pure or 100%) methanol
MAOP	maximum allowable operating pressure; also called maximum allowable working pressure (MAWP)
MAWP	maximum allowable working pressure: specification used for, among other things, high-pressure gas storage cylinders; also called maximum allowable operating pressure (MAOP)
max	maximum
MeOH	methanol
MERC	mobile source emissions reduction credit: a credit that a party can earn by implementing an innovative mobile source emissions reduction program (e.g., vehicle scrappage, clean fuel fleets, urban bus programs) and which can be used, under a procedure administered by EPA, in a SIP to offset emissions of stationary sources. MERCs are also intended to be marketable, such that the holder could

	sell a MERC to an entity mandated to achieve emissions reductions.
mercaptan	ethyl mercaptan (an odorant added in small amounts to natural gas)
metal hydride	alloy that can store hydrogen within the alloy's internal structure, at relatively low pressure
methane	a hydrocarbon whose molecule consists of a carbon atom surrounded by four hydrogen atoms; chemical formula: CH <sub>4</sub> . Methane is the primary constituent of natural gas.
methanol	an alcohol, sometimes referred to as wood alcohol or methyl alcohol; chemical formula: CH <sub>3</sub> OH; sometimes written MeOH. Methanol is commonly made from natural gas and also can be made from other raw materials, including coal and biomass materials. (see also ethanol, flexible fuel vehicle, M85, M100, MTBE, oxygenate, and oxygenated fuel)
micron	unit of length equal to 1-millionth of a meter (1 x 10 <sup>-6</sup> m); also written μm; also called micrometer
model year	vehicle manufacturer's designated production period for a specific vehicle design. By custom, the model year assigned normally is the same as the calendar year following the first occurrence of January 1 during the production period.
MON	motor octane number: an octane rating number determined by the Motor Method, as specified in ASTM D 2699 and D 2700. MON is generally considered to be an index of high-speed knock; i.e., the tendency of a specific gasoline blend, relative to other blends, to pre-ignite (ignite before the spark plug fires) at high engine speeds. The MON value for a gasoline is usually lower than the research octane number (RON). (see also octane number and RON)
motor octane number	see MON

mpg	miles per gallon
mpge	miles per gallon equivalent; the miles that an AFV can be driven using the same amount of energy (lower heating value) as in a gallon of gasoline or diesel fuel (depending on which is the relevant baseline fuel)
mph	miles per hour
MSA	Metropolitan Statistical Area
MSBA	see LIB or Long Island Bus
MTA	Metropolitan Transit Authority: transit authority serving NYC
MTBE	methyl tertiary butyl ether: a fuel additive made from methanol and used to increase the octane rating of gasoline, or to increase the oxygen content of gasoline to comply with emissions requirements.
NAAQS	National Ambient Air Quality Standards (set by EPA)
NAFA	National Association of Fleet Administrators
natural gas	A naturally occurring mixture of hydrocarbons, but predominantly methane, found in geologic formations, often in association with petroleum reservoirs, and usually extracted by drilling wells. After leaving the well, the gas is often subjected to processing to remove heavy hydrocarbons and undesirable trace chemicals. Natural gas is distributed throughout the U.S. through an extensive pipeline system. (see also CNG, LNG, L-CNG, NGL, and SNG)
NCWM	National Conference on Weights and Measures
NEC	National Electrical Code

NFPA	National Fire Protection Association: NFPA maintains technical committees and issues codes and standards covering vehicle onboard fuel systems and fueling stations.
NFTA	Niagara Frontier Transportation Authority; transit authority serving Buffalo, NY and environs
NG	natural gas
NGL	natural gas liquids: includes ethane, propane, butane, and higher hydrocarbons removed from natural gas before it is sent through a pipeline
NGV	natural gas vehicle: vehicle that uses natural gas, either CNG or LNG, as fuel in bifuel, dual fuel, or dedicated configurations
NGVC	Natural Gas Vehicle Coalition
NHA	National Hydrogen Association
NHTSA	U.S. National Highway Traffic Safety Administration; unit of U.S. DOT
nitric oxide	gaseous, poisonous chemical whose molecule consists of one atom of nitrogen and one atom of oxygen; chemical formula: NO (see also nitrogen dioxide and nitrogen oxides)
nitrogen dioxide	gaseous chemical whose molecule consists of one atom of nitrogen and two atoms of oxygen; chemical formula: NO <sub>2</sub> . (see also nitric oxide and nitrogen oxides)
nitrogen oxides	gaseous chemicals that can be formed when air (i.e., a mixture of nitrogen and oxygen) is subjected to high temperature and pressure, as in the combustion chamber of an engine; also called oxides of nitrogen; chemical symbol: NO <sub>x</sub> . NO <sub>x</sub> contributes to the formation of ground level ozone and also to formation of acid rain, and is a criteria pollutant under the CAA and CAAA. The primary nitrogen

