Frequently Asked Questions About
Converting Vehicles to Operate on Natural Gas

The rising cost of gasoline and diesel fuel is prompting many people to investigate options to retrofit ("convert") their car or pick-up truck to run solely on natural gas (referred to as "dedicated") or to run on gasoline OR natural gas (referred to as "bi-fuel). This document answers the basic questions most often posed to NGVAmerica about this topic including: conversion system availability; installation, service and warranty issues; costs; and available tax credits. This document does not address conversion of medium- and heavy-duty vehicles over 10,000 pounds GVWR such as shuttles, buses and/or work trucks.

"Conversion" System Availability

The Environmental Protection Agency (EPA) has rules concerning the manufacture, sale and installation of alternative fuel engine conversion systems. In California, similar and even more stringent emission rules and guidelines have been established by the state's Air Resources Board (CARB). As allowed under federal law, some states have adopted or have announced they will adopt the CARB guidelines. These include: Arizona, Colorado, Connecticut, Florida, Maine, Massachusetts, Maryland, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Utah, Vermont, Washington These rules apply to both natural gas- and propane-powered engine retrofit systems, and will presumably apply to ethanol and/or hydrogen retrofit systems if/when they are ever approved. [Note: Presently, there are no EPA- or CARB-approved hydrogen or ethanol retrofit systems available in the US]. Only EPA and/or CARB-certified conversion systems are permitted to be installed on vehicles. While a variety of non-certified systems are sold on the Internet and/or offered by some automotive shops, EPA has taken the position that installation of these systems is "tampering with a federally approved emission control system," a federal violation punishable by a substantial financial penalty (more than $5000/day). Many of these non-certified systems are allowed in other countries that have less strict vehicle emissions and safety laws.

To obtain EPA and/or CARB certification for a specific engine or engine family, manufacturers of retrofit systems (referred to as Small Volume Manufacturers – SVM) must submit a converted vehicle to EPA or CARB for rigorous testing along with substantial technical documentation. This testing assures that the retrofitted vehicle meets the same stringent emissions requirements the original equipment manufacturers (OEM) -- e.g., GM and Ford --met when they submitted their gasoline or diesel-powered vehicle for certification. The testing also ensures that the retrofit system works seamlessly with the OEM's on-board diagnostics (OBD) system to indicate when emissions are outside of approved parameters and to log those anomalies in the computer memory for downloading by the automotive service technician. The process of engineering, manufacturing, installing, pre-testing and then submitting a proposed retrofit system to an EPA- or CARB-approved laboratory for certification is a time-consuming and expensive process that may cost as much as $200,000 or more per engine family. SVMs recoup this R&D investment by amortizing the cost across the expected sales volume, adding it to the price they charge for the various components (computer control module, regulator, injectors, high-pressure hoses and fittings, etc).

A retrofit system certification applies to a specific engine for specific model year, e.g. 2008 GM 6.0L engine family "XYZ", which applies to several – but not all – 2008 GM vehicles with a GM 6.0L engine. Furthermore, this certification applies only to the installation of that system for a limited time period (e.g. installations

completed during the 2008 calendar year). SVMs may opt to 'carry-over" their certifications into future years by filing additional documentation and paying a fee, thus allowing them to convert a previous model-year vehicle (for which they obtained certification) in later years (e.g. carry-over of a 2007 certification to allow conversion of a 2007 vehicle in 2008). This decision to carry over a certification is usually based on the SVM's projected sales volume.

Due to the technical difficulty and the expense, only a few SVMs have elected to go through the EPA- and/or CARB-certification process and, even then, only for a limited number of engine families and applicable vehicle models. Currently, there are only three SVMs offering EPA- certified systems (two have CARB certifications) for four GM and Ford light-duty engine families covering about twenty vehicle models. These include the GM 6.0L engine and the Ford 4.6L, 5.4L and 6.8L engines. Currently, there are no natural gas engine conversion systems available in the U.S. for any other light-duty vehicle brands -- although American Honda does manufacture the natural gas Civic GX at their East Liberty, Ohio plant. [Note: Additional medium- and heavy-duty engines are available]. An up-to-date list of ALL currently available EPA- and CARB-certified engine retrofit and repower systems – and the contact info for the SVMs - is available at the following link: http://www.ngvamerica.org/pdfs/marketplace/MP.Analyses.NGVs-a.pdf . As new certifications are granted, this list will be updated as will the SVM contact information.

Installation

Installation of an engine conversion package and fueling system may be done after the vehicle has been in service or when the vehicle is first purchased. EPA and CARB require that SVMs provide appropriate documentation and training to installers of their systems, commonly referred to as "qualified system retrofitters" (QSR). Installation by a non-qualified installer could damage the retrofit equipment or the engine (or both), compromise vehicle performance, or render the vehicle unsafe to operate. No EPA- or CARB-certified engine conversion systems are sold to untrained/unapproved installers. This is not a "kit" you buy and install in your own garage or have installed by the local untrained mechanic. Some SVMs prefer to install their systems themselves at their corporate facilities while other SVMs choose not to install their own equipment – opting instead to sell their systems only through QSRs.

NGVAmerica does not maintain a list of QSRs. Contact the SVMs for information about the QSR that is closest to you. Automotive shops interested in becoming a QSR should contact the SVMs directly to inquire about the technical, equipment and financial capabilities/resources they require and the process to become one of their QSRs.

Service and Warranty Issues

Generally, vehicle warranties offered by the original automotive manufacturer (OEM) are not affected by the installation of an engine retrofit system, with the exception that the engine warranty for all items related directly to the retrofit system which will now be covered by the SVM. The OEM's warranty on non-engine-retrofit-system-related items (e.g., a defective lock, leaking power steering pump) remains in force. Many OEM dealers are unfamiliar with NGV retrofit systems and logistics, and may errantly tell customers that the "vehicle warranty" will be voided, but this is inaccurate. Courts have upheld the OEM's non-engine-retrofit-system-related warranty obligations.

Because natural gas engines work essentially the same way as gasoline engines -- i.e. an air-fuel mixture is injected into the head or directly into the combustion chamber and ignited by a sparkplug -- most engine service issues are very similar and can be handled by the OEM dealer or local automotive service shop. These include oil changes, air filter changes etc. If and when a retrofit system-related service issue arises (e.g., a faulty injector or loose compression fitting), the SVM usually recommends that a QSR perform this work, or, in the case of the SVM that installs the system themselves, a local SVM-trained OEM dealer or automotive shop will be recommended.

Occasional inspection of all vehicle systems is generally good practice, regardless of fuel type. NHTSA, the federal agency with jurisdiction concerning vehicle safety, requires that all CNG fuel storage cylinders have a label that (1) states the date of manufacture and the date that the cylinder is required to be removed from service (typically 15-20 years), and (2) instructs the vehicle owner/operator to have a qualified visual inspection of the tank every 36,000 miles or every 3 years (whichever occurs first) and/or after an accident or fire. Inspections are performed to look for tank and bracket damage (e.g. gouges, cuts, abrasions, dents, corrosion, rust, general wear, etc). Qualified cylinder inspectors are located throughout the US and Canada. The cost/time associated with a cylinder inspection is minimal. More information about CNG cylinder inspections and links to certified inspectors is available at http://www.cleanvehicle.org/technology/cylinder.shtml. Always check with the SVM and/or the QSR concerning recommended service practices and warranty coverage.

Costs of Converting a Vehicle to Run on Natural Gas

The cost of converting a vehicle to run on natural gas includes the SVM's retrofit system, fuel tanks and related tubing/brackets, and the installation. The amount of fuel capacity requested by the customer (and thus the number, type, dimensions and configuration of the fuel tanks) significantly impacts cost since CNG cylinders are expensive.

For most people, an important consideration is whether the net costs associated with converting a vehicle to run on natural gas (after all costs, grants and/or tax credits are taken into account) will be recouped in fuel savings over the remaining life of the vehicle. Generally, it is not cost-effective to convert an older vehicle unless it has plenty of mileage left and will now be driven enough to recoup the investment in fuel savings. For this reason, SVMs generally do not carry over their previous model year certifications more than one or two years. For example, none of the light-duty SVMs currently offer EPA- or CARB-certified conversion systems for vehicles earlier than 2006. However, if a fleet operator requested the retrofit of 30 of their 2005 pick-up trucks, the SVM with the specific 2005 certification might be persuaded to incur the cost of re-filing with EPA or CARB.

A more common occurrence is the retrofit of a new vehicle. Conversion of new vehicles provides the greatest opportunity to save fuel cost and, thereby, pay back the conversion cost and generate life-cycle savings.

While NGVAmerica recommends that potential customers contact the appropriate SVMs directly about vehicle conversion costs, the following are general "ballpark" estimates of retail light-duty vehicle conversion costs provided by SVMs. Specific quotes will vary based on fuel capacity, number of vehicles, wheel base, etc.