oxides occurring in vehicle exhaust are NO and NO<sub>2</sub>. (see also CARB vehicle emissions standards, catalytic converter, nitric oxide, reformulated gasoline, and three-way catalyst)

nitrous oxide	gaseous chemical whose molecule consists of two atoms of nitrogen and one atom of oxygen; chemical formula: N <sub>2</sub> O; used as an anesthetic (laughing gas). Nitrous oxide is a greenhouse gas but plays a minor role as compared to other greenhouse gases.
NMHC	nonmethane hydrocarbons: hydrocarbon emissions minus the methane component; provides a better measure of ozone-forming potential because methane does not participate significantly in reactions that produce ozone
NMOG	nonmethane organic gases (see also CARB vehicle emissions standards, NMHC, OMHCE, reactivity, and ROG)
NO	nitric oxide
NO <sub>2</sub>	nitrogen dioxide
NO <sub>x</sub>	nitrogen oxides (exhaust emission caused by high temperature combustion).
N <sub>2</sub> O	nitrous oxide
nonattainment	failure of a geographic region to comply with NAAQS
nonattainment area	region in the U.S. that is deemed by EPA to have levels of air pollution, such as ground level ozone, carbon monoxide, or particulate matter, that are higher than levels defined in the National Ambient Air Quality Standards; also written non-attainment area; abbreviation: NAA (see also SIP)
NPGA	National Propane Gas Association
NREL	National Renewable Energy Laboratory: operated by Midwest Research Institute on behalf of DOE (see also AFDC)

NYC	New York City
NYCC	New York City Cycle: widely used procedure for determining the emissions of urban light-duty vehicles; performed with vehicle sitting on a chassis dynamometer, it is meant to simulate driving in New York City (see also FTP)
NYCDEP	New York City Department of Environmental Protection
NYGAS	New York Gas Group: research consortium of New York State gas utilities
NYPGA	New York Propane Gas Association
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation (see also DOT)
NYSERDA	New York State Energy Research and Development Authority
NYSOGS	New York State Office of General Services
NYSOMH	New York State Office of Mental Health
NYSOPR	NYS Office of Parks, Recreation, and Historic Preservation
NYSTA	New York State Thruway Authority (see also Thruway)
O&M	operating and maintenance (refers to a vehicle's variable expenses, not usually counting fuel costs)
O <sub>2</sub>	oxygen
O <sub>2</sub> sensor	see oxygen sensor

O <sub>3</sub>	ozone
OBD	on-board diagnostics
OBD I	specification, introduced by CARB in 1988, for OBD system designed to monitor a vehicle's performance and detect problems that could lead to increased emissions. OBD I systems monitor the engine computer, sensors, fuel metering system, and exhaust recirculation.
OBD II	specification, introduced by CARB in 1994, for OBD system designed to monitor a vehicle's performance and detect problems that could lead to increased emissions. Differs from OBD I by inclusion of malfunction indicator lamp in instrument panel and storage of diagnostic trouble codes readable by a scan tool.
octane	a liquid hydrocarbon used to determine the octane rating of gasoline-like fuels
octane number	resistance of a fuel to autoignition, which can cause undue stress on, or damage to, an engine; gasoline with insufficient octane sometimes causes an audible knocking sound (engine knock). Octane number (also called octane rating, pump octane, or antiknock index) is an important specification for fuels used in spark-ignited engines and the value displayed on fuel pumps is normally the arithmetic average of motor octane number (MON) and research octane number (RON). MON is determined by the Motor Method and is a good indicator of knock resistance at high engine speeds. RON is determined by the Research Method and is a good indicator of knock resistance during hard acceleration.
octane rating	see octane number
OEM	original equipment manufacturer: refers to vehicles and parts produced by a vehicle manufacturer, as opposed to parts produced by another company for add-on to the vehicle (aftermarket supplier)
OMHCE	Organic material hydrocarbon equivalent: a type of vehicular air pollution measurement used to determine the emissions impact of oxygenated fuels. Defined as organic emissions (hydrocarbons and oxygenated organics) calculated

in a manner that attempts to compensate for the mass bias (relative to non-oxygenated fuels) resulting from the presence of additional oxygen atoms in the fuel. (see also NMHC, NMOG, reactivity, and ROG)

OPD	overflow protection device: for example, a device that ensures that the flow of LPG into a tank is stopped before the liquid exceeds a safe level (safety requires that at least 20% of the volume of an LPG tank be occupied by vapor)
OPEC	Organization of Petroleum Exporting Countries
open-loop	emission control system than cannot adjust operation based on exhaust-gas composition
organic compounds	carbon-based compounds
Orion	Orion Bus Industries, Inc. (bus manufacturer)
OSHA	U.S. Occupational Safety and Health Administration
OTAG	Ozone Transport Assessment Group: group formed under the auspices of EPA and comprised of representatives from 37 states east of the Mississippi or abutting it. OTAG committees have focused on emissions monitoring and modeling, in preparation for developing regional air quality strategies.
OTC	Ozone Transport Commission: established under the CAA, the OTC seeks to develop, for states in the northeastern U.S., a coordinated strategy for attaining the ground level ozone requirements of the CAA. Major subunits: Mobile Source Committee and Area and Stationary Source Committee (see also OTAG). The geographic area, or Ozone Transport Region (OTR), covered by the OTC includes the District of Columbia CMSA (including part of Virginia) plus:  Connecticut Delaware New Jersey New York

Maine	Pennsylvania
Massachusetts	Rhode Island
Maryland	Vermont
New Hampshire	

OTR	Ozone Transport Region (see also OTC)
Otto cycle	the thermodynamic cycle employed by spark-ignited piston engines, e.g., gasoline engines; named after Nikolaus Otto, the cycle's inventor.
oxidation catalyst	see catalytic converter and catalyst
oxides of nitrogen	see nitrogen oxides
oxygen sensor	sensor located in engine's exhaust system that generates an output voltage inversely proportional to the amount of oxygen in the exhaust gases; used in engines with closed-loop emissions control; also called lambda sensor (lambda is Greek letter commonly used to denote air/fuel ratio) or O <sub>2</sub> sensor
oxygenate	an additive used to increase the oxygen content of fuel (see also oxygenated fuel and reformulated gasoline)
oxygenated fuel	usually refers to gasoline containing oxygen-rich additives, called oxygenates, that improve octane rating and produce lower carbon monoxide emissions. Ethers and alcohols are commonly used oxygenates. Oxygenated fuel (e.g., 2.0 or greater weight percent oxygen) has been found to reduce tailpipe emissions in some vehicles. Oxygenates also tend to reduce production of carbon dioxide, a greenhouse gas, because they derive more of their energy from hydrogen than carbon; i.e., they have lower carbon-to-energy ratios, as compared to other gasoline constituents. (see also reformulated gasoline)
oxygenated gasoline	gasoline to which oxygen-containing components, such as alcohols or ethers, have been added to reduce carbon monoxide and other emissions

ozone	air pollutant created from reactions between vehicle emissions in the presence of sunlight
Ozone Transport Commission	see OTC
Ozone Transport Region	see OTC
particulate matter	airborne particles produced by human activity and nature; abbreviation: PM. PM is thought to have a significant negative affect on human health, causing respiratory and other diseases and exacerbating the symptoms of disease. In urban areas, vehicle engines produce a large portion of the measured PM, both directly during the combustion process and also through reactions that occur after exhaust gases enter the atmosphere. Diesel engines produce significant amounts of PM during combustion, and certification standards for diesels used in heavy-duty trucks and buses include a limit on PM emissions. Gasoline engine exhaust contains compounds such as POM, aromatics, NO <sub>x</sub> , and SO <sub>x</sub> , all of which contribute to formation of fine particulates. (see also PM-10 and TSP)
particulates	see particulate matter
Pd	palladium: a metal used as a catalyst in catalytic converters
PEM	proton exchange membrane: type of fuel cell
pilot injection	a technique for burning alternative fuels in diesel engines whereby a small amount of diesel fuel is injected as a pilot fuel to begin the combustion process. This technique allows the engine to burn alternative fuels, such as natural gas or methanol, that are more difficult to ignite than diesel fuel. Pilot injection is an alternative to techniques such as installing spark plugs, using glow plugs to increase combustion chamber temperature, or mixing an ignition-promoting chemical into the alternative fuel. (see also dual fuel vehicle)

piston engine	generally, a reciprocating internal combustion engine; e.g., a typical gasoline or diesel engine (see also internal combustion engine)
PM	see particulate matter
PM-10	particulate matter with mean diameter of 10 microns or less
PNGV	Partnership for a New Generation of Vehicles: U.S. Department of Commerce program funded from eight federal departments (primarily DOE). Goals include developing a low-emission, 80-mpg "supercar." Major elements include hybrid vehicle programs with major U.S. automakers.
POM	polycyclic organic matter: a general category of airborne toxics (see also TAP)
ppb	parts per billion
ppm	parts per million
PRD	pressure relief device: as it relates to a CNG vehicle, a PRD is normally included in the system design and may consist of a rupture disk; i.e., a disk that fails and releases the CNG if a specified pressure is exceeded, the purpose being to prevent potential overpressurization and resulting catastrophic failure of the fuel system during fueling or in the event the CNG tanks are exposed to fire
propane	a hydrocarbon occurring in petroleum and natural gas, and normally diverted into a separate byproduct stream, along with other constituents having similar properties, at petroleum refineries and at facilities used to prepare natural gas for pipeline transmission; chemical formula: C <sub>3</sub> H <sub>8</sub> . Propane is a liquid under modest pressures (under 300 psi). The HD-5 specification is often used to define the properties of commercial-grade propane being purchased for use as an engine fuel. HD-5 requires that the fuel contain at least 90 volume percent propane and no more than 5 volume percent propylene. (see also LPG and NGL)
propane-air	Mixture of propane and air used as substitute for natural gas during periods of peak demand in some natural gas distribution systems. Propane-air should not be

used in CNG systems, as the propane condenses when compressed, endangering the CNG compressor and potentially causing NGV engine damage because propane has a lower octane rating than natural gas.

PRV	pressure relief valve: same as PRD
PSC	New York State Public Service Commission
psi	pounds per square inch
Pt	platinum: a metal used as a catalyst in catalytic converters (see catalyst)
pump octane	see octane number
PVC	Propane Vehicle Coalition
QVM	Qualified Vehicle Modifier: Ford Motor Company program to certify and assist companies in converting Ford vehicles to alternative fuels. The goal is to enable Ford customers to specify alternative fuel hardware as an option when ordering vehicles from a Ford dealer, and to coordinate dealer, QVM, and Ford actions to ensure that the customer receives full product support and warranty protection. (see also aftermarket, conversion, conversion kit, conversion shop, downfit, OEM, retrofit, and upfit)
reactivity	tendency of an air emissions constituent to form ground level ozone; often expressed as reactivity factor (RF), specific reactivity or incremental reactivity, e.g., the estimated number of grams of ozone produced per gram of a particular emissions constituent (see also NMOG, OMHCE, and ROG)
reducing catalyst	reduction catalyst
reduction catalyst	see catalytic converter and catalyst
reformulated gasoline	gasoline that has been specially formulated to reduce exhaust emissions (see also CARB 2 RFG, EPA I, and EPA II)

Reid vapor pressure	vapor pressure of liquid fuels at 100°F; higher values indicate fuels that vaporize easily, which may help engine performance but can increase emissions; abbreviation RVP.
research octane number	see RON
retrofit	the process of modifying a product after it has been sold to the end user; may include installation of new, factory-approved components or, alternatively, installation of aftermarket components, such as when a conventional fuel vehicle is modified to become an AFV (see also aftermarket, conversion, conversion kit, conversion shop, downfit, OEM, QVM, and upfit)
RF	radio frequency
RFG	reformulated gasoline
RFI	radio frequency interference
RGR	Rochester-Genesee Regional Transportation Authority: transit authority serving Rochester and environs
Rh	rhodium: a metal used as a catalyst in a catalytic converter (see catalyst)
Rio Treaty	United Nations Framework Convention on Climate Change, signed in 1992; international treaty addressing global warming and governing reductions in greenhouse gases (see also Berlin Mandate, greenhouse effect, and IPCC)
ROG	reactive organic gases (see also NMHC, NMOG, OMHCE, reactivity, and VOC)
RON	research octane number: an octane rating number determined by the Research Method, as specified in DIN 51 756. RON is generally considered to be an index of acceleration knock; i.e., the tendency of a specific gasoline blend, relative to other blends, to pre-ignite (ignite before the spark plug fires) during hard acceleration. The RON value for a gasoline is usually higher than the motor

	octane number (MON). (see also octane number)
rpm	revolutions per minute
running losses	gasoline vapors released from a vehicle's fuel system when the engine is running
RVP	Reid vapor pressure; also written Rvp
SAE	Society of Automotive Engineers
SBC	Standard Building Code: covers, among other things, aspects of building design that may be affected by the presence of vehicles, vehicle fuel systems, and vehicle fueling equipment; may in some cases be superseded by proposed International Mechanical Code (IMC) (see also BOCA, ICC, UBC, and UMC)
SBCCI	Southern Building Code Conference International: major issuer of building codes covering, among other things, aspects of building design that may be affected by the presence of vehicles, vehicle fuel systems, and vehicle fueling equipment. BOCA, ICBO, and SBCCI are trying to consolidate their efforts by participating in the International Code Council (ICC). (see also IMC)
scf	standard cubic foot: basic measure of natural gas
scfm	standard cubic feet per minute; also written SCFM: the volume of a gas, normalized to standard temperature and pressure, passing a given point in a pipe, duct, etc. in 1 minute. Used to specify, among other things, the capacity of blowers and compressors. In the U.S., standard temperature is generally 60°F and standard pressure is generally 14.696 psia.
SCFM	standard cubic feet per minute (see scfm)
SEMA	Specialty Equipment Marketing Association: industry association representing, among others, manufacturers of vehicle aftermarket products

SHED	sealed housing for evaporative determination: device used to measure evaporative emissions of vehicles
SI	spark-ignited; i.e., a spark-ignited engine
SIE	spark-ignited engine
SIP	State Implementation Plan: required by EPA; identifies the actions and programs to be undertaken by a state to control emissions within its boundaries
slow-fill	refueling a CNG vehicle over several hours; also called time-fill
smog	visible haze caused by air pollution
SMSA	Standard Metropolitan Statistical Area
SNG	Synthetic natural gas; also called substitute natural gas: methane or methane-rich gas mixtures made from coal, biomass, or other carbonaceous sources
SO <sub>2</sub>	sulfur dioxide (exhaust emission)
SOF	soluble oil fraction: a liquid component of exhaust emissions consisting of unburned fuel (8-15 carbon atoms per molecule) and lubrication oil (>15 carbon atoms per molecule)
Solectria	Solectria Corporation (electric vehicle manufacturer)
SO <sub>x</sub>	sulfur oxides
spark-ignited engines	generally, piston engines that operate on the Otto thermodynamic cycle; e.g., a typical gasoline engine; abbreviation: SI or SIE. SI engines usually employ spark plugs to initiate the combustion process, plus a throttle that controls engine power/speed by regulating air flow into the engine. Most alternative fuels (especially natural gas and LPG/propane) are easier to burn in spark-ignited engines, as opposed to diesel engines, but spark-ignited engines generally are not

as efficient as diesels when idling or under other low-load conditions, which may be a drawback in some applications. (see also four-stroke, octane, and pilot injection)

**SRD** safety relief device: protective device installed on high pressure cylinders; see also **PRD**

**STAPPA** State & Territorial Air Pollution Program Administrators

**State Implementation Plan** see **SIP**

**stratospheric ozone** ozone in the atmosphere above an altitude of about 50,000 feet; considered beneficial because it absorbs cancer-causing solar ultraviolet radiation (see also tropospheric ozone)

**Supercar** see **PNGV**

**TAME** tertiary amyl methyl ether; a fuel additive sometimes used in reformulated gasoline

**TAP** toxic air pollutants: EPA term for chemical compounds found in vehicle exhaust that are directly harmful (known carcinogens) to humans; also called air toxics; includes benzene, 1,3-butadiene, formaldehyde, acetaldehyde, and polycyclic organic material (POM) (see also NMHC, NMOG, OMHCE, reactivity, reformulated gasoline, ROG, and VOC)

**Teflon®** Dupont brand name for polytetrafluoroethylene (PTFE), a plastic valued for its resistance to chemical attack and high temperatures, and for use as an anti-friction coating