Crown Vic/Lincoln Town Car/Mercury Marquis with 13 gasoline gallon equivalent (GGE): $13,500
E350 Cargo/Passenger Van with 20 GGE fuel: $15,500
F150/250/350 Pick-up Truck with 20 GGE: $16,500; with 30 GGE: $18,500

E450 Cutaway Shuttle Van with 24-38 GGE: $18,500-22,500
Sierra/Silverado 1500/2500HD Pick-up Truck with 11GGE: $12,500; with 20GGE: $15,500
Savanna/Express G1500/2500 Cargo/Passenger Van 12-20GGE: $12,500-16,000

Tax Credits Offset Part of Vehicle Conversion Cost

The federal Energy Policy Act of 2005 included an income tax **credit** that offsets 50-80% of the buyer's incremental cost of purchasing a new dedicated NGV and -- especially important to the discussion here -- also applies to the cost to convert an existing vehicle to operate on natural gas. For a conversion, the "incremental price" is the full cost of the conversion. The credit applies only to a dedicated NGV. Furthermore, it only applies to EPA- or CARB-certified OEM vehicles or EPA- or CARB-certified SVM retrofit systems. The credits are applicable to NGVs placed in service after December 31, 2005 (which includes previous gasoline-fueled vehicles placed in service prior to December 31, 2005 but converted to CNG after December 31, 2005). The tax credit does NOT apply to non-EPA-/non-CARB-certified vehicles, nor does it apply to bi-fuel vehicles, nor does it apply to the purchase of used/existing CNG vehicles.

The amount of the tax credit is determined by two basic criteria: the vehicle's gross vehicle weight rating and the EPA- or CARB certification level. Dedicated NGVs certified to the minimum federal level qualify for 50% of the incremental cost (within the cap) while "extra clean" vehicles given an extra 30% "bonus" for a total of 80% of their incremental cost (again, within the cap for that GVWR group). The four GVWR groups and applicable incremental cost caps are:

GVWR up to 8500#: Incremental cost capped at $5000: Credits from $2500 to $4000
GVWR 8501# - 14,000#: Incremental cost capped at $10,000: credits from $5000-$8000
GVWR 14,001# - 26,000#: Incremental cost capped at $25,000; Credits from $12,500-$20,000
GVWR over 26,000#: Incremental cost capped at $40,000: credits from $20,000-$32,000

All sedans and most vans and pick-up trucks will fall into the first GVWR group, but there are many "beefed up" pick-up trucks and vans that have GVWRs between 8500-10,000# and thus would qualify for the higher "second tier" federal tax credit.

In addition, there may be a STATE tax credit available for converting a vehicle to natural gas. These tax credits are state-specific and some are temporary in nature (e.g., while funds last, first 200 vehicles). Check with your appropriate state taxation office concerning availability of state tax credits. We suggest that you search the Internet under "alt fuel vehicles+ tax credits+(your state)."

Below are a few examples of the FEDERAL tax credits available for sedans, vans and pick-up trucks.

American Honda Civic GX: $4000 (dedicated OEM-produced NGV ; GVWR <8500# so incremental cost cap is $5000, CARB SULEV-certified so qualifies for 80% credit: .8 x $5000 = $4000)

BAF Crown Victoria sedan: $4000 (dedicated NGV; GVWR <8500# so incremental cost capped at $5000; CARB SULEV certified so it qualifies for 80% credit; .8 x $5000 = $4000

BAF Technologies Ford E350 Passenger van: $8000 (dedicated NGV; GVWR = 9600# so incremental cost cap is $10,000; CARB SULEV certified so it qualifies for 80% credit: .8 x $10,000 = $8000)

Baytech Silverado C1500 pick-up truck: $4000 (dedicated NGV; GVWR <8500# so incremental cost capped at $5000; CARB SULEV certified so it qualifies for 80% credit: .8 x $5000 = $4000)

Baytech Silverado C2500HD pick-up truck: $8000 (dedicated NGV; GVWR 8700/9100 so incremental cost capped at $10,000; CARB SULEV certified so it qualifies for 80% credit: .8 x 10,000 = $8000)

IMPCO Silverado C1500 bi-fuel pick-up truck: $0 (bi-fuel vehicles don't qualify for federal tax credits – may qualify for some states incentives)

More information about the available FEDERAL tax incentives for purchase of new NGVs and conversions is available at: http://www.ngvc.org/pdfs/FederalVehicleTaxCredit0508.pdf

Options to Investigate If Converting Your Vehicle Isn't Viable

If converting your vehicle to run on natural gas is not an option – either because an EPA-/CARB-certified system is not available or the economics don't make sense, NGVAmerica suggests that you investigate the option of purchasing a used NGV. Government agencies have been the largest purchasers of light-duty NGVs, and many sell their vehicles after reaching a specific age or mileage benchmark. Examples include federal, state and local government agencies, airport and transit authorities (light-duty sedans and pick-up trucks are often used by their security, route supervisor and/or maintenance personnel). While these vehicles do not qualify for the vehicle purchase tax credit because they were already placed in service, they are often low-cost and have remaining life on them for you to garner fuel savings.