**TEL** tetraethyl lead

tetraethyl lead	Pb(C <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> ; also written TEL. A poisonous compound that is the primary constituent of an additive, usually in the form of an ethyl fluid also containing ethylene dibromide or ethylene dichloride, used to increase the octane rating of gasoline. Gasoline thus modified is called leaded gasoline. Use of lead in U.S. fuels is now largely prohibited. (see also leaded gasoline, oxygenated fuel, and unleaded gasoline)
three-way catalyst	catalytic converter designed to convert three primary pollutants (CO, HC, and NO <sub>x</sub> ) in an engine's exhaust to less harmful constituents. Often uses platinum, palladium, and rhodium as active catalytic materials
Thruway	Governor Thomas E. Dewey Thruway: a 559-mile toll road system connecting the nine largest cities in New York State; operated by the New York State Thruway Authority (NYSTA); the largest superhighway of its kind in the U.S.
Thruway Authority	New York State Thruway Authority (NYSTA) (see also Thruway)
time-fill	see slow-fill
TLEV	transitional low-emission vehicle (California emission standard)
toxic air pollutants	see TAP
toxics	any pollutant that may cause cancer or other serious health problems; examples of toxics from conventional fuels as defined by EPA include benzene, formaldehyde, acetaldehyde, and 1,3-butadiene
tropospheric ozone	ozone in the atmosphere below an altitude of about 35,000 feet; also called ground level ozone; defined as a criteria pollutant in the CAA because it is in direct contact with humans and causes significant health problems (see also stratospheric ozone)
TSP	total suspended particles: a measure of airborne particulate matter (PM)

UBC	Uniform Building Code: covers, among other things, aspects of building design that may be affected by the presence of vehicles, vehicle fuel systems, and vehicle fueling equipment; may in some cases be superseded by proposed International Mechanical Code (IMC) (see also BOCA, ICC, SBC, and UMC)
UFL	upper flammability limit; also called higher flammability limit (HFL): for a combustible gas in air, the maximum concentration above which flame will not propagate; expressed in terms of combustible gas volume percentage (see also flammability limits and LFL)
UL	Underwriters Laboratories, Inc.
ULEV	ultra low-emission vehicle (California emission standard)
ullage	the amount of empty space remaining in a fuel tank when the tank is filled to its rated volume
UMC	Universal Mechanical Code: written by the ICBO, a major issuer of building codes covering, among other things, aspects of building design that may be affected by the presence of vehicles, vehicle fuel systems, and vehicle fueling equipment; may in some cases be superseded by proposed International Mechanical Code (IMC) (see also BOCA, ICC, SBC, and UBC)
UMTA	U.S. Urban Mass Transit Administration. Has been renamed Federal Transit Administration (FTA)
Unique Mobility	Unique Mobility, Inc. (electric and hybrid-electric vehicle component supplier)
unleaded gasoline	gasoline that contains lead at levels low enough to meet U.S. EPA regulations. In the U.S., starting July 1, 1974, gasoline retailers were required to begin offering at least one grade of unleaded gasoline at every station. (see also leaded gasoline, oxygenated fuel, tetraethyl lead, and RON)
upfit	as it applies to AFVs, the process of adding AFV components to an otherwise conventional vehicle; may include retrofit processes as well as arrangements

whereby a vehicle manufacturer contracts with a third party to modify vehicles after they leave the assembly line and before delivery to a dealer (see also aftermarket, conversion, conversion kit, conversion shop, downfit, OEM, QVM, retrofit, and upfitter)

upfitter	a person or organization that performs an upfit
USPS	U.S. Postal Service
USWG	U.S. water gallons: used to describe the actual interior volume of a tank, such as an LPG/propane tank, as opposed to the rated storage capacity, which may be lower; e.g., to allow for expansion of the liquid during changes in ambient temperature
vapor pressure	see RVP
VFV	variable fuel vehicle (see flexible fuel vehicle)
VMT	vehicle miles traveled
VNG	vehicular natural gas
VOC	volatile organic compound (exhaust and evaporative emissions; synonymous with HC)
vol	volume
volatile organic compound	see VOC

VRA	vehicle refueling appliance: A packaged compressor system designed for overnight refueling (i.e., slow filling) of one or more light-duty CNG vehicles; also called vehicle refueling unit, home refueling appliance, or Fuelmaker (a trade name)
wear metals	metal particles rubbed from internal surfaces of a machine as a result of normal internal friction, and potentially from abnormal causes as well, and that can be found suspended in the machine's lubricating oil. As related to AFVs, analysis of wear metals in engine lubricating oil can be used to determine the relative effect that a fuel is having on wear inside the engine.
WOT	wide-open throttle
wt	weight
ZEV	zero-emission vehicle as defined under California, Massachusetts, and New York laws; synonymous with electric vehicle