NGVAmerica does not maintain a list of vehicle auctioneers or resellers of used NGVs but we are aware that many of the NGVs being purchased by consumers are used government vehicles. Again, we suggest that you search the Internet under "CNG+vehicles+used+auction." The federal government (GSA) site for auctions is http://www.autoauctions.gsa.gov/index.cfm

Fueling Your CNG Vehicle

Before you convert your vehicle to run on natural gas – or purchase a used CNG vehicle, be sure to investigate your fueling options. While there are over 1000 CNG fueling locations in the U.S., many (about one-half) are not open to the public. Instead, they are restricted to use only by the fleet operator (referred to as private access stations). Others allow public refueling only after an account and "charge" card account have been established (referred to as limited public access), while still others allow public fueling with convenient credit card and/or proprietary billing card access (referred to as full public access). Many of these existing CNG stations were originally installed by natural gas utilities and, thu,s are in "clusters" associated with their service territories. Some gas utilities left the market, either closing their stations or selling them to a small cadre of independent retail CNG fuel companies that have built upon these networks and added new stations. The most comprehensive lists of CNG stations are available from the following web sites (Note: There are no consistent reporting/registration requirements when new stations are opened so the following sites may be incomplete):

http://www.eere.energy.gov/afdc/fuels/natural_gas_stations.html (U.S. DOE- maintained site of U.S. stations)

http://www.cngvc.org/ngv/cngvc.nsf/bytitle/fuellocator.htm (Calif. NGV Coalition site of CA fueling locations)

http://www.cleancarmaps.com/home/ (WestStart/CALSTART- maintained web site)

It is always a good idea to contact the station prior to your trip to make sure that the information on the station lists noted above is accurate and current. This is especially true if you plan to make a trip that is out of your local area network and when only a very limited infrastructure is in place.

If a CNG fueling site is not available in your immediate area or within reasonable distance from your regularly traveled route to work, school or other frequented location, you may elect to purchase and install a fueling device at your home. Currently, the only home fueling devices available are two types of units from FuelMaker Corporation (http://www.fuelmaker.com).

One type of device that is available across the country is the FuelMaker "Q" series vehicle refueling appliance (VRA), the least expensive of which is referred to as the "small Q." It compresses and dispenses about 0.9 gasoline-gallon-equivalent (GGE) per hour…. This is a "time-fill" fueling device that has no storage other than the storage onboard your vehicle. Gas from the same supply lines that feed your house's appliances (furnace, water heater, stove, etc) is compressed and stored onboard your vehicle by a device about the size of an outdoor house air-conditioning unit that is installed outdoors, usually adjacent to your garage. Fueling is accomplished overnight or whenever you vehicle is idle and available to attach to the VRA's supply hose. It is possible to purchase storage and fast-fill dispensing capability from FuelMaker (which provides much more fueling capacity), but this option is not designed for, nor is it cost-effective for most homeowners. A "small Q" with time-fill capability costs about $9875 + installation. Visit FuelMaker's website for FMQ dealer contacts by state.

Another FuelMaker device called the Phill was introduced in limited areas of the country several years ago, and has been gradually offered in more markets as demand and service/supply/installer networks have been established. The Phill is a small home compression/dispensing unit that dispenses about 0.5GGE per hour. It is also a time-fill device, but it has been engineered to be smaller (about the size of a pay telephone box) and installed inside your garage with proper safety-relief venting to the outside. The Phill is priced at approximately $4500+ installation but this device is available only in very limited areas. Visit the Phill portion of FuelMaker's web site to find out IF this device is available in your area and – if so, who is qualified to install it.

Home CNG refueling devices qualify for a federal tax incentive of $1000 and may qualify for additional state tax incentives or grant subsidies. More information about the available FEDERAL tax incentive is available at the following link: http://www.ngvc.org/pdfs/FederalInfrastruct.pdf. For information about potential STATE tax incentives and/or grant subsidies for your home refueling installation, contact your appropriate state authority or search the Internet under "CNG+refueling+tax incentives."

We appreciate the public's interest in taking advantage of the clean burning, domestic-energy-secure, imported-oil-displacement, fuel efficient and cost-effective benefits of NGVs, we are inundated with calls and e-mails requesting assistance. We hope that this document answers most, if not all, your questions. If your question was NOT answered by this document, then call or e-mail us so we can answer it and then include it in revised versions of this informational document. PLEASE DO NOT CALL US TO ASK WHY AN EPA- OR CARB-CERTIFICATION IS NOT AVAILABLE FOR YOUR VEHICLE OR WHY THE CERTIFICATION PROCESS

IS SO TECHNICALLY CHALLENGING OR EXPENSIVE. WE HAVE NO AUTHORITY/JURISDICTION OVER THE PROCESS, NOR DO WE HAVE ANY INFLUENCE IN THESE POLICIES.

